# InoBioProd: innovation challenges and scientific perspectives

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**Keywords:**

InoBioProd
Milk
Goat
Innovation
Research
Education

**Article history:**

Received 30.04.2017
Received in revised form 24.06.2017
Accepted 29.06.2017

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**DOI:**
10.24263/2304-974X-2017-6-2-17

## Abstract

**Introduction.** InoBioProd represents the project under the title „Innovative product from goat milk with high biological properties" listed as independent project for young researchers, domain „Biotechnology", grant agreement No 16.80012.51.23A.

**Materials and methods.** Agrofood industrial wests and by-products are used as a source of bioactive copounds. At the same time goat milk, indigenous lactic acid bacteria and fermented milk products with high biological properties are main objects of research. Project intends application of standard and innovative methods and processes.

**Results and discussion.** The scientific results, in particular the expected technologies are absolutely innovative for the Republic of Moldova and are in the framework of the UNICEF recommendations for food and nutrition policy. InoBioProd contribues to the development of investigations in the field of food biotechnology, engineering technology, food chemistry and microbiology, offering a high potential for application: innovative methods for manufacturing of bioactive compounds from local food sources; chemical composition and functional potential of the bioactive compounds; characteristics of goat milk; isolation and identification of lactic acid bacteria from dairy products of spontaneous fermentation; symbiotic indigenous cultures of lactic acid bacteria; justified scientific manufacturing processes and recipes for fermented dairy products from goat milk and scientific development of methods for evaluation of the self-life of designed fermented dairy products. Special attention of InoBioProd gives to the elaboration of BSc, MSc and PhD thesis, dissemination of scientific results at national and international levels.

**Conclusions.** The Project was developed under the main provision of the local market - the lack of industrial production of the goat milk and products. In addition, it aims to initiate, develop and strengthen new collaborations of young scientists from R&D and higher education institutions.

## Introduction

In many regions of the world, food industry follows similar trends: increasing affluence, demographic changes and enhance consumer awareness of health. This trend has led to increased demand for ingredients and natural food products. For this reason, food industry experts are concerned on development of new, innovative products with ingredients that have additional benefits. One of the present trends of consumers is a greater consumption of foods with high content in biologically active compounds with positive effects on health.

Likewise, consumer interest has increased for „clean label" foods, with low content or without synthetic additives, but at the same time with high innocuity. InoBioProd proposes the use of indigenous agrofood sources known to have antioxidant and antimicrobial potential in order to improve food quality and durability and, therefore, food safety of fermented dairy products from goat milk. In addition, InoBioProd is aimed to strengthen scientific knowledge, promoting scientific cooperation and encouraging the interaction between the research institution and higher education and the creation of a common and shared scientific results, information and knowledge. Development of fundamental and applied studies with a high impact on the field of food technology, valorisation of local agrofood sources through innovative methods with the possibility of their use in diversification of fermented goat dairy products is an important issue of the InoBioProd.

In the Republic of Moldova is observed upward trend in the herd of goats, which currently lists about 120-130 thousand heads and produce about 70 thousand tons of milk annually. Goat milk has a promising source of protein, vitamins, minerals and fatty acids [2, 4, 7]. Goat milk has better digestibility, reduced allergenicity, due to the low content of lactose [11, 15]. From goat milk usually obtain butter, yogurt, sour milk, catic. Fermented dairy products has delicios sensory properties, fine consistency and pleasant specific taste. In the Republic of Moldova goat milk is not used at industrial level and in the markets those dairy products from goat milk is absent. Currently Moldova has no scientific results about goat milk processing.

Internationally the theme proposed for research is carried out on the preparation and optimization of manufacturing technology of yogurt from goat milk [3, 10, 20]. There are also conducted research on the analysis of physical-chemical, microbiological and sensorial properties of yogurt from goat, bovine and cow milk [9, 13, 23]. There are comparative study on influence of the incorporation of synthetic and natural preservatives on the yogurt characteristics [6]. Some researchers conducted studies regarding the improvement of the properties of goat milk yogurt by adding aromatic oils and plant [1]. The study conducted by scientists from Bulgaria showed the possibility of yougurt supplimentation with fruit juice [5]. Documented results are aimed to understand the correlation between fortification with shell pineapple and physico-chemical and rheological properties of yogurt with probiotics [21]. The results of researchers from Sri Lanka have shown that incorporation of beetroot juice can be an insight to improve the characteristic organoleptic properties of goat milk [8]. A group of scientists studied the effect of Cinnamomum verum yogurt fortification with Allium sativum and the bifidobacteria [24]. The level of applied knowledge about technology production of yogurt from goat milk and nutritional properties in our country is lower compared to other developed countries.

The research team has already achieved certain results in the field (scientific results have been disseminated in research journals and communicated at different scientific events) [16-19]. Scientific and research activities planned under the Project InoBioProd is strictly necessary to extend these achievements and obtain some of innovative elements of research.

## Mission of the InoBioProd

Integration of the Republic of Moldova into the European Union imposes special requirements on the quality of food products in the country. Increased worldwide demand for goat milk production due to impressive health benefits [22, 25]. Ministry of Agriculture and Food Industry of the Rpublic of Moldova also notes the need of manufacturing of these products on industrial scale, and lack of advanced technologies, normative documents regarding the quality and safety of those products in accordance with international regulations.

InoBioProd Project provides the development and further research with impact in valorisation of goat milk through innovative methods [12, 16]. In particular, it is planned to develop and diversify fermented dairy products with indigenous lactic acid bacteria with characteristic symbiotic and bioactive compounds with functional potential (Table 1).

InoBioProd research Project solves scientifical and practical problems. Project research team includes young competent specialists in organizing and conducting investigation. A strong innovation potential resulting from large-scale approach to technology development of fermented dairy products with high biological properties, due to the direct colaboration of specialists in food technology, biotechnology and microbiology.

## Potential Activities of InoBioProd

The Project facilitate the development of science in the field, ensure increasing of research capabilities, innovation and dissemination of obtained scientific results and strengthening scientific collaboration of young researchers from R&D and higher education institutions.

Reseachers use obtained bioactive compounds from local agrofood sources in the manufacture of fermented dairy products from goat milk with indigenous lactic acid bacteria. The InoBioProd potential activities are organized in 4 Work Packagies, each managed by a work package leader responsible for the outcome and timing of its work package (Figure 1).

The figure 1 shows the graphical presentation of the four WPs and their independencies. WPs include also the main outputs, which will be obtained thanks to the planned activitiess. Relationship with Scientific and Practical Institute of Horticulture and Food Technologies (SPIHFT) and Technical University (TUM) are also highlighted.

## Methods and experimental protocols

The research is organized into special teams according to the activity directions. The Project is designed with technological, physico-chemical, biochemical and microbiological standard methods, in accordance with the ISO (Official Methods of Analysis of AOAC International). Statistical method, including the analysis of experimental data by means of control charts X-R, $S^2$, and other methods are applied. The Project applies new methods and processes (Figure 2).

**Table 1**

**Strategies of the InoBioProd Project**

| | |
|---|---|
| **Concept** | – The Project is oriented for production (from laboratory to market).<br>– Elaboration of methods, technologies and technical regulations for fermented dairy products from goat milk.<br>– Project includes strategic direction of development of innovative and competitive food product with positive implications on consumer health. |
| **Objects** | – Bioactive compounds from local food sources.<br>– Goat milk.<br>– Indigenous lactic acid bacteria.<br>– Fermented dairy products with high biological properties. |
| **Objectives** | – Fabrication and characterization of bioactive compounds from local vegetal sources using innovative techniques.<br>– Isolation, selection and testing of new indigenous lactic acid bacteria for fermentation of goat milk.<br>– Development of technology to produce yogurt from goat milk. Recipes and technological flux that keep native and curative nutritional properties of goat milk.<br>– Testing functional potential of bioactive compounds on the quality and self-life of yogurt.<br>– Evaluation of the quality characteristics of yogurt from goat milk. Safety and inoffensiveness properties.<br>– Establishing the self-life of yogurt. Methodology for the evaluation of yogurt shelf-life.<br>– Preparing young specialists/researchers in the field of biotechnology, engineering technology, quality and safety through the development of BSc, MSc and PhD theses. |
| **Ideas and original features** | – Advanced Processing of local food sources to obtain bioactive compounds with functional potential.<br>– Use of lactic acid bacteria with symbiotic characteristics from indigenous sources.<br>– Creation of fermented dairy products from goat milk with high biological properties for consumers benefits. |
| **Interdisciplinary character** | – Novelty and unique methodological approach of the Project consists in different fields of application (biotechnology, engineering technology, chemistry, microbiology) to obtain original data for the creation of innovative product.<br>– Project team consists from young researchers of different profiles that will ensure a comprehensive approach in goals achievement.<br>– The Project intends collaboration of young and experiensed researchers in the field of food industry. |

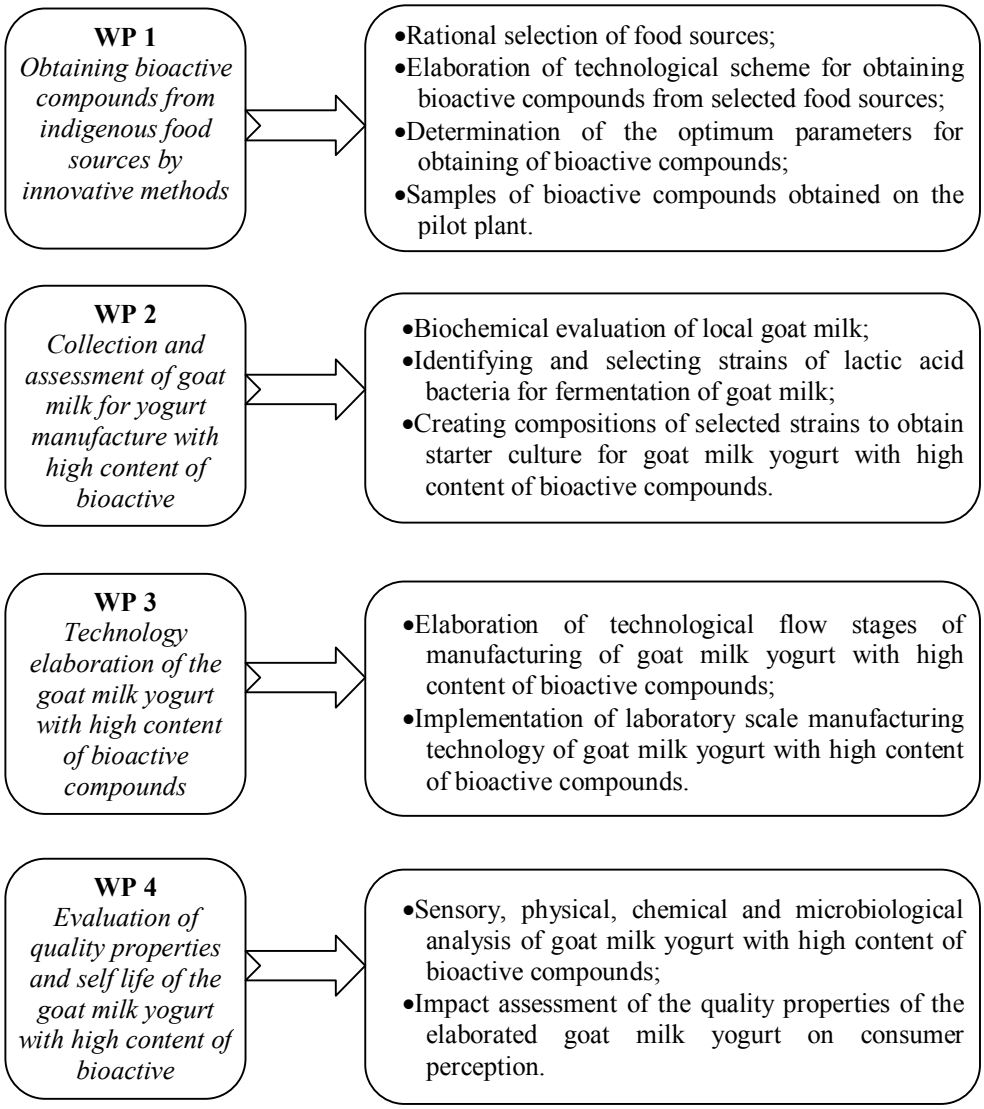


**Figure 1. Main stages of realization of the InoBioProd**

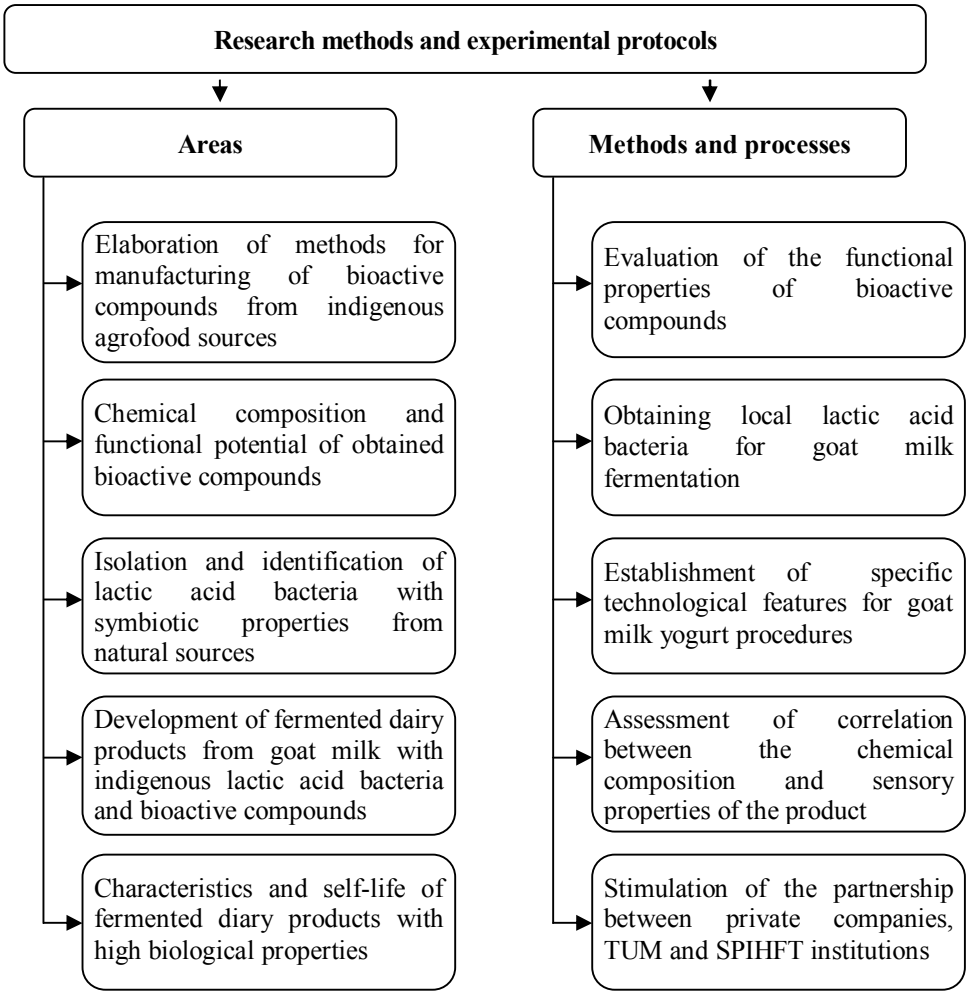


**Figure 2. Research areas, methods and processes of InoBioProd**

## Expected scientific results

InoBioProd Project contribues to the development of investigations in the field of food biotechnology, engineering technology, food chemistry and microbiology, offering a high potential for application:

- Innovative technology for manufacturing of obtained bioactive compounds from local sources;
- General characteristic of functional potential of bioactive compounds;
- Scientifically justified process for producing of goat milk yogurt with high biological properties;

- Sensorial, physico-chemical, structural and microbiological properties of developed yogurt;
- Technical regulations for goat milk yogurt.

However, manufacturing technology of goat milk yogurt by using original physical and chemical methods is a perspective direction that has a real potential for patenting. Unordinary solutions for resolving actual problems are expected. Real objects for patent present know-how, intellectual property of authors. It is obvious that the degree of patent and intellectual capacities depend on the level of special knowledge and fundamentals of young researchers, the ability of creative thinking, problem solving skills in biotechnology, engineering and microbiological analysis. Predicting the level prior patent is planned based on the preliminary results of the team, the dynamics of obtaining these results, the number of patents remain in force, whose authors are members of the team, the number of patents can be estimated:

- Patents regarding to processing technologies of raw materials 1-2 patents;
- Patents regarding to elaboration of food products 1-2 patents.

We note that this "account" number of patents do not appreciate their quality parameter, which we consider basic to any business, especially the scientific research.

## Benefits of InoBioProd

The Project contributes to the diversification of food technology through valorisation of emerging technologies to meet the demands of consumers. The Project induces increased use of existing infrastructure, improves documentation and scientific information on basic and applied research in the field of food quality and safety, helps to explore human, research and development resources. The most valuable results are planned to be implemented partially at specialized university courses. Benefits of the InoBioProd Project have several areas (Figure 3).

The InoBioProd Project contribute significantly in the training of young researchers through obtaining team building skills for planning and conducting scientific researches, accumulation of new knowledge, obtaining and dissemination of scientific results. To increase participation and capacity of team building of young researchers in the Project are intended to finish PhD thesis of team members.

Realization and defending of PhD thesis in the frame of InoBioProd Project will increase the number of young researchers with scientific grade and respectively national competitiveness of internationalization and participation in different international programs, including the Framework Programme H2020.

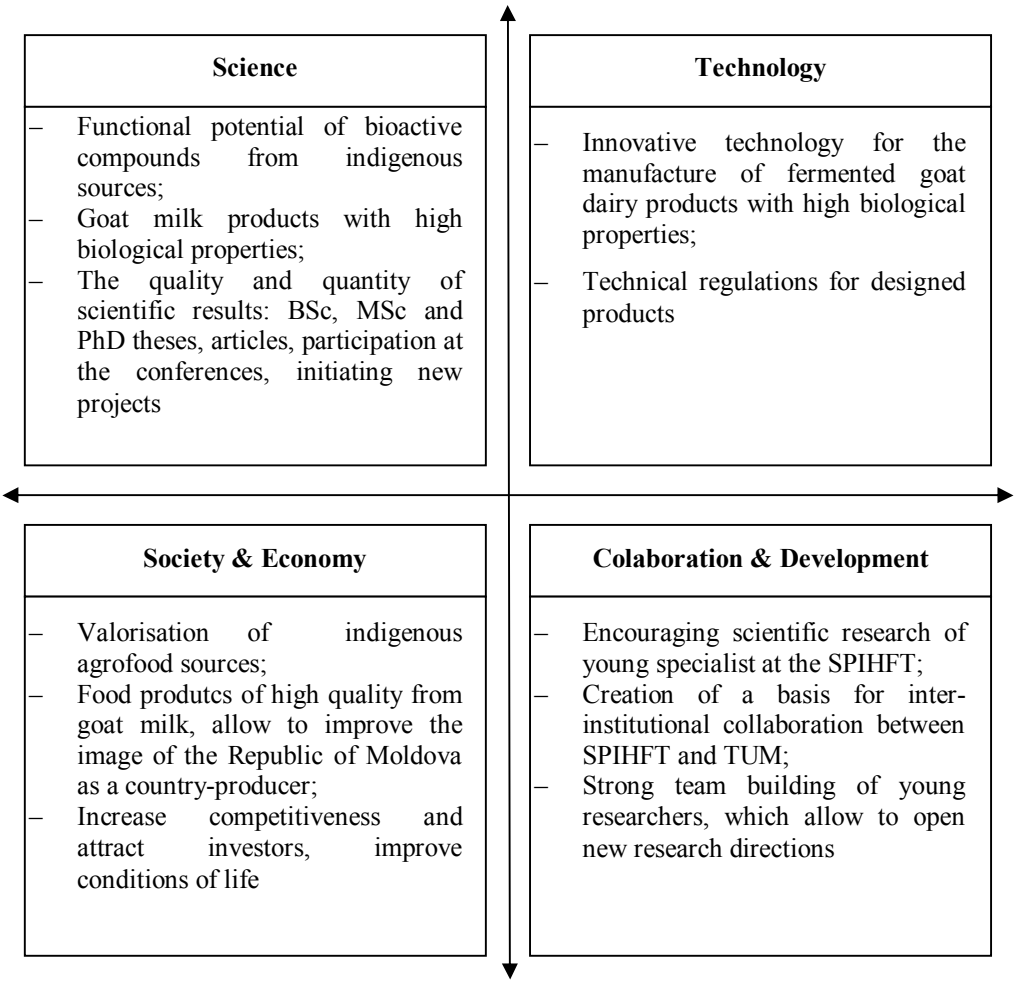


**Figure 3. The Benefits of InoBioProd**

## Application of InoBioProd

Considering the importance of fermented dairy products from goat milk, which are in demand on internal and external markets, elaboration of the technological process for manufacturing of the products is necessary. Developed processes for the production of yogurt from goat milk with high biological properties will be approved in the *Laboratory of Food Biotechnology* of Scientific and Practical Institute of Horticulture and Food Technology and *Scientific Centre for Training and Technology Transfer in Food Industry of TUM* in the frame of "Etalon" enterprise. Application of the results on a large scale will be possible in case of producers motivation for investment in manufacturing new developed products, because all economic units, dealing with dairy production in the Republic of Moldova are private.

At the first stage of research results implementation, potential beneficiaries are small private enterprises (II and SRL) from the filed of dairy technology. Furthermore, the volume of internal production of goat milk allows loading of enterprises of SA "JLC" type with high volumes of work.

Application of InoBioProd Project results in research and education is a step of major importance. The results will be included in the cycle of lectures, seminars and laboratory works for training in higher education, first and second cycle disciplines: Dairy Technology, Food Biotechnology, Food Chemistry, Physical Chemistry (Figure 4).

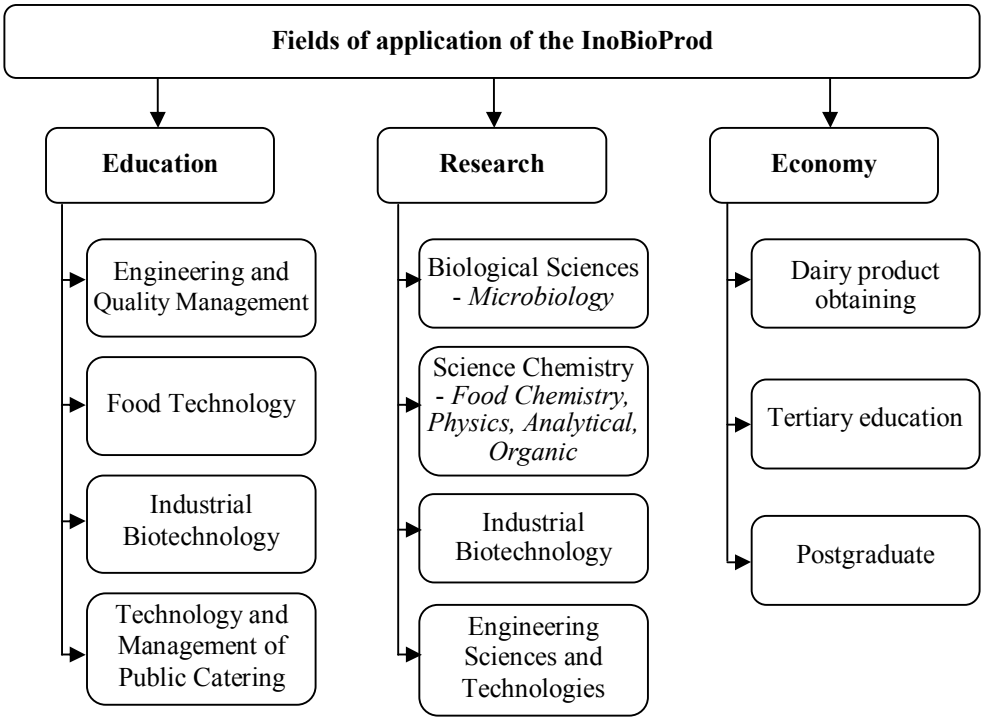


**Figure 4. Application of InoBioProd**

## Perspectives and further research

Effective methods for bioactive compounds obtaining, identifying indigenous lactic acid bacteria, developement of yogurt with high biological properties and analysis of scientific results contribue to training and development of young researchers in the field.

During the Project work there is build a team of young researchers with high-potential, their results create perspectives for further research in the frame of the European Partnership for innovation and technology, increase competitiveness through creation of opportunities for new consortia (units, scientific researchers - businesses) to develop new

improved technologies to increase the added value of technology at enterprises. In addition, this create opportunities for international collaboration through achieving top results, with prospects for marketing of new products.

The Project contributes to the diversification of food technology through valorisation of emerging technologies to meet the demands of consumers. The Project induces increased use of existing infrastructure, improves documentation and scientific information on basic and applied research in the field of food quality and safety, helps to explore human, research and development resources. The most valuable results will be implemented at specialized university courses.

## Conclusions

Consumer interest for potential health benefits of a proper alimentation has led to a growing importance of the relationship between diet, specific food ingredients and health. Through the InoBioProd, it facilitates the development of science to solve some problems in this field, ensures increased research capabilities, innovation and dissemination of obtained scientific results and strengthens scientific cooperation of young researchers of R&D and higher education institutions of the Republic of Moldova.

InoBioProd is planning to elaborate methods and recommendations on technological regimes for manufacturing of bioactive compounds from agrofood sources; technological scheme for obtaining of bioactive compounds; evaluate characteristics of nutritional, antioxidant and antimicrobial potential of samples of bioactive compounds and propose procedures and recipes justified scientifically regarding the manufacturing of yogurt with high biological properties according to the international regulations on food processing.

**Acknowledgments**

This work was done in the framework of Independent Project for Young Researchers 16.80012.51.23A "Innovative product from goat milk with high biological properties" (InoBioProd), cofounded by the Ministry of Agriculture and Food Industry and coordinated by the Academy of Science of Moldova.

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