Study of the ICT sector in Greece: Current Situation and Future Trends

Deliverable 15

Main Conclusions (part A, B and C)

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1. Executive Review

This report summarizes the basic findings of the implementation of the "Study of the Information and Communications Technologies sectors in Greece: Current Situation and Future trends". The objectives of this project are threefold:

- the presentation of the current state of information technology and telecommunications (ICTs) in Greece and in an international perspective
- the analysis of the growth prospects of ICTs in Greece
- policy implications, which could under circumstances support its growth

More specifically, an extensive research of various sources, official statistics, other reliable studies and reports, took place in order to identify the basic characteristics of the ICT sector in Greece. The conduct of field research in ICT firms, which addressed business issues that we could not find reliable information was necessary, and the financial analysis of the sector are considered as significant advantages of this study. Thus, primary and secondary data sources are combined in this study.

Concerning the demand side, all the available data for the basic categories of ICT customers (domestic demand, external demand) were gathered. Special emphasis was placed upon the diffusion of ICTs to firms and the Greek population, areas that constitute determinative factors for the sector's growth. At the same time, e-business indicators were measured extensively in 10 sectors of the Greek economy, in order to find more evidence about the introduction of Greek firms to the digital economy. Additionally, four case-studies on firms that have successfully adopted some forms of ICTs were included in the study, in order to point out the appropriate strategies, the benefits, and the lessons learned that could guide other firms as well, towards the same direction.

Furthermore, the role of public policy, having a direct and indirect impact on ICTs' supply and demand during the last years, is examined. Of course, the domestic business environment of the sector is part of the broader macroeconomic environment of the country, as ICTs are infrastructure technologies that can push up the whole economy's growth. Analysing all related parameters allows some conclusions for the sector's prospects during the next couple of years, while we propose some actions at the firm level and at the level of public policy that could support the sector's growth.

The analysis of the international environment of the ICT sector aims on one hand at picturing the current developments of the ICT market and on the other hand in analyzing those factors that are important for the diffusion of ICTs on the economy in a long-term basis. Thus, the sector's size and structure, data on the international trade and investments in ICTs, and their

importance for the economic growth and productivity were examined. Additionally, the products / services that will have a major effect in the development of ICTs in the short-term are pointed out. Concerning the policies for the ICTs, some best strategies at the level of public policy or other initiatives are identified, while the analysis ends up with an extensive view on the relevant EU policies since 1998.

The analysis showed that the ICT sector has definitely upturned after the recession of 2001-2002. The excessively optimistic expectations due to the boom of Internet at the end of 90's were not verified. A decrease of the demand and the recession of the ICT market both at an international and Greek level was evident. However, the growth rates of the ICT market are now more stable, while the upturn is sustainable at least in the medium-term. In contrast with the past, the IT sector seems to grow more rapidly than the telecommunications. Thus, it tends to lead to a almost 50-50% market (in the European environment), although the boundaries between them are becoming more blurry. The increase of demand is a result of the diffusion of broadband, which allows for added-value services at more affordable prices. This attracts new users on one hand, while ICTs represent a greater proportion of firms' investments, than in the previous years. Hence, the increase of the demand depends on the IT services and software growth, while outsourcing, which is becoming a common practice for many firms, is also increasing.

In terms of Trade, the telecommunication equipment dominates and leads to a substantial increase of the total trade flows of ICTs. The dynamic entry of emerging and developing economies, and especially China, into the international trade is a crucial parameter. Although China dominates so far in the exports area, it will gradually grow in demand as well. This will radically transform the terms and the direction of the international trade and underlines the increasing importance of these markets. The technological developments in the short-term are based mainly on advanced products/ services through new broadband infrastructures. Triple play services (data, voice, and video), as a result of the convergence of telecommunications and IT on one hand and because of the collaboration with content providers, create a new environment and new products. Thus, they can attract new users (RFID, VoD, VoIP), transform the ICT sector's structural characteristics, and contribute to its growth.

At the level of EU policies, the implemented actions led to certain tangible results and gradually led to the adoption of more focused strategies. However, what is now stressed (through i-2010) is the need for a better conjunction of the policies for the Information Society with other policies concerning education/ training, employment, entrepreneurship and R&D. Emphasis is also placed upon bridging the digital gap concerning the citizens, social

groups, firms and geographical areas that do not participate in the Information Society and face problems in their entry into the digital era. The successful practices, which contribute towards that end, increase globally. Nevertheless, the commitment of all involved parties and their consent for the final aim, are mandatory for their success.

Structural characteristics of the domestic ICT sector

The first objective of the study was to set the boundaries of the domestic ICT sector, not only by adopting a methodology compatible with an international definition but also by taking into consideration the particularities of the Greek environment. The specific NACE codes that constitute the ICT sector have been defined by OECD. Nevertheless, following that definition left outside the sector's boundaries a number of Greek firms that were considered as important players. Therefore, the adopted definition was broadened and developed around four criteria for the inclusion of a firm in the domestic ICT sector (cf. deliverable 2). It is important to note that firms were classified - according to their primary and then secondary activities – first to either the IT or the telecommunication sectors and secondary to five basic sub-categories: a) ICT manufacturing, b) ICT Trade, c) Telecommunication and Internet service providers, d) IT services, and e) Software products. This classification is used throughout the study, while the trends in each of these categories is further analysed where possible and necessary[1] .

Within this framework, it is important to note that the ICT sector includes approximately 1870 firms. Almost 40% of the firms has as primary activity in IT and related activities (NACE 72), although the IT sector is much larger (85% of the total firms). The sector can be considered as an emerging one (83% of the firms were founded during 1990-2005). In IT, five out of nine firms have been founded during the last decade, while in Telecommunications the relevant proportion is two out of three. The majority of the firms (~ 42%) belong to the Trade, whereas 36% of them to the IT services (subcategory). The rest of the sub-categories include a smaller number of firms (7.6% in manufacture, 6.5% in software, and 8% in telecommunications/ Internet services).

Their size does not differ from the average size of a Greek firm. Four out of five employ up to 49 employees, while the IT firms tend to be smaller than the telecommunications ones (the average firm of each sector employs 14 and 25 employees respectively). 55% of the ICT employees work in IT firms (if OTE is excluded, the employment in telecommunications

[1] The primary data source (structural characteristics and financial data) were retrieved from a reliable business registry (primarily HELLASTAT and supplementary ICAP), which cover more than 85% of the business activities in Greece (in terms of turnover).

decreases to 22%). Furthermore, the sector is geographically concentrated in Attica (77% of the firms), while the sector's structure will not change substantially in the short-term, as the number of newly established firms in the periphery does not lead to such a conclusion. Furthermore, the average size of the firms in the periphery is smaller (mainly firms < 10 employees) than the respective one in Attica and operate mostly in ICT Trade.

Financial trends of the ICT sector

One of the basic sections of this study is the extensive financial analysis of the sector. It is the first time that an analysis of the whole population (census) of the sector (including more than 1600 firms) takes place. The most common analyses so far have been using either samples or using the data of the 100 largest firms. Despite the fact that actually 200 firms represent more than 90% of the total turnover, the census analysis allows for a reliable analysis of the trends and financial indicators not only for the sector as a whole, but also for the sector's subcategories and an analysis by size (micro firms, SMEs, and large firms).

The analysis showed that the poor results of the past, which followed the international recession but also the impacts of the Athens Stock Exchange crisis, seem to be overcome. Although there are still some open and pending issues and further restructuring is still taking place and needs to be completed, the sector seems to have recovered allowing for its more rapid growth. However, there are certain particularities, which should be pointed out.

OTE's losses during 2004 and 2005 influenced negatively the sector's results, while mobile carriers had a positive impact. The rest of the firms performed well enough during the period under study. Increasing turnover led to a more rapid increase of the net profits and owners' equity, while capital lending also increase. The total ICT turnover in 2005 is estimated at 18 billion € (decrease by 2% in comparison to the turnover in 2004), while more than 60% of it comes from the telecommunication sector.

Small firms (11-49 employees) are relatively dynamic, as several of them are the ones that contribute to the growth of the whole sector. On the contrary, medium-sized firms (50-249 employees) were weak to maintain in 2004 the important rise of turnover and net profits observed in 2003, which resulted to a small deceleration. Large firms also show some satisfactory results, while bad financial results of specific firms are counterbalanced by the good performance of some of the most important firms of the sector. Besides, large firms have greater profit margins than the smaller ones, which also suffer from high debt equity ratio

Firms in the IT sector show some good results, especially the small ones (11 to 49 employees), which prove to be more flexible and outstrip financial ups and downs. Besides,

their profit margin is decreasing at lower levels than Telecommunications. In the latter, the increased competition, the maturation of growth rates in mobile carriers, changes in the fixed telephony ("alternative carriers") and the decrease of OTE's figures are the main characteristics of the financial environment (deceleration of revenues and profits). A dualism is evident in the sector, as one part seems capable to overcome the barriers, while the prospects of the other are not optimistic. Still however telecommunications, are the most dynamic part of ICT market. IT Services also mark some good results, in contrast with ICT manufacturing and Software Products. Finally, profits in the rather volatile and heterogeneous sub sector of ICT Trade are increasing at a lower rate than 2003. However, it can grow substantially during the next couple of years, as the reforms that are taking place are being finalized.

Nevertheless, this upturn seems to cease in 2005 especially for the smaller firms. In IT, sales of the large firms hold on to their last year's level, while profits decrease. In Telecommunications, OTE keeps on having a bad impact on the sector. In any case, telecommunications grow slightly and are benefited by the increasing technological convergence between IT and communications. Despite the discouraging results in 2005, the financial environment is not as unstable and problematic as in 2002. Additionally, liquidity allows for large scale investments especially in telecommunications. According to the predictions for 2006, the sector will upturn, with an increase of turnover at the level of more than 3-4%. In 2007, the increase may be more than 7%, while the sector may achieve a two-digit increase in 2008.

Field research in the ICT sector: Basic characteristics of the business environment

A field research has taken place in the ICT firms, in order to identify some of the crucial characteristics of their environment. Almost 100 firms, representative of the IT and telecommunications sectors, participated to the research. In most of the cases, and in order to validate our results, we made an effort to cross check the trends identified with other studies, reports, official statistics, etc.

Field research results showed that Public as a market is the smallest one (8-10%) among the three main categories of the domestic demand (firms, consumers, Public). A small number of firms addresses mainly to the Public (10% approximately), although the majority (more than 60%) sells to the Public at least 1% of its turnover. Other firms from various sectors (25-27%) are the most important market for ICT firms, whereas consumers (25-27%) are the second most important. Some head customers come usually from the sectors of Trade,

Industry, and Telecommunications. Finally, Tourism, Shipping, and to a lesser extent firms from the Health sector constitute niche markets.

Participating in the 3rd CFS's actions is rather limited, as it is mostly large firms that participate to the implementation of large scales projects. Still however, this contribution is less than the 6% of their total turnover. Smaller firms participate mainly through subcontracting, but their majority face difficulties and chooses other markets/ customers.

Export activity is limited (60% operates exclusively in Greece). It stems mainly from some large firms from Trade/ box moving and ICT Manufacturing, while it is geographically concentrated mainly in the Balkans. Thus, the external trade of ICT products does not play an important role in the total trade of the country. Nevertheless, some IT Service and Software firms seem to become more internationalized. Some of them seems to follow their chances to more developed markets, which may provide a more stable clientele for more added-value products. These developments have improved the participation of high-tech and IT firms to the export results of Greece in 2006.

Investments mainly stem from telecommunications, although they were limited during the previous years. However, most firms of the sector have introduced plans or are actually implementing some investments (broadband infrastructures) for the development of their network, pushed by a more lucid regulatory framework. This will allow them to develop some additional and at reasonable price new value-added services (triple play) .

R&D in the sector is rather limited, although there are some important firms in IT services and Software, which in collaboration with universities, work on the basis of an extensive research agenda. As a result, the number of the Greek firms participating to the research Programmes of EU increases.

Employment in the ICT sector tends to increase, as it is ameliorated in comparison to 2004. The most important element, however, is that firms' predictions for the employment during the next couple of years are positive (especially in telecommunications and IT services) and they contribute to the expectations for the sector's growth. The demand for managers thus increases, in spite of the uncertainties caused by the reformation actions and the pressure of the international competition (for the multinational ones). The human capital of the sector is its competitive advantage, but there is still a need for further training and higher quality. A more profound collaboration with the universities in R&D, but also better prepared graduates in relation to market terms and practises are needed.

Supply is scattered, small in size, with numerous firms, while it seems to lack some intensive efforts for learning, market specialization, and an established entrepreneurial culture. Price competition is intense, but all the firms sell similar products/ services without any substantial differentiation.

Indeed, the competition is based mainly on price policy and secondary on marketing, and not on added value or technology. Within this framework, the most important aim of the firms is the increase of the market share for the existing products/ services in the existing markets, as well as the increase of their sales through the introduction of new products/ services. Thus, their objective is twofold: a) an extensive as possible diffusion of the existing products in the market in which they already operate, b) innovativeness as a competitive advantage by introducing new products, which aim to attract not only the current users, but also to attract new ICT users. However, the small size of the domestic sector does not lead to extroversion efforts, which do not seem to constitute a substantial strategy for the firms.

Firms, in order to achieve these objectives, adopt a strategy that places emphasis on the added-value products/ services. Many firms also choose differentiation strategies, with the emphasis given on relative products/ services. Furthermore, focusing on niche markets and improving their organizational flexibility also characterizes their strategic profile. A second group of strategies includes: upgrading their internal environment (attractive work environment), innovation regarding new products, improvement of the productivity, and strategic alliances. Strategic alliances are considered as a substantial form of strategic growth, especially in comparison to the limited willingness for M&A.

The results of the study have showed that there are still more barriers than driving forces for growth. The high cost for obtaining ICT equipment/ connection to the Internet, the small size of the domestic market, and the low quality of the telecommunication infrastructure are the main barriers for its further growth. The low diffusion of broadband at a reasonable price is an even more substantive barrier, while the limited electronic culture of the potential users further limits the ICT demand. Thus, the limited electronic culture of the consumers, the organizational problems of the firms and the possibility for their restructure are not satisfactory.

On the other hand, firms consider the implementation of OPIS as the most essential source for growth. Another important factor is the diffusion of ICTs in other sectors, although many firms argue that the diffusion remains limited. The third factor refers to the education/

training concerning the ICTs, whereas the adequacy of specialized personnel in the labour market is also important.

Prospects – Proposed Policies

The appraisal of the aforementioned data and results of the project lead to a position that the prospects of the domestic sector during the next couple of years are moderately optimistic. They are based on the gradual attenuation of demand and supply limitations, the macroeconomic environment that favours investments, and the gradual transition of the State to the digital era, improving its efficiency and infrastructures by offering more electronic advanced services. More specifically:

The macroeconomic environment keeps on growing at a rapid rate, while emerging and developing economies are contributing more and more to this growth and to the international trade. Greece sustains its high growth rates, which are due to the private consumption and lately to the public investments. **The improved business climate, the expressed willingness for reformatory initiatives, and the favourable macroeconomic environment imply that economic conditions do not constitute an obstacle for the domestic sector**. Nevertheless, it is important to note that favourable macroeconomic conditions are not a necessary and mandatory condition for the sector's growth, while as long as the long established structural problems of the Greek economy remain unresolved, they will create difficulties for firms and entrepreneurship.

Domestic demand for ICT products or services is small scaled and problematic. Public sector's primary demand is not strong and is hindered by legislative inflexibilities and bureaucracy. The firms mainly and the consumers secondarily, i.e. the basic markets, face some common problems: lack of information, technophobia, population's limited ICT skills, as well as organization difficulties towards the necessary organizational changes required by firms. These phenomena, in combination with the fact that some broad sections of consumers and firms are not convinced about the tangible benefits of ICT investments eventually shape clients of a rather low maturity. External demand is increasing, but attracts only a small number of firms. Hence, export activity of ICT firms has been limited so far (mainly telecommunication equipment in non-EU countries).

However, there are some indications that domestic demand is strengthening, while firms tend to exploit the external demand, at a greater extent. A significant number of large and medium-sized firms of the country adopt ICT tools to an extent comparable to the one of other developed countries. As these firms cooperate with numerous smaller firms, the latter

will be forced to collaborate, in order to maintain their position in the relevant market. At the same time, younger and more intense ICT users, who are entering in the economic activity, are increasing. Besides, the total consumption of Greek households for ICTs is more than 4.3 billions Euros per year and it represents greater proportion of their monthly expenditures (5.7%) in comparison to 1999. However, this mainly concerns Telecommunication Services (90%) and reflects the strong diffusion of mobile phone services in the population.

State's role on the creation of secondary demand is also reinforced, as it is gradually providing more advanced electronic services. Indeed, although the State's primary demand is limited, secondary demand, which is created by information/ training and awareness actions, and the multiplying benefits from the implementation of the projects specify a strong potential customer base (citizens and firms) more familiar with the ICTs.

Upgrading infrastructures and the distribution of broadband- a main barrier for sector's further growth - is a basic precondition for development, as they will allow for more attractive services at reasonable prices. Given the technological convergence between IT and telecommunications, the innovative integrated value-added services (triple Play IPTV, VoD, VoIP) constitute attractive services with tangible benefits for the potential users. Thus, the increase of (public and private) investments in broadband infrastructures and the more aggressive actions from the public policy's side for broadband expansion, create some positive expectations for the future. Furthermore, the number of the broadband connections is increased due to the substantive cost decrease (although it is mainly a technological upgrade of the dial-up users). Thus, the predictions are better, concerning also new users.

Firms' beliefs about their sector are also moderately optimistic, since field research and business and consumers' surveys show an improved economic climate in 2006 (better predictions for the demand, expectations for the increase of sales, reinforcement of external demand, increase of employment). Although, ICT firms are moderately optimistic for the sector's growth, they are considerably optimistic for themselves. **Consequently,** although firms are not very optimistic concerning the growth prospects of the sector, **as there are many barriers for its growth, they point out certain competitive advantages for themselves,** as well as their capability to survive in such an environment, by winning stealing market shares from their weak competitors.

Besides, at a financial level, projections for 2006 and 2007 show a substantial increase in the turnover. Employment and investments at the sector will increase, while firms intend to intensify their efforts for greater differentiation, specialization, and focus on niche markets. Moreover, some restructuring actions have already been taken place, in order to rationalize the sector's structure, while the increased interest from foreign investors indicates that there are certain business opportunities in the domestic market. At the same time, the sector accumulates know-how and experience, by implementing large scaled and

innovative ICT projects. This is a competitive advantage that should be further exploited at the international level. Besides, this is why the human capital of the sector constitutes a significant advantage, although it should be further reinforced by the collaboration between firms and universities.

To summarize, the preconditions for the sector's growth are: a) the increase of the investments in broadband infrastructures that will in turn increase the competition in the sector and the new value-added products/ services, b) the development of some Greek digital context by ICT firms, which will allow a more intense diffusion of the Internet and diffusion of ICTs in other sectors of the Greek economy, c) the reinforcement of training/ information/ education actions in relation to ICTs, d) the rapid organizational integration of ICTs in Public Administration, so as to offer advanced e-services, which facilitate the citizens' and firms' activities, e) extroversion efforts along with some more mature professional business attitudes, in parallel with specialization and segmentation of the market (market niche) and f) the reinforcement of a more profound and intense collaboration between universities and firms, so as to ensure a better fit of market needs and human capital preparation, while improving the R&D collaboration as well.

The study also proposes a bundle of public policies and certain propositions for the ICT firms. These refer to actions, which can ensure for a long-term and sustainable growth of the domestic sector.

2. Introduction

The aim of this report is to synthesize the basic findings of this study. More specifically, this deliverable includes:

- The basic conclusions from the analysis of the international ICT environment. More specifically we cover, the sector in terms of its main figures and structure are analyzed, the international trade of ICT products and the investments in ICTs in OECD countries and Europe, the correlation of ICTs with the economic growth and productivity, the implemented EU policies, certain best practices for the adoption of ICTs, and the technological developments that will determine the sector's growth in the mid-term at an international level.

- The structure and main characteristics of the domestic ICT sector.

- The conclusions of the financial analysis, which included more than 1,600 ICT firms for the period 2002-2004. It also includes conclusions for each sector, sub-sector and size, but also some results from a sample for the 2005 data.

- The results of the field research in ICT firms that address issues regarding the sector's business environment for which no secondary data are available. However, it is important to note that the trends are further validated with other sources, recent studies, and official statistics, thus increasing their credibility and reliability.

- The basic conclusions from a field research regarding the e-business practices in 10 sectors of the Greek economy. The aim of this research was to identify the adopted practices by firms that have already entered into the digital economy, that is they have already adopted ICT practices.

- The conclusions of the four case studies regarding the successful implementation of ICTs in Greek firms.

- The conclusions for the ICT sector's prospects during the next couple of years, based on all data gathered and empirical work undertaken, along with some policy actions that can support a growth process for the domestic ICT sector.

It should be noted that, this is a concluding report and thus, it does not incorporate all the methodological, technical, and theoretical assumptions that have been posed in other parts of the project. Any reader interested for further details should look at the specific deliverables.

3. International environment

The international environment of ICTs is analyzed in six sections. The first section, analyses the ICT sub-sectors in terms of size and structure at an international level. Nevertheless, the emphasis is given in Europe and on the investments in ICTs in OECD countries. The second section examines trends and developments of the international trade of ICT products/ services. The next session stresses the correlation of ICTs with the economic growth and the productivity indexes, while it also argues for the importance of the ICT sector in Greece's innovative performance. The fourth section tracks down the best strategies mainly at the level of public policy, but also at the level of firm level initiatives. These are mainly oriented towards actions, which could be adopted by Greek institutions as well. Finally, the fifth and the sixth sections report the guidelines and directions of the implemented EU policies and map the products/ services that will contribute to the international growth of ICTs in the short-term. More specifically:

The decade of '90s was a decade under development regarding the growth of the ICT market. The share of ICT Services in the total added-value of Services increased substantially in OECD countries, with Czech Republic, Finland, Korea, and Sweden being first in the rank. Greece also performed well: the share of telecommunication services in the total added-value of Services was 6.7% in 2001. This percentage outperforms both the European average and the average of the OECD countries. Thus, ICT sector boomed, especially during 2000-2001.

However, this growth was build on very optimistic predictions which proved to be not reliable after all. Therefore predictions for its dynamic growth were not verified in the short-term, as demand decreased and an intense recession characterised the ICT market. However, the economic climate gradually improved, and thus the market upturned in 2004-2005. This upturn seems sustainable at least in the mid-term.

Hence, market shares in 2005 are as follows: Europe dominates the market (market share of 33.6%), USA ranks second (28%) and Japan third (14.3%). In Europe, the ICT market reaches 659 billion euros, of which 47% represents the IT market (office equipment, electronic data processing, software, IT services). Additionally, the annual rate of IT market's growth outperforms telecommunications' rate for the first time, while it is predicted that this trend will hold on 2007 as well. Nevertheless, the total growth of the European ICT market slowed down in 2006, mainly due to the slow down of Telecommunications. On the contrary, IT sector will keep on growing rapidly, mainly due to the increase of IT services and software demand. Furthermore, outsourcing services, which are becoming a common practice for many firms, are also growing.

Concerning the ICT sub-markets in Europe, software products market increased by 5.5% in 2005, while this performance is expected to be even more intense in the next two years. Moreover, a growth by 4.3% of IT service market was observed and it is estimated to increase even more in 2006 and 2007. In contrast, hardware sector keeps on slowing down.

Investments in ICTs have increased, being probably the most dynamic element of the total investments during the last years. The proportion of ICTs in the total investments is constantly increasing in all OECD countries, with Sweden, Finland, Australia, and the USA to outperform. However, the investment expenditures as a percentage of GDP are not positive in the period 2002-2005. Especially Greece has the lowest investments in ICTs in Europe, while it has a significant structural particularity in comparison to the other countries: The proportion of telecommunication expenditures to IT expenditures is 3:1, because of higher telecommunication fees. On the contrary, the respective proportion in Europe ranges from 53% - 47%.

3.1. International Trade in the ICT sector

Recent data for the trade flows show that the increasing rate of the ICT trade is higher than the whole trade's rate, while the difference is higher in telecommunications and IT services. The three countries that have the highest trade surplus in ICT products are Japan, Korea, and Ireland. Ireland was actually the country participating most to the total ICT trade during 1996-2002. However, Europe has a trade deficit in its trade balance of ICT equipment (36 billion euros in 2004).

Concerning the exports of ICTs, OECD countries form 3 groups: the USA, Korea, Japan, and Germany are the dominant countries in the export activity. Ireland, France, Mexico, the United Kingdom, and Netherlands are the mid range, having though a significant export performance, while the remaining countries (including Greece) form the third group with the lower value of ICT equipment exports.

The growth of exports of ICT equipment was particularly high during the period 1996-2004 for the countries that had had low exports so far (e.g. Hungary, Czech, Slovakia, and Poland). The USA, Japan, the United Kingdom, and France grew at a more moderate rate, although they had a significant export activity in 1996. On the contrary, the export activity of ICT equipment in Germany and mainly Korea grows at an exceptional rate.

In the non-OECD large countries (Brazil, China, India, Russia, and S. Africa), the growth of exports was slow with the exception of China that presented a significant increase (the increase of exports of ICTs per year was more than 30% in the 1996-2004 period). As a result, its exports exceed the exports of the USA, pointing a new force in the global environment.

Concerning the trade of individual ICT products, the development of the Internet and the fast diffusion of mobile telecommunications have made the communications equipment as the fastest developing part of ICT trade. During the period 1996-2002, the total equipment exports of OECD countries increased by 7.9% per year and the imports by 9.5%. Nevertheless, computer and related equipment represent the greatest share in the ICT product trade in OECD, while the USA, Japan, Holland, Korea, the United Kingdom, and Ireland are the biggest export countries. It is important, though, to note that the balance of trade of OECD countries had a deficit, which is increasing, as the production and assembling take place in non member-states because of their lower labour cost.

The electronic components trade constituted the 27% of the total trade of ICT products in 2002 in the OECD countries (growth per year 2.4% during the period 1996-2002), while the share of audio and video equipment trade was 12% approximately. Finally, trade for software products, although it was one of the most dynamic sectors in the ICTs, is limited. USA and Ireland (22% and 16% of the total exports of software products in 2002) are the most prominent exporters, while the United Kingdom and Germany (2002) are the main importers from the OECD countries.

In any case, foreign direct investments are a determinative factor for the trade flows of each country. Especially in the telecommunication sector, Foreign Direct Investments during 1990-2003 equalled 12% of the total Foreign Direct Investments in the developing countries. Indeed, the countries of Latin America attracted more than the half of foreign direct investments in telecommunication, while Europe and Central Asia attracted about ¼ of them. These big shares reflect the hegemonic position of the countries of mid income regarding the attraction of foreign direct investments in telecommunications.

3.2. Assessment of the implemented EU policies: best practices

The Action Plan eEurope 2002 was the first substantial and crucial initiative adopted at an EU level regarding the Information Society. This was assessed as extremely successful and led to significant changes in the various sectors in the European environment. The next initiative, the Action Plan eEurope 2005, aimed at ensuring a widespread as possible diffusion of broadband access at reasonable prices, providing also secure infrastructures for the transmission of information. A clear vision of this plan was to transform the constantly increasing Internet connectivity to substantial electronic economic operations in a way that will trigger growth in Europe. E-government, e-learning, and e-health in a new dynamic environment of e-business were the main pillars of this plan. Special emphasis was placed upon broadband development, as it was perceived the basic factor for the growth of these services and applications.

European Commission grouped the countries when assessing the effectiveness of the Action Plan eEurope 2005. Thus, according to their performance towards the Plan's objectives, the groups formed are: Group I (Denmark, United Kingdom, Sweden, Finland, Germany, Holland, and Austria) includes those countries- leaders regarding the application of ICTs. Group II (Belgium, Ireland, Estonia, Luxembourg, and France) includes countries, which are in the mid range of EU and have very good ICT infrastructures and high use of ICTs by the citizens, firms and the public sector. Group III (Spain, Italy, Portugal, Greece, and Slovenia) includes countries, which are in the low range of EU regarding ICT development. Group IV includes five new member-states (Lithuania, Latvia, Czech Republic, Poland, and Slovakia) and Rumania. These countries are the ones that need more extensive effort to keep pace with the eEurope 2005 indicators. Finally, Group V includes Hungary and Bulgaria, whose performance is far from the average performance of the other groups.

I-2010, which was adopted next, is included in the portfolio of policies under the Lisbon's Strategy. Its objective is to promote a more flexible approach with a better coordination between EU and Member-States' services, better coordination between the policies of Innovation and Research, and synergy between the various financial tools. The i-2010 sets three priorities: a) the completion of an integrated European area of information by promoting an open and competitive internal market for the Information Society and the Media, b) the reinforcement of innovation and investments in research for ICTs, in order to enhance growth and to create more and better jobs, and c) the formation of an Information Society without digital exclusions that will promote sustainable growth and employment and that will set as a priority better public services and improved life quality for all the citizens.

Within this framework, several initiatives have been identified in the international environment - depending on the degree of embedness of ICTs in the respective socio-economic environment- that can be characterized as best practices. The emphasis lately is placed mainly upon e-government, e-health, and e-learning services. These practices have some common characteristics: a) a focus on policies on sectors with prevalent needs and

weaknesses regarding the use of ICTs, without, though, neglecting the sectors that show dynamism and can push the economy at several levels, b) a more strong and profound collaboration between universities and firms at the R&D level, and c) the predefined and complete determination of the goals of each action, but also the attendance of quantitative indicators that trace the progress towards the final end. In any event, the broad collaboration and commitment of all interested parties for the implementation of the Information Society are mandatory for the successful adoption of any mechanism.

3.3. Technological developments and trends in the international ICT Market

Reviewing the international literature shows that the technological developments, which are going to dominate the European (and not only that) economy are mainly based on the further development of broadband infrastructures. At the same time, the successful convergence between telecommunications, technology, and media is increasing: Telecommunication services are transforming to digital broadcasting; ISPs develop more rich digital content and the Media are becoming Digital Entertainment providers. Wi-Fi's development to WiMax, Triple Play, RFID, VoIP, and GRID are the dominant technological developments.

4. Profile of firms in the domestic ICT sector

In order to gather data for the domestic ICT sector's firms' profile, a methodology, compatible with the international definition of the sector (OECD), was adopted. A reliable Greek business registry (HELLASTAT and supplementary ICAP) was used for retrieving the necessary data. The data were then analyzed and results show the basic structural characteristics of the domestic ICT sector:

- The domestic ICT sector includes 1,870 firms approximately. The majority of those firms (90,6%) are included in our analysis based on the international definition of the ICT sector by OECD.

- Almost 40% of the firms report NACE 72 as their primary activity: Computer and related activities, while 36,7% reports activities in wholesale trade (NACE codes 514 & 518). In total, IT sector represents almost 85% of ICT sector in terms of number of firms.

- 82.8% of the ICT firms were founded during 1990-2005. Three out of ten IT firms were founded during 1996-2000, while 57.4% of the IT firms were established during the last decade (67% in Telecommunications). At the very opposite, 7% of the telecommunication firms were established before 1980 (mainly manufacturing of telecommunication equipment) and only 3.5% of the IT firms. 67.4% of the micro

firms (<10 employees) have been founded after 1996. Furthermore, the firms, which were established after 2000, employ on average 24 persons, while the firms, which were founded during the '80s, employ 77 persons.

- Four out of five ICT firms employ up to 49 persons. On average, every ICT firm employs 51 persons (15 persons in the median firm). 83.1% and 66.0% of IT firms and telecommunication firms respectively employ up to 49 persons (i.e. micro and small firms). IT firms are, thus, substantially smaller than telecommunication firms, as every IT firm employs 43 persons on average (against 142 persons in telecommunications, excluding OTE). The median IT firm employs 14 persons (against 25 persons in telecommunications).

- 55.1% of the employees in ICT sector work in the IT sector, while 44.9% work in Telecommunications. However, if OTE is excluded from the set, telecommunications represent 22% of the total employment in the sector.

- The majority (~42%) of ICT firms come from ICT Trade (wholesale and retail trade of office equipment, computers, and telecommunication equipment). 36% operate in IT Services, which includes firms that provide integrated IT solutions. The rest of the subsectors used represent lower percentages (manufacturing 7.6%, software 6.5% and telecommunication/ internet services 8%).

- 77.2% of the ICT firms have their headquarters in Attica, 10.7% in Thessalonica, and only 12.1% in the rest of Greece. The average size of the firms in the rest of Greece is substantially smaller, since the majority of them are micro firms (<10 employees). Despite, the geographical concentration in Attica, the establishment rate of new firms in the periphery is higher than in Attica. However, this does not mean that the structure of the domestic ICT sector can change substantially in the short-term.

- A higher geographical concentration of Software firms and IT Service firms is observed in Attica, whereas Trade firms are more concentrated in the rest of the country (48% instead of 40% in Attica).

- IT Services are the second most "new" category behind telecommunications: Almost three out of eight firms of this category have been established since 2000, while 70% of them have been founded during the last decade. Additionally, the average number of their employees is 37 persons, while 44% employs up to 10 persons.

- In terms of employment, 35% of the employees in the ICT sector (including OTE) work in the carriers / internet services, while 35% work in ICT Trade.

Although the classification of the firms to subcategories is based on their primary activity, many of them have some secondary activities in other subcategories, related or not to ICTs. If these are taken into account in the analysis, they we see that:

- 35.0% of manufacturing firms are also active in the trade, while 28% have secondary activities not related to the ICT sector.
- Trade sector presents the highest percentage of operations outside the ICTs (42%), as they concern electrical machines or other equipment non-related to the ICTs
- 12% of the telecommunication services firms also operate in Trade.
- 4.9% of Software firms also provides telecommunication/ networking services, whereas 30.3% operates in activities non relevant to ICTs.
- One out of five firms in IT Services also operates in trade.

5. Field Research in the ICT sector

Since secondary data concerning various dimensions of the ICT firms were not available, an effort was made to collect primary data for the crucial characteristics of the firms' business environment. In this framework, a field research of ICT firms took place. Based on the received information but also from their corroboration with other sources, studies and reports, the main conclusions are the following:

Structure of ICTs domestic demand

The results of the research showed that the Public represents the smallest (8-10%) part of the market among the three main categories of domestic demand (firms, consumers, Public). However, 60% of the firms sell to the Public at least 1% of their turnover, although in quantitative terms this market is less than 8-10%.

In the private sector, the main market for the majority of the ICT firms is the other firms rather than the consumers. Thus, 63-65% and 25-27% of the private sector's market are firms and consumers respectively. The main customers of ICT firms are other commercial firms and Industry. The Telecommunication is also a significant market. Tourism and Shipping constitute small niche markets, while Health is not the primary market for any firm.

Participation to 3rd CFS Programmes

Two out of three ICTs firms have not participated to any action of CFS or at least they do not consider that their participation had any significant impact on their turnover. Indeed, only 6%

of the total turnover of the participants concern inflows from the CFS. Results also prove that the size of a firm is a determinative factor for its participation to one of the - significant in terms of budget - actions of CFS. A "participating" firm should employ an adequate number of persons and have an appropriate portfolio of resources and capabilities, so as to carry out CFS projects (although subcontracting and alliances are a common practise, especially in the large scaled infrastructure projects). Thus, three out of four large ICT firms have participated to the implementation of CFS projects.

Extroversion and exports

Almost 60% of the ICT firms report that do not have any exports (independently and not via multinationals), placing emphasis only on the domestic market. For the exporters, three almost equal groups have been identified: a 1/3 of them export less than 5% of their turnover, 37% export 10-30% of their turnover (average of 20%) and finally a dynamically extrovert 29% states that exports more than 35% of their turnover. These "international" firms belong mostly - in terms of turnover - to Trade/ box moving and Manufacturing sectors, but also to IT services and Software sectors. Besides, the size influences decisively this business choice: the "exporters" employ 89 persons on average, while the "solely domestic" ones employ 46 persons. Nevertheless, there are also small firms with substantial export activity, as 42% of the micro and small firms report that at least 1% of their turnover comes from their export activities.

Balkans and Cyprus are the main markets of the ICT firms' export activity. It is interesting, though, that the firms addressing to more developed markets are more export intensive, as a higher percentage of their turnover is channelled to these markets. These firms, as they having developed commercial relations with more demanding customers, seem to have focused on fulfilling the needs of those markets. These may have greater growth margins in the future and can thus constitute a more stable customer base for higher added-value products.

The general trends shows a small improvement in 2006. High-tech and IT firms' participation to the export activity of the country increases, while 21 out 100 main export Greek firms in Trade and Industry are ICT firms.

Investments and Expenditures in R&D

37% of the firms stated that they undertake investments of more than 10% of their turnover per year. However, investments in quantitative terms in the ICT sector mainly take place in telecommunications, although given the technological convergence, they also involve some large IT firms. Investments during the previous period were limited because of the low participation of the new firms from the area of fixed telephony. Nevertheless, significant firms from this sub-sector plan or are actually implementing high amount of investments in infrastructures for the development of their network. OTE, which had invested 300 million €

for the Olympic Games, also does so (broadband infrastructures). The integration of the institutional framework and the regulatory interventions of EETT (law for the Electronic Communications, decisions about the obligations of OTE, etc.) are additional motives for more investment plans in infrastructures by the so called "alternative" fixed telephony carriers.

Regarding the expenditure in R&D, 29% of the firms report that they spend more than 10% of their annual turnover in R&D, whereas 43.3% of the firms spend more than 5% of their turnover in R&D. At the sectoral level, most of the investments are held in IT Services and Software. Although the majority of the sample firms state that they spend won resources for R&D, previous studies have ascertained that a big part of R&D is undertaken through subsided collaborations and EU funds. Greek firms in general participate more than other EU countries to the EU research Programmes. Especially in the IST Programme, 234 Greek firms participated to 2,203 research projects. This participation shows the significant representation of Greek firms to the specific Programme. Despite that, other R&D data related to the ICT sector cannot be characterized as satisfactory.

Employment and training in the ICT sector

Employment in the ICT sector in 2006 is stable and has increased slightly in comparison to the previous couple of years. 45% approximately work in the areas of production, development and product support, while 25% work in sales. Estimations for the employment in ICT firms in 2007 are optimistic. Although the majority of firms (75% approximately) will not undertake any significant changes in their employment, a 25% predict significant increase of their personnel. This trend is not depended though, on the firm size. This means that this increasing trend stems form all firm sizes. Furthermore, IT firms and especially IT service firms are slightly more optimistic than telecommunications. It should be also noted that other types of employment, which refer to more flexible relations (external co-operators, part-timers, students) seem to increase.

These positive trends are validated by results from other studies related to the domestic labour market. These studies report an increase of the demand for managers in the ICT sector (especially in IT Services and Telecommunication Services). The prospects are also positive in a European environment: an IDC's study predicts that 1.5 million new jobs will be created in the ICT sector in Europe in the next four years. However, there are several exogenous factors that create uncertainty about these prospects. International competition especially in the manufacturing of ICT equipment is increasing (Chinese suppliers), while mergers and acquisitions are also proliferating at the international level. Hence, they may have a negative impact on the employment in the domestic sector.

ICT firms are generally satisfied from the quality of human capital in the domestic labour market. However, there is the need for a better training and quality from the supply side. Mot of the firms agree that there are remarkable managers and good scientists in the field. There

is, though, a missing link between universities and market needs. There should be a more profound and intense collaboration between universities and firms regarding R&D, working experience, and more lectures by managers in the universities so as the students have a better understanding of the market terms and practises.

Intensity and characteristics of competition in the ICT sector

Field research results – across sectors and sizes - indicate that ICT firms consider price competition as the basic element of their environment. Marketing and advertising methods are also significant elements of the competition, however, they are ranked far away from the main characteristic (price). Firms place even less value on quality and added-value competition and technology. Hence, it seem that most of them sell similar products or common technological products differentiating only in price and mean of promoting.

In any case, competition in the ICT sector is constantly changing because of the changes in telecommunications. The mobile carriers cannot achieve as high growth rates as in the past. This shifts competition from attracting new customers to the development of more attractive services that can increase their profits (triple play services at affordable prices). In fixed telephony, a small number of economically sound firms, which are now investing in infrastructures in order to develop a privately owned network, will further compete in the market. The competition with the mobile carriers will increase, as fixed telephony is gradually being substituted by mobile phones (especially in households). Competition has also increased in the IT sector- which is influenced by the convergence with telecommunications- in the last couple of years, since supply of services is greater than the demand in a rather small domestic market.

Business Strategies: Goals and business actions

The most important strategic goal of ICT firms is increasing of their market share for the existing products/ services in the existing markets, as well as sales increase through the development of new products/ services. Thus, the goal of ICT firms is twofold: first, to diffuse as much as possible their existing products in the market they already operate in order to attract customers from their weakest competitors. Second, they believe in innovation as a competitive advantage. Thus, they introduce new products/ services that do not aim solely to attract the customers of the existing market (users of ICTs), but also to enlarge the market by attracting new customers (non-users of ICTs). However, the small size of the market does not allow for an opening-up to new geographical areas or new sectors, as it is not a significant strategic choice for the sector's firms.

Firms in order to meet these goals, adopt or will adopt in the mid-term, several strategies that have mainly four characteristics (strategic profile). The emphasis on the added-value of products/ services is the main strategy of ICT firms. Furthermore, some firms adopt differentiation strategies, placing though the emphasis on the relevant products/ services.

Focusing on specific customer groups (niche markets) is the third characteristic of their strategy, while the emphasis on their organizational flexibility is the fourth one.

A second group of strategies includes actions regarding both the external and the internal environment of the firms. Within the framework of improving their weaknesses and upgrading their internal environment, ICT firms give high value on their human capital. The creation of an attractive working environment is a significant strategic choice of the firms, as it allows them to sustain the remarkable personnel they may have and to attract new capable personnel. In the field of innovation, differentiation in new (for the firm) products/ services is a strategy option. However, it is more challenging than the differentiation in relative products that is a more common strategic choice. The effectiveness of internal processes refers to actions that a firm should do in order to improve its internal operations, to identify its strengths and weaknesses, and thus become more competitive. In this framework, the cost decrease due to the improvement of productivity is a strategic goal of many firms. Finally, strategic alliances are perceived as a significant way of the strategic development of the firms, instead of mergers and acquisitions.

Geographical opportunities and threats

The extroversion of Greek ICT firms, as a solution to a small domestic market, is not an easy option for every firm. That is why it proves to be not a strategic priority for many firms. In any case, potential business opportunities are located primarily in Balkans (especially Bulgaria and Romania) and secondarily in Cyprus and East countries. There is special interest for the Arab countries, while it is rather limited for the most developed countries of Central Europe. Firms from the most developed countries (West-Central and North Europe) constitute the main competitive threats for the domestic ICT sector. Additionally, neighbouring countries are also potential threats, as the empowerment of the relevant sectors will probably lead to the substitution of Greek firms in these markets, while they may have even more aggressive strategies in the longer term. Thus, they may extend their operation in the Greek environment, providing products and services at lower prices. In this framework, it is argued that this trend may probably render that environment more favourable for the investors and thus withdraw the foreign investments from Greece. Hence, the opportunities arising in the neighbouring countries should be exploited on time.

Determinative factors for supply and demand side in the ICT sector

The results of the field research show that the barriers are more numerous than the sources of growth for the domestic ICT sector. Firms think that the implementation of the OPIS is most important source for growth of the sector, although 25% of them are not satisfied with its progress. The second most important factor is the diffusion of ICTs in other sectors of the economy, although a high percentage of firms also think that the progress is not satisfactory. Furthermore, the level of education/ training of the employees regarding ICTs and the adequacy of specialized personnel in the labour market are some positive factors.

On the other hand, the high cost of ICT equipment and Internet connecting fees, the small size of the domestic market, and the low quality of the telecommunication infrastructures are the main barriers for the further development of the sector. The limited diffusion of broadband at reasonable prices is the main barrier, which should be overcome so as the domestic ICT market can grow. The limited electronic culture of the potential customers of ICT firms is a significant barrier for the demand. Both the low information culture of the customers and the organizational structure of firms which does not easily allows for structural changes hinder demand. Certain dimensions of the broader business environment also have a negative impact on the development of ICT sector: the macroeconomic environment, the institutional framework for the security of electronic transactions, the regulatory framework, and the lack of tax motives for the further use of ICTs. Finally, many firms face problems regarding the capital cost. So, the need for new financial mechanisms and funding tools, such as PPPs, Digital Leap Fund, etc, are more than necessary.

Prospects of the ICT sector

The field research concludes that the firms are reluctant and moderately optimistic for the sector's growth, but particularly optimistic for themselves. 45% of the firms approximately are optimistic for themselves, while 15% are very optimistic. This means that seven out of ten firms are optimistic for their progress in the short-term. On the contrary, only 26% of the firms are optimistic for the sector's growth, while the majority of them (55.4%) express more moderate opinions.

At the level of sectors, although the relation is only marginally significant, a greater optimism is observed in telecommunications than in IT. The greater pessimism of IT firms mainly concerns the trade/ box moving of ICTs, while the optimism stems mainly from ICT manufacturing. In terms of firm size, there is a weak relation between firm size and optimism. Therefore, firms hold the position that the sector's prospects are very moderately optimistic, as the market has more obstacles than sources for development. However, they identify certain competitive advantages to themselves as well as their capability to survive in such an environment by increasing their market shares and banishing their weak competitors.

6. Other characteristics of supply and demand side of the ICT sector

6.1. Aspects of Demand

Households budget survey (HBS)

The household survey conducted by the National Statistical Service - ESYE (2004-2005), reports data about the total expenses of Greek households. Results show that their expenses

on ICT products/ services during 2004-2005 exceed 4.3 billion Euros per year and have increased faster than their whole monthly expenditures. Therefore, they represent a greater part in comparison to 1999.

More specifically, expenditures in ICTs represent the 5.7% of the total monthly households' expenditures. A clear 5% involves the basic core of ICTs. In comparison to 1999, these expenditures have increased by one percentage unit, gradually absorbing more than 1.4 billion € from the yearly expenditures of the average household. Their increase rate is almost double to their total expenditures. This justifies their greater contribution to the total.

However, this increase is mainly attributable to Telecommunication Services (90% of the total) and reflects the extensive use of the mobile phoning and the increase of the relevant expenditures. This does not allow for any determining relationships for factors such as the total income or the profession. What should be noted is that new households create positive inflows of potential expenditures in ICTs (substantial percentage increase for computers, monitors and printers, but also training for the use of ICTs), as they constitute the most dynamic part of users. These users are expected to adopt new technologies, which result from the convergence of IT with communication, at a faster rate.

External Demand: The external trade of ICT products

Data regarding the external trade of ICT products in Greece show that the trade flows of the country has decreased by -2.3% (cumulatively -16.5%) during 2000-2005. Trade flows of ICTs represent the 5.4% of the total (instead of 7.3% in 2000), while there was a balance trade deficit throughout the period. However, the deficit has decreased from 2000 (in contrast with the whole trade balance deficit of the country that has increased). The imports are estimated to be 2.58 billions € in 2005, while exports continually decrease and are estimated to be 419 million €.

Concerning the direction of ICT trade, EU-25 is the main business partner of Greece, as it is its main supplier with ICT products. In terms of exports, EU-25 ha become the basic recipient of Greek exports only in 2005. Hence, the imports within the EU are gradually reducing (80% in 2005), while the exports between the EU countries increase at a slighter rate (60% in 2005). In general, Greece keeps on importing from EU much more than it exports to it.

34% and 26% of the total ICT trade in 2005 involve telecommunication equipment and computers (and related equipment) respectively, although the participation of these two categories has decreased since 2000. The relation is more acute however when examining the imports – exports structure. Thus, more than half of the exports' volume in 2005 involve telecommunication equipment (65% in 2000), whereas at least half was exported to non-EU countries.

Diffusion of ICTs to population and firms

The surveys, which have been conducted in Greece in order to assess the diffusion of ICTs in the country, shows that the ICT penetration in the Greek population has not changed in the last years, while firms slowly increase their use. A significant part of the firms, use ICTs to a degree comparable to other European countries, but the larger part does not follow. As a result, the total indicators for ICT use (excluding mobile phones) are lower than those of the other developed countries. The Internet penetration in households is much lower than the European average, while firms' indicators are at a better level.

The age remains one of the most important determinants for the adoption and use of ICTs. The use of ICTs by younger will definitely have an effect in increasing the use of ICTs in all sectors of the economy, as they will gradually enter into the production process, while they can communicate their knowledge to their family and working environment. Following the same line of argument, the size of the firm is considered as the most important determinant, along with sectoral and geographical differentiations. Lack of training and unawareness primarily and the issue of cost secondarily are the basic barriers for the ICTs' use. However, what is more discouraging is that the majority of citizens and firms, which have not yet adopted ICTs, argue that they do not need them. As a result, a substantial proportion of the firms state that there no incentives or motives that could make them change their mind regarding the usefulness of ICTs. In any case, internet can become more attractive, as its role in entertainment and the search for information can contribute positively.

The significant increase of broadband connections during the last year is considered as a positive development, although it is mainly a technological upgrade of the dial-up users. The policies that are planned, private and public investments in infrastructures, and the development of new attractive services (IPTV, VoD, VoIP) will increase broadband' s diffusion, including new users.

Hence, while a proportion of the population and firms adopt rapidly the new technologies, a significant part is left out as it has not yet adopted ICTs. The greatest challenge for the applied policies at a European level is that the citizens are aware of the possibilities, acknowledge and get familiarized with the new technologies, so as to bridge the digital gap.

6.2. Supply side

IOBE Business' Surveys

The BCS that are conducted by IOBE on a monthly basis lead to some interesting findings about the economic climate in the sectors under study. The analysis of ICT Industry, ICT Retail, and ICT Services show that:

Business Climate Index in ICT manufacturing sector shows some intense ups and downs. While it was following the whole Industry index till 2004, then it fell short. In the mid 2005, the index was at its lower levels during the period 2000-2006, because of the low levels of demand. However, a trend for improvement has been observed since the end of 2005 which is further stabilized since the beginning of 2006. Thus, there are more positive predictions for the demand and new orders, which lead to an increase in sales. This, in parallel with the stock levels, leads to positive predictions for the short-term progress of their production. Furthermore, firms which are exports, point out also an increase of external demand in 2006.

In ICT Services, the Business Climate Index is at the same levels with the index of the service sector. It has had some intense ups and downs since May 2005, but it was always, lower that the general index, while it decreased in 2006. Except for the inadequate demand, the inadequacy of capital also hinders the operation of the firms. However, their effect gradually decreases, while the short-term predictions from the beginning of 2006 refer to an increase in employment: 40% of firms predict an increase of employment. In Retail Trade, the Business Climate Index fluctuates intensively, while the predictions for sales are favourable in 2006. This course will be maintained in the short term. At the same time, the empowerment of related trade may have a positive effect on the relative employment in the sector.

The ICT manufacturing sectors

Some hard data about the manufacturing sectors have been retrieved from ESYE. Data show that the sector which seems to be more dynamic during 2000-2006 is manufacturing of instruments and appliances for measuring, checking, testing, navigating and other purposes (NACE 33.2). During the second semester of 2006 the production is cumulatively increasing by 68% in comparison to 2000. The sector of manufacturing insulated wire and cable also shows some growth, reaching its highest level of production in the second semester of 2006 (cumulative increase by 43% in comparison to 2000).

On the contrary, the other two subsectors face problems. Especially the sector of office equipment and computers has many ups and downs, indicative of the problematic demand. Thus, it should be radically restructured (cumulative decrease by 85% in comparison to 2000). Moreover, the production of the sector of manufacturing radio, television, and communications is very low and is further decreasing. However, the manufacturing of television and radio receivers, sound or video recording or reproducing apparatus and associated goods, which is one of its three sub-sectors, is substantially increasing.

Public Policies for the Information Society

The public policies, which have undertaken for the intromission of the country into the Information Society influence the developments in the domestic ICT sector in Greece. OPIS

represents the basic tool for the diffusion of ICTs in Greece during the period 2000-2006, as it supported the diffusion of new technologies in the country through large scaled and significant projects. Its aim was to create a crucial group of users, infrastructures (especially in the Public sector), e-services and mechanisms that relate to the development of the Information Society in Greece. These can contribute together to the broader diffusion of ICTs in Greece, but also to the better financial utilization of ICTs, in order to improve the productivity and competitiveness of the Greek economy.

The Programme supports primary demand via the projects that are being implemented, which along with the Public Investments define the Public sector's demand. However, this side of demand is of small size and contributes to a small degree to the ICTs firms' turnover in a long term basis (2000-2008). On the contrary, secondary demand, which is created by the core group of users and their familiarization with the ICTs, is more significant. Thus, benefits that the implementation of the projects yield through the creation of a strong customer base (firms and citizens) more familiarized with the ICTs, are far more important.

Furthermore, the projects that are implemented can contribute to the education and specialization of the domestic firms. The acquisition of know-how and experience through the implementation of these projects may constitute a significant competitive advantage for the domestic sector. This can be further exploited in the broader area of the South-East Europe. Besides, Bulgaria and Romania as new comers to the EU are about to implement soon similar Information Society Programmes. Domestic firms could play a significant role and may effectively compete even some multinational firms.

7. Financial analysis of the ICT sector

The published balance sheets of 1,628 firms, which constitute the ICT sector in Greece, were used for the financial analysis of the ICT sector. The report used the data of the firms for the period 2002-2004 and a sample for 2005. The analysis reveals the trends in terms of firms' size and sector categories by using specific indicators. The main findings of the analysis are the following:

- The financial situation of the ICT sector is mainly influenced by OTE (National Telecommunication Company). Thus, net results of 2004 are influenced considerably by the latter's high losses which are a result of internal organizational changes, while they also reflect the on going substitution of fixed telephone use by mobile telecommunications. Despite the marginal turnover's decrease, the sale cost increased while the net results reduced considerably. The sector's turnover in 2004 reached 19 billion € (6,7% increase). A 36% of that turnover comes from OTE and the three main mobile carriers (38% in 2003). At the net results level, the sector's

results reached 1.4 billion € (2004) that comes out of 1.75 billion € of net profits and 360 million € of losses (37% of the losses are due to OTE).

- Despite the decrease of total assets, there was a rise in the fixed assets of the sector, while at the same time the sector turned in to more short-termed liabilities. Therefore, the permanent working capital was decreased, pressing the lending cash ratio to a lower level, while equity funding pushed the debt ratio up. The return on total assets decreased and the only ratio with a satisfactory progress was assets turnover.

- The rest of the ICT firms (excluding OTE and the three main mobile carriers) showed some good and rather promising results in their balance sheets for 2004. The increase in their turnover led to higher net profits, despite the increase of the sales' costs, a result which is rather indicative for a good financial year for the sector in 2004. Their equity funds also increase, against the decrease of the sector's total. Lending in 2004 was strengthened, in a longer termed horizon (medium and large firm's bonds). However, in terms of total liabilities structure, the long termed liabilities still account for only a small percentage in relation with short termed liabilities. Therefore, the debt ratio is estimated around 1.7, since mobile carriers have a great impact on short termed liabilities.

- Generally speaking, all size classes of ICT firms show rather satisfactory financial trends (referring to 2002-2004 period). However, micro firms (firms that employ less than 10 employees) sum up to net losses, due to the bad performance of some few unprofitable firms. Their net losses outweigh the profits of the rest. On the other hand, small firms (firms with 11-49 employees) hold on a very healthy picture, since many such firms were the catalysts of growth and stimulated the whole sector, pushing their results up. Medium firms (50-249 employees) failed to hold on their significant increase of turnover and net profits from 2003, thus leading that way to deceleration of growth rate in 2004. The major large firms of the sector show also some satisfactory results, doubling turnover's growth rate in 2004 and keeping an almost 20% increase of net results in the examined period. This trend is not surprising since this group of firms includes mobile carriers, while the results of some unprofitable firms is counterbalanced by the majority's good performance.

- In terms of ratios, small firms seem to have improve their gross profit margin and their profits gradually, but compared to larger firms, still remain at low levels. Most of the firms suffer from high dept equity ratio, which in fact gradually increases for most of the size classes (except large firms). Assets turnover ratio increases for all size classes, while large firms of the sector seem to have a more satisfactory cash flow and fixed assets growth.

- IT sector represents 45% of the total ICT turnover and 33% of the net profits (2004). IT firms in total get along quite well during the 2002-2004. Turnover's growth rate almost doubles in 2004 (8,5% towards 4,1% in 2003) reaching 9 billions €. Despite the intense expansion of cost of goods sold, net results further increase, exceeding 500 million € in 2004. Even if ¼ of the ICT sector shows losses in 2004, many of the profitable firms increased their profits, while at the same time the losses of the rest were considerably reduced. These results are also captured in the main ratios. Apart from the gross profit margin that keeps on declining in the examined period, being significantly lower than that of Telecommunications (excluding OTE), the other ratios hold an upward trend. Medium IT firms (11-49 employees) seem to be the most "healthy" representatives opposed to smaller and larger firms. This indicates that they represent a driving force of the sector as they seem to hold their position and withstand the fiscal ups and downs. However, it should be mentioned that micro, small and medium firms suffer from high dept equity ratio.

- In Telecommunications, the increasing level of competition, the stabilisation of growth rates in the mobile market and the continuous strategic changes, as well as the significant decrease in OTE' s share in the domestic market during the last couple of years, are the main elements of the financial environment. Therefore, a deceleration in the subsector's revenues is recorded as well as a pressure in its gross and net profits. Not surprisingly from the three pillars of the market (OTE, mobile carriers, other telecommunication firms) only mobile companies remain profitable in 2004. The three main mobile companies have a share of more than 19% of the total turnover in the ICT sector and 53% of the turnover of telecommunications services in 2004. Inevitably, almost all the rations are decreasing, while gross profit margin of the subsector narrows by at least 4 percentage units from 2002. A decrease is reported also in the gross profit margin of mobile companies, which however remains well above 50%. Return of total assets touched upon the lower level of the last years and only turnover increased.

- The bad financial condition of smaller firms (firms up to 49 employees) in the Telecommunication sector during the examined period is confirmed not only in terms of absolute numbers, but also in terms of ratios performance. Excluding OTE from the large firms' analysis, improves the obtained picture, however it is true that there is a certain degree of dualism in the sector: there is a significant part of the sector that seems capable of overcoming difficulties and will manage to survive in such a competitive environment; a respective number of firms however does not seem healthy enough and its prospects are not positive.

- Despite the deceleration in their growth rate in 2004, ICT firms from the subsector of carrier / internet services remain the most healthy and growing part of the ICT market. Quite satisfactory results are reported in IT services, while on the other hand ICT manufacturing and Software seem to face several difficulties. Particularly, ICT

manufacturing presents some negative signs in almost all of their results, while Software presents decrease in sales, receivables, owner's equity, current and fixed assets. In the rather uncertain and heterogeneous subsector of ICT trade, upturn of 2003 doesn't repeat itself since there is a deceleration in the accumulated capital, assets decrease and net profits increase at a lower than 2003 rate. ICT trade, though, seems to be one section of the market that will be significant developed in the next couple of years, once all the restructuring and reforming actions take place.

- The results of 46 ICT firms listed in Athens Stock Exchange in 2005 (results under IFRS), are rather discouraging. Sales, earnings and profits seem to be reduced and only total assets increase indicating the sector's enlargement. In IT sector, large firms' turnover is rather stable, profits decrease, while total assets and owner's equities are also decreasing. In Telecommunications, OTE still influences 2005 total results, as it remains unprofitable. The main reason for this is the fact that due to the implementation of IFRS, the total cost of the Early Retirement Program that was implemented in the company, was wholly attributed to the fiscal year of 2006. Losses in fixed telephony carriers remain at a significant volume but the most discouraging element for the emerging "alternative" market in fixed telephony has decreased to growth rates below 10%. In any case, further restructuring is expected in the relevant market, which it remains in a phase of moderate growth. It should be also mentioned that the specific market is benefited by the sharpened technological convergence of information technology and telecommunications.

8. Results of the e-business watch survey

The e-business watch survey refers to 10 sectors of the Greek economy that attracted our research interest. Each of these sectors is of particular importance for the Greek economy. The data collection method includes telephone interviews with the person responsible for ICTs (e.g. IT managers) or any other person holding a similar post in 800 firms. Furthermore the examined firms are those that use computers. Thus, the study included firms, which can be considered as already to a some extent into the digital economy. The main trends are as follows:

- Greek firms do not lag behind in terms of basic ICT infrastructure for e-business. Nearly all enterprises (97,4%) in the sectors examined, accounting for 99.5% of employment, have access to the Internet.

- 71.4% of the firms, which participated to the study (92.6% in terms of employees), possess LAN.

- Less than a third (27,4%) of enterprises, accounting for nearly half of employment (49.4%) in the 10 sectors examined, reported providing remote access to their companies' IT systems.

- About 40% of medium-sized companies and about 62% of large firms regularly send their employees to ICT training seminars. The overriding preference, even among large firms, is for traditional methods of training rather than electronic methods, such as e-learning.

- 43% of companies, accounting for more than 67% of employment have an intranet.

- 30% of companies, accounting for more than 63% of employment have an ERP.

- 85%, of firms accounting for 80% of employment, do not use any specific ICT solution of electronic procurement, which is indicative of the sporadic character of online purchasing.

- 69,3% of firms, accounting for 83% of employment, in the 10 sectors have a website.

- A small number of firms (25,5% accounting for 20% of employment) sell online. For the majority of firms (38% in employment terms), online sales represent less than 5% of their total sales. Furthermore, most Greek firms sell their products and services mainly to individual consumers than to other companies: 56% of employees work in companies that sell their products online to individual consumers as compared to only 16% who work in companies engaged in Business-to Business selling.

- About 12% of firms, accounting for 20% of employment, reported the use of specific software solutions for supporting marketing and sales activities.

- The use of CRM systems is not particularly popular among Greek enterprises. 16% of enterprises across all sectors, accounting for 20% of employment, reported to use such systems.

- 66% of firms, accounting for 82% of employment reported the use of conventional measures, such as firewalls, to counter ICT security threats.

- 44% of firms, accounting for 40% of employment reported that e-business was an important component of their business activities. Of those companies that reported e-business to play no role in their currrent operations (about 13% of companies interviewed), 40% accounting for 54% of employment, identified unresolved legal and regulatory issues surrounding e-business as the major inhibiting factor.

- Greek firms have benefited most from the introduction of ICTs in office automation, commercial, and accounting applications. In terms of business processes, ICTs have had positive impacts on firms' internal organisation (87% of employment), on business operations' effectiveness (83% of employment), and on productivity (84% of employment).

- In the future, Greek firms believe ICTs are likely to have a significant impact on administrative and control activities (61% of firms accounting for 72% of employment), on management and accounting (73% of firms accounting for 74% of employment), and on customer services (58% of firms accounting for 63% of employment).

- The investments in ICTs are sustainable, as 40% of the firms will increase the investments in ICTs during the next year.

- With respect to the main motives behind the adoption of e-business practices, achieving an advantage over the main competitors is the most crucial one, while pressure from customers that asked for such changes follows.

- The main barriers for the adoption of e-business tools are the small size of the firms, the security and regulatory problems, and the high cost of the ICT applications. Additionally, firms, when adopting e-business tools, face problems regarding the limited skills of their personnel and their limited information about the benefits form ICT investments.

9. Case studies

Four case studies were undertaken, in order to point out the successful implementation of ICTs in Greek firms. The data gathering method used was face-to-face interviews with the firms' managers, while the interview schedule was based on the e-business watch model. The case study firms were:

- VIVARTIA (food and beverage sector): integrated sales system, updating of the production process

- DANAOS SHIPPING (Shipping sector): specific software and communication applications.

- PIRAEUS BANK (banking sector): electronic platform of winbank and its incremental development

- GRECOTEL (Tourism sector): ERP application

Although each of the case studies has certain particularities, there are certain general points that can be made. More specifically:

The common characteristic between all cases is the willingness of each firm to introduce some organizational changes, in order to achieve better effectiveness and efficiency in its operations. Thus, in the internal environment of VIVARTIA, the aims were the elimination of the organizational and management inadequacies (endogenous inflexibilities), the reinforcement of the efficiency of the production process, the increase of the quality and security of the products/ services, and the decrease of the sticks and losses. GRECOTEL also had the same objectives. It restructured its operation model by adopting an ERP and through merging its management processes and amending its structure. Thus, it achieved economies of scale and scope. The other two firms also had had cost benefits, while they became more flexible regarding the adaptation cost of their consequent ICT investments.

In the external environment, the increase of sales and the efficient promotion of VIVARTIA's new products, because of the more rapid identification of market trends, the requirements, and the satisfaction of the customers, ameliorated the communication with the customers and the services provided. Thus, the firm increased its prestige and reliability of its products. PIRAEUS BANK also achieved the same benefits being a pioneer in e-banking. It did not only outperform its competitors by taking proactive actions, but also improved its image. Moreover, it became more competitive at an international level, by accomplishing better services for its customers and by adapting more rapidly to the requirements of the new global markets.

Each firm, which wants to enter into the digital economy, should manage effectively its human capital. The inadequate information and education regarding ICTs generates technophobia and hinders the adoption of the new technologies. This distrust is expressed not only by the employees, but also by the managers of the firms. As a consequence, there is high uncertainty concerning the actual benefits of ICT investments.

As all the case studies have showed, the benefits yielded from better communication between managers and human capital and the increase of the employees' productivity were substantial. Nevertheless, the education of the personnel was a mandatory condition for the successful adoption of ICTs. The employees feel that they work in an attractive environment. This improves their view for the prospects and the effectiveness of their firms. Besides, in most cases, ICTs facilitate their own job, increasing their performance.

All firms examined faced more or less the same problems: the high cost of investments in ICTs (which discouraged SMEs), the complexity of the information systems, the low levels of broadband, which do not permit for advanced services, and the lack of standards for the

digital applications. Additionally, PIRAEUS BANK and GRECOTEL stated the security level of the electronic transactions as one their most significant barriers. Besides the technical improvements, there are still problems that are related with technophobia, which is a basic element of the Greek environment.

10. Prospects - Propositions

The analysis of the results of parts A and B of the project, as well as the additional sources and reports, which pointed out the current developments, the obstacles, and the possible sources for further development for the ICT sector led to the conclusion that its growth prospects are moderately optimistic for the next couple of years. These appraisals are based on several factors: the gradual attenuation of demand and supply limitations, especially in the telecommunication sector; the macroeconomic environment that favours investments; and the gradual transition of the State to the digital era, ameliorating its efficiency by offering more electronic services to citizens and firms. However, the verification of these positive expectations depends also on certain preconditions, whereas there are actions on behalf of both the firms and public policy that could support this growth. More specifically:

The international environment keeps on growing at a rapid rate, while emerging and developing economies are contributing more and more to this growth and are gradually changing the structure of the international trade. Within this framework, Greek economy sustains its high growth rates that outweigh the European averages. This is due to the strong domestic demand, which leads to high private consumption, and the public investments in 2006. The improved business climate and the expressed willingness for reform initiatives imply that economic conditions do not constitute an obstacle for the domestic sector. Nevertheless, it should be noted that favourable macroeconomic conditions are not a necessary and mandatory condition for the sector's growth, while the long established structural problems of the Greek economy create difficulties for all firms, touching upon ICT firms as well.

Domestic demand for ICT products or services is small scaled and problematic. Public sector's primary demand is not strong and is hindered by legislative inflexibilities and bureaucracy. However, a secondary demand, that is the demand induced by actions that aim at greater familiarization of citizens and firms with ICTs and by the proliferation of additional electronic services, is far more important. It offers multiplying benefits and increases the potential client base of the whole ICT sector. It is mostly firms and then consumers that constitute a far more important market, than the Public sector. Nevertheless, they both face some common problems: lack of information, technophobia, population's limited ICT skills, as well as organization difficulties towards the necessary organizational changes required by firms. These phenomena, in combination with the fact that some broad sections of consumers and firms are not convinced about the tangible benefits of ICT investments eventually shape

clients of a rather low maturity. External demand is increasing, but attracts only a small number of firms. Hence, export activity of ICT firms has been limited so far.

However, there are some indications that domestic demand is strengthening, while firms tend to exploit the external demand, at a greater extent. A significant number of large and medium-sized firms of the country adopt ICT tools to an extent comparable to other developed countries. As these firms cooperate throughout their value chain with numerous smaller firms, the latter will be forced to collaborate, in order to maintain their position in the relevant market. At the same time, younger and more intense ICT users, who are entering in the economic activity, are increasing. Furthermore, State's role on the creation of secondary demand is also reinforced, as it is gradually providing more electronic services.

Looking at the supply side, it is scattered, small in size, with numerous firms, while it seems to lack some intensive efforts for learning and market specialization. Furthermore, there is not an established entrepreneurial culture, while R&D is limited to a small number of firms. Price competition is intense, but all the firms seem to sell similar products/ services without any substantial differentiation.

One of the basic barriers for the sector's growth is the limited broadband diffusion and the rather low quality of the relevant infrastructures. Improving infrastructures is a basic precondition for further growth, as it allows for more attractive and at a reasonable price services. Given the technological convergence between IT and telecommunications, the innovative integrated value added services (triple Play IPTV, VoD, VoIP) constitute attractive services with tangible benefits for the potential users. Thus, the increase of (public and private) investments in broadband infrastructures and the more aggressive from the public policy's side for broadband expansion create some positive expectations for the future.

Firms' beliefs about their sector are also moderately optimistic, since field research and business and consumers' surveys show an improved economic climate. At the same time, the poor outcomes of the past fiscal years seem to be overcome, providing greater liquidity to the various sub-sectors. Furthermore, projections for 2006 and 2007 show an increase in the turnover, despite the small recession in 2005. Additionally, employment and investments at the sector are estimated to increase on the short-term basis, while firms report that they intend to intensify their efforts for greater differentiation, specialization, and focus on niche markets. Moreover, some restructuring actions have been taken, in order to rationalize the sector's structure, while the increased interest from foreign investors indicates that there are some good business opportunities in the domestic market. At the same time, the sector accumulates know-how and experience, by implementing large scaled and innovative ICT projects. This is a competitive advantage that should be further exploited at the international level. Besides, this is why the human capital of the sector constitutes another significant advantage, although it should be further reinforced by the collaboration between firms and universities.

To sum up, the preconditions for the verification of the positive expectations are:

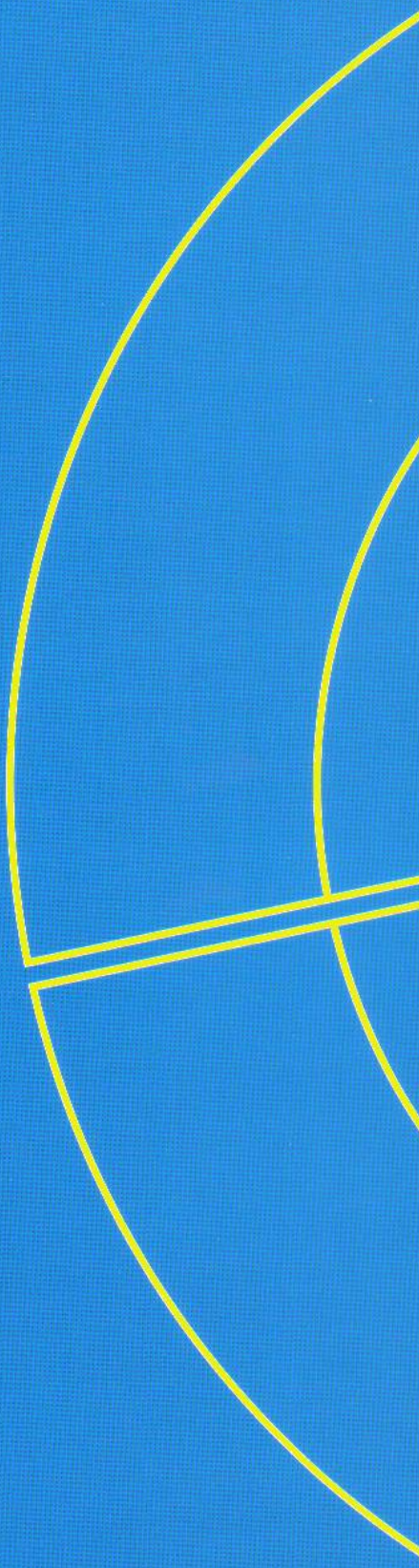
- The increase of investments in broadband infrastructure. This will increase the competition in the sector with new value-added products/services, which will contribute to the further diffusion of the Internet
- The development of some Greek digital context by ICT firms, which will lead to a more intense diffusion of the Internet and the introduction of ICTs to other sectors
- The reinforcement of training and information actions mainly by the State, but also by a more consumer-oriented strategy by firms
- The rapid functional integration of the systems in Public Administration, so as to offer real e-services that facilitate the citizens and the firms
- Extroversion efforts, clearing up the field from problematic cases from the past, and speeding up the mergers & acquisitions, etc.
- The reinforcement of a more profound and intense collaboration between universities and firms, so as to ensure a better fit of market needs and human capital preparation, while improving the R&D collaboration as well.

The study also proposes several policies, which can be distinguished at three levels: a) ICT firm level, b) public policy for the Information Society, and c) broader policies that have an impact on the ICT sector and can support its growth**. At the firm level of the ICT sector** there is the need for: a) the speedup of restructuring actions, M&A, etc., with the aim of rationalizing and improving the efficiency of ICT sector's structure / more efforts for specialization and focus on niche markets, but also more innovation and differentiation through more intensive R&D, b) Consumer-oriented strategies with the emphasis placed upon the cost for the ICT users and the promotion of the benefits that the use of ICTs can entail to the willing and/ or more cautious potential users, c) more investments in broadband infrastructures and high added-value services, but also the development of a Greek and sector-based digital content, d) extroversion efforts by those that are capable and can exploit business opportunities, which exist in the neighbouring countries.

At the level of public policy for the Information Society: a) improvement of broadband infrastructure, development of additional digital content and new e-government value -added services, b) emphasis on organizational change of the Public sector, through the more efficient integration of ICTs, and transformation of the electronic services, c) expansion of ICTs' use in Public Administration, in order to improve its functions and operation, d) completion of the regulatory framework for telecommunications, but also the settlement of the unresolved institutional issues (security of transactions, electronic signature, etc.), and empowerment of EETT (National Regulatory Service for Telecommunications), e)

reinforcement of training and skills' enrichment, in order to limit the digital gap (this can be succeeded by providing additional motives not only for the adoption of ICTS, but also their more extensive use), f) reinforcement of the teaching of ICTs at all levels of education, but also the use of them in the teaching process, g) simplification of the procedures for the public offerings and tenders which will allow for a tighter project cycle, and h) introduction of a strategy unit, assisting the prime minister in relation to the ICT sector.

At the level of broader public policies and State's functioning: a) boosting entrepreneurship and financial mechanisms for the initiation of entrepreneurial activity, b) simplification of the institutional and regulatory framework of Public Administration's functioning so as to improve the business environment, c) increase of the total expenditures on R&D, providing motives for research collaboration with universities, d) greater effort for matching market needs with academia, e) effective allocation and management of the resources of the 4th Programming period, by utilizing the past experience and successful mechanisms, f) a more stable and simpler tax environment, g) removal of the obstacles of foreign direct investments on the ICT sector.



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