



## Sustainable Agriculture through ICT innovation

### Current Status and Future Projection of ICT Use in Turkey

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#### ABSTRACT

Information and Communication Technology (ICT) is a generic technology due to its potential of value creation across a wide range of industries and applications. It has yielded benefits for a wide range of sectors of the economy and/or society.

Agriculture is a strategic sector of producing food and fibre to supply basic human requirements. Its strategic importance has been increasing due to raise in world population and environmental constraints. Therefore, the survival and growth of agricultural production could be managed through the effective use ICT. This article aims to reveal the current status of ICT in Turkey by evaluating data published by the Turkish Statistical Institute (TUIK). In addition, the author argued challenges and prospects of ICT use in agriculture.

**Keywords:** ICT, adoption, agriculture, Turkey

#### 1. INTRODUCTION

The world has experienced a great revolution in several technologies over the two decades. Throughout next few decades, the shape and potential of industries will be transformed. A significant part of the tools and services that will be available in the market in future are unknown, but the main driving force behind their development will be the deployment of emerging and generic technologies. While former refers to technologies that are currently not fully developed or ready enough for market uptake, but with a high potential of creating new products and applications for market development in a decade, Elder refers to technologies that are directly related and have implications across a range of industries, sectors of the economy and society.

Turkey, in 2002, performed a national foresight exercise, the Technology Foresight Programme to gather data on the current science, technology and innovation capacity of the country (Vision 2023). The exercise's goals were:

- to build a 'science and technology' vision for Turkey,
- to determine strategic technologies and priority areas for R&D,

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- to formulate science and technology policies for Turkey for the next 2 decades.

“Information and communications” and “agriculture and food” are the key sectors considering the close future. ICT is identified as a generic technology, capable of changing the economic and social environment. Innovation and knowledge are the new drivers of economies (Tekin and Sindir, 2002).

External and internal gap in terms of information and communication technology are the main concern for the last decade. The digital gap has been tried to close via national and international programs. To be succeeding in these attempts, there is a need to monitor the level of ICT.

In order to check the status of ICT at the different segment of the society and to compare them, an OECD Working Party on Indicators for the Information Society has developed a list of core ICT indicators which can serve as a basis for internationally comparable statistics. The list consists of indicators such as proportion of households with a computer, proportion of individuals who have used the Internet (from any location) in the last 12 months, proportion of households with a mobile cellular telephone.

### 1.1 The ICT development index (IDI)

International Telecommunication Union (ITU) has developed a composite index combining 11 indicators into one criterion in order to measure (ICT development index); the level and evolution over time of ICT developments in countries and relative to other countries; Progress in ICT development in both developed and developing countries: the index should be global and reflect changes taking place in countries at different levels of ICT development; the digital divide, i.e. differences between countries with different levels of ICT development; the development potential of ICTs or the extent to which countries can make use of ICTs to enhance growth and development, based on available capabilities and skills, that helps to monitor and check improvements in ICT among nations (MIS, 2012). The index was created depend on the asking from member states and published annually.

The reports provide valuable information for use in formulating developments worldwide as well as to create policies. Moreover, the index (IDI) ranks countries' performance in terms of ICT infrastructure and uptake. There are dramatic differences between developed and developing countries. The IDI values for the former groups as high as twice compared with the latter (Figure 1). While more people are getting connected, Turkey took part at upper class.

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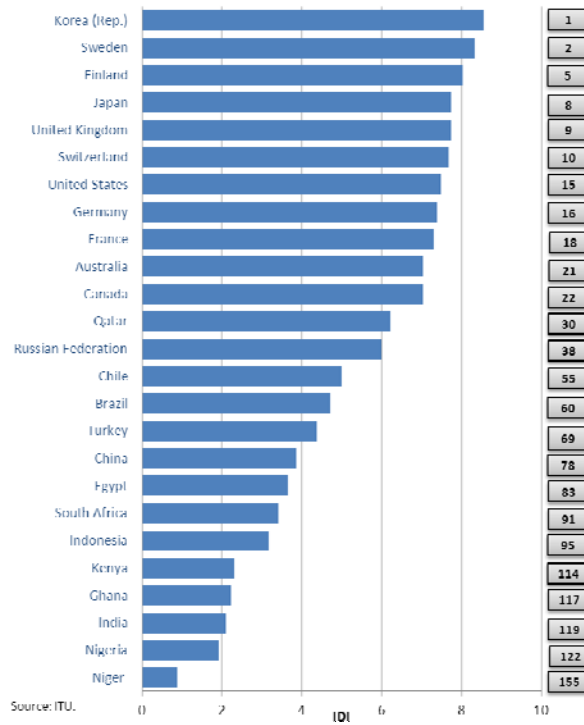


Figure 1. ICT development index, selected economies, 2011

Globally, more attractive ICT tools are; mobile phone, internet access in household and active mobile broadband subscription. Their uptakes are increasing exponentially. Mobile phone penetrated with a %85.7 ratio in 2011 (Figure 2).

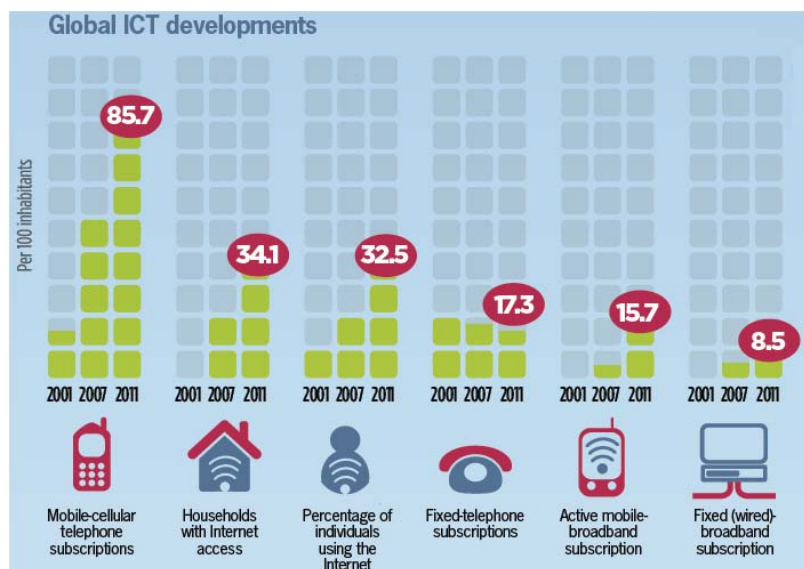


Figure 2. Global ICT developments, 2011

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Although ICT development index serves information on ICT penetration globally, there is a need to monitor the status of ICT uptake at nationwide. Turkey's National Statistical Institute (TUIK) has carried out surveys to measure the extent of the information society, to monitor progress and to determine the level of the digital gap between different groups such as urban, rural etc.

## 1.2 ICT adoption

Gelb and Parker (2005) studied to analyse the effectiveness of ICT adoption for agriculture at national and regional policy level since computers first became available for agricultural use. Then the study was carried to reveal ICT adoption constraints and their relative impact over the period 1998–2005. The study was based only on the opinions of scientists and experts; but it provides picture on ICT adoption and its constraints in rural areas. The factors were summarized as:

- lack of effective training, which is the major ICT adoption constraint,
- inability of farmers to use ICT (personal impediments),
- failure to understand economic or other benefits,
- fear of technology,
- cost of technology,
- lack of technological infrastructure,
- hard-to-use, unfriendly systems,
- poor integration with other agricultural systems,
- no useful information,
- time limitations.

Despite the fact that there have been various attempts to monitor the progress at ICT adoption in rural areas, there is a growing need for checking the ICT level and its constraints due to dynamic environment.

In this paper, two strategic sectors – information and communication technology (ICT) and agriculture – will be analysed in the context of ICT use in agriculture. The aim is to reveal the current situation and to discuss prospects and challenges.

## 2. METHODOLOGY

The 'ICT Usage in Households and by Individuals Survey', employing core ICT indicators, was started in Turkey in 2005 to determine the nature and extent of the use of information and communication technologies. The frequency of surveys was related to national priorities, available resources and the evolution of the ICT market in each country participating. Where ICTs are being introduced rapidly, an annual survey may be justifiable. Where the level of access to ICT is low and not growing rapidly, it might

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be more appropriate to adopt a longer interval (Anon, 2005). In Turkey (except for 2006), the surveys have been conducted annually since 2005 (Tekin, 2011).

Until 2009, population projections were calculated on the basis of population censuses. In 2007, the Address Based Population Registration System (ABPRS) was established. There are some differences in the distribution of population by age, sex and region in ABPRS compared with the censuses. The new population projections were, therefore, produced using the most recent population data obtained from this new system. National and regional population projections were revised using the results of the 2008 ABPRS, from which the most up-to-date projections were, gathered (Tekin, 2011).

New population projections have been used in the ICT Usage in Households and by Individuals Survey results since 2009; in order to obtain comparability, the results of 2007 and 2008 have also been revised according to the new population projections (Tekin, 2011).

In this study, information and communication technology penetration in The Turkish agricultural sector was analysed. The reference period was 2007–12 using the Address Based Population Registration System (ABPRS).

### 3. RESULTS and CONCLUSION

The Turkish agricultural sector is defined as ‘rural’ in terms of culture, movements and trends. Thus, it is proposed to use ‘rural’ data, since no data exist for ICT use for agricultural holdings and other partners in the sector. ‘Rural’ will be used synonymously with ‘agriculture’ in this part of the study (Tekin, 2011).

There has been insistently continues growth in ICT uptake in the country, with an increase in all indicators except the number of fixed telephone lines, which has been decreased for eight years (Figure 3). Information and communication technologies (ICTs) keep its increase to penetrate countries in the urban area, as more and more people are getting connected.

Agriculture is a strategic sector in most parts of the world for using natural resources and employing people. Rural people depend on agriculture for their livelihoods and, if the cycles of poverty, malnutrition and disease are aimed to decrease, high ICT penetration and their effective use in agriculture must be a priority. Although there is a parallel increasing in terms of ICT up-take in rural area comparing with urban. The rates are almost half of the urban. Most popular ICT tool is mobile phone which is following by desktop computer and portable computer respectively (Tekin, 2011).

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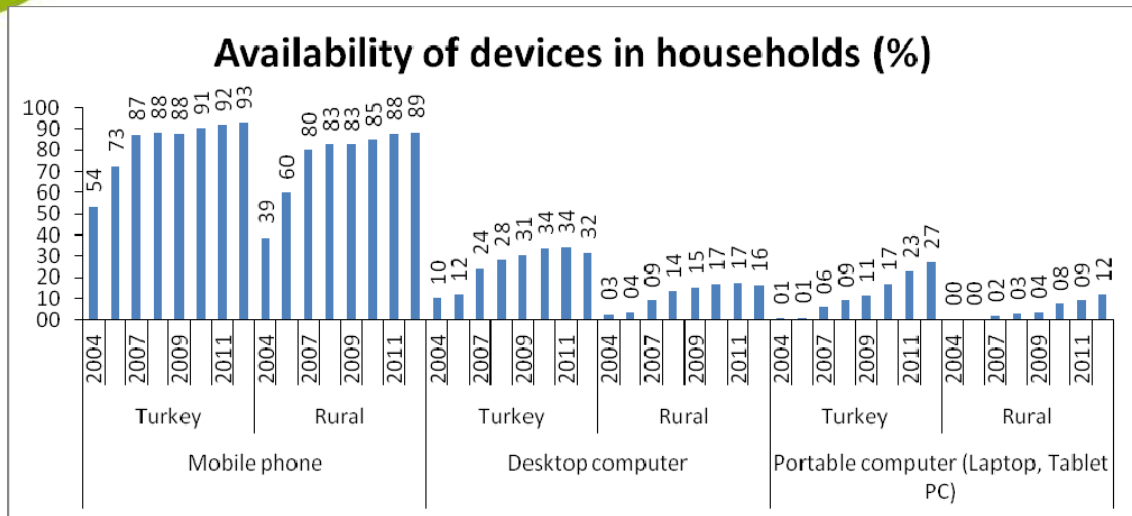


Figure 3. Availability of devices in households

The number of household connecting internet grew steadily (Figure 4). By end 2009, more than one-third of the population in urban was online, while % 15 of the rural people are connected in rural. Average rate growth to connect the internet was moderate in Turkey (34 per cent). This reflects the large differences in penetration rates, which by end 2009 stood at 34 per cent in Turkey compared with 17.6 per cent in rural. The fact that depend on the previous information the level would be assessed higher for the current case.

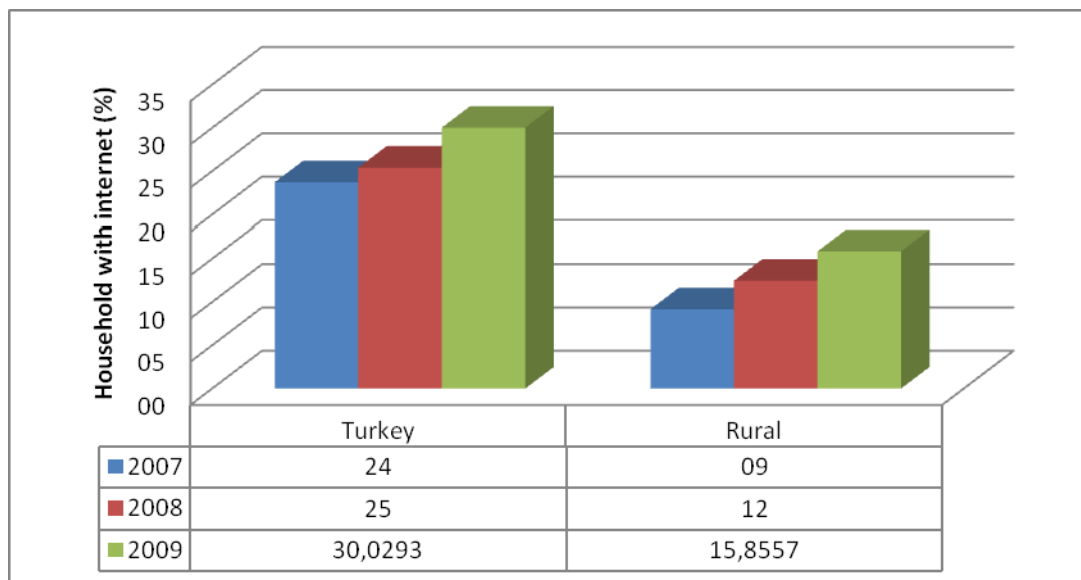
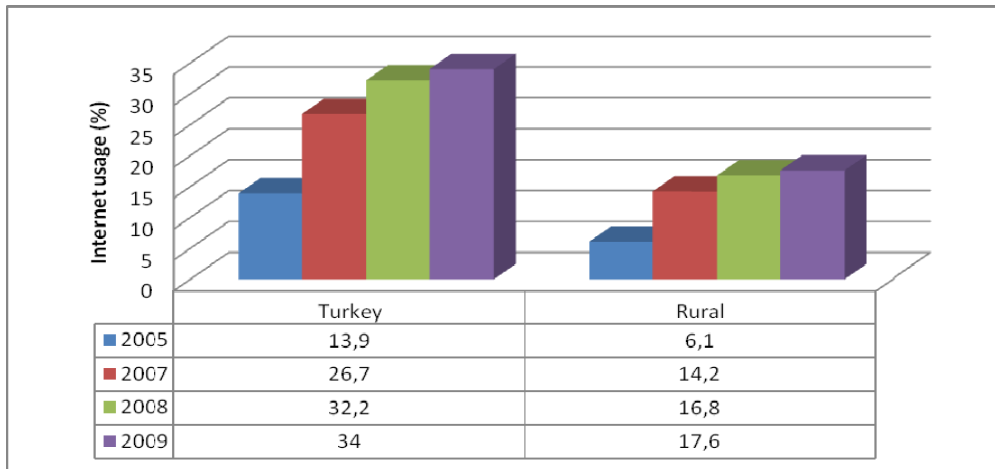


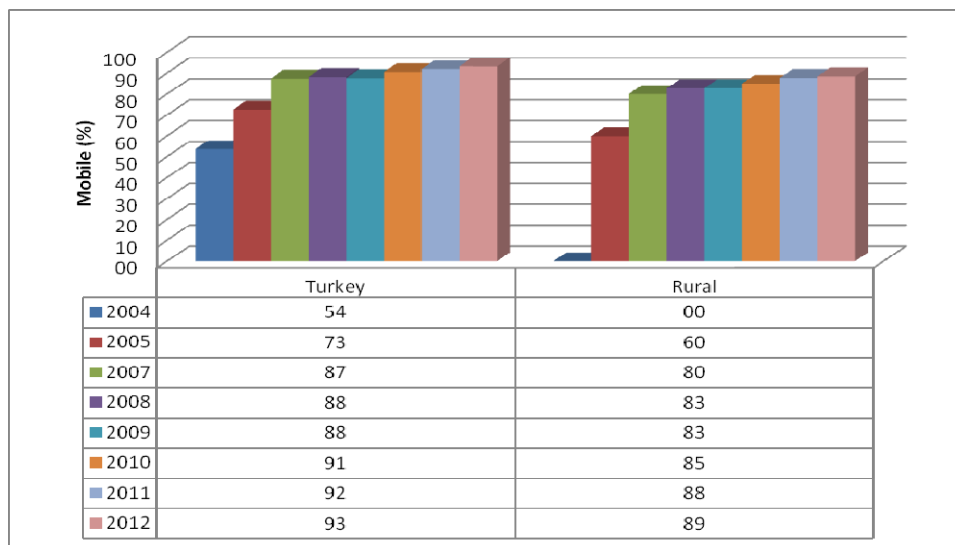
Figure 4. Households with access to the Internet.

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**Figure 5.** Internet use in Turkey

There is an increased competition and affordable services and devices that force the growth in the mobile sector. Mobile device continues to replace fixed-line services. There is little difference between Turkey average and rural. Penetration rate is 93 per cent and 89 per cent respectively.



**Figure 6.** Mobile sector in Turkey

Statistics on access to and the use of ICTs are strategic assets that can help in monitoring and evaluating the progress and impact of ICTs on regional, national and international developments. The IT sector is growing exponentially in urban areas and offers enormous potential for synergistic benefits affecting the growth of all sectors. This kind of transformation is needed even more in rural areas, where access to ICTs and their effective use can make a great difference to development outcomes. A good

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example of a potential practical benefit is that, with a mobile phone, a farmer can identify the market where s/he can get the best price for her/his products (Tekin, 2011).

ICT penetration has been steadily increasing. Indicators show that there is a difference between the average and the rural sectors; the percentage for urban uptake is higher than average. Gender is also a key factor for ICT usage: female usage predominates. Moreover, age is limiting factor for the penetration. Young people prefer to live and work in urban area instead of staying in the rural and engaging farm operations.

Rural has specific conditions and constraints such as absence of service provider, infrastructure. The causes on the lower rate in the level of ICT adoption in the rural can be classified:

- agricultural holding structure;
- holding size;
- holding income;
- cost of technology;
- lack of infrastructure; and
- lack of training

As a developing country, Turkey has unique characteristics. There has been strong effort to prevent digital gap with other countries. The efforts also covers the gap between urban and rural. Therefore, these constraints must be carefully analysed and formulated to keep away from the digital divide.

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