

The Experience of RI "Siga" towards Improved Research Capacity and Better Integration into European Research Area

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Abstract. Requirement of consumers towards quality and safety of food is increasing. The society is more materially secure, better informed and educated, and is paying more attention to food quality and health issues than 10-15 years ago. Industries, working in the field of growing and processing of animal food are interested to implement and use technologies which would ensure high-quality and healthy products. The Research Institute of Biotechnology and Veterinary Medicine "Siga" was founded in 1946 as the Institute of Zootechnics and Zoohygiene within the Latvian Academy of Sciences. In 1956, the Institute was reconstituted under the Ministry of Agriculture. Since 1963 it has been located in Sigulda, and in 1998 was integrated with the Latvia University of Agriculture. The mission of "Siga" is to develop scientific methods for obtaining high-quality, non-polluted, safe and healthy products from animals. The main research areas are: production methods of animal-origin products, improvement of the genetic potential of domestic animals, practical application of the genetic potential of various breeds, elaboration of selection conditions for healthy and economically profitable breeds, investigation of beef cattle breed acclimatization possibilities and cross-breeding effectiveness, elaboration of a beef-production system, elaboration of fodder preparation methods for increasing of the preservation and feeding-value, ecological aspects in the field of production of animal-origin products, development of new methods for prophylaxis and treatment of infectious and non-infectious diseases, organic farming, and elaboration of vaccines against infectious diseases and medicines from plant extracts.

Key words: consumers, food quality, safe food, healthy food.

Introduction

Fundamental sciences are critical to development since they act as the building blocks for the new technologies. The development of new and improved tools for control of animal diseases is unlikely to be successful without the basic knowledge. A strong base of fundamental science is essential if progress is to be made and if the competitiveness of European industry is to be improved.

Five potential barriers to the efficient transfer of technology to enable development of new products are identified: quality management, intellectual property rights, facilitation of technology transfer, education and training, and infrastructure. It is essential to minimize or overcome the effects of these barriers if the EU is to remain competitive, and to produce innovative and new products. Many enabling factors are involved in a successful delivery of the new products. Perhaps one of the most important is the urgent need to establish a method for Europe to identify innovation, ensure that the scientists involved understand the need to acquire patents and to fill the critical gap which currently exists between the science and the major pharmaceutical companies. A series of recommendations for action and research are made to improve the potential and reality of technology transfer.

The Research Institute of Biotechnology and Veterinary Medicine "Siga" (RI "Siga") of the Latvia University of Agriculture (LLU) is the leading research centre in Latvia and in the Baltic region in the field of elaboration of research for production of high-quality, uncontaminated, safe and healthy food of animal origin. "Siga" has obtained significant experience which can be used in the further scientific and research work. The developed promising research teams at "Siga" as well as the qualitative research carried out using insufficient research equipment demonstrated the feasible development potential. In order to become an excellence centre and to implement high-quality research, support for reinforcing research potential was necessary. Knowledge and experience improved, equipment updated, as well as targeted partnership with research centres in the EU, having similar scientific interest, is what "Siga" was missing for achievement of the goal till recently.

Only international collaboration in common European research area can ensure further development of agriculture science including food research. Soon after regaining independence, "Sigra" developed activities in the EU Common Research Space. For example, "Sigra" participated in the project "SafeFoodNet" and received funding within the 6th Framework Programme. Activities were continued in the 7th Framework where the project proposal "Unlocking Animal Food Quality Research Potential in Baltic Region by Developing Scientific and Technical Capacities of the Research Institute "Sigra"" (BaltFoodQual) was submitted.

The scope of the project is to develop science-and-technology (S&T) potential of the research excellence centre in Latvia – "Sigra" – in order to enforce high-level research on animal feed and food quality in collaboration with research teams from other EU countries, as well as to contribute to the development of research capacity of the Baltic region and its integration into the European Research Area (ERA).

The long-term objectives of "Sigra": to stimulate realization of full research potential of the enlarged European Union by unlocking and developing the present research potential in one of the convergence regions – the Baltics.

Short-term objectives of "Sigra":

- 1) to strengthen capacity of researchers to participate at EU level in the research projects and activities on animal feed and food quality;
- 2) to improve technical capacity to carry out high-quality research on animal feed and food quality and their impact on consumers' health;
- 3) to promote collaboration with other research institutions in the ERA, having similar scientific interest, in order to use research capacity more synergetically and efficiently.

Main activities planned:

- 1) secondments of the research staff;
- 2) development of the "Collaboration Research Program";
- 3) acquisition and development of research equipment;
- 4) organization of conferences and workshops;
- 5) participation in international exhibitions and congresses in order to disseminate information about the projects and the research institute;
- 6) publishing and dissemination of a brochure;
- 7) publications in scientific journals.

Results expected:

- 1) upgrading of the research and technical development (RTD) capacity and research quality;
- 2) better integration of the research team of "Sigra" into the ERA;
- 3) improved capacity of "Sigra" for participation in FP 7 projects;
- 4) formation of the Centre of Excellence in the research of veterinary medicine and animal science on the base of "Sigra".

Technology Transfer

There is an urgent need for the research scientists to understand technology transfer processes as many of the scientists do not consider the future development of their discoveries. The need for collaborative work between all concerned must be emphasized. A mechanism is needed which delivers flexibility by allowing a scientist to work collaboratively employing other specialized experts as necessary. It is often important to patent new discoveries so that companies are then prepared to take the risks involved in development.

The increasing gap between what is happening in research and the breeding and veterinary medicine practice (of an average-size breeding organization) must be recognized and addressed. We need to:

- optimize research to applicable results by increasing exchange of knowledge and technologies;
- increase collaboration between research and industry by decreasing the distance between new knowledge and new products.

Public funding normally supports activity at the front of the research-and-development (R&D) pipeline with industry picking up the costs once the uncertainties and risks are reduced to the point that a return on "shareholder" investment can be realistically envisaged. The point along the pipeline and which industry is willing to invest varies by sector, and the investment returns in agriculture are generally low. Therefore, public

fundors need to ensure that they are willing to fund both basic and strategic research relevant to farm animal breeding and reproduction if we are to realize the promise offered by current developments in the biological sciences. Mechanisms that support shared-cost projects between industry and public funds in the middle of the pipeline are particularly valuable mechanisms that should be developed further.

Technology transfer needs to be (come) an integral part of research. It is crucial for innovations to be implemented continuously. However, it is complicated for scientific results and, what is more important, the opportunities for the practice of scientific results to get their way to the breeding and artificial insemination (AI) organizations. The old situation of implementation from R&D in an institute/university to the research, science and development (R, S&D) in a company is a top-down approach that is not working anymore – a more interactive approach is needed. R&D of the industry will (need to) be more involved in/with the research in the institutions.

Examples of technology transfer are:

- government-industry-research programmes;
- club of interest around (complicated, precompetitive) research/education project;
- technology transfer facilitators partnering several (small-scale) industries and research organizations.

Public funding support of the pipeline should include appropriate structures and mechanisms that promote both business development from the research base, and product and process innovation in industry. Knowledge transfer networks or similar mechanisms that deliver two-way facilitation at the interface of scientific capability and industrial need within specific technology sectors are valuable mechanisms. In the animal breeding and reproduction sector, the combination of excellent scientific opportunities and structural challenges within industry means that public support of relevant knowledge transfer mechanisms is appropriate if the potential benefits are to be realized. "Sigra" has close contacts with more than 30 partner organizations (private farmers, professional associations) in Latvia to ensure technology transfer in the fields where the Institute is carrying out its activities.

Relevance to the Objectives of the Food Quality and Safety Priority

For Latvia as well as for European consumers, safety is a most important issue concerning food. Recent episodes have undermined public confidence in the capacity of the food industry and of the public authorities to ensure that food is safe. The European Union's food policy must be built around high food safety standards in order to protect and promote health throughout Europe. The objective of "Sigra" is to improve the health and well-being of Latvia citizens through a higher quality of their food, somehow re-addressing the classical "farm-to-fork" approach by giving priority to consumers, demands and rights for high-quality and safe food. This approach has a relevant impact on food production, i.e. we move from the needs of the consumer along the production chain rather than simply assessing the safety of the food being produced. However, food safety with respect to chemical contaminants cannot be assessed without appropriate exposure assessments and surveillance programmes from farm to table and increased capability of the scientific advice system, so as to guarantee a high level of human health and consumer protection. This implies that comparable standards of food safety should be elaborated and implemented throughout Latvia. Science has a paramount role concerning food safety, through the identification of sources and pathways of contamination, the assessment of the actual importance of specific pollutants and their impact on health, the elaboration of strategies for risk control and management which will assist in ensuring protection, particularly with the identification of the more exposed and/or vulnerable population subgroups. Therefore, the completion and smooth operation of the internal market for foodstuffs make it necessary to examine and evaluate scientific questions relating to food in such disciplines as medicine, nutrition, toxicology, food hygiene, biotechnology, and chemistry, particularly when these questions concern human health.

The primary goal of "Sigra" activities is to promote and facilitate the interaction of interested local parties with mainstream research activities, with EFSA and other international and supranational bodies or activities. The impact of this "Sigra" work will be at both national and European level. Problems will be characterized in terms of existing resources, infrastructures, organizational features, data sources, points of strength and weakness, with a view of contributing to improved understanding of gaps

and needs, and to highlight actions needed to harmonize processes in Latvia with those of the member states. At the European level, the results of "Sigra" will mainly contribute to a better integration of Latvia institutions involved in food safety with ongoing activities and bodies of the European Union, and to the development of durable links to join mainstream European research in related scientific fields. This work will ultimately lead to societal benefits in terms of consumer health.

Networks and Centres of Excellence

The 7th EU Framework Programme seeks to reduce fragmentation, develop synergies, avoid duplication, and enhance integration and coordination of the programmes of research. With major problems in animal food production, it is important to strengthen competencies and networking aimed at increasing collaboration between research centres, reference laboratories and other stakeholders. This is an essential component in strengthening the research area and in ensuring that Europe's position is not undermined.

Research should be concentrated in centres of excellence. Research institutions should avoid covering the complete range of subjects and instead should concentrate on specific areas of excellence although this could create the risk of "islands" of research and reduced knowledge about activities at other centres of excellence. Integration of researchers and good communication links are essential, and provisions should be made to encourage this. "Sigra" has advanced an aim to reach conformity to the requirements of the Excellence Centre in the year 2010.

Education

High-quality research needs to feed an effective R&D and innovation pipeline that delivers new or improved products and processes. To be effective and efficient, support is needed for people development – skills of the scientists and knowledge transfer (KT) professionals working in the research base and industry by means of:

- high-quality education encouraging a constant flow of young people interested in careers in the biological sciences applicable to animal agriculture and in veterinary medicine;
- graduates with the skills needed by the research base and industry including the interface of mathematics and biology, and of genomics/genetics and reproduction;
- encouragement of young scientists to take up research or innovation careers in the animal agriculture and veterinary medicine sector and to remain there as they grow in skills and experience;
- access to training in specialist skills (including KT and innovation);
- recognition that KT requires skilled professionals who understand and work with both the research base and industry. These individuals need appropriate training, public funding support and career opportunities. Fine-tuning with industry of methods, which works, is vital;
- fostering continuous professional development through distance and life-long learning mechanisms;
- people movement and sharing of best practice among and between the research base and industry through mobility funding;
- effective networks, partnering schemes and communication channels for professionals in the sector (industry and academia) to access up-to-date information and best practice across the whole EU and to propose common research programmes to the EU.

The research and innovation structures at both national and EU level need to ensure a healthy R&D pipeline with an appropriate balance between:

- "blue-skies" basic research of unknown application;
- strategic pre-competitive research aimed at particular applications or challenges;
- applied research with a direct and near market application in mind;
- innovation and development that convert scientific developments into wealth creation or other societal improvements.

"Sigra" pays attention to mentioned above issues in the field of education.

The Sigulda branch of LLU was founded in the year 2005 on the basis of "Sigra", and every year about 150 students are learning there. During the last five years, 5-6 post-graduate and 2-3 master degree students of LLU take their courses at "Sigra" yearly.

The Most Significant Investigations and Projects during the Years 2001-2009

The future activities will differ from the present situation – after fulfilling the development research capacities of "Sigrā" till the level of the Excellence Centre in the field of veterinary medicine and animal science in the year 2010, "Sigrā" will have such intellectual and technical potential that will allow determining the slightest changes in the metabolism dynamics of the animal's organism, and in such a way identify and solve the possible problems in animal feeding and in the evaluation of the animal's state of health as well as make the necessary recommendations to private farmers (Sematoviča et al., 2008; Šematoviča et al., 2008; Valdovska et al., 2008a; 2008b; Zitāre et al., 2002; 2003a; 2003b; 2005).

During the last ten years, investigations into morphofunctional state of the animal organs' tissue in the norm and pathology have been started in the world. Only regularities of the changes in cell structure allow investigating the new medicines and their effectiveness in order to solve issues pertaining to disease prophylaxis, to evaluate homeostasis of the animal's organism systems, possibilities of producing animal products and their conformity to the criteria for healthy and safe food products. The lifetime, destruction (apoptosis) and regeneration abilities of the organism's functional basic element – cell – are dependent on the environmental influence. If cell regeneration is not in the norm, functional deviations and diseasing process take place which clinical expression not always appear instantaneously. Morphofunctional characterization of cells, tissue and organs in the norm and pathology is essential in disease pathogenesis investigations as it has been observed in the investigations of cow spongioencephalopathy (BSE) pathogenesis during the last years and while compiling a database on differential diagnostics of animal diseases connected with nervous system diseases. To deepen the investigations, a new morphological laboratory is being developed at "Sigrā" in which investigations in histology, histochemistry and immunohistochemistry will be carried out by using the newest equipment and updated investigation methods. The investigations on Latvian Brown cattle breed PRL gene have begun to develop traits that will improve milk quality and quantity (Jemeljanovs, Konosonoka et al., 2008; Jemeljanovs, Sterna et al., 2008; Jemeljanovs, Zitāre et al., 2008; Sjakste, 2008).

Provision of the population with microbiologically non-polluted safe and healthy food products is one of the main tasks of the producers. The investigations carried out at "Sigrā" are connected with the identification of microbiological pollution sources of animal-origin food products in all links of these products' production chain. By using modern methods of microbiological investigations (chromomeric culture medium, BBL Crystal microorganism's identification system, Fourier transform infrared spectroscopy, etc.), different food polluting pathogenic microorganisms such as *Salmonella* spp., *Listeria monocytogenes*, *Bacillus cereus*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, etc. have been identified. During the investigations a special attention is paid to microbiological and mycological analyses of animal feed because the quality of animal feed affects animal health and safety and harmlessness of the raw materials of animal-origin food. The investigations into determination of aflatoxines B1, B2, G1, and G2 in animal feed, and aflatoxine M1 in milk by using ELISA equipment have been started (Jemeljanovs, 2004; Jemeljanovs et al., 2006a; 2006b; Konosonoka, Ciprovica, 2003; Konošonoka et al., 2004; 2008).

List of the Projects Elaborated at "Sigrā"

"Innovation technologies for obtaining high value, safe and healthy food products from genetically, physiologically and biochemically multiform plants and animals raw material" within the State Research Programme "Agro Biotechnology" (2006-2009).

Collaborative projects

Investigation of the regularities of plant conversion and biotechnological processes in animals for obtaining high-value food (2008-2004).

The influence of agrotechnological factors and health and welfare of domestic animals on the safety and quality of sustainable food products (2006-2009).

Investigation of the possibilities of evaluating grass fodder quality risk factors by regulating the fermentative processes during preparation, storage and feeding (2001-2004).

The influence of domestic animals' feeding factors on the cholesterol level and fatty acids composition and amount in the obtained animal food products (2001-2004).

The influence of destructive etiopathogenetic processes on the animal's physiological status and production (2001-2004).

Etiopathogenesis of cow's mastitis caused by the prevailing conditionally pathogenic microorganism associations and elaboration of scientifically based amboceptors for their prophylaxis (2001-2004).

Etiopathogenetic investigation of the reproductive system diseases, elaboration of scientifically motivated medicines and their influence on the product quality (2005-2008).

Investigation of the influence of the feeding value, hygienic status and aerobic stability of preserved fodder on milk quality with combined double effect additives (2005-2008).

Optimization of the protein metabolism processes in the organism of domestic animals for increasing the production quality in sustainable farming systems (2005-2007).

Morphofunctional investigation of the digestive system and its innervation, and a correlative analysis of the characterization of biochemical changes in the organism for diagnosis of diseases (2005-2008).

International projects

EC 6th Framework Programme Project "Chemical food safety network for the enlarging Europe" – SafeFoodNet.

EC 7th Framework Programme Project "Unlocking animal food quality research potential in Baltic region by developing scientific and technical capacities of the Research Institute "Sigra" – BaltFoodQual.

During the last 10 years, 44 projects in applied science funded by the Ministry of Education and Science and the Ministry of Agriculture were elaborated. At the beginning of the year 2009, "Sigra" has started to elaborate new projects funded by the Latvian Council of Science – "Investigations of the composition of cow milk lipids and their influencing ferments in connection with the content of carotenoids and tocoferol in the fed out feed", and "Factors influencing formation of the polycyclic aromatic carbohydrates markers – benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranteen, and chrusene – by using traditional meat and fish smoking methods in Latvia".

Conclusions

For further development of "Sigra" over the next 10 years it is vital to foster a creative environment for fundamental research and to stimulate investment in research, in particular in the fields of molecular biology, immunology, genomics, bioinformatics, etc. It is important to recognize that there is a considerable overlap between many of these disciplines which suggest that the fundamental sciences must be considered in a holistic manner to achieve the best results from research. A sound and stable base for fundamental science is vital if innovation and development of new tools are to be successful. To achieve this, programmes need to be established which inherently support fundamental research either directly or indirectly linked to the priority diseases and animal welfare.

A multidisciplinary approach should be encouraged involving all those whose input has the potential to identify or develop new concepts and take these through to proof of concept stage (European Technology Platform ..., 2006).

According to the Strategic development plan of LLU, "Sigra" should reach research capacities corresponding to the level of the Centre of Excellence, therefore it is important to identify all the functions which ideally would be included in the terms of reference for such a Centre and to develop a virtual centre which would involve all centres of excellence around Europe combined in a way to enable ultrafast information links and methods for data exchange.

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