

Importance of Innovation in Agriculture

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Abstract: This paper focuses on how companies can develop new technologies leading to high added value products. The impact and importance of R&D and innovation in the long term success for different sectors is discussed with special emphasis on the agricultural sector. The sectoral distribution of national R&D and innovation grants is analyzed and the agricultural sector's share discussed. Since innovation and R&D have a huge impact on the development of new technologies, companies are encouraged to engage in innovation and R&D, and be informed about the ways and means of obtaining financial support for innovation in Turkey. Subsequently, a new innovation network is being proposed to initiate an innovative approach in existing companies as well as to promote the establishment of new innovative companies.

Key words: Agriculture sector, R&D, innovation, innovation network

INTRODUCTION

Due to changes in demand and a rapid reduction in natural resources, very high competition in all sectors, including agriculture, has been created. It is already well known that Turkey is an agricultural country with rich natural resources. In spite of this, competition is very high in the agricultural sector as well as in others.

It has been accepted, specifically by developed countries, that the agricultural sector is strategically important today and will continue to be so in the future. Therefore, many countries have started to create major projects in the sector.

Even large companies can stay in the market, as long as they focus on R&D and innovation projects. In addition to this, companies should increase their skills of innovation. To remain competitive and thus retain advantages in the market companies need to develop their ability to supply new products and innovations before their competitors. Competition has pushed companies to cut their expenses, as a result of which they generally outsource their innovation and R&D projects, instead of doing everything in-house. In this

way, efficient use is made of limited resources and also companies profit from external knowledge.

The gradual increase in demand for agricultural products has channeled companies towards innovation and R&D for both products and process. Likewise from seed to machinery, from plant to harvest, many R&D and innovation projects have been implemented, As a result of this work, new products and systems have been introduced into the marketplace. In order to become a major player in the agricultural sector, it is not enough to have large fields, sufficient water resources and to use them efficiently, it is also very important to employ researchers effectively and to channel them towards research and innovation. This will bring highlight the need for new technology. It is of prime importance to first to find out our strengths in the agricultural sector and then to strengthen our power in that sector. Without doubt, it is necessary to support all steps, from the acquisition of knowledge and skills to the final technology in order to achieve success in technological development.

R&D, INNOVATION AND THEIR IMPORTANCE

In today's economy all economic units are involved in competition. In order to be competitive, companies have started to focus on innovation; therefore, the starting point of competition has been moved from product to R&D and innovation projects. This can be seen from the usage, sequence of terms; invention, R&D and innovation in daily life.

Invention has been described as a technological achievement that has not yet been commercially exploited (BEIJE, 1998). It has also been described as a product (prototype) which is converted from knowledge (CYER, MOWER 1987).

Innovations are new things applied in the business of producing, distributing, and consuming products or services. They can take many different forms, such as new management procedures, new financial services, new distribution facilities, new products and so on (BEIJE, 1998).

Innovation was accepted as the engine for companies' success in the 20th century. However, nowadays, due to more rapid changes in technological development and continuous change in consumer demand, success in a competitive market is not permanent. To cope with this, a prime objective of companies must be to enhance their skills so as to be able to bring out new products continuously, before their competitors, by defining and establishing new and appropriate R&D projects. Companies should have an effective mechanism for implementing the above strategy and should consider innovation management as a crucial and main objective. Although it is a part of the purchasing, marketing and production unit, the "R&D Unit" has a unique role to play in continuous R&D and in the innovation process: It is therefore essential to support this unit financially.

It is extremely difficult to predict the success of R&D projects at the beginning. According to studies, it has been seen that the rate of success in innovation and R&D is very low. Only a few projects bring successful products onto the market (Cooper, 1999). These findings are proof that companies should be very careful at the selection stage of innovation and R&D projects. They should therefore devise projects that are parallel to their activities and determine what the key success factors for these projects are. Through this stage, they will be able to identify the most fruitful and discard the most risky projects.

Innovation has been described as a 'creative destruction' by Schumpeter (Schumpeter, 1934). According to Schumpeter, it includes not only the

creation of a new product, but also its commercialization and the creation of a system. To define the importance of innovation, the American Management Association (AMA) conducted a study of 1.396 companies in 2006 and found that 95% of them defined innovation as a "the most important factor". In addition to this, innovation has also been defined as a single work or a sub process of unrelated systems (Marquis 1969). Consequently, the innovation process involves all factors, from idea and decision making to the market itself.

Since companies currently adopt an approach which limits the innovation process within a project or around a project, innovation projects are allocated a limited time to bring out new products, or a limited time frame for the application of a production process.

Within innovative companies, different units like R&D, Marketing, Production and Purchasing can work together effectively as a group. This group collaborates during all the different processes of the project, from the initial idea and decision making up to the introduction of the products into the market. Generally the R&D unit identifies an appropriate innovation project for a company, and then informs other units and responsible individuals within the company. The sequence of information sharing depends on urgency and necessity. Besides this, the absence of a system that can forecast the success of project beforehand is the most critical and risky point of the innovation process. It is very important for companies to determine which may be the most successful projects before investing and to abandon the projects that are not promising (Cooper, Edgett, Kleinschmidt, 1999).

According to academic research done by The American Management Association (AMA) among 1.396 Companies in North America and Europe, customer preferences, group working and collaboration, the availability of resources (time and money), organizational communication and the ability and freedom to select the right projects are found to be key success factors (Jamrog, 2006). In addition, creating a good working atmosphere, forming interdisciplinary groups and sharing responsibilities in the team are key success factor indicators.

TURKEY'S PLACE IN R&D AND INNOVATION

According to the European Innovation Scoreboard 2008 statistics, Sweden, Finland, Germany, Denmark and the UK are the innovation leaders. The European Countries can measure their relative performance compared to that of the US and Japan in innovation with the help of EU Framework programs (European Innovation Scoreboard 2008).

The main challenges for Turkey are identified on the basis of the fact that the country needs to focus on input innovation drivers and knowledge creation to be able to increase its innovation performance. For this purpose, these topics should be considered seriously;

- Increasing investments in human resources for innovation,
- Developing a university/industry relationship and promoting research commercialization from universities,
- Increasing early stage funding (INNO-Policy Trend Chart-Turkey 2008).

According to the European Score Board 2008 statistics, in spite of an increase in the number of universities, Turkey still ranks low among the EU member and candidate countries. Stimulating the commercialization of university research results and establishing strong linkages between the private sector and the research community is critical for Turkey as most R&D is performed by universities. Universities account for 51.3 percent of the country's R&D expenditure, employ 49.1 percent of researchers and produce a high level of scientific output which is not transformed into innovation. That means a lack of efficient ties between university and industry, which deprives the private sector of new knowledge and opportunities.

One of the reasons for low commercialization of R&D and innovation results is a lack of seed capital and joint ventures. Channeling limited financial resources into low, risky areas for R&D and innovation projects is one of the reasons for the low financial support for innovation. As mentioned above, Turkey has weak indicators in terms of competition and innovation. In terms of competition indicators among 131 countries, Turkey ranks as shown above (Table 1);

MAIN FACTORS FOR R&D AND INNOVATION

All technological developments may differ by sector, not only giving benefits to the sector itself, but also to other parts of the economy. A social rate of return is the interest rate received by society as a whole from investment. To many researchers, the social rate of return from investment in new technology is important, because it measures the payoff to society from these investments (Mansfield, 1996)

In accordance with research, the social rate of return in the construction sector is bigger than the investment (96%) in the same sector. This means society has enormous benefit from the technological development in this sector (Mansfield, May 1991). In the same study, the social rate of return was calculated for different sectors and it is 307% for thread innovation (health), 209% for household cleaning and 116% for stain remover sectors. To have the aforementioned benefits from technological developments, it is vitally important to gather all the necessary factors, acquired knowledge and to combine them effectively.

Table1: The global competitiveness Index of Turkey

Advantages		Disadvantages	
	131 County		131 County
Availability of scientists and engineers	41	Government procurement of advanced technology products	73
Capacity for innovation	47	Utility patents	67
University-industry research collaboration	49	Company spending on R&D	62
Quality of scientific research institutions	50		

Source: *European Score Board 2008*

R&D AND INNOVATION CENTRES

Today, it is not enough to just have knowledge to develop new technology, it is also very important to have an organizational structure and financial resources. The main ways of developing new technology are via:

- R&D Units of companies,
- Contacted research,
- University Industry Joint Research Centers,
- Technopark and Technology Development Zones.

All these ways have advantages and disadvantages compared to each other. Setting up an R&D Department in a company is costly and it is also difficult to find the right expert. Companies can develop new technologies by setting up contracted research projects with universities. University Industry Joint Research Centers, Technology Development Centers and Technoparks are also places for technology development.

The share of Turkish companies' financial resource for R&D and innovation is lower than the EU average. According to the European Innovation Scoreboard (EIS) 2007, Turkey is one of the lowest-ranking countries in most of the indicators. But, the very poor availability of data prevents the generation of a reliable summary innovation index of the EIS and of the identification of trends. In general, with the available data, although Turkey's overall performance is below that of EU Member States, it has a stronger performance than some Member States on knowledge creation. According to the same study, with respect to the university/ industry relationship, Turkey is ranked 49th out of 131 countries. This result proves that companies conduct their R&D project in their own departments instead of collaborating with university and research centers. Research shows that companies that rely exclusively on their internal R&D and internally possessed knowledge perform less well on innovation compared with companies that acquire external knowledge and capacities, because those companies innovating in-house will miss opportunities, and because they will not be able to catch up with rapid technological developments (CHESBROUGH, 2006).

Studies show that, in order to remain competitive, the only way is for companies to focus on innovation and R&D and to sustain this work. Companies will have great advantages in the long run if they apply open innovation methods to their innovation strategy. Collaboration with university and research centers allows companies to gain new knowledge and create joint projects, as well as helping companies to follow their competitors and the scientific world. In this way, companies receive enormous benefits at a low cost, which thus allows them to use their limited financial sources very effectively.

R&D AND INNOVATION FINANCE IN TURKEY

The increase in competitiveness has pushed Turkey to look for new alternatives to be successful. These days, all countries aim to increase companies' competitiveness by supporting them on financial and non financial issues, creating leader companies in innovation and technological development. This is also one of the reasons behind the well-financed EU framework programme.

The remarkable expansion in all sectors of China's economy has pushed EU and American companies to focus on high value-added products and knowledge-intensive products. The Chinese and other Far East economies' developments show that Turkey should take measures to remain competitive.

After the Uruguay Round, Turkey decided to support only R&D and innovation projects. As a result of this decision, the Turkish Technology Development Centre (TTGV) was established to support innovation and R&D projects in SMEs in 1991. The TTGV also facilitated the university/industry relationship by creating an expert pool that gathered university researchers and sent them to companies to define and assess their innovative projects. The financial support from the TTGV to companies served to strengthen the dialogue between university and industry and also to help companies to understand the importance of R&D and innovation (GÖKER, 2004).

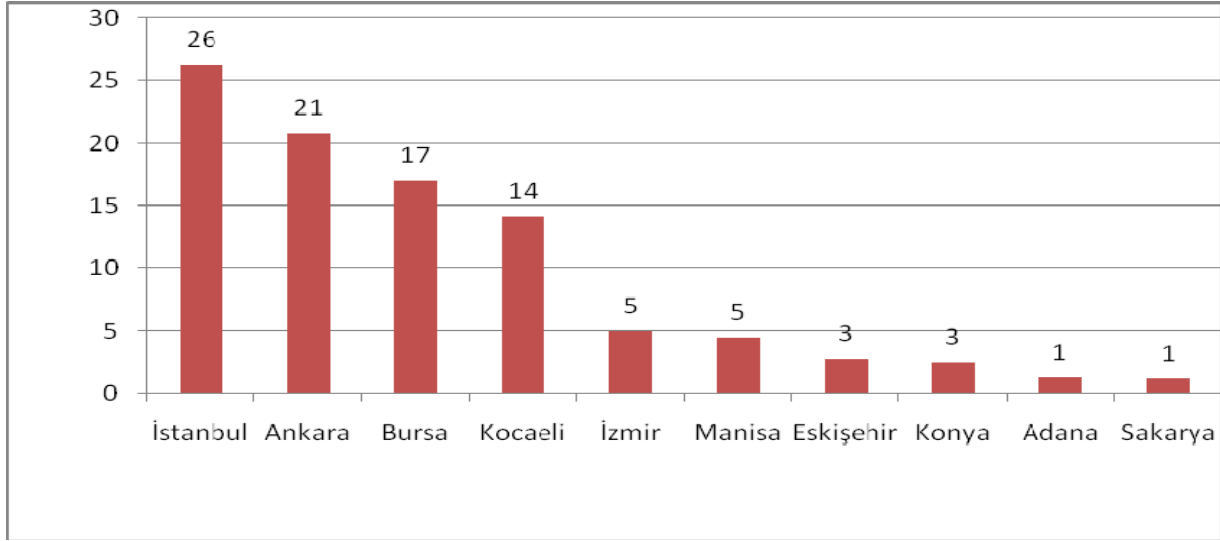
After the TTGV, in 1995, the TUBITAK-TIDEB (Directorate of Technology Monitoring and Assessment) was established to diversify financial support for innovation and technological development

and in 2006 the name of Directorship changed to Technology and Innovation Funding Programs Directorate (TEYDEB). TEYDEB has increased the amount of support to companies for innovation and R&D and urged them to collaborate with universities on joint projects. To satisfy this aim, TEYDEB adds 10% more on top of the supporting rate if companies collaborate with universities. This additional financial support provides companies with extra financial

support, and also helps the university/industry relationship. The table of R&D financial support from TUBITAK TEYDEB is given in Table 1 below.

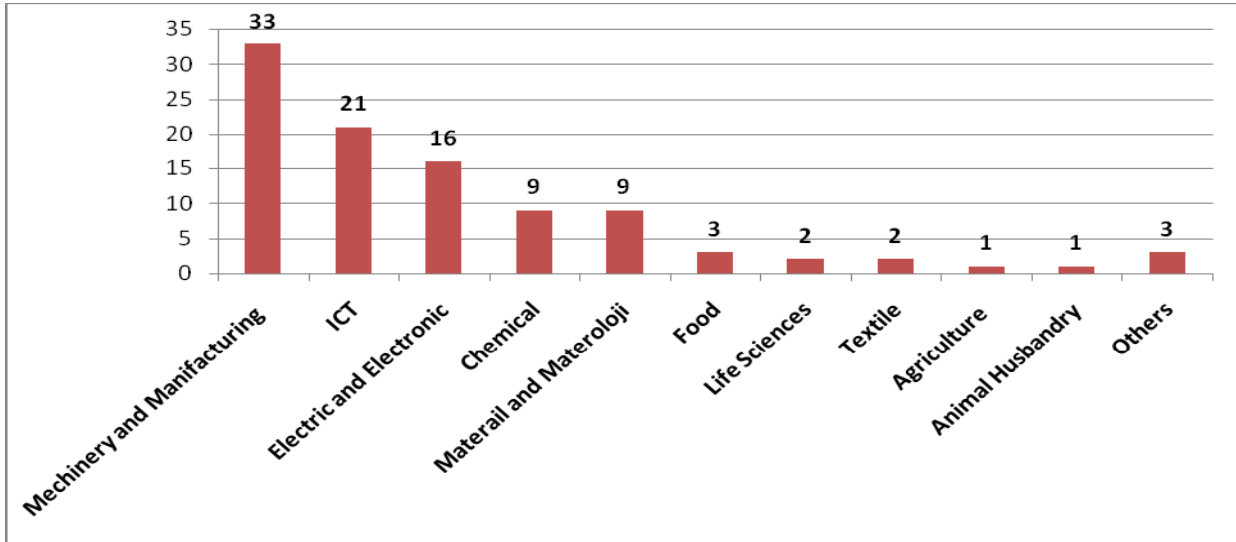
According to Table 1, while Istanbul, Ankara, Bursa and Kocaeli having the major part of TÜBİTAK – TEYDEB grand, Izmir, the third biggest and developed City of Turkey has only %5.

Table 1. Share of Cities from TUBITAK R&D Financial Support (1995–2008)



Source: TEYDEB Financial Support Statistics, 2009.

Table 2. TUBITAK R&D Support by Sectors (Accumulated 2000-2008)



Source: TEYDEB R&D Grand Statistics, 2009.

According to table 2, the agricultural sector has the lowest share of TUBITAK R&D support during the period 2000-2008. Although the agricultural sector is very important to the production and employment sides of the Turkish economy, the share of the sector's R&D grant is the lowest. The reason for the low level of the sector can be explained as follows:

- Companies in the agricultural sector neither create R&D and innovation projects, nor get funds from TUBITAK, nor do they finance those projects from their own capital.
- There is not a very efficient tie between companies in the sector and university and research centers.

In 2006, The Ministry of Industry and Commerce created a new program calls Industry Dissertation Program (SANTEZ) to sustain the university/industry relationship and support innovation and R&D activities in the company. In the concept of this program, 75% of the total budget is supported by the Ministry of Industry and Commerce. The remainder of the project cost is covered by the industrial partner, and IPRs also become the property of the company. The objectives of the program are:

- To sustain university-industry collaboration,
- To increase and accelerate the number of spin-off companies and the commercialization of knowledge produced at universities and to help companies to produce high value-added products,
- To direct researchers to choose their Masters and PhD project topics according to the needs of companies,

(T.C. Ministry of Commerce and Industry, SAN-TEZ AR-GE Destek Projesi Gerçekleşme Raporu, 2009).

There are different kinds of support for innovation and R&D in Turkey. The most important thing for the companies is to access and benefit from them.

Therefore, the companies in the sector, research centers and universities should collaborate to create new strategic programs for innovation.

AN INNOVATION NETWORK FOR AGRICULTURE

Despite having great resources for animal breeding and agriculture, Turkey has not reached a desirable R&D and innovation level in the agricultural sector.

It is necessary to create a new and efficient model to accelerate technological development in this sector. Rapid knowledge transfer, collecting all technology offers and requests in a "project pool", and speedy and effective communication should be part of a common approach for this model. In addition to this, to convert new ideas into investment, the dissemination of new technology ideas and projects from university and research centers to entrepreneurs and their companies via the Internet and other platforms should be compulsory.

Researchers' research topics, expertise and projects as well as their contact details should be registered regularly. Furthermore, TUBITAK and other entities should inform companies and researchers about their new support programs for innovation and R&D in a single web portal.

With the help of the "Innovation Network for Agriculture", companies, entrepreneurs, venture capitals, business angels, universities and research centers would be gathering and this collaboration would create high added value for the sector(Fig. 1).

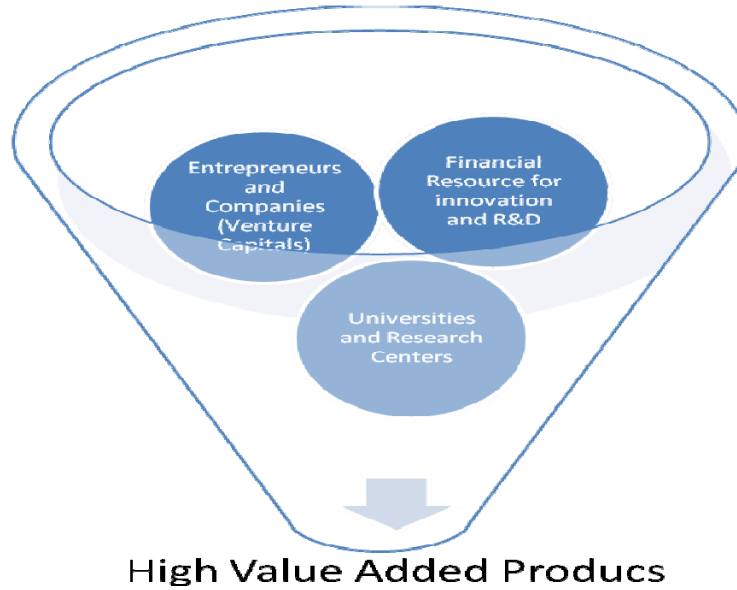


Fig. 1. Main Factors of Agriculture Innovation Network

The Industry-University-Finance triangle is the main factor behind knowledge-intensive production and therefore it should be applied to the agricultural sector. This triangle will carry Turkey from basic goods production to high technology production and is the only way for Turkey to make the leap to join the technology producer countries.

RESULTS

Rapid developments in communication technologies have made international competitors our neighbors. This trend has affected regular companies negatively. Consequently, due to a lack of innovation, vision and finance for innovation many companies have been made bankrupt recently. Therefore, as a matter of urgency, companies should create a strategy for innovation and technological development, and also this concept should be the main and long-term strategy.

Research shows that companies using a closed innovation model will miss opportunities coming from the outside world and will be not able to catch up with rapid technological developments. Consequently, they will lose their skill in innovation and technological development. In order to avoid this serious problem, it is necessary for the

companies especially in the agricultural sector to use an open innovation model.

Under an open innovation concept, agriculture companies should set up efficient and sustainable ties with universities and research centers in their region.

Finance for R&D and innovation has been an essential concern, especially for the Turkish Agriculture sector, where a low added-value product has been produced. According to TUBITAK-TEYDEB statistic (2002-2008) the agricultural sector has the lowest share in innovation and R&D funds. The main reasons are a lack of knowledge about the financial support for innovation and R&D in the sector or a lack of skills to develop new projects in the sector.

Sustaining efficiency and productivity in the agricultural sector has become a major issue in today's conditions, where the consumption of natural resources and production of waste has increased. Therefore, companies should focus on innovation, R&D and product diversification and start looking for new alternative resources to increase efficiency. For this purpose, the University-Industry-Finance Triangle should be formed and actively used.

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