Technological innovation and entrepreneurship in animal production

Júlio Otávio Jardim Barcellos1,2, Luiz Antonio Queiroz Filho3, Alessandra Carla Ceolin4, Miguelangelo Gianezini5, Concepta McManus1,6, Guilherme Cunha Malafaia7, Ricardo Pedroso Oaigen8

1 Departamento de Zootecnia da UFRGS – Pesquisador do CNPq.
2 Centro de Estudos e Pesquisas em Agronegócios – CEPAN/UFRGS.
3 Mestrando do PPG-Zootecnia – UFRGS.
4 Doutora em Agronegócios – UFRGS - Bolsista PNPD/CAPES.
5 Doutorando do PPG-Agronegócios – UFRGS.
6 Membro do INCT - IGSPB
7 Pesquisador CNPGC/EMBRAPA – Campo Grande – MS.
8 Faculdade de Medicina Veterinária – UFPA – Castanhal, PA.

ABSTRACT - The classic model for producing knowledge and technology has changed. A new conceptual process is necessary to meet the assumptions of the future dimension of animal production. It should provide answers to the key drivers of livestock production, represented by population growth and urbanization, economic development and globalization and changes in market demand. Therefore, to address this scenario is necessary to innovate in a holistic and sometimes diffuse manner in production processes. From this perspective, this article looks at technological innovation in the field of animal production, with emphasis on new knowledge in the area of ruminant production. Additionally, it looks at the model for carrying out research so that the generation of new knowledge is integrated to meet problems identified as important to society. Moreover, the demand for a new professional in the field of agricultural sciences is also discussed.

Key Words: innovative models, integrated system, patents, research & development

Inovação tecnológica e empreendedorismo na produção animal

RESUMO - O modelo clássico para produção de conhecimento e de tecnologia mudou, pois, para atender os pressupostos da futura dimensão da produção animal, será necessária nova abordagem conceitual. Esta abordagem deverá contemplar as respostas para os principais direcionadores da produção animal no mundo, representados pelo crescimento populacional e urbanização, pelo desenvolvimento econômico e pela globalização e mudanças na demanda de mercado. Portanto, para enfrentar este cenário, é necessário inovar de forma holística e, às vezes, difusa nos processos de produção. Nesta perspectiva, é apresentado este artigo cuja abordagem está voltada à inovação tecnológica no campo da produção animal, com ênfase nos novos conhecimentos dirigidos à área de ruminantes. Adicionalmente, trata do modelo de condução da pesquisa para integrar a geração de novos conhecimentos para problemas importantes para a sociedade. Além disso, a demanda por um novo profissional no campo das ciências agrárias também é discutida.

Palavras-chave: modelo de inovação, patentes, pesquisa e desenvolvimento

Introduction

Contemporary civilization is living in a fascinating and challenging time during which lifestyle changes may become necessary. Nevertheless, without exception, everyone will continue to need fundamental physical elements for collective living – water, food, shelter and energy. By 2050 the earth will have more than 2.3 billion people and will need to produce 70% more food than present. Of the aforementioned fundamental elements, water and energy are linked in the different food production systems, sometimes in a synergetic manner (where water leads to food production) and other times antagonistic (where for example excess water can destroy this same production). The challenges for increasing feed production under these diverse situations, especially that of animal origin, will be the vectors for new models of production.

The imbalance between offer and demand of animal protein, especially meat, meant that this product became a luxury item in the 1950s. At that time, production was limited by technology which made an increase in availability more difficult. In 2020 this scenario will repeat itself, with meat once again becoming a luxury item. Nevertheless, the nature of this situation will be different as current knowledge...
would allow for a considerable increase in the availability of animal protein. If sufficient knowledge exists to increase production why will there be a deficit and high price for the product? Some would say that this is a complex problem with a multifactorial solution. This paper will show that the problem has changed. The localized technology aspects needed in the 1950s have modified to a need to understand the complexity involved in animal production systems. Complex production processes have now been coupled with many other aspects, often not seen as important in earlier years. This new dimension in animal production leads to the discussion of production efficiency, social responsibility and environmental compatibility for which useful knowledge must be produced.

The classical model for production of knowledge and technology has changed and new conceptual models must meet presumptions of the future dimension of animal production. It should contemplate responses to the principal drivers of animal production, represented by population growth and urbanization, economic development and globalization, changes in market demand and a new agricultural revolution. Therefore, innovation is necessary. This innovation is different from that which led the green revolution and technological era. It is now more ample, holistic and sometimes diffuse in production processes. It leaves the Cartesian field and enters the systemic. It does not come from specific techniques but demands an innovation in innovation. With this perspective, the concept of technological innovation emerges and obviously, the emphasis on animal production.

Innovation generates technology in its widest sense. Brazil has shown a significant increase in agricultural knowledge but is still behind countries where many times animal production is less relevant in terms of the economy. Many times, the knowledge produced is of low impact and little used (Lyra & Guimarães, 2007; ISI, 2010). Added to this, most knowledge produced is not applied. Validation, appropriation and simplification is necessary for this knowledge to reach production systems as a new technology. This occurs, in part, because research laboratories and education centers are still far from technological applications of their discovery or, when closer, they lack a connection with the business sector or the very society which would benefit from the innovation. Conflicts related to scientific curiosity, intellectual property and profit also haunt this reality.

In Brazil, the Law of Innovation was approved in 2004, therefore there are regulations available. It is therefore important that researchers and businesses understand that patents or intellectual property are not a barrier to the diffusion of knowledge and may even aid in its transfer. This topic is relatively new for researchers in animal production, and new professional postures are needed in carrying out and valorisation of research. With this, knowledge will have a new dimension of use for society. This will the greatest innovation, not in terms of number of patents but a group of integrated actions and attitudes capable of changing the present state of entropy.

In this paper, the role of innovation in animal production is contextualized. For this, it was necessary to understand its classical concept, what are the rules involved, characteristics of the innovator, what is needed to innovate, passing through technology in animal production produced in Brazil and finally the new professional needed by society. For ethical reasons, all technologies generated by animal production research in the country will not be named or cited, as there is a risk of classifying knowledge as technological innovation when it isn’t and vice-versa.

**Conceptual basis and state of the art**

**Technological innovation**

More than a novelty or renewal, innovation is an idea, method or object that is created and is different from earlier options. One of the acceptable definitions of innovation characterizes it as the search, discovery, experimentation, development, imitation and use of new products, processes and organizational techniques (Dosi, 1988).

What is researched cannot be fully known before the research and experimentation takes place, and the technical results are rarely known *ex ante*. Therefore, the parties involved in the new process must possess some sort of insight as to the technical and economic opportunities of something that has not yet been explored. Innovation involves a fundamental element of uncertainty, which is not explained simply by lack of information about the occurrence of known events, but because of technical – economic problems, whose solutions are unknown, and the inability to trace precisely the technological paradigms. Price (2009) presents a new concept regarding the institutional arrangements that drive innovation, whose synthesis is in the holistic view of finding solutions to complex problems or in collaboration and investment for specific problems.

Another perception is that innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or service (Drucker, 2001). Moreover, innovation is critical for accelerating and sustaining economic growth of a nation, but it is also important with regard to resource conservation and the environment (Freeman, 1988). It is an arena of
unpredictable relationships, a meeting of several rationales that acquire a unique conformation from the exchange of experiences among the productive sectors, consumers, public administrators and researchers. Is it credible to say that there are evolutionary principles that determine a priori the direction of the evolutionary process of a technology.

The impact of innovations is crucial, because it must be assumed to be of sufficient magnitude to upset the balance of the circular flow, so that the reactions caused are not only localized, continuous and adaptive, but are able to characterize a development and eventually lead to the cyclic motion for the economy as a whole (Possas, 1989).

The types of innovation that lead to this development can be classified as radical or incremental. The first moves through the development and introduction of an entirely new product, process or way of organizing production and may represent a structural break with a previous technological standard, resulting in many new industries, sectors and markets. The second refers to the introduction of any kind of improvement in a product, process or organization of production within a company, with no change in industrial structure (Freeman, 1988; Lemos, 1999; Luecke, 2003).

Among the various possibilities to innovate, those related to product innovations or processes are known as technological innovations (Schumpeter, 1934). A technologically new product is a product whose technological characteristics or intended uses differ significantly from products previously produced and were derived from the use of new knowledge. A technologically improved product is an existing product whose performance is significantly improved. A complex product, which consists of integrated technical subsystems may be improved by partial changes in one subsystem. The technological innovation process is the adoption of production methods which are technologically new or significantly improved, including methods of product presentation. These methods may involve changes in equipment, organization of production, or a combination of these changes, and can be derived from the use of new knowledge (OECD/Eurostat, 1997).

Technological innovation has been the object of Schumpeterian and neo-Schumpeterian theories that have, in common, an emphasis on innovation as a dynamic engine of the economy. Within this study, the central theme of the latter theory is highlighted - technological change, which takes place through the trilogy of invention - innovation - diffusion. Thus, changes in the economy are the result of the relentless pursuit by businesses for technological innovations, which undergo the selection process inherent in the market and competition. Therefore, the search for innovations in products and processes is irreversible.

The theory of the triple helix: company - university - state can be considered as a model that needs to be overcome (Andrade, 2006). For the author, it would meet only certain, specific innovations. Moreover, new proposals continually emerge regarding innovation and its dimensions. Chesbrough (2003) created the theory of open innovation where the new is created from networks of institutional knowledge.

Currently there is emphasis on product generated by innovation in the broad sense, proposing a debate between development and innovation. It goes beyond the logic of invention - new technical properties and new products - to compatibility between technological advancement and social institutions. In this sense, it identifies a new train of thought which establishes the premise that innovation depends less on capital investment and technical ingenuity and more on the network of traffic of innovation and knowledge (Figure 1).

Within business, the choice for innovation, considering the innovation movements in the market and the motivations identified by each firm, will depend on its own specificity, i.e. the resources that a company has available or can collect. Thus, the innovations result from the combination of three basic requirements: opportunity: which is related to the designated driver for innovation, with the market (current or future) and the existence of needs; desire: intent related to the identification of opportunity and the acceptance that innovation is an ongoing process that requires a permanent effort, and capacity which translates into a set of financial, human, technical and information without which you cannot solve any problems (Freire, 2002; Wycoff, 2003). Thus, while most of the external opportunities such as customers, suppliers and other agents that interact with companies are part of the innovation process (Hipel, 1994), the willingness and capacity for innovation are key requirements directly related to the company itself.

Another issue, that occupies a prominent place on the list of priorities for organizations today, is related to critical factors that underpin successful innovation processes. Such processes are crucial in creating and maintaining the economic success of countries and enterprises. However, the challenge is to sustain these processes continuously. The analysis of innovation strategies used by the most dynamic sectors of the economy in leading countries indicates as vital: the problem-solving skills and ability to interpret (Lester & Piore, 2004).
In the Brazilian context, to assess the ability of a country to transform scientific knowledge into products or technological innovations, the Ministry of Science and Technology (MCT) consider patents as relevant indicators in the definition metrics of inventions and technological innovations (MCT, 2011). The distinction between inventions and innovations has been recently incorporated in economic theory and conceptualizes invention as an idea, a scheme or model for a new product, process or system (Freeman, 1988).

Studies conducted by Innometrics (2011) defines an indicator for innovation. There is no one single factor to reach the highest degree - the forefront of innovation. In all countries leading in innovation there is a high investment in research and development, high public-private co-authorship in scientific publications, a strong link between science and business and a marketing system of technological knowledge. Besides these factors, the research establishes eight dimensions to construct an index for the country in innovative performance (Figure 2).

The result of innovation, in general, is protected by the granting of patents. Araújo et al. (2010) point out that intellectual property is the main legal instrument and means to facilitate the ownership of innovation in knowledge and technology. In Brazil, this control is given by the INPI (National Institute of Industrial Property). Table 1 shows the number of patents registered and the origin of the depositor, in the period 2000 to 2010, revealing the dominance of concessions for non-residents (MCT, 2011). This is associated with the origin of major businesses, which have headquarters in developed countries, thus being outside Brazil.

In addition to the concessions deposited in INPI, Brazil had 131 patents granted in 2008, 146 in 2009 and 209 in 2010, in UPSTO (United States Patent and Trademark Office) (MCT, 2011). In one study, which examined 83 countries over a period of four years (2004-2007), Brazil ranked as the 49th in innovation. This ranking measures the performance of countries according to the number of registered patents, investments in research and development, technical level of the workforce and other factors that contribute to innovation (Economist, 2009).

By analyzing only the patent applications made by residents in the country at INPI, the state with more requests in the period from 2003 to 2007 was São Paulo state with 2,997, followed by Minas Gerais with 669, 646 by Parana and Rio Grande do Sul with 639 patent applications (INPI, 2011). Given the territorial dimensions and large number of research

<table>
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<th>Innovative profile</th>
<th>HR</th>
<th>ARS</th>
<th>F&amp;S</th>
<th>FI</th>
<th>L&amp;E</th>
<th>IA</th>
<th>INN</th>
<th>EE</th>
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<tr>
<td>Modest innovators</td>
<td>+++</td>
<td>+</td>
<td>++</td>
<td>+</td>
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<tr>
<td>Moderate innovators</td>
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<td>Innovation followers</td>
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<td>Innovation leaders</td>
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HR - human resources; ARS - attractive research systems; F&S - finance and support; FI - firm investments; L&E - linkages & entrepreneurship; IA - intellectual assets; INN - innovators; EE - economic effects. (+ : low; ++++: high).

Figure 1 - Basic presumptions for innovation based on the model used.

Figure 2 - Innovation union scoreboard indicators.
centers and technological development in Brazil, it is clear that the pace of innovation is slow.

The current trends in technological development has a diffuse and unpredictable dimension, given the complexity of the processes and institutional arrangements and business. It is necessary to create a closer relationship between innovation as knowledge and knowledge as a technical and cultural experience. To innovate it is necessary to have lived the old, as technical expertise represents the condition to build innovation in both the cultural and operative dimensions. Therefore, a more dynamic model is essential for integrating innovation between universities, the business sector and entrepreneurship, as the whole innovation process is rooted in the universities (Carrer et al., 2010).

Livestock production in the face of technological innovation

The development of new technologies applied to livestock production is relatively modest when compared with other areas of knowledge or economic activity. Therefore, innovation follows a rhythm of its own and is dependent on, in many cases, the needs of the industry involved with production. This may be related to the fact that farmers have developed their production activities based on tacit or empirical knowledge for decades. Moreover, innovations are rarely used systematically, they require that paradigms are broken and behavior changed, sometimes radically, depending on the complexity and diversity of the implications of their use.

The concept of technological innovation in animal production involves the understanding of technology inputs (product) and process technology (knowledge management). A classic example of input technology occurs in poultry inputs. In this industry, growth in productivity is the result of using few inputs, usually resulting from scientific advances, new breeding lines, nutritional additives, vaccines, ingredients, growth promoters, plant and equipment, all of which are capable of changing cost and productivity levels quickly. All of these changes are marketable, easily introduced into production, developed and managed by only a few agents – these are raw material technologies (products). They are introduced to many poultry farms, with systemic repercussions on the productivity of a region or country. This explains the growth of Brazilian poultry farming in relation to its competitors. In addition, process technology is available, which involves management of the poultry installation, food, ambience, etc. But the latter result is less striking than that of inputs.

Few companies carry out research, generate inputs and put them on sale. Competition makes them more competitive and efficient in attracting clients and valorizing innovation. With that the advances are rapid and focused exclusively on the immediate economic results.

On the other hand, with beef cattle farming, and particularly in cow calf systems, scientific progress and technology is developed in universities and research centers. This knowledge has a long road to travel to reach the end user and is usually associated with the processes. Moreover, the knowledge when employed in a timely manner, and used on a point in the production chain, does not have the ability to substantially change the outcome of the process because it depends on many other factors. If these are not managed in a systemic way they can neutralize the benefits of the knowledge technology that was introduced. It is also difficult for a business to buy a technology and convert it into input. Therefore, those who innovated have little marketing ability to sell it, through the lack of standardized, systematic distribution and predictability of results (Barcellos et al., 2004).

Examples of process technology in beef cattle include adjusting the energy demands of animals and food availability (energy accounting), adjusting the production cycle of the suckling cow with pasture growth, manipulating animal growth curves with the use of compensatory growth and the management herd structure by the participation of each category of animal. All these techniques are results of science, but none has been transformed in technology input to generate a large impact with widespread use. None of this was patented and appropriated as technological innovation. Therefore, it is necessary that new knowledge is appropriated as an input

Table 1 - Brazil: Concession of patents by origin of depositor registered in INPI, 2000-2010

<table>
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<tr>
<th>Patents and Origin</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
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<tr>
<td>Resident</td>
<td>6,280</td>
<td>6,718</td>
<td>6,838</td>
<td>7,231</td>
<td>7,502</td>
<td>7,113</td>
<td>6,966</td>
<td>6,975</td>
<td>8,056</td>
<td>7,875</td>
<td>7,256</td>
</tr>
<tr>
<td>Non-resident</td>
<td>14,487</td>
<td>14,030</td>
<td>12,734</td>
<td>14,108</td>
<td>15,406</td>
<td>16,983</td>
<td>18,440</td>
<td>17,710</td>
<td>18,994</td>
<td>18,076</td>
<td>20,796</td>
</tr>
<tr>
<td>Total</td>
<td>20,767</td>
<td>20,748</td>
<td>19,572</td>
<td>21,339</td>
<td>22,908</td>
<td>24,096</td>
<td>25,406</td>
<td>24,685</td>
<td>27,050</td>
<td>25,951</td>
<td>28,052</td>
</tr>
</tbody>
</table>

Source(s): INPI. Updated in March 2011. General coordination of Indicators - ASCAV/SEXEC - MCT. Note(s): Non-consolidated data.
or process, to consolidate its position as innovation, regardless of whether it is protected as intellectual property (Barcellos, 2004).

The need to improve efficiency in animal production will require new scientific approaches to technologies that will be used, which can generate conflicts between new products or processes (Portugal, 2002). It is possible there new products will appear without technological innovation, such as organic produce, natural products with designation of origin, and where the new product is the result of a new process.

Nemeth & Meuwissen (2009) described objective convenience as the new focus of innovation processes in animal production, seeking sustainability and human health. For the authors, technology will be directed in animal breeding and reproduction to exchanging quantity for quality and sustainability; in animal nutrition from sufficient to optimum; in animal management systems that deal with uniformity of product and food processing with less focus on conservation and more on quality and sustainability.

The generation of new applied knowledge requires an evolutionary logic to consolidate itself as a innovative technology (Figure 3). Dijk & Boekel (2001) discussed the linear model of innovation in animal production, where universities and research centers focus their efforts on generating a process or product based on cooperation. However, the reality of the consumer market is creating a new governance model, where demands on innovation meant that the inter-institutional cooperation networks of have not been sufficiently agile to act in this scenario. Furthermore, the use of the technology originated from research-extension-application model may fall into disuse in the future, especially due to the effects of globalization.

Figure 3 - Cycle of knowledge to innovation.

There is a new connection chain between the consumer and the information flow, integrating the agents more quickly. With this there is development of technologies adapted to the reality of systems.

The demand for innovation is not specific to guide research in the pursuit of new knowledge to meet sectarian needs (Rezvanfar, 2007). Often, in the identification of a problem, the basic premises of the technological gap are disregarded and the solutions are researched for their consequences and not the causes. The result is the creation of a variety of temporary solutions that are not consolidated as new technologies, because the problem is often not replicated in the real world and what was proposed as new loses its value. Alternatively, Klerkx et al. (2010) proposed a process of networks and interactions for learning from heterogeneous groups of actors such as farmers, industry, trades, researchers, farmers, government and civil society. For the authors, innovation in animal production cannot be exclusively of new technologies but also focused on institutional changes.

From this theoretical-applied approach it should be noted that in the various fields of knowledge a set of scientific developments can modify livestock production which are appropriated as technological innovations. Jobim et al. (2007) demystifies terminology and procedures for the analysis of conserved forages, therefore, a innovation of processes still without their product innovation. The methodological process and postulation of new paradigms and tools to answer the questions with the evaluation of forage intake and feeding behavior by ruminants for precision were themes of recent advances in scientific knowledge in the area (Carvalho et al., 2007, 2009). In a related theme, Euclides et al. (2010) points to the fact that there is a void in information on issues related to the response of the grazing animal. The authors highlight the innovations associated with the release of cultivars of forage species, with patent registration by EMBRAPA, which can impact on the production of beef at pasture.

Several authors have innovated in methodologies for evaluating production systems through data envelopment analysis (Abreu et al., 2006), cost center (Oaigen et al., 2009), meta-analysis applied to predicting intake (Azevêdo et al., 2010) and indicators of efficiency (Rosado Júnior & Lobato, 2010). Also in the methodological field, rich in innovation in knowledge, the study of Reis et al. (2009) should be highlighted. All of these advances, specifically in ruminant production, aim to maximize animal production, however, have some limitations for their standardization and dissemination in the technological field. Therefore, it is
feasible to say that there is a long way from the generation of knowledge to its transformation into technology.

In the field of genetic improvement, Ferraz & Eler (2010) propose public-private partnerships as a way to integrate all sectors involved in the generation of knowledge and technological innovations. Perhaps in this area of scientific knowledge and through the nature of their progress the direction of technological innovation, especially product, is evident. Here the first patent was obtained in 1991 with the discovery of genetic markers for milk quality, and includes the latest methods for large-scale identification of marker genotypes (Caetano, 2009; McManus et al., 2011). For the latter authors, the consolidation of this progress will depend on its analysis in a context of cost benefit and the true integration and evaluation of these technologies in the production system.

In non-ruminant production scientific progress is more rapid and discussions occur in areas such as nanotechnology, particularly for the improvement of nutritional health of animals and product quality (Kuzma, 2010).

Meat and milk are the main sources of animal protein and their supply chains use the value added in manufacturing as the most appropriate way for the introduction of a management practice, as well as tools and technologies. Therefore, the decision to use an innovation is designed to demonstrate the maximum value for the business. This is in reference to both product or process (Burrow, 2010). Igreja et al. (2010), through a study for development and innovation in the beef chain, indicated that the farmers want biotechnologies that can be incorporated quickly, reproductive technologies, precision animal production and information technology.

The consolidation of an innovation often depends on the time between its discovery and use. An innovation of high economic impact takes five years to go into use by the production system. On the other hand, if the economic results arising from their use are not clearly quantified the time frame is around 25 years (Moser, 2001). So it is understandable that the universe of knowledge generated by research in animal production, with rare exceptions, have difficulties in being appropriated and validated as a everyday use technological innovation.

Access to technological innovation is a competitive factor for animal production systems. In this sense, Oaigen (2010) and Marques (2011) developed and validated specific methodologies to assess competitiveness of beef cattle on farm. The method was based on questionnaires to farmers to analyze the drivers of competitiveness and their respective factors (Figure 4). At the same time, they identified the threats and opportunities for internal competitiveness, leading to an index of competitiveness for the production systems. The results showed the extent to which raising the level of competitiveness of the systems increased the demand for technological innovation. The studies also identified flaws in the system of access and diffusion of new technologies. Moreover, individualism in sector agents also constitute a barrier to access and introduction of new technologies. Revzanfar (2007) found that the greatest difficulties in the use of technological innovations in milk production systems included a lack of training, the asymmetry of information and transfer the new information and processes.

A study of scientific data bases including Scielo (http://www.scielo.br), Web of Science (http://
portal.isiknowledge.com) and Periodicals Capes (http://www.periodicos.capes.gov.br), using the analysis tool of data entry (QDA Miner) and specific statistics (Heatmaps, Dendrograms and Similarity Graphs), showed that applied innovation in the meat production chain has a 14% participation of the government dimension, 25% in science and 6% in media (Ceolin, 2011). The author found a positive similarity coefficient between innovation and costs, reproduction, feed and health with a greater emphasis on nutrition. The study suggests that there are promising perspectives in the area of nutrition for the development of technological innovations.

Understanding the signs of innovation, which are being sent to consumers and the information that consumers expect to receive from animal production systems, may facilitate research for scientific advancement accompanied by greater integration with society.

Innovation, entrepreneurship and a vocation in agricultural sciences

Necessity is the mother of invention, but to create the new it is necessary to have a clear need, a source of relevant ideas, information, meaning for the market and capital to invent. The perception of this may lead an individual to take steps towards a new business, a new posture or professional attitude. However, the group of instruments necessary to the successful entrepreneur, i.e. the technological know-how and domain of management tools, is seen as a consequence of the learning process from someone capable of defining attitudes when facing new contexts.

Entrepreneurship can be understood as a process by which individuals, acting alone or in organizations pursue opportunities without regard to the resources present. In addition, it is necessary to combine the companies with a sense of destiny, an understanding of technology trends and a dream of improving people’s lives (Lopes & Nantes, 2007). Therefore, the entrepreneur is a professional who meets a set of characteristics or prerequisites able to express themselves through an idea and, specifically, an innovative attitude (Figure 5).

Brazil is a country where the rate of entrepreneurship in the classic sense, is relatively high compared to the developed world. However, if the definition is widened to consider innovators, who are creative and persistent in introducing new ideas that truly contribute to the

Figure 5 - Characteristics of the enterprising professional.
field of animal production, Brazil’s participation is relatively modest.

Professionals in agricultural sciences need to look at the job market from a different perspective, as expertise and individual knowledge do not make much difference. The move is towards a complete conceptual fragmentation, where teaching and research remain in the questionable Cartesian model, i.e. based on specific expertise. New job requirements are marked by society, especially with regard to food production. Therefore, it is necessary to create interactive mechanisms between the different knowledge types reflecting on a new professional with a set of new skills and competencies (Figure 6).

In synthesis, the formative actions are founded on basic training, their understanding of basic knowledge is through the understanding of the conceptual model developed. From here it is necessary to understand the world before and after the farm gate as the basis for the professional actions within the production chain. His conceptual models should be aligned with an integrated view of knowledge - Production System. With this the market and the consumer will be more fully understood, because these are the main drivers for the technologies employed. Living with the “different or differences” will be essential for the professional so he does not remain in his comfort zone, thereby leaving the path of accommodation, stagnation and “mediocrity”. Therefore, the new professional competitiveness, now for a challenging environment is a result of new training actions, especially in the university environment, to incorporate five dogmatic principles (Figure 7).

Figure 6 - New approach to vocational training in agricultural science.
The curriculum and lecturers need to prepare students for the social, political and economic present and future, giving them a basis for identifying the problems of society, facilitating the process and giving them the ability to find solutions. Finally, we highlight that the university needs to train individuals for life.

Conclusions and Implications

There are clear signs of a lack of harmony between the demands of production systems, research and knowledge and technological innovation. The definition of the research problem focused on an innovative response stems from the knowledge of science applied in production systems. Only from this premise can the researcher be sure of his object of study. This is fundamental to reach the consensus that the problem characterized as relevant is associated with questions that have not been answered. Innovation originates in this assumption.

The new technologies will change from the model animal to the animal molecule. There will be intensive animal production systems, with productive efficiency based on lower maintenance costs and natural or less intensive systems based on preserving the genuine qualities of the product. The consumer will make his choice and be the driver for both systems.

Most technological innovations applied in animal production are only effective when managed in group. This is called the management of technology. Therefore, it is a process of management rather than of inputs. All management processes are characterized by slowness in utilization and commercialization. This may be changed in the future, but the complexities of the various factors involved in the contemporary production of food mean that this scenario will be difficult to alter. The result could lead to the validation of many processes and technologies to the point of being transformed into a product called input.

Competition between universities, research centers and the strengthening of public policies for the sector should result in greater efficiency. New products and market brands of technological processes will be developed. Only then will there be a rapid, balanced and generalized advance in the various fields of animal production to make it more competitive and attractive to farmers. This also includes input businesses involved in this segment, improving the economy of the country and ultimately reflecting in benefits for society.

It is worth reflecting on what we are producing in science at present and compare this with indications from the past so that we can be sure we are on the right path at the right time.
References


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