

INFORMATION and COMMUNICATION TECHNOLOGIES in TURKEY and OTHER OECD MEMBER COUNTRIES

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Abstract

This paper investigates the economic effects of the ICT revolution. In this regard, economic impacts of ICT are evaluated by touching various segments of social and economic spheres that are deeply affected by the ICT revolution. Further, we present summary of a comprehensive survey of previous studies in the literature on the relationship between economic growth and ICT. Then, we examine the ICT sector in OECD area in general and specifically in Turkey. Depending on the results of all these attempts, we propose some policy suggestions for Turkey.

Keywords: *ICT, economic growth, Turkey, OECD.*

JEL Classification: *O30, O38.*

Türkiye ve Diğer OECD Üyesi Ülkelerde Bilgi ve İletişim Teknolojileri Ekonomisi

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Özet

Bu makale, bilgi ve iletişim teknolojileri alanında yaşanan önemli gelişmelerin ekonomik etkilerini incelemektedir. Bu kapsamda, bilgi ve iletişim teknolojilerinin ekonomik etkileri ekonomik ve sosyal açılardan ele alınmıştır. Ayrıca, alan yazınında ekonomik büyüme ile bilgi ve iletişim teknolojileri arasındaki

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ilişkilerin incelendiği çalışmaların kapsamlı bir taramasına ait özet bilgiler sunulmuştur. Daha sonra, bilgi ve iletişim teknolojileri sektörünün OECD üyesi ülkelerdeki ve özellikle de Türkiye'deki durumu analiz edilmiştir. Elde edilen bulgular ışığında konuyla ilgili olarak Türkiye için çeşitli politika önerileri geliştirilmiştir.

Anahtar Kelimeler: *Bilgi ve iletişim teknolojileri, ekonomik büyüme, Türkiye, OECD*

JEL Sınıflandırması: *O30, O38.*

1. Introduction

Being a general purpose technology and thanks to great improvements within itself during recent decades, information and communication technologies (ICT) diffuse to the all segments of the economy and the society and, thus, leads to use of knowledge and other physical and human capital more efficiently which eventually creates productivity gains. As a result of ICT diffusion, new jobs, professions and fields of business activity emerge; some of the old ones disappear. Structure of labor market, characteristics of jobs and organizational forms may radically change. Furthermore, significant changes in public administration as well as social and daily lives of individuals occur.

The term ICT revolution is used to express the widespread ICT diffusion and concomitant radical and influential changes in different aspects of social and economic lives. Main motivation of the current study is examining the economic influences of ICT revolution. We evaluate the economics of ICT with a broad perspective by touching on various segments of social and economic spheres. In addition, we summarize the results of a number of empirical studies that analyzes the relationship between ICT and economic growth. In order to capture the complete picture we have a closer look into ICT sector in OECD area in general and specifically in Turkey by investigating policy frameworks, priorities and implementations as well as developments in ICT area from the point of ICT diffusion, ICT production and ICT employment. Ultimately, we sketch some lessons peculiarly for Turkey. Moreover, we hope that these lessons also include further evidence for other developing countries.

The organization of the paper is as follows. Second section presents theoretical discussion of economics of ICT and a representative sample of similar studies. Third section browses the ICT sector in OECD area and Turkey. Finally, the fourth section concludes by summarizing and evaluating the results as well as discussing several policy recommendations.

2. Theory in Retrospect

The term technology has been so popular due to general view that technological progress has a positive impact on economic growth. The main argument behind this view is that technology is an enabler to perform tasks on a timely and efficient manner as well as with less effort and cost. Therefore, technology contributes to improve the existing processes and products; it also helps further technological change and innovation. All these result in a number of positive impacts in terms of economic perspective.

2.1 The Economic Impacts of ICT

Both dynamics of ICT sector in itself and diffusion of ICT in other sectors leads to various great transformations in economic and social aspects. These repercussions can be grouped under numerous areas. First of all, ICT has become one of the major sectors of the modern economies as a general purpose technology. With high R&D and innovation capabilities of the sector and continuous and growing demand to its products as either final or intermediate goods, ICT sector has been expanding steadily. Worldwide ICT spending has increased about eighty five per cent from 2003 to 2012. Not only ICT spending but also value added in ICT sector is raising. In addition, ICT sector's employment growth was higher than total business employment growth for the same period (OECD, 2012b). ICT sector has a high degree of globalization; global ICT trade had an 8.5% compound annual growth rate since 1996 and approached 4 trillion USD in 2008 (OECD, 2010).

By the widespread usage of ICT in all areas of economic and social life and Internet becoming a network that spreads the entire globe, dynamics of the knowledge creation process has altered substantially. ICT provided great advancements in producing, processing, storing, sharing and easy access to information (SPO, 2006a). Developments in ICT area made knowledge-creating activities more efficient. Thus, knowledge became much more accessible and abundant. Faster and easier diffusion and absorption of new knowledge enhances further knowledge accumulation and creation. These favorable impacts of ICT grow further as more people use ICT thanks to network effects (Bartelsman and Hinlopen, 2005). The positive effects of ICT regarding the knowledge result in various economic improvements through increase in efficiency and productivity as well as improved innovation and R&D activities.

ICT becomes influential on nature, variety and the way of all sorts of activities of organizations. Within the firm; organizational structures, hierarchical relationships, types, numbers and methods of tasks may alter. Outside the firm, if

advantages of ICT can be captured properly new business opportunities may become available to the firm or inversely firm may lose its previous advantages against other firms that achieve to reap the benefits of ICT revolution better.

Thanks to ICT, flow and diffusion of information within the firm gets easier. This brings about more informed employees, reduces necessary coordination efforts, facilitates team work, increases flexibility and leads to creation of a more open and innovative culture in the firm. Interrelationships with customers and suppliers are also affected by the ICT revolution. Flow of information between firms and their stakeholders increases substantially. Firms are now more aware of customers' needs and desires and process more successfully the signals from market. Thus, they can direct their customization, production and advertising activities accordingly. More effective supply chain management becomes possible. Even further it enhances the management of value chain. Thanks to ICT, settlement of employees may become independent of some of the old limitations. This provides more flexibility while organizing the workplace in both office and building wide level (David Skyrme Associates, 2012). The rise in flexibility works as a leverage to remove uncertainty.

Transfer of many daily life applications to the virtual environment and dissemination of electronic services such as e-banking, e-health, e-learning, etc. provide easiness for people by removing some of the traditional constraints, especially geographical barriers, as well as making great time and money savings possible.

E-banking services enable customers to carry out almost all practices that are available in branches of banks. Individuals can get detailed information on their accounts, conduct fund transfers, pay bills, exchange financial instruments like stocks, bonds and shares, create new accounts and apply for credits with no need to visit a bank branch (Cristina et al., 2008). Banks make advantage of e-banking by reducing their transaction costs and expenditures for branches. Therefore, ICT improves the working of financial markets as well as goods market.

E-health applications enable healthcare staff to obtain, exchange and track information about patients in more advanced ways. Patients can also reach more information about their own health status. Patients' condition can be monitored remotely and some health services can be presented with no need to patients leaving their inhabitations. E-health tools are useful in relieving limits on resources in both budgetary and staffing terms and by this way affect productivity positively (European Commission, 2012). Consequently, it further eases the functioning of labor market.

Thanks to e-learning it becomes possible to capture, store and distribute enriched and more up-to-date information and resources in more diversified types and formats. In addition, e-learning provides great flexibility in terms of time, place and pace. Educational institutions can reach markets that are beyond their periphery. As well, e-learning promise important cost savings; especially corporate users show interest in it to be able train their personnel more effectively (Naidu, 2006). This discussion shows another aspect of ICT that assists the development of human capital and, in turn, labor market.

E-commerce transforms the marketplace by changing the way business is conducted, paving the way for new products and markets, string up new and closer relationships between firms and customers, changing the organization in work and introducing a work environment with more knowledge diffusion, human interactivity, openness and flexibility. E-commerce also brings about enhanced interaction and transparency in the economic activities while decreasing the importance of time and physical limitations (OECD, 1999). E-commerce creates a new and more efficient marketplace where search, customization, exchange, distribution and consumption processes are improved (Coppel, 2000). E-commerce increases efficiency and effectiveness of economic activities and processes, decreases a number of costs, and promotes productivity in certain areas through several channels in different layers of the economy.

With the widespread usage of these technologies in other sectors, radical changes take place in work patterns and occupations. Demand for ICT experts and ICT literate staff grows. As new tasks and processes appear in work environment or complexity of existing ones increases due to involvement of ICT, some new job descriptions and professions emerge. Moreover, some traditional jobs are ruled out while some of them are transformed. A great number of tasks that were performed mainly based on manpower previously started to be carried out automatically or with fewer but more qualified labor force. ICT revolution leads the separation of work from physical environments completely or partly thanks to applications like teleworking. Providing service via telephone or internet also becomes a common practice and creates new working types. These help people who normally cannot participate to labor force due to several limitations like age, gender and geographical location to find a job and contribute to the economy.

E-government brings about improved efficiency, diminished costs, time savings and increased productivity in public services. Thanks to e-government applications public institutions can perform their tasks in an automated way with a higher speed and more accurately and reliably. This improves their performance while reducing transaction costs. As well, general service quality of public sector

risers significantly. E-government enhances availability and accessibility of government services. Citizens can perform government-related operations without being bound to office hours or geographical constraints and this provides great flexibility and cost-saving opportunity for them (Almarabeh and AbuAli, 2010).

Increasing usage of ICT in daily and working lives of people brings about a wide range of novelties for individuals such as those in habits, way of entertaining and networking, distribution of expenditures, education and training forms. These alterations affect a lot of complex interrelations and result in some economic consequences. Those new opportunities play an important role in achievement of easier self-fulfillment, increased personal prosperity, advanced standards of living and grown social welfare. In addition, quality of services is improved and they are generalized throughout the country equally. Disadvantageous segments of the society, especially disabled people, who cannot or can only limitedly benefit from services become more active and integrated to the society. These aspects of ICT contribute to social development.

2.2 Literature Survey and Some Stylized Facts

The link between ICT and economic growth has been subject to a great number of empirical studies. These studies commonly share a curiosity about exact worth of ICT and try to quantify it with different methods, data sets, countries and time intervals. Table 1 summarizes the scope and main findings of various studies that are dedicated to ascertain the impacts of ICT revolution on economic growth experiences. As it is seen there is a general tendency in favor of growth-friendly results of ICT revolution.

Table 1: Summary of Literature Survey

| Study | Method | Period | Country(s) | Result |
|-----------------------------|--------|-----------|-------------------|---------------|
| Norton (1992) | P.F | 1957-1977 | 47 Countries | Positive |
| Jorgenson and Stiroh (1999) | G.A | 1948-1996 | US | Insignificant |
| Röller and Waverman (2001) | P.F | 1970-1990 | 21 OECD Countries | Positive |
| Oliner and Sichel (1994) | G.A | 1970-1992 | US | Insignificant |
| Parham,et al. (2001) | G.A | 1964-2000 | Australia | Positive |
| Ramlan,et al. (2007) | G.A | 1966-2005 | Malaysia | Positive |
| Yoo (2003) | P.F | 1970-1998 | 56 D/g Countries | Positive |

| Study | Method | Period | Country(s) | Result |
|--------------------------------|--------|-----------|---------------------------|--|
| Kim (2002) | G.A | 1971-2000 | Korea | Positive |
| Jorgenson and Motohashi (2005) | G.A | 1975-2003 | Japan and US | Positive |
| Whelan (2000) | G.A | 1974-1998 | US | Positive |
| Oliner and Sichel (2000) | G.A | 1974-1999 | US | Positive |
| Breitenbach,et al. (2005) | P.F | 1975-2002 | South Africa | Positive |
| Pohjola (2000) | P.F | 1980-1995 | 39 Countries | Positive for D/d, I nsignificant for D/g |
| Oulton (2001) | G.A | 1979-1998 | UK | Positive |
| Dewan and Kraemer (2000) | P.F | 1985-1993 | 36 Countries | Positive for D/d, Insignificant for D/g |
| Schreyer (2000) | G.A | 1980-1996 | G7 countries | Positive |
| Colecchia and Schreyer (2001) | G.A | 1980-2000 | 9 OECD Countries | Positive |
| Armstrong,et al. (2002) | G.A | 1981-2000 | Canada | Positive |
| Van Ark (2001) | G.A | 1990-1999 | 10 OECD Countries | Positive |
| Simon and Wardrop (2002) | G.A | 1990-2000 | Australia | Positive |
| Daveri (2002) | G.A | 1992-2001 | EU and US | Positive for the US, Insignificant for EU |
| Gordon (2000) | G.A | 1995-1999 | US | Insignificant |
| Piatkowski (2003) | G.A | 1995-2000 | Poland | Positive |
| Jalava and Pohjola (2005) | G.A | 1995-2002 | Finland | Positive |
| Nasab and Aghaei (2009) | P.F | 1990-2007 | 7 OPEC Countries | Positive |
| Erdil,et al. (2010) | P.F | 1995-2006 | 131 UnD and D/g Countries | Positive |

Note: P.F stands for production function and G.A for growth-accounting.

This retrospective travel in provide us following stylized facts:

* ICT is a general purpose technology.

* ICT influences the economy through two main channels as ICT production and ICT usage.

* There are some different views and findings about whether ICT production capacity is a necessary condition for the economic impacts of ICT revolution.

* ICT revolution has significant effects on economic growth of developed countries.

* There are some doubts about whether underdeveloped and developing countries can benefit from ICT investments in an extensive manner.

* Extent and scope of the growth effects of ICT revolution are highly dependent on the share of ICT sector in total economy.

* Other elements such as complementary physical infrastructure and human capital as well as social and cultural factors have also critical importance for reaping the benefits of the ICT revolution.

* There are strong signs on the existence of externalities and spillover effects associated with the ICT investments.

* The impacts of ICT investments on economic growth take time. The full impact is realized with a time lag.

3. Information and Communication Technologies in OECD

As the previous section reveals, there seems to be a positive relationship between ICT and economic growth, especially for developed countries. Among OECD countries, which are overwhelmingly developed ones, ICT has been treated as an important issue and paid special attention in order to foster economic growth.

3.1 ICT in OECD Member Countries

Being aware of the economic and social importance and impacts of ICT, most OECD member countries have been designing and implementing ICT strategy and policies as well as embedding those to the broader policy visions. It is generally seen that ICT policies have become gradually more integrated to the general economic and other policies. In the early stage of ICT revolution during the 1990s, OECD gave priority to competition, private investment, regulatory framework and infrastructures regarding ICT area. As time progresses and top level policy frameworks settle, different topics started to become prominent in the agenda depending on the developments in technology, economy and social structure (OECD, 1997).

In the beginning of the twenty first century, OECD was mainly focusing on electronic commerce with its technical, social and economic aspects and other

related issues. In addition to e-commerce, intelligent agent technologies, global navigation satellite systems and flat panel displays were other topics addressed by OECD (OECD, 2000). Later, the effect of ICT on competitiveness of businesses; the possible improvements thanks to ICT regarding output, employment and productivity; the digital divide and utilizing ICT in delivery of government services as well as improving government efficiency became the key policy issues that gain particular attention from the OECD member countries generally (OECD, 2002). In 2004, ICT R&D and innovation, technology diffusion, ICT skills, broadband and digital content and delivery were at the focal point of ICT policies of OECD member countries. It became more important to coordinate and evaluate economic impacts of ICT policies for countries in OECD area. In addition, building and extending high-speed networks like broadband infrastructure were a priority for almost all OECD member countries (OECD, 2004).

Towards 2008, ICT was seen as a driving force behind innovation, economic growth and job creation increasingly. Besides previously mentioned ones, public sector information started to be treated among highly prioritized policy areas (OECD, 2008). In 2010, ICT policies in OECD member countries have become mainstream policies and intended to serve for the general social and economic objectives. ICT policies are now designed to foster economic growth and employment, raise productivity, improve delivery of public and private services and enhance the welfare and living standards of the citizens. In this respect, ICT policies are more integrated into other policy areas like health, education, environment, transportation, etc. Furthermore, importance attributed to the certain policy areas like broadband development, technology diffusion to individuals and households and e-government activities has increased considerably in recent years (OECD, 2010). Recently, top three ICT policy priority areas among OECD member countries are broadband, ICT skills and employment and e-government. In addition, security, R&D, technology diffusion to businesses, e-payment and digital content are other hot topics in those countries (OECD, 2012b).

Despite a declining trend, OECD area is the largest ICT market in the world. 92 per cent of total worldwide ICT spending in 1992 belongs to OECD member countries (OECD, 2000). However, when it comes to year 2009, this share decreased to 72 per cent. This fact is mostly due to the rapid increases in ICT expenditures of emerging non-OECD economies (OECD, 2012b). The US is the largest national ICT market by far and followed by the Japan.

Above mentioned huge ICT budgets brought about important improvements in ICT diffusion throughout the OECD member countries. From 2001 to 2007, total mobile subscribers in 30 OECD countries increased to 1.14 billion people from 604

million people and internet subscribers increased to 382 million people from 189 million people. Broadband is the dominant way of internet access recently and broadband penetration rates may give an idea about the level of ICT diffusion in OECD countries. Total broadband subscription per 100 inhabitants for the whole OECD area was 4.8 in 2002 while this value is increased to 23.3 in 2009. Together with being in different magnitudes, all OECD member countries proceeded significantly in this area since 2002. By 2009, Netherlands is at the best position in terms of broadband subscription while Turkey is the country that has the longest way to make (OECD, 2011).

OECD countries have also strong ICT production capability and capacity. 197 of top 250 ICT firms in the world belong to OECD countries and US is by far the best country with 75 ICT firms. Between 1995 and 2008 ICT sector value added in OECD area grew 4.7 per cent annually and outpaced the growth in total business sector value added. By 2008, share of ICT value added in business sector value added in whole OECD area is about 8.2 per cent; Finland, Ireland and Korea are the leading countries in this respect (OECD, 2010). In terms of ICT exports there is a slightly upward trend in total amount but share of OECD countries' total ICT goods exports in worldwide is decreasing. While in 2000 67 per cent of world's total ICT goods exports were from OECD countries, in 2009 this ratio decreased to 43 per cent. That simultaneity of increasing ICT spending and production and decreasing share in worldwide ICT spending and exports of OECD member countries indicate that emerging non-OECD economies started to become serious rivals of OECD economies in ICT area (OECD, 2011).

By 2008, approximately 15 million people were employed in the ICT sector in OECD countries and this value corresponds to almost 6 per cent of total business sector employment in OECD area. Employment in ICT sector as a whole in OECD area grew on average 0.8 per cent annually between 1995 and 2009 and this is higher than growth in employment of total business sector (OECD, 2012b). It is possible to categorize ICT employment as ICT specialists and ICT-using professions. By 2009, in most OECD countries approximately 3-4 per cent of total employment was ICT specialists, employers who deal with ICT systems directly as a fundamental part of their jobs. Besides, ICT-using professions (including ICT specialist) constitute about 20 per cent of total employment in most OECD countries. These two rates are generally lower in Eastern European countries (OECD, 2010).

3.2. A Closer Look on ICT Sector in Turkey

Turkey, as other OECD member countries, has been attributing great importance to ICT and paying considerable attention to this area, at least by drafting a great number of policy documents. According to these documents, transformation to an information society, raising computer literacy, extending the usage of computers and supporting R&D activities were primary ICT policy objectives during 1990s (SPO, 1989 and 1995; TÜBİTAK, 1993 and).

The Eighth Five Year Development Plan (2001-2005) of Turkey treats ICT as a strategic sector and prioritize the boosting the competitiveness of the Turkish ICT sector. Major policy concerns regarding ICT was stated as facilitating the competition in telecommunication sector, promoting electronic commerce, supporting R&D activities in ICT area, improving the Internet and mobile communication infrastructure, ensuring information security and underlying e-transformation of government (SPO, 2000). In 2001, with an intention about accelerating the technological progress in Turkey, Technology Development Zones Law was introduced which has specific attention to the ICT sector (Official Gazette, 2001).

In 2003 “e-Transformation Turkey Project” was initiated under the coordination of State Planning Organization (SPO). This project aimed at rearranging policy and legislations about ICT within the framework of EU legal acquis, rendering public services more efficient, transparent and accountable by availing from ICT as much as possible, extending the usage of ICT, coordinating, monitoring and evaluating public investment projects in ICT area and guiding private actors in ICT sector (Prime Ministry Memorandum, 2003). After a while, a short-term action plan, which proposed actions about information society strategy, technical and judicial infrastructure, information security, education, human resources, standards, e-government, e-health and e-commerce, was put into effect (SPO, 2003a). In 2004, Turkey’s Information Society Transformation Policy document was accepted by e-Transformation Turkey Executive Board. According to this document Turkey’s vision in this transformation was being a country that has become a focal point in the production of science and technology, that uses information and technology as an effective tool, that produces more value with information-based decision-making processes, that is successful in global competition and that has a high level of welfare (e-Transformation Turkey Executive Board, 2004). In 2005, a new action plan, which includes updated actions in the same areas with previous short term plan, was brought into force.

In 2004 National Science and Technology Policies 2003-2023 Strategy Document was published by The Scientific and Technological Research Council of

Turkey (TÜBİTAK). Being one of the strategic areas in this document, ICT sector was expected to contribute to sustainable economic development by creating new products and technologies as well as putting more effective communication opportunities and richer information sources into service of other sectors (TÜBİTAK, 2004a). Moreover, Science and Technology Policies Application Plan 2005-2010 was accepted by The Supreme Council for Science and Technology (BTYK) in 2004. With this document Turkish Research Area (TARAL), which was a conceptual unity aiming to bring synergy among all actors in IT and R&D fields, was defined (TÜBİTAK, 2004b).

In the Ninth Development Plan (2007-2013) of Turkey, disseminating ICT was determined as one of the main strategic economic and social priorities in order to raise competitiveness of the country. Within this framework, improving ICT infrastructure by encouraging competition in the electronic communication sector, introducing alternative infrastructure and services, ensuring efficient, fast, secure, and widespread access to information at affordable costs; extending broadband coverage; increasing the usage of ICT by enterprises, citizens and institutions and using public procurement as an effective tool to foster development of ICT within the country were the major policy priorities in this document (SPO, 2006c).

In addition to previous efforts within the scope of e-Transformation Turkey Project, Information Society Strategy (2006-2010) and its annexed Information Society Strategy Action Plan were prepared by SPO with the contributions of other stakeholders in order to enable Turkey to benefit from ICT effectively and identifying the medium and long- term strategies and targets for the realization of that transformation. Strategic priorities in this document were social transformation, ICT adoption by businesses, citizen-focused service transformation, modernization in public administration, a globally competitive IT sector, competitive, widespread and affordable telecommunications infrastructure and services and improvement of R&D and innovation (SPO, 2006a). The Action Plan covers the activities and projects that would be implemented to achieve the identified strategic objectives (SPO, 2006b).

In its fifteenth meeting in 2007, BTYK (Supreme Council for Science and Technology) adopted National Innovation Strategy 2008-2010 to achieve desired progress by coordination and strategic management of all innovation elements and instruments within the country (TÜBİTAK, 2007b). Another document named as International Science, Technology and Innovation Strategy Application Plan (2007-2010) was also approved in the same meeting. This document aims increasing science, technology and innovation competencies of Turkey in international arena by taking advantage of international cooperation with countries that were advanced in these areas (TÜBİTAK, 2007a).

In 2008, Law on Supporting R&D Activities and Electronic Communication Law were enacted (Official Gazette, 2008a and 2008b). Last but not the least, National Science, Technology and Innovation Strategy 2011-2016 was prepared by TÜBİTAK and adopted by BTYK in 2010. The vision drawn by this document for Turkey involved producing knowledge, developing new technologies and transforming these to innovative products, processes and services for the sake of the country and humanity. Moreover, in this document, ICT was among prioritized sectors (TÜBİTAK, 2010).

As a result of these efforts, ICT have been becoming widespread in all segments of the society in Turkey as it is the case in other OECD member countries. Main ICT indicators of Turkey that are represented in Table 2 show that usage of ICT has been steadily increasing. Apart from this increase in quantity, there are also significant improvements in terms of quality. Share of mobile communication which is obviously a higher level of technology application than public switched telephone network (PSTN) and share of broadband internet connection which provides much better service than dial-up network have risen significantly. In addition, share of information technology sector in ICT market has been enlarging though it is still much smaller compared to communications' share.

Table 2: Main ICT Indicators of Turkey

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 ¹ |
|---------------------------------------|------|------|------|------|------|------|------|------|------|------|-------------------|
| PSTN Penetration (%) | 27 | 26.8 | 26.7 | 26.3 | 25.8 | 24.9 | 24.5 | 22.8 | 22.3 | 20.6 | 19 |
| Mobile Penetration (%) | 33.3 | 39.7 | 48.5 | 60.5 | 72.2 | 84.9 | 92.1 | 86.6 | 85.1 | 88.6 | 89 |
| Broadband Penetration (%) | - | - | - | 2.2 | 3.8 | 6 | 8.4 | 9.4 | 11.6 | 19 | 30 |
| Internet Penetration (%) ² | - | 8.5 | 13.5 | 13.9 | 18 | 26.7 | 35.8 | 38.1 | 43.2 | 46.4 | 48.7 |
| ICT Market Size (billion \$) | - | 10.3 | 11.9 | 15.8 | 17.9 | 21.7 | 23.8 | 22.2 | 25.8 | 25.4 | 27.5 |
| *Telecommunications | - | 8.5 | 9.6 | 12.4 | 13.8 | 17 | 16.7 | 15.5 | 17.8 | 16.5 | 17 |
| *Information Technology | - | 1.8 | 2.3 | 3.4 | 4.1 | 4.7 | 7.1 | 6.7 | 8 | 8.9 | 10.5 |

Source: Annual Programmes between 2004 and 2013.

(1) Ministry of Development estimation.

(2) The ratios cover 16-74 age groups.

When it is compared with the OECD area, it is seen that Turkey has a long way to go in ICT diffusion. As it is represented in Table 3, broadband penetration rates are much lower in Turkey compared to the OECD averages.

Table 3: Broadband Penetrations in Turkey and OECD

| | Turkey | OECD Average |
|---|--------|--------------|
| Fixed broadband subscriptions per 100 inhabitants | 10.4 | 26 |
| Mobile wireless broadband subscriptions per 100 inhabitants | 14.4 | 56.6 |

Source: OECD Broadband Portal.

Note: Data are as of June 2012.

Computer and internet ownerships have been fairly increasing in both enterprises and households since 2005. In parallel with the growing ICT diffusion in Turkey, there seems to be a positive trend also in terms of ICT employment. While the employment in ICT services sector was about 145,000 people in 2004, it increased to 260,000 by the October 2012 with an 80 per cent raise in eight years. If this fact is taken into consideration together with the rise in total employment in Turkey for the same period just being 30 per cent, enlargement and employment creation potential of ICT sector becomes more apparent (TURKSTAT, 2013).

Public ICT investment has also been following a similar trend and its value for 2012 is about 2.5 billion Turkish liras and more than fourfold of the 2002 level in real terms (Ministry of Development, 2012b). Thanks to these public funds allocated to ICT investments, usage of ICT in delivery of public services has increased as a result of several e-government projects in areas like judicial system, population and citizenship affairs, social security, tax collection and security issues. Likewise, computer and internet facilities in schools and curriculum have been developed in order to provide students with relevant ICT skills. Despite these positive developments, as the previous section reveal Turkey's position in ICT area by comparison with other OECD member countries is certainly not as favorable as desired.

4. Policy Recommendations and Concluding Remarks

As our theoretical discussions and literature survey reveal, there seems to be a positive relationship between ICT and economic growth, especially for developed countries. Concordantly, OECD countries, including Turkey, have treated ICT as an important issue and paid special attention to it in order to foster economic growth. When the policy documents of last two decades are investigated, it is seen that ICT has been regarded as a strategic sector and among top priority policy areas in both OECD and Turkey. As a result of this particular attention towards ICT area, recent statistics usually show upward trends in demand, production, investment, exports and employment regarding ICT sector for OECD area. Similar trends are also observed in Turkey; but she is among stragglers in most of the comparative statistics among OECD countries.

We think that Turkey should certainly play her role in the ICT revolution at global level. Because, as it is discussed throughout this study, ICT bring forth various economic and social advantages for those that can take necessary steps in an appropriate and timely manner. In this regard, the main aim of Turkish ICT policy should be “utilizing ICT as an effective tool to foster economic and social development”.

To be able to reach this target, one of the priorities of ICT policy should be dealing with the ICT demand side. Turkey should not content itself with advancements in absolute terms regarding ICT diffusion. Instead, believing the growth-friendly results of ICT usage, it should make some steps to improve its comparative position against other countries. On the other hand, just making more and more ICT investment and, thus, increasing ICT diffusion to whole economy and society cannot be the ultimate goal. Surely, qualitative improvements in ICT usage should accompany those developments. ICT spending should be directed to more productive aims; ICT investments should serve for increasing the efficiency, effectiveness and value added capacity of the economic activities. In addition to these, necessary precautions should be taken to channel individual users to benefit from ICT for more meaningful purposes.

In order to enhance ICT diffusion throughout the economy and society, various financial instruments in the hands of the government can be mobilized. In the simplest term, taxes on ICT should be decreased by stretching the budgetary constraints. This reduction should be put into practice fractionally. A decisive tax exemption tool can be used. Taxes on certain ICT products and services, which are determined as the most rewarding ones in terms of economic and social outcomes, should be cut more compared to others or even removed completely. Thus, both quantitative and qualitative improvements regarding ICT diffusion could be attained.

Moreover, people that belong to disadvantaged segments of the society in terms of income, education, age, geographical location and physical or mental disabilities should be encouraged to own and effectively use ICT by the relevant tools. Tax reductions could be advanced specifically for these groups of people and also direct financial support for their ICT purchases can be provided. In addition to these, powerful precautions should be taken regarding the computer literacy and competencies of both citizens and businesses. Undergoing efforts to provide computer skills to students should continue increasingly. These efforts should also involve other civilians, especially employees. In this sense, firms may be encouraged financially to gain required computer competencies to their personnel. Further to that, economic and social opportunities and advantages that are brought by ICT, especially Internet, should be put across to relevant bodies effectively.

We strongly think that ICT revolution is not just an intensive usage of ICT in various segments of economic and social lives; it has also a supply side. Thanks to continuous and growing demand to its mostly value-added products, ICT sector matter a lot for modern economies. Therefore, Turkey should urge upon ICT production without loss of time. Thus, she can succeed towards sustainable economic growth and proceed in solving the unemployment problem.

In accordance with this purpose, certain sub-fields in ICT area should be determined and all kinds of meaningful efforts in those fields should be encouraged and supported by the government by all available means. Designating the ICT as strategic sector as a whole is not sufficient and efficient enough. Instead, Turkey should focus on particular ICT products with the aim of constituting a worldwide perception as “that product can be produced best in Turkey”. For this assertive target, government should mobilize all financial, technical, legislative, administrative and regulatory possibilities. Although private sector mostly follows the new technological trends in the world better than the public sector, firms may suffer from lack of enough support and scale. Government should bring together and lead forth actors from private sector and academia to develop new business in promising ICT fields. As the most extreme possibility, government may become a partner of such enterprises. What is more, with its gradually increasing ICT spending budget, government is an important customer of ICT sector. This fact should be used to strengthen domestic ICT firms as far as they satisfy the quality requirements. Besides opting for the existing products and services of domestic ICT firms, government can make them to produce new ICT products and services that fulfill its necessities by giving guarantee of purchase. Therefore, an active domestic public procurement policy may enhance supply of ICT products both in scale and scope.

As ICT diffuses and influence deeply to other sectors, ICT policy should also be highly integrated with policies in other topics like education, industry, foreign trade, labor, energy, transportation, environment, etc. As it is mentioned before, gaining sufficient computer skills to citizens and training qualified ICT professionals should be among priorities of education policy. Curriculums on computer-related subjects in both vocational and higher education systems should be developed and transformed in line with technological trends and requirements of other sectors. Furthermore, while designing and implementing industry and foreign trade policies, high-value added ICT products should have priority.

Moreover, opportunities and risks of ICT revolution should be kept in mind for labor policies. People, who do not have necessary skills required by the ICT revolution, face with threat of losing their jobs or retrogression in terms of income statue. Labor policy should ensure either updating competencies of this kind of people in order to help them to retain their current employment or retraining them to find new jobs in different areas. Besides, working forms like teleworking may be used as a tool for actualizing flexible employment policies. Labor policy instruments can be developed to make it possible for people, who cannot find an ordinary full time job, to earn money by accomplishing certain tasks via internet. Thus, ICT policies may be a counterpart of active labor market policies.

Eco-friendly or green ICT products and services offer tremendous opportunities for cutting energy costs and decreasing carbon dioxide emissions by enabling energy efficiency improvements especially in manufacturing, buildings, transport systems and electric grids. Policies regarding energy, transportation, environment, construction and manufacturing sectors should pay attention to those innovative ICT solutions. Firms that operate in these sectors should be encouraged to adapt energy efficient ICT applications to their business and, thus, gain competitive advantage by cutting their costs.

Lastly, Turkey should strengthen its physical and social infrastructures in order to reap the benefits of ICT revolution fully. ICT makes factors of production more productive, but this positive impact is highly dependent on both quantity and quality of those factors. As well, because ICT diffuse in all aspects of economic and social lives, its effects occur in mutual interaction with economic and social conditions. Actually, measures to improve physical and social infrastructures comprise a very wide range of practices and this issue is a much more top level one compared to ICT policy. Generally speaking, Turkey should allocate proportionately more funds to long-termed physical and social infrastructure investments to benefit from ICT revolution properly as well as increasing social welfare.

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