1. BACKGROUND INFORMATION

1.1. Partner country

The Republic of Turkey

1.2. Contracting authority

Ministry of Industry and Technology, Directorate General for European Union and Foreign Affairs - Directorate of EU Financial Programmes (MolT/DoEUFP}.

1.3. Country background

After the recognition as a candidate country in the Helsinki European Council in December 1999, Turkey started to fully benefit from the pre-accession funds of the new Instrument for Pre-Accession regulation (IPA II) which came into force in March 2014. IPA Il covers the 2014-2020 period and aims to provide EU support in implementing reforms to move towards EU membership.

Improved competitiveness towards a model of increased export is the key factor to rebalance Turkey's economic growth, which is currently highly dependent on domestic demand. Ministry of Industry and Technology (MolT} is the leading institution in competitiveness and innovation sector, which acts as the operating structure for the Competitiveness, and Innovation Sector Operational Programme (CISOP) in IPA II. The aim of the programme is to improve the business environment and strengthen research, technological development and innovation. The overarching strategy of the ClSOP is rooted in the NDPl0's growth strategy: "Developing an export-oriented, private sector-led competitive production structure by increasing productivity and accelerating industrialization". More specifically, CISOP's main strategy consists of followings:

- Enhancement of the functionality of the existing or developing, public and private research infrastructure in Turkey.
- Improvement of the functionality of the structures/ facilities that incubate innovative start-ups and SMEs.
- Improvement of university-industry collaboration.

For detailed information on IP A-II period and CI SOP please refer to:

https://rekabetcisektorler.sanayi.gov.tr/tr/cati/?bref=RSP2&kref=Dok%C3%BCmanlar&sref=AraSaya

As regards competitiveness and growth goals of IP A Programme, significant challenges foreseen in all enlargement countries, especially for agri-food sector. Turkey has the land, labor, location, and climate needed to potentially supply high-value products to domestic and European markets. However, high technology business environments should be strengthened so as to create added-value product chains.

Most of agricultural technology developments are specific to geographical regions, which makes technology transfer more complicated than industry sector. This makes imperative to conduct region specific research in order to close the technology transfer gap. Despite its rich genetic resources and suitable land and climatic conditions, Turkey lags behind its targets by means of productivity and efficiency increase using new production technologies such as biotechnological methods. Transforming agricultural activities into a new industry can only be possible by using the advantages of new biotechnological and high-tech agricultural methods and by creating and reinforcing the capacity of producers through incubation, trainings and awareness raising activities.

Agrigenomics is the application of genomics to agriculture, livestock breeding and food sector with the intent of increasing and sustaining productivity.

Main disadvantages of SMEs in the field of Agrigenomics sector in Turkey can be summarized as follows:

- High manufacturing costs due to high infrastructure investments
- High manufacturing costs due to foreign dependency on high-tech analyses (increasing of cost up to 50% related to exchange rates, tariffs, shipping, time constraints)
- Lack of compliance to international standards (accreditations, certificates etc.) due to limited financial resources resulting in difficulties in penetration to international markets and scaling-up the production
- Failing in translating research into a commercialization success

1.4. Current situation in the sector

According to market analyses, the size of the Agrigenomics sector was 8.6 billion $ in 2015 and is expected to reach l 3.5 billion $ in 2021 in the world. The study is confined to platforms, consumables and services provided by few companies. Nowadays, the sector is dominated by the demand for the agricultural products; however, better growth is projected in the area of livestock breeding due to the rise in demand for genomic databases by livestock breeders. Next Generation Sequencing (NGS) ensures faster, more accurate, more reliable and more cost-effective solutions. Researchers are using microarray and next-generation sequencing (NGS) technologies to study various aspects of plant and animal genomics, including genotype, gene expression and regulation, and epigenetics. These approaches offer the throughput, sensitivity, and precision needed to

evaluate genetic markers and discover new ones associated with traits or disease.

Agriculture, Food and Livestock sectors come in the first lines of strategic sectors pointed on

Turkey's Policy Documents.

Industrial applications about Agrigenomics sector in Turkey is increasing with each passing day. Agrigenomics activities are carried out by agricultural biotechnology firms. Also, scientists have many research projects in this topic. Nowadays, Agrigenomics sector is evolving in the world and in Turkey. Statistical data of agricultural biotechnology in Turkey were summarized as stated below.

- 273 companies applied to TUBJTAK-TEYDEB for 438 projects in biotechnology field between 1995 and 2014. 267 of these applications from 197 companies were accepted with a total of 61 Million TL grant (2014 base prices).
- 73 companies of which working area is NACE Rev.2, 72.11. "Research and experimental development on biotechnology" were supported by KOSGEB.
- 85 biotechnology projects (27 of them agricultural biotechnology) were granted by Ministry of Industry and Technology -University-Industry Collaboration Program between 2006 and 2013.
- There are 236 biotechnology projects in 154 companies (25,97%) is in agriculture biotechnology, 8,44% is in bioinformatics field) operating in Technology Development Zones (Act No 4691).

9 out of 40 agricultural biotechnology companies are located in Ankara University Technology Development Zone corresponding to a ratio of 22% of all companies in Turkey which is the highest rate. Only 10 of these companies are exporting. It is of critical importance that entrepreneurs and academics start-up companies established in the Technology Development Zones conducting sustainable R&D projects, product development and commercialization activities in this field as well as improving the capacity of enterprises to utilize R&D results, innovation and technology commercially for products, processes and services.

Agrifood is one of the leading sectors in Turkish economy having 6.1 % share of GDP and

contributes to the economy with 57,3 billion $ added value in 20165. By applying genetic research outputs in Agrifood sector, high-tech products will increase the competitiveness of SMEs.

The main components of agricultural productivity increase are;

a) Field change
b) Improvements in efficiency
c) Product pattern diversification
d) Product pattern and efficiency interactions.

In Turkey, most of the SM Es having the potential of using Agrigenomics methods are start-ups and academic spin-offs lacking the resources and time needed for sustainable manufacturing and growth. Agrigenomics is a field of expertise where technology and know-how evolves fast. Therefore, it has a great potential for (bio) technology transfer and industry-academia collaboration.

Infrastructures in Biotechnology and Agrifood fields are generally established within the framework of investment programs for basic and applied research activities that are carried out by universities and public institutions in consideration of national priorities.

It is understood that the activity areas of the research infrastructures and the studies which are conducted under universities and public institutions are largely parallel to the biotechnology research trends of the world. They use the R&D and innovation support from the Ministry of Industry and Technology, TOBiTAK, the Ministry of Agriculture and Forestry as well as EU framework programs for their projects. It is observed that the cooperation of research centers with universities, private sector and international counterparts is not at the desired level. Hence, the establishment of Agrigenomics Hub will increase manufacturing and rise the scientific standards of all shareholders in agricultural biotechnology sector. Thus, the whole process for reaching biotechnological research will be flourished both in national and international level.

DNNcell/genes are important part of -R&D activities in the field of biotechnology. So, establishment of DNA / gene bank infrastructures so as to keep them under appropriate conditions, is ongoing. DNA / gene bank infrastructures in Turkey listed below;

Infrastructure	Institution
National Indigenous Animal Gene Bank	Ministry of Agriculture and Forestry - Lalahan Livestock Central Research Institute and TÜBİTAK MAM
Biotechnology Reference Center	Alata Horticultural Research Station
Seed Gene Bank	Central Research Institute for Field Crops of the Ministry of Agriculture and Forestry
National Food Starter Culture Gene Bank	Bursa Food and Feed Control Central Research Institute Directorate
DNA identification of STR and DNA strands	Veterinary Control Central Research Institute Genetic Laboratory of the Ministry of Agriculture and Forestry

Some Research Infrastructures in Higher Education Institutions and Public Institutions in the field of Agrigenomics given below;

- Ankara University Biotechnology Institute
- Adnan Menderes University Agricultural Biotechnology and Food Security Research Center
- Akdeniz University Food Safety and Agricultural Research Center
- Cukurova University Biotechnology Research and Application Center

Ankara University TIO currently in close cooperation with Akdeniz and Cukurova Universities. Once the Agrigenomics Hub is operational, all those research infrastructures will be informed, and possible cooperation strategies will be investigated.

New Perspectives via Agrigenomics Hub: Above-mentioned 4 research centers have training, consultancy and testing services for biotechnological research in food, agriculture and livestock breeding sectors. None of them has applicable quality management system and/or accreditation for certification. These research infrastructures are also being used by academia and companies are using their results. Agrigenomics Hub which will be operationalized within this project, on the other hand is going to be high technology design, prototype manufacturing and testing provider for food, agriculture and livestock breeding sectors. SMEs will be able to use Agrigenomics Hub's accredited infrastructure for their research. They will also be able to implement their R&D projects in collaboration with academia. Incubation, mentorship and accelerator programs will enable SMEs to reach high tech food, agriculture and animal husbandry market.

In order to address the issues mentioned above, Agrigenomics Hub will be operationalized to serve as a specialized Hub on high technology design and prototype manufacturing for agrigenomics sector. This project will also aim to increase the capacities of agrigenomics SMEs and entrepreneurs as well as will boost R&D and product development of SMEs in Agrigenomics.

1.5. Related programmes and other donor activities

A link and synergy could be established among this operation and below operations in order to boost the efficiency and effectiveness of this operation. Best practices and experience could also be shared among the operations.

- Ankara University has several BSL-3 (Bio Safety Level) laboratories and GMP (Good Manufacturing Practices) accredited infrastructure established under the Presidency of the

Republic of Turkey, Department of Strategy and Budget. These infrastructures can be linked to Agrigenomics Hub services;

- Ankara University Technology Transfer Office offers Pre-Incubation, Incubation and Accelerator Services to Ankara University students, alumni and academic staff (These services supported by TUBITAK. 1513 Program).
- Ankara University Technology Transfer Office continues Technopreneurship Support
- Program for Entrepreneurs in 2 fields; i. Sustainable Agriculture and Nutrition, ii. Well Life and Medical Technologies {These services supported by TUB IT AK 1512 Program).

2.OBJECTIVE, PURPOSE & EXPECTED RESULTS

2.1. Overall objective

The overall objective of the project of which this contract will be a part is as follows:

- To develop thematic competencies in Agrigenomics sector to increase research and development capacities of Turkey.

2.2. Purpose

The purpose of this contract is as follows:

To increase the R&D, product development and competitiveness capacity of SMEs in Agrigenomics sector of Turkey.

2.3. Results to be achieved by the contractor

The Operation shall pursue the achievement of the following results:

• Having operational and accredited Agrigenomics Hub-Animal and Plant Genomics Research Innovation Center and shared infrastructure for SMEs/entrepreneurs in the field

•Increasing the Productivity and Product Development Capabilities of the Agrigenomics SMEs and Entrepreneurs in the field.

4. SCOPE OF THE WORK

4.1. General

4.1.1. Project description

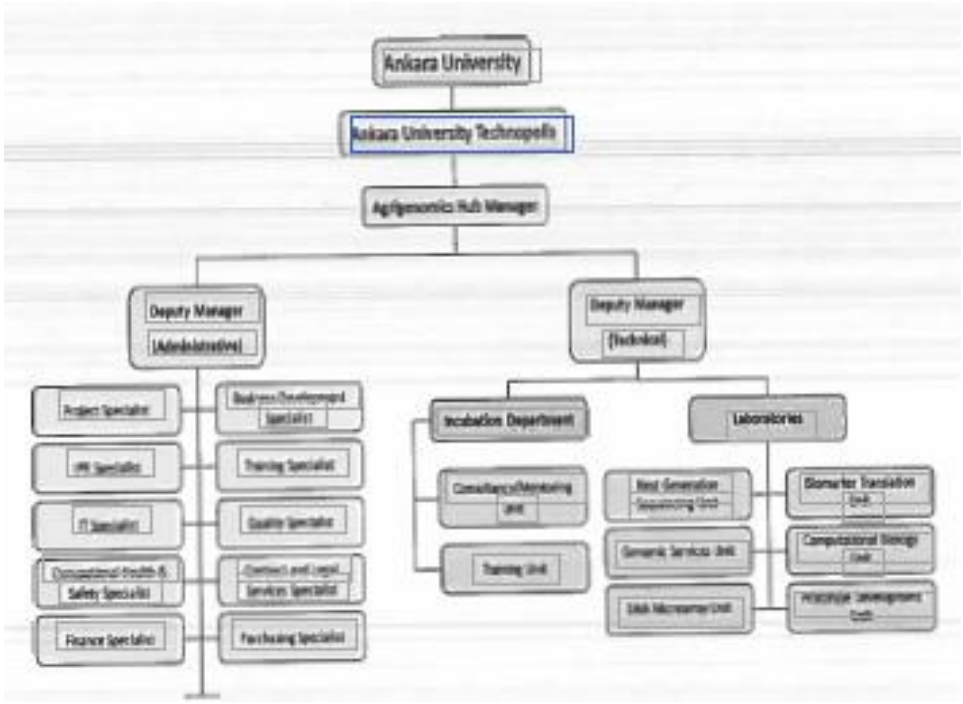
The Operation is in line with the CISOP under the specific Activity 2.1: "Research and Development". Expected contribution of the Operation to the targets of CISOP is presented in the following table:

Output Indicators	CISOP Targets	Operation 's Contribution
Number of research partnerships initiated for development new and innovative products	10	3
Number of new and innovative products developed and prototyped	60	12
Number of national patent applications	60	7
Number of international patent applications originated from Turkey (PCT + EPC)	12	2
Number of woman researchers (Eng., tech etc.) involved in R&D projects	45	15
Result Indicators		
Number of national patents obtained	30	3
Number of international and regional approved patents (PCT +EPC)	7	1
Number of products, including eco-innovative products successfully commercialized	12	1
Number of innovative enterprises created	50	5
Number of research job created in supported entities /enterprises	150	20

The Operation is composed of Technical Assistance and Supply components. The Agrigonemics Hub-Animal and Plant Genomics Research Innovation Center, hereinafter the Hub, will be located in the Ankara University Technopolis' Thematic Campus on Agriculture, Livestock and Food Center. Construction and infrastructure of the Hub, by the ERA, will be completed before the delivery of the supplies. On-the-job trainings of supplies will be the responsibility of supply contractor (s).

Within the scope of the TA Component (which will be referred to as 'the Project'), Agrigenomics Hub will be operationalized to serve as a specialized Hub on high technology design and prototype manufacturing for agrigenomics sector. This project will also aim to increase the capacities of Agrigenomics SMEs and entrepreneurs as well as will boost R&D and product development of SMEs in the field.

Indicative organizational structure of Agrigenomics Hub is given below. Managerial roles and responsibilities defined under the Administrative Manager of Agrigenomics Hub as well as Incubation Department activities will be conducted by Ankara University Technopolis and Ankara University Technology Transfer personnel. The project partner Ankara University Agriculture Faculty Evolutionary Genetics Laboratory (eGL) is going to be responsible for the activities under 6 technical units (laboratories).



Agrigenomics is the application of genomics to agriculture, livestock breeding and food sector with the intent of increasing and sustaining productivity.

At first, techniques used in Agrigenomics can be seen as individual tests/analyses that can be provided from independent firms or laboratories. However, these tests/analyses have to be realised in comprehensive and full-fledged centers in order to make meaningful and applicable inferences from the results of these test/analyses which can be used as cost effective, time-saving, reliable and accurate analytical solutions for specific demands of the clients.

These methods such as next generation sequencing (NGS), single nucleotide polymorphism analysis ($NP), real-time polymerase chain reaction (RT-PCR), development of microarrays is planned to be offered to SMEs through Agrigenomics Hub Units given in the organization chart.

4.1.2. Geographical area to be covered

Ankara region with all districts.

4.1.3. Target groups

- SMEs
- Small-sized (micro) enterprises
- Entrepreneurs
- Start-ups

4.2. Specific work

This Technical Assistance contract is composed of two activities:

- Establishment and Operationalization of the Agrigenomics Hub (Activity A)
- Increasing the Productivity and Product Development Capabilities of the Agrigenomics SMEs and Entrepreneurs (Activity B)