

**INNOVATION OF PRODUCTS IN THE BRAZILIAN POULTRY CHAIN: THE  
CASE OF THE INSUMES INDUSTRY**

**Giuliana Aparecida Santini<sup>1</sup>**

Via Washington Luiz, Km 235  
CEP: 13565-905 São Carlos/SP Brasil  
E- mail: [giusantini@dep.ufscar.br](mailto:giusantini@dep.ufscar.br)

**Hildo Meirelles de Souza Filho<sup>1</sup>**

Via Washington Luiz, Km 235  
CEP: 13565-905 São Carlos/SP Brasil  
E- mail: [hildo@dep.ufscar.br](mailto:hildo@dep.ufscar.br)

**Gessuir Pigatto<sup>2</sup>**

Av. Domingos da Costa Lopes, 780  
CEP: 17602-496 Tupã/SP Brasil  
E- mail: [pigatto@tupa.unesp.br](mailto:pigatto@tupa.unesp.br)

<sup>1</sup> Universidade Federal de São Carlos - UFSCAR  
Centro de Ciências Exatas e de Tecnologia  
CEP: 13565-905 São Carlos/SP Brasil

<sup>2</sup> Universidade Estadual Paulista – Unidade Diferenciada de Tupã  
Curso de Administração de Empresas e Agronegócios  
CEP: 17602-496 Tupã/SP Brasil

**Abstract:**

The main goal of this paper is to discuss product innovations implemented in the period of 1999-2003 in the poultry chain insumes in Brazil. The analysis presented was made possible according to the multi-case studies involving fourteen organizations belonging to the following productive chains: genetics, medication and animal nutrition. This broad segmentation of operations follows its own understanding of the agro-industrial chain of production, which is related to a succession of dissociable transformation operations capable of being separated and linked to themselves by a technical chaining. Among the various results, stands out the inventive effort from the firms on innovating not only on better products, but also in new products. That is possible due to the necessity of incorporating alterations that come from other areas, such as medical and nutrition (introduction of medication for insertion in ration) as well as demands from the internal

and external market. In this aspect, the companies which were analyzed showed themselves to be up-to-date, following new market demands.

**Key word:** poultry industry, insumes, technological innovation, products, markets.

## 1. Introduction

The poultry industry in Brazil has been showing dynamism regarding productive, commercial and technological factors. Some indicators show the country as one of the largest producers and exporters of the product worldwide, along with the United States. In 2003, the country produced 7.6 million tons of chicken meat, while the United States produced 14.6 million tons and China, 10 million tons. In export volume, Brazil has an increased market, showing a 17% growth in the 2002-2003 period, while the United States grew only 2.5%, and the European Union (third largest exporter) had their sales reduced in 15% (BRASIL, 2004). The main product in this chain is the whole chicken, frozen or cooled, with growing participation of cuts, and industrialized chicken, following the industrial demand.

To keep up with this expansion, technological innovations – incremental or radical – are taking place in the productive chains, and dictating a new dynamics to this sector, promoting therefore a better performance of companies in the poultry industry<sup>1</sup>. The incremental innovations are of biggest appeal, since in this sector, technological innovations occur mainly outside its main activities. Innovations are seen in equipments and insumes, with origins in the sectors of poultry industry equipments and the production of insumes.

In the production sector, the main technological changes have as *locus* the areas of genetics, animal nutrition, medication and meat processing. Chemical insumes and rations allow an increase in animal and industrial processes productivity. As for insumes, with emphasis in animal genetics, the innovations occur by means of food development with protein enhanced characteristics and lineage enhancement which provide better market performance. New techniques associated with slaughtering techniques and

processing of meat have been incorporated to meet the demands of the internal and external market.

In the sphere of commercialization and distribution, it amplifies the tendencies of information technologies to the managing of not only the individual, but the whole cluster of authors that form agro-industrial chains. On the other hand it demands changes related to transporting and packing systems, in which it observes the quality of the product up to its delivery. The processing area innovations are related to the flux of production, with the acquisition of automated equipment and the restructuring of productive processes.

In this context, this article focuses its purpose on discussing innovations of products implemented in the period of 1999-2003 in the national poultry insumes segment, more precisely genetics, medication and animal nutrition<sup>2</sup>.

The article is segmented in five sections. In the second section the methods used in the completing of the task are presented. The third, topics regarding technological innovations are discussed. In the fourth section, subdivided in three areas, posterior analysis is made. In conclusion, the fifth section, some considerations are made regarding the topics in question.

## **2. Methodology**

The analyses presented were made possible thanks to the multi-case study, involving organizations linked to the insume production of the agro-industrial poultry chain.

Agents of fourteen companies were interviewed (four of them being genetics; five of them being medication and five being animal nutrition).

The choice of the sample obeyed the classification criteria according to participation of the company in the internal and external markets. However, no ranking of the classifications of the companies involving sales and profit was found, but it could be

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<sup>1</sup> According to FREEMAN (1994), radical innovations as those deeply alter the technological base of a productive process, while incremental innovations refer simply to improvements in the existing production sequence or areas.

<sup>2</sup> This article is included in a two-project context, conducted since 2002. The first, named Diretório da Pesquisa Privada no Brasil or Brazilian Private Research Directory, (funded by FINEP, an organ linked to the Ministry of Science and Technology), sought to provide a map of private technological research in the country (including the poultry chain). The second, entitled Redes Cooperativas de Pesquisas or Corporate Research Networks, RECOPE (also financed by FINEP) sought to identify changes in the entire productive chain. Both prioritizing technological changes occurring in the 1999-2003 period.

classified in accordance with its relevance in productive terms, nationality (including national and international companies), tradition in the Brazilian market, coverage regarding commercial demand, etc.

The information found originated from the Association of Slaughterhouses (Associação das Empresas Abatedouras, as companies *websites* (Poultry, Eggs, and Genetic Material, Animal Nutrition) and in the general report of the National Union of Animal Health Industry (Sindicato Nacional da Indústria de Produtos para Saúde Animal).

In addition to the information collected by means of a questionnaire, secondary data was obtained by academic study revisions, local sources (such as FINEP funded projects, Social and Economical Development Institutes, Associations, consulting agencies, etc), journalistic publishing (Gazeta Mercantil, Estado de São Paulo, Folha de São Paulo, Valor econômico, and others) and statistical sources (Ministério da Agricultura e Abastecimento, Ministério do Desenvolvimento Indústria e Comércio, Instituto Brasileiro de Geografia e Estatística, among others).

### **3. Concepts of innovations**

Some innovation theories are based on central ideas. The first is that any innovation develops itself by means of an evolutionary process, interacting among authors and different development stages of an idea in the innovation process. This focus, based on the benefits of experimentation, differs itself from the neo-classic economics theory, in which the attention unfolds upon the market failure and static efficiency. The second main idea, it establishes knowledge and learning play an important role in developed economies. It is also influenced by the fact that knowledge is accumulative over time, and quick diffusion of information and communication technologies are available not only in industries but also in products (ARUNDEL et al, 1998).

The definition of innovation widely used by those who work with technological changes derives from SCHUMPETER (1912; 1943). According to this author the innovative process consists on three sequential phases: invention, innovation and diffusion. Invention distinguishes itself from innovation because innovation is essentially an economic phenomenon in which occurs the commercialization of a new product or the

implementation of a new process. In contrast, inventions assemble new knowledge, in which its application can or cannot be viable.

Schumpeter's definition of innovation crafts two main paths. Initially, a firm can innovate by investing in equipments used in new processes, which are bought from a supplier, or by selling a new product, which also is obtained from a new corporation. In that case being, that kind of innovation does not require relevant, creative or inventive intellectual effort. Subsequently, a corporation can also innovate by means of commercializing new products and implementing new equipments made by the corporation itself in midst its own inventive activities. Two definitions can be established regarding those two paths:

- *Embracement or innovation as diffusion*: the acquisition of new products or external sources of processes from the corporation.
- *Inventive effort*: creative activities intended on formulating new or better products, processes or services.

However, these two paths to innovation are capable of surrounding all other possibilities. The corporations can also innovate combining the adoption with inventive effort. That occurs, for example, when the corporation makes an inventive effort to adapt to enhanced process technologies in means of attempting to stand up to its own production process. It must be considered that the diffusion of ideas, knowledge and information, also play a vital role in the origination of innovation. That being, the two paths to innovation must be understood as types of ideas that are not mutually excluded, being innovation normally characterized by the combination of the two main paths.

Considering the poultry chain, mainly in the insumes and processing segments, innovations are characterized both by diffusion and inventive efforts. For the corporations innovating on acquiring equipments to implement new processes, and also, in the production and commercialization of new already existing products (therefore, improved) or products that prior to that, were not part of their *portfolio*. The definitions of product and process innovations are presented as following.

### **3.1 Product and Process Innovations**

According to OEDC (1996) and JARAMILLO (2000), technological innovation finds itself divided in two categories: technical product innovation and technical process

innovation. Product innovations can be subdivided into new products and improved products. The definitions for these three types of innovations are:

- A *technologically new product* is a product which technological characteristics or intended usage differ significantly from previously fabricated products. Such innovations can involve radically new technologies; it can be based on the combination of already existing technologies, or can derive from the use of new knowledge.
- A *technologically improved product* is an already existing product, which the performance has been significantly enhanced and modernized. A simple product can be improved (in terms of performance or lower costs) by the use of high-performance equipment. A complex product, which consists on a certain number of technical integrated sub-systems, can be improved by partial changes of one of the sub-systems.
- A *technological process innovation* is the embracing of technologically new or significantly enhanced methods of production including methods of presentation of the product. These methods can involve equipment changes, changes in the organization of the production, or even those two combined, and can originate from the use of new knowledge. The methods can have as goal the production and presentation of technologically new or enhanced products, which cannot be manufactured or offered using conventional methods of production. It can also have as goal the increase of production efficiency or presentation of existing products.

To DEVINE et al (1985), innovation is a task for the great corporations, despite the fact that small corporations play an important role in some industries. That idea suggests that great industries tend to acquire competitive advantages in industries where there are opportunities to continue innovation. That advantage would be related to resources possessed by great corporations to explore new opportunities, by acquiring new equipment, crafting new products or differentiating. On the other hand, the author considers that entrepreneurs present higher advantages in the market, once they are precisely the followers with a wider development than those initiated by the pioneers. The firm that originally introduces an innovation must grow in the marketplace with new ideas in an even shorter time-span so that it maintains itself ahead of the opponents.

Having evaluated up to this moment, innovation characteristics under many authors different points of views, we move on to the next session, the analysis of innovation and development of products in the segment of poultry insumes.

#### **4. Technological Innovation and development of new products**

##### **4.1 Animal genetics**

In the genetics area there are several techniques which can be used to enhance the development of animal genetics, aiming the acquisition of characteristics of interest. One of the techniques widely used at the moment is the quantitative genetic, allied to the use of computational and statistical techniques, which assure a continuous progress of the production characteristics. That kind of selection, based on the phenotype of the animal does not consider the number of genes which act in the characteristic of interest, nor the effect of each gene. However, the performance rates that have been obtained in these programs demonstrate the importance of the usage of quantitative genetics in the selection.

With the advance of Biotechnology, which allows the analysis and identification of genes in species that contain characteristics of interest, the poultry industry could also show good results. The development of molecular techniques has shown how certain genes act in the determination of characteristics of economical interest. In that ambit, there are many techniques with potential for application in genetic enhancement; among those are cloning, insertion and repairing of genes, and genetic or molecular markers.

Gene Assisted Selection (CGS) and Marker Assisted Selection (MAS) are being considered the best methods of incorporation to molecular genetics in enhancement programs intended to elevate selection efficiency. CGS depends on the knowledge of higher effecting genes involved in characteristics of economical interest, and MAS depends on genes linked to fractions of DNA which affect relevant characteristic. The molecular marking technologies are the most researched and used of those cited before, because of their application, which can be: genome mapping, establishment of parent degree, gene selection and selection direct use (LEDUR & SCHMIDT, 2000).

Particularly in Brazil, the molecular biology technique and the marker assisted selection are used only by one of the researched companies, but in a conjunctive form with its

Europe's matrix. That company also operates in Brazil with pure own lineage, development of the whole process of reproduction, which involves: the choice of individuals in an orderly fashion (according to their size, weight, among other characteristics), mating (1 male for 10 females), egg collecting, incubation process (where the reproductive characteristics are measured), obtaining various newborns from mother and father. As they are born, the chicks receive an identification tag (bar-code of 11 digits informing its lineages data); the animals are registered by means of a reader, weighed, go through ultra-sonogram; subsequently that data is processed and sent to farms in the company headquarters. In Europe, the information is worked on and sent back to Brazil with the genetic mapping of the individuals. By that point the animals which genes of interest were identified are chosen.

We then observe that the changes in the product in this segment are elaborated starting from the genetic enhancement of pure lineages, that is, the very job of animal selection completed in the farms of genetic selection. In the case of some corporations operating in the national market, the initial innovation is not completed in Brazil, but in that company headquarters, where the *pedigrees* are located. The enhancement is accomplished by importing generations of great grandparents or grandparents. Regarding EMBRAPA (Brazilian Company of Farming Research), which maintains all lineages, there is a process of animal selection with the goal of raising the feeding conversion rate, the increase in the speed of weight gaining, resistance to diseases, conformities, etc, characterizing the inventive effort starting from its own lineages. To do so, statistical programs of quantitative genetics are used, such as ultra-sonogram and X-rays that can be used to control the characteristics inherited by future generations.

These corporations' inventive efforts are paid off by the positioning of new products on market, which, by that time, can occur a fast (or slow) diffusion in the sector, which is nothing more than the implementation of innovations by the group of processing companies or even by the producers, as time comes.

It is worth accentuating that this technological diffusion process involves not only the genetics area, but other areas in the same field, such as animal nutrition and medications, which are responsible for supplying the products necessary for the genetics area to achieve proper results.



Another point worth accentuating is that, despite the fact the products present an extended life-span (around 10 years), intensive genetic enhancement is always taking place (incremental innovations), which intends to attend specific demands (according to the purpose in sight). For example, currently, due to that increase of product industrialization and intensified exportations, researches are focusing on the increase of productivity in frigorific companies (birds with less fat and more meat) and the production of products without residue and resistance to diseases.

#### **4.2 Animal nutrition**

The main product lines produced by companies in that area are segmented in: complete rations, concentrates, nucleus and premix. In each line there are different products for distinct growing period of the animals. There are rations for the early age of the animal (up to 21 days); growth (from 21 to 42 days) and finish (42 days up to the slaughtering). The concentrates, nucleus and premix are specific for each kind of ration.

The *premix* is a mineral composition, vitamin and amino acids. The purpose of this product is to cover the nutritional blanks in feeding, prevent diseases, enhance food absorption and stimulate growth. The concentrates compose a sum of foods, such as ground soy, cotton, meat flour, supplements, additives, which when added to corn become complete rations. Therefore, the concentrate is the premix mixed with ground soy and cotton, meat and macro mineral flour (phosphorus and calcium), not including corn. An alternative between the concentrate and the premix is the nucleus, which is constituted by macro minerals added to the premix, lacking grains (SANTINI & ROHENKOHLN, 2003).

What was observed in most of the researched companies is the main interest to the production of premix, nucleus and vitamin and mineral supplements. From the perspective of the companies, ration and nucleus do not demand elevated technological knowledge of production, being formulated by producers from the process of combination of the ingredients. On the other hand, the manufacturing of nucleus and *premix* demands more knowledge of animal nutrition from the companies, and mostly, in the importation of minerals and vitamins. That way, the technologies involved in the production of rations and concentrates would be stable and completely abundant in the

market, while the manufacturing of supplements, premix, and nucleus would be under constant changes, being restricted by some companies.

The introduction and withdrawal process of products have been dynamic in this segment, directing the production based on enzymes, products with herbal extracts and minerals in the organic form (quilatos – molecule wrapping, such as the iron, with a layer of amino acids of vegetal origin). The line of products that has had most investments are the nucleus and premix, with a release of new products and an enhancement of the already existing ones, with the purpose of following the animals genetic progress (the changes include the addition of more vitamins and amino acids in the diet of animals). Therefore the most strategically important products are those from the *pet* line, aquatic and equine, that is, a specialty line of products which has had a significant growth at the present time, and which consists an opportunity for competition.

The changes in the product in this segment are primordially related to the improvement of its fundamental characteristics, due to the extensive development cycle of the products, of approximately five years. Specifically, as new discoveries are being made in terms of replaceability of components, new lines of products are created and aged ones are being excluded. That occurs, for example, in the release of products with different nutritional quantities. In the lactose component case, we can use it on powdered milk, semi-skimmed milk, skimmed milk, and milk serum, that is, different ingredients are selected which can provide the same nutrient to the product.

It is worth emphasizing that, due to sales in the external market, produced rations are being enhanced in order to avoid the use of meat sub-products, due to restrictions in the external market regarding the “mad-cow” disease. That way, original mineral products are being applied in the line of production, with a rigid monitoring in the receiving of raw-materials as a result of no contamination.

The release of organic formed mineral products is evaluated as highly innovative in the national and worldwide market, being developed upon efforts of a national company. This product was originally developed in Italy, and began being developed and commercialized by a company in Brazil, which hired a researcher of the University of Milan (where the technology was developed). Being so, the tactical knowledge diffusion, along with the press innovative effort, resulted in the introduction of new products in the

market. In that context, tactical knowledge can be defined as the dimension of knowledge placed in individuals (and/or organizations), hardly transferable knowledge (NELSON & WINTER, 1982).

Those changes have brought as main impacts to companies: the improvement in the quality of the products; adjustment to the demands of producers; - increasing the animal productivity -; adjustment to the importing market and increase of sales in the external market.

Other changes which do not alter the fundamental characteristics of the products can also be noticed, culminating in technologically enhanced products. Changes in wrapping, such as layout and type of material – replacing paper by plastic- which contributes to the better preservation of the product and, mostly, a smaller amount of returned products, once paper wrappings do not preserve the products so well.

In this product change process, the task of market researched completed by the technical assistance team obtains fundamental importance in the identification of business opportunities and product release. In some cases by means of an automated system, the company obtains information as to which clients benefit from their products, for how long, what their evaluation of the product is, suggestions, etc. That way, the sales and technical assistance team bring suggestions to the company, doing so the evaluation of already existing products or developing new ones. Many products are also created by means of the company's internal research, and mainly, following the tendencies of the animal genetics area, thus the two areas, along with medications, must be adjusted to reach the objectives in terms of development and animal growth.

### **4.3 Medications**

Vaccines (biological line), antibiotics, chemotherapeutics (sulpha), anticoccidia, endoparasiticide among others (hormones, growth promoters, acidifiers, toxin inactivators and vitamin and mineral supplements) come up as stream-line products in this area. These products are for internal use, emphasizing the disinfectants and ectoparasiticides for external use.

The differentiating aspects from each company are mainly costs, prices and the possession or not of the seeds, which originate the product, that is, what differentiates them as the producers or simply resellers of the imported products. The vaccines, specifically, are produced by only one company in Brazil, importing simply little components.

As the process of development is very dynamic, the withdrawal and inclusion of products in the market were frequent. Estimating, from 2 to 10 products were extracted from the market by the companies in the last three years. The withdrawal of antibiotics and chemotherapeutic products from the market was observed, in common, with the inclusion of natural products in the growth promoters, antiparasitics and ration additive lines.

In regard to next years investments or researches accomplished by companies, it is accentuated that multinationals have shown interest to start producing in Brazil what, up to this moment, was simply resold. One other company has been working to distribute their own vaccines produced elsewhere. Another line of products researched by the companies is the probiotics (natural products based on lactobacillus); phitotherapeutics (based on natural plants) and symbiotics (based on lactobacillus), that is, minimal meat residue products, but are still studied.

Designated to the identification of new business and research areas, companies use information that comes from the field (an example are the clients which specify the results of those products in field), the information generated by the own internal research, following internal and external market changes, and the corporative function of the group, precisely in the case of multinationals, there is always a search to seek for what other units must be carrying out to think of new products.

The changes in the product in this area are dynamic, since they involve from complete alterations in the product characteristics, resulting in technologically new products, to changes without any alterations in the fundamental characteristics, meaning, technologically enhanced products. Regarding the first aspect, we notice the release of: antibiotics – for isolated and combined with ration usage -; ectoparasiticides; natural additives for ration insertion, fermentation derivates, and vaccine against microplasmose, probiotics, among others. Implying, there is an elevated preoccupation from the

companies to manufacture natural and pharmaceutical products to be added to the animal diet.

With the antibiotic, natural and ectoparasiticida products, the companies have been able to increase sales in the internal and external markets, mainly by the fact that they demonstrate competence for associating these products with the animal diet.

The antibiotics specifically for use in ration are an innovation in Brazil. The market had to be thoroughly developed by a number of companies, since the prices were elevated due to extraordinary costs, slowing down the process of innovation. The same occurs with natural additives, which are particularly new in the Brazilian market, although thoroughly diffused abroad.

The changes which show only improvement in the fundamental characteristics of the products are represented by alteration in the formulation of the products (concentration adjustment, supplier changes) and substance alterations in all the product lines. These changes seek lower costs, improve quality, adjust to the needs of the clients, decrease the resistance of parasites in relation to the animal, improvement in the efficiency of the product, reinstatement of sales (essentially for the alterations were made to products in which presented a small decline in sales), etc.

The changes which do not alter the fundamental characteristics of the product are related to new packaging – the substitution of paper to plastic, which reduces the damage of the product in non-adequate conditions. Some of those alterations occurred for the adaptation of the worldwide pattern of the company headquarter; also, the reduction of weight in the pastilles (anticoccidia) from 10g to 5g, improving the quality of the product and the absorption by the animal.

## **5. Final considerations**

Innovations are intensely present in the segment of insumes of the poultry chain in Brazil. When thinking of innovations, not only the changes taken place from inventions or by the own creation of the firms acquire relevancy, but also the processes of technological diffusion to which many companies are submitted. Thus, the companies have been creating completely new products, basing themselves on productive terms to pursue the demands of the external market and to attend a larger share of the internal market.

In the area of animal genetics, the main aspects applied by the companies has been the food change – which carries a strong impact in the production expenses; return of chest meat, resistance to diseases and feathering (an animal with smaller quantity of feather quickly loses weight in cold regions). For that, some techniques such as statistical quantitative genetic programs, Molecular Biology, ultra-sonogram and X-rays can be used to control characteristics from future generations.

In the area of animal nutrition, the innovations have also been constant, motivated by the external market, which demands rations not containing meat sub-products, and also by the genetic research area, which demands products that offer higher food conversion. Therefore, the companies have acted in the production of premix and nucleus, which guarantees rapid growth of the animals and enhanced nutritive, mineral quality in the organic form, herb based products, etc. Further on, the constant change in the formulation of the products, with the objective of replacing raw-materials so that the production cost and quality are improved.

Parallel to the genetics and nutrition areas, the medication area restructures itself to follow the new market tendencies. Companies develop products which replace the antibiotics, attending external market demands; additives and mineral and vitamin supplements to be inserted in the ration; biological growth promoters; vaccines; natural probiotics which ease the absorption of food and do not leave meat residue; among others.

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