Measuring the information society: the case of Cyprus

Department of Information Studies

Aberystwyth University, UK

Costas K. Diamantides

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Abstract

Purpose: The purpose of this research is to study the development of the information society in Cyprus. By applying a conceptual model, a comprehensive measurement of the information society in Cyprus is carried out and comparison with Malta and the EU average is performed. Specific proposals are made for the successful development of the information society in Cyprus.

Methods: A major part of this thesis is the review of the literature and in this respect the exploratory nature of the first two research questions prompted the application of a systematic narrative review by using a unique and well defined procedure. Then the OECD framework descriptive model is applied to Cyprus and Malta.

Findings: This research reaffirms the lack of a universally accepted definition for the information society due its complex and diverse nature. However, a common denominator of all definitions is that this concept is based on the ICTs and that it is related to technology, economy and society. The systematic narrative review demonstrated three distinct groups of indices. The ranking of Cyprus does not differ significantly regardless of the scope of measurement of each composite index. The relationship between small countries and information societies has not drawn the interest of the scientific community. The application of the model confirmed the position of Cyprus behind Malta and helped to explain some reasons for the differences.

Conclusions: None of the available indices seemed appropriate for policymakers in small countries trying to assess, and explain the relative position of their countries. The OECD's model appears the most helpful approach in pinpointing problems, by comparing the results for two countries that are relatively similar in size, location, history and general development but which occupy different positions on other indicators. Recommendations concern an information strategy and evaluation framework for Cyprus.

Acknowledgments

Keep Ithaka always in your mind.
Arriving there is what you're destined for.
But don't hurry the journey at all.
Better if it lasts for years,
so you're old by the time you reach the island,
wealthy with all you've gained on the way,
not expecting Ithaka to make you rich.
(Konstantinos Kavafis, "Ithaca")

The completion of this thesis has been a long and challenging journey. By reaching the destination, a lifetime aim has been fulfilled. In addition to the vast amount of knowledge I gained, this journey has taught me that when there is a will, reaching Ithaca is possible.

This journey would not have been completed without the support of other people, to whom I feel the need to express my sincere gratitude.

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Abbreviations

ABS	Australian Bureau of Statistics
ADSL	Asymmetric Digital Subscriber Line
BERD	Business Enterprise Expenditure on R&D
bn	Billion
CRD	Centre for Reviews and Dissemination
CSPP	Computer Systems Policy Project
CY	Cyprus
CYSTAT	Statistical Service of Cyprus
CYTA	Cyprus Telecommunications Authority
DAI	Digital Access Index
DESI	Digital Economy and Society Index
DG	Directorate General
DITS	Department of Information Technology Services
DOI	Digital Opportunity Index
DSL	Digital Subscriber Line
EC	European Communities
EDI	Electronic Data Interchange
EGDI	eGovernment Development Index
EIU	Economist Intelligence Unit
EPPI-Centre	Evidence for Policy and Practise Information and Co-ordinating Centre
EU	European Union
EU15	European Union of 15 countries
EU27	European Union of 27 countries
EU28	European Union of 28 countries
EUROSTAT	Statistical Office of the European Communities
FITA	Foundation for Technology Accessibility
GDI	Global Diffusion of the Internet Project
GDN	Government Data Network

GDP	Gross Domestic Product
GITR	Global Information Technology Report
GNI	Gross National Income
G7	Group of Seven
HDI	Human Development Index
HP	Hewlett-Packard
IBICT	Brazilian Institute for Information in Science and Technology
IBM	International Business Machines Corporation
ICT	Information and Communication Technology
ICTs	Information and Communication Technologies
ICT-OI	ICT Opportunity Index
IDC	International Data Corporation
IDI	ICT Development Index
IFAP	Information Society for All Programme
IGF	Internet Governance Forum
INSEAD	Institut Européen d'Administration des Affaires
INSINC	National Working Party on Social Inclusion in the Information Society
IPB	ICT Price Basket
ISA	Interoperability Solutions for Public Administrations
ISD	Information Society Dialogue
ISI	Information Society Index
IT	Information Technology
ITU	International Telecommunications Unit
IUP	Information Utilization Potential
JRC	Joint Research Centre
KADO	Korea Agency for Digital Opportunity and Promotion
KAM	Knowledge Assessment Methodology
KEI	Knowledge Economy Index

KI	Knowledge Index
Mbps	Megabits Per Second
MCA	Malta Communications Authority
MDGs	Millennium Development Goals
MITA	Malta Information Technology Agency
MITTS	Malta Information Technology and Training Services
mn	Million
MTN	Mobile Telephone Networks
NACE	Nomenclature statistique des Activités économiques dans la Communauté Européenne
NCB	National Computer Board
NISCO	National Information Society Advisory Council
NRI	Network Readiness Index
NSO	National Statistical Office
OCECPR	Office of the Commissioner of Electronic Communications and Postal Regulation
OCTPR	Office of the Commissioner of Telecommunications and Postal Regulations
OECD	Organisation for Economic Co-operation and Development
PC	Personal Computer
PCA	Principal Components Analysis
PPS	Purchasing Power Parity
R&D	Research and Development
RFID	Radio Frequency Identification
SEM	Structural Equation Modelling
SIM	Subscriber Identification Module
SSO	Single Sign on
TAI	Technology Achievement Index
UK	United Kingdom
UMTS	Universal Mobile Telecommunications System
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development

UN-DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO/PGI	United Nations Educational, Scientific and Cultural Organization General Information Programme
UNU-ISP	United Nations University Institute for Sustainability and Peace
U.S.	Unites States
USA	United States of America
USB	Universal Serial Bus
VA	Value Added
VDSL	Very High Speed Digital Subscriber Line
WEF	World Economic Forum
WSIS	World Summit on the Information Society
WTID	ITU World Telecommunication/ICT Indicators Database
XML	Extensible Markup Language
3G	Third Generation

Chapter 1: INTRODUCTION

1.1 Background to the study

My interest in the measurement of information society began at the dawn of the 21st century when it was decided for the first time to produce official statistics for the information society in Cyprus. The decision was taken in the framework of the eEurope+ action plan in which Cyprus was participating as a candidate country to the European Union (EU).

In Cyprus, the responsible agency for the production of official statistics is the Statistical Service of Cyprus (CYSTAT). I have been working at CYSTAT since 1994. In 2001, I was appointed responsible for the production of official statistics on the information society. The main driver for this decision by CYSTAT's management was my academic background in the area of computer science.

Annual comparable statistics on the information society for all EU member states have been available since 2004, the year when Cyprus joined the EU. The statistics are produced from two surveys, one on enterprises and the other on households and individuals. Both surveys are composed of model questionnaires and accompanying methodological guidelines for implementation. The surveys are carried out in the framework of a European Regulation and thus they are compulsory for all member states.

According to the results of these surveys, Cyprus has remained one of the lowest performers in Europe. Taking into consideration that Cyprus has developed a state-of-the-art telecommunications infrastructure - mainly due to the fact that it is an island and thus, there is a problem for transportation and telecommunications - and in addition, the high literacy rate of the Cypriots – for instance, compared to the rest of EU countries Cyprus has a very high proportion of population aged 30-34 with tertiary education (2015: 54,6%) - someone would expect a higher performance in the information society indicators. This contradiction has been the main driver for me in deciding to explore further the topic of measuring the information society in Cyprus.

The introduction contains some of the themes that are discussed in subsequent chapters. For ease of reading only the main citations are included in the introduction.

1.2 The context of the study

1.2.1 Definition and measurement of the Information Society

What is the Information Society? Although this term has been used extensively in the last twenty years by researchers, politicians, policy makers and others, there is no simple and unambiguous answer. Several definitions have been given and many related statistics are produced.

A common denominator of all the attempts to explain and define not only the information society, but all those concepts related to it, is the significance of the Information and Communication Technologies (ICTs). Without the rapid technological advancements and the consequent convergence of the computer, the internet and mobile phones the development of information societies would not be feasible. Naturally the developed countries are more advanced due to their superior infrastructure, both technical and in human resources. Developing counties, including small countries like Cyprus, need to learn from the experiences of the more advanced and developed countries. However the road towards the information and knowledge society for all countries is not an easy one. Technologies cannot be considered as a magic box having the ability to lead to economic growth and prosperity. In 2000 we lived an unprecedented situation with the internet hype. All companies working with the internet were expecting to make huge profits. But this never happened and many companies went bankrupt. Several years after we all learned that ICTs are only beneficial if used properly.

Tripathi (2006, p. 142) cites Preston (2003) to explain that “Information and Communication Technologies are clusters or interrelated systems of technological innovations in the field of microelectronics computing electronic communications including broadcasting and the Internet”. ICTs role in the transformation into an information society is vital. ICTs are the main drivers of the economy and of the changes in the society. A growing number of businesses have adopted ICT by transforming their supply and demand chains as well as by changing their organizational structure. Many new enterprises

dealing with the ICT sector have been established creating new employment opportunities. Citizens have modified their consumption and spending patterns, as well as their behavior. Governments are restructuring their internal functions and the way they deliver services and generally interact with citizens and businesses.

Defining the information society is not an easy task as it is an ambiguous, multi-faceted concept that is related to technology, economy and society. Consequently there has been no universally accepted definition. There are mainly two approaches for providing definitions, the first is a “direct” definition and the second is by providing a conceptual framework. Taking into consideration that the concept of information society is a multi faceted and consequently very difficult to define, I believe that the latter approach is more appropriate.

The information society is related with various other concepts such as knowledge society, information economy, knowledge economy, digital economy and new economy and the distinction between them is not always clear. For instance, the UNCTAD (2007) refers to both information society and information economy without specifying the differences, if any, between the two. Another example is the UNCTAD (2007, p. 13) which defines the building blocks of the information economy by adapting the model of OECD (2005, p. 9) that had been proposed as an information society statistics conceptual model.

Statistics are essential for quantifying the impact of ICT on the economy, business, society and the government and they provide a useful tool for policy makers and business people in order to make well informed decisions. Moreover statistics are an important tool in the quest to quantify the progress towards information societies. Thus all statistics must be both clearly defined and of high quality as all the conclusions and decisions rely on those statistics.

The measurement of the information society is also a complex issue. The measurements can be classified in three different types. The first measurement type produces a single value for the whole information society. The second type provides a measurement framework, i.e. several indicators, each corresponding to a different aspect of the information society. Finally, the third type provides a measurement corresponding to a specific aspect of the information society. In the scientific literature the most common type of measurement is the third and

the least popular the first. This ranking in popularity is not surprising as it is very difficult to construct a single index for the whole information society whereas it is much easier, and more convenient for policy makers, to examine just a particular topic.

Each country has its own culture and history. There are small and big countries each with different characteristics. It is important to take into consideration the specificities of the country when defining a conceptual framework for measuring the information society in that country. Bigger countries or countries with more history in utilizing the advantages of the ICTs have different priorities than the small countries or with the countries that the adoption of the ICTs takes place at a slower pace. All these factors should be taken into consideration when the countries develop and implement their strategies in becoming information societies. Neither can be one size fit for all strategies nor common measuring frameworks. The common measuring frameworks are appropriate for comparing countries but they are not always suitable in fulfilling the national goals.

1.2.2 Cyprus

Cyprus (Figure 1) is the third largest island in the Mediterranean and it is situated at the north-eastern end of the Mediterranean basin. Cyprus became a full member of the European Union in 2004 and joined the eurozone in 2008.It is the third smallest member state of the European Union with a population of 847.000 (end of 2014). Since its independence in 1960, Cyprus anticipated several political problems. As a result of the Turkish invasion in 1974, the island has since then been divided. For this reason, in this thesis all data referring to Cyprus - as well as all official statistics - concern the areas which are under the control of the official government of the island.

Despite of the political problems, prior to the global financial crisis of 2008, Cyprus had displayed throughout the years a significant economic growth with low unemployment and relatively stable macroeconomic conditions. Unfortunately the Cyprus economy was severely affected by the global financial crisis and faced an unprecedented economic crisis which escalated in 2013. The economy exhibited a contractionary path and unemployment followed a rapidly increasing trend (from 3,7% in 2008 to 16,1% in 2014). Despite the

economic crisis, Cyprus is still classified by the World Bank among the countries with high income (i.e. GNI per capita of $12.736 or more). The recession in 2013 was contained to -5,9% and in 2014 the Cyprus economy recorded a contraction of -2,5%. However, in contrast with the original forecasts in 2015 the economic situation of the country improved due to the resilience of key productive sectors such as business services, tourism and shipping. In 2015, there was a positive growth rate for the first time since 2011 reaching +1,6% and the unemployment rate was reduced to 15%. Despite of those improvements the economy of Cyprus faces several challenges like high external debt (108% of GDP), high unemployment (15%), high percentage of nonperforming loans (55%) and deflation (-1,7%).

During the life span of work on this thesis the economic situation in Cyprus has changed drastically. When this thesis was started the economy of Cyprus was blooming and it was one of the best in the European Union whereas towards the end the picture changed completely. However, this change has not influenced the progress or the conclusions of this thesis because the analysis carried out has no direct relation with the economic situation.

Figure 1: Map of Cyprus

Although not described as an official information society strategy, the first strategic objective related to the creation of the information society in Cyprus

was established in 1989 when the Council of Ministers approved the first Government Computerization Plan (information systems strategy). Almost ten years later, in 1998, due to the rapid technology changes and EU accession requirements, a revised version of the information systems strategy was approved. In 2002, the e-Government strategy was first published and updated in 2014. Perhaps the most important milestone towards the development of the information society in Cyprus can be considered the decision taken by the Council of Ministers in 2009, in which the Minister of Communications and Works was appointed as the responsible Minister for Information Society and the Department of Electronic Communications (part of the Ministry of Communications and Works) as the executive arm of the Minister to develop and implement a comprehensive National Information Society Strategy. This decision is extremely important as it shows for the first time the willingness of the government to develop the Information Society in Cyprus. Although this decision is with no doubt on the right track as it is the first time to assign the responsibility to an official authority, I argue that the appointment of the task to an already existing authority has at least two major drawbacks, the inefficient coordination of activities and the disparagement of the topic.

Despite the reference in several official documents about either the availability of a national information strategy or to plans in developing one, the first strategy namely Digital Strategy for Cyprus was only published in 2012. The strategy is fully aligned with the EU plan Digital Agenda for Europe and it is based on five pillars. The first pillar seeks to address the phenomenon of non-association on internet use in the daily activities of the Cypriots. The second pillar concerns the strengthening of human resources and seeks to involve all citizens in the Digital Cyprus with emphasis on vulnerable groups by providing tools to access and acquire the ability to use the internet. The third pillar is to promote the culture of "green culture" and the fourth to inform citizens about the benefits of using ICT. The fifth and final pillar of the strategy is the implementation and governance, to address the fragmentation of responsibilities and inefficiencies in coordinating the design and implementation of actions for the development of ICT. Being a member state of the EU several directions or targets are set for all member states and in several cases these do not take into consideration either the specific needs of the country or its unique

characteristics and idiosyncrasies. The absence of national based comprehensive Information Society strategy in Cyprus allowed the country to be a “blind follower” of EU directions.

1.2.3 European Union

After a period of almost 60 years of significant economic growth, the economy of the USA started in 1972 to slow down. However, in the second half of the nineties the USA economic growth accelerated driven by faster productivity growth. The shift in the rate of growth coincided with a reduction in the price of computers and with the widespread adoption of the Internet. The major boost to productivity was given by the very high productivity level of the ICT sector. Increased productivity in the non IT industries was observed when the computers became widely available and got connected, thus affecting the production processes.

At the end of the nineties there was an evident economic divergence between the USA and Europe. As the U.S. economy accelerated, the economy of Europe slowed down and the growth in investment was reduced.

The European Union needed a quick response and that was the eEurope action plan. The political decision to bring forward the eEurope action plan was based on the experience of the USA which showed that new technologies can drive growth and create jobs. Although in 2000 the quantitative implications of the new technologies were not yet fully understood, the analysis of the development of the “new economy” and its impact was taken as given.

The eEurope 2002 Action Plan was a political initiative to ensure the European Union fully benefits in the future from the changes of the Information Society. It was expected to have a significant impact on European employment, growth and productivity. The three main goals of the eEurope 2002 action plan were: provide a cheaper, faster, secure internet; invest in people and skills; stimulate internet use. The European Commission’s evaluation of the outcome of the Action Plan, published in the Final Report (Commission of the European Communities, 2003), is that although the competitive knowledge based economy has not been reached, the results are considered to be successful as the Action Plan has laid solid foundations. Major achievements are considered: the set up of the regulatory environment for communication networks, services

and e-commerce, the acquisition of e-skills by the workforce, the introduction of the ICTs in education and the presence of governments online.

Despite the success of eEurope 2002 in connectivity, the use was still lagging behind. That was going to change with the implementation of the eEurope 2005 Action Plan which was the next step in the development of the information society in the European Union. The eEurope 2005 Action Plan covered the period 2003 – 2005. The overall aims were that by the end of 2005 Europe should had modern online public services and a dynamic e-business environment based on the widespread availability of broadband access at competitive prices and a secure information infrastructure. The implementation of eEurope 2005 coincided with the biggest expansion ever of the European Union with the accession of eight new member states from central and eastern Europe plus Malta and Cyprus thus bringing the total number of member states to 25. Consequently the eEurope 2005 final report published in 2007 (Ramboll Management AB, 2007) included the 10 new member states as well. According to this report, eEurope has been very important in promoting the dialogue between countries with different cultures and institutional set ups and it has enabled the member states to set up operational policy programmes and to improve internal coordination.

In order to ensure a smooth transmission to the EU, the central and eastern European countries agreed in 2000 to launch the eEurope+ initiative covering the period 2001 -2003. In 2001 Cyprus, Malta and Turkey joined the other candidate countries in the Action Plan. eEurope+ had the same objectives as eEurope and additionally, one objective aiming to assist in putting in place the fundamental building blocks of the information society. According to the 2003 final eEurope+ report (European Union Acceeding and Candidate countries, 2004), all acceding and candidate countries made significant efforts towards the implementation of a knowledge based society. However, the report showed that there was a significant difference between the accession and candidate countries with the EU15 as regards the availability and use of the ICT.

In 2005, the European Commission set out a new strategic framework for the information society i2010 – a European Information Society for growth and employment (Commission of the European Communities, 2005a). Its policy

initiatives centred on three main aims: establish a European Information Space; reinforce innovation and investment in ICT research; and promote inclusion, public services and quality of life. As indicated in the i2010 mid-term review report (Commission of the European Communities, 2008) Europe is now considered to be among the world leaders in the development of the digital economy. Denmark, Finland and Netherlands are world leaders in broadband take-up, mobile penetration and data traffic. However, not all member states perform so well and there is a big divergence within the European Union. Cyprus is at the lower side of the comparison figures.

The next EU strategy, launched in 2010 and currently running, is the Digital Agenda for Europe. The aim of the strategy is to boost Europe's economy by delivering sustainable economic and social benefits from a digital single market. The Digital Agenda for Europe is one of the seven flagship initiatives of the Europe 2020 Strategy, set out to define the key enabling role that the use of Information and Communication Technologies will have to play if Europe wants to succeed in its ambitions for 2020. The strategy consists of seven action areas: digital single market, interoperability and standards, trust and security, fast and ultra fast internet access, research and innovation, digital literacy and ICT-enabled benefits for EU society. Each year the European Commission publishes the Digital Scoreboard which measures the progress of the European digital economy and a report is published for each member state separately.

1.3 Research Questions

This thesis examines the measurement of the information society in Cyprus. The main aim is not to provide another general definition and measurement framework of the information society but rather to demonstrate that any attempt to measure this multifaceted concept called information society should take into consideration the history, culture, idiosyncrasies and infrastructures of the countries. Being a small country with a small economy Cyprus is not considered as an important player in the world economic scene. However, having learned from the experiences of other countries on the benefits of investing in ICTs, Cyprus should take the initiative and have the leading role in defining a national strategy to build the information society in order to achieve a better economy

and consequently a higher standard of living for all of its citizens. The aim of this thesis is to apply a conceptual framework for measuring information society. In the light of this, the broad research problem is framed as:

"**What are the key factors in the development of the information society and how can these factors facilitate the information society in Cyprus?**"

To identify the key factors I initially attempted to answer the following research questions:

1. **Which are the available information society measurements? Do those measurements include Cyprus?**
2. **Do the available information society measurements take into consideration the different sizes of the countries?**

My findings indicated that all currently available measurements of the information society in Cyprus have resulted from initiatives coming from abroad and not within Cyprus. The measurements concern different aspects of the information society and are either single or composite indices. There has been no attempt to measure the information society in Cyprus as a whole. The topic of examining the progress of Cyprus towards the information society has not been dealt with by the academic world. The majority of the available measurements are either produced in the framework of EU membership (EU regulations or specific EU action plans) or by international organisations.

Although several authors argue that it is important when measuring the information society either as a whole or specific aspects of it, to take into consideration the specific characteristics and idiosyncrasies of each country, not much has been done in this direction. The result is that Cyprus, similarly to other small countries, is to be compared with other bigger countries with different infrastructures, cultures and histories.

In light of my findings and the literature search, I decided to focus on those factors that are considered to be more suitable for Cyprus and thus, the third research question:

3. **How can the development towards the information society of a small country like Cyprus be measured?**

Finally, taking into consideration the findings of the first three research questions, I investigated the ways in which these factors can facilitate the development of the information society in Cyprus by defining the fourth research question as follows:

4. **What further measures should be implemented in order to secure the successful conversion of Cyprus into an information society?**

1.4 Organisation of the Thesis

The Thesis is divided into six chapters. The Biography and a set of Appendices can be found at the end.

Chapter Two reviews the literature focusing on the three pillars of this research: a) definition and measurement of the information society, b) characteristics of Cyprus and information society strategies and finally, c) European Union plans on the information society.

Chapter Three describes the methodological approach applied to carry out the study which is the systematic narrative review.

Chapter Four presents the findings of the systematic narrative review and provide the answers to the first two research questions.

Chapter Five responds to the third research question and provides a measurement of the information society in Cyprus based on an already available information society statistics conceptual model. For benchmarking purposes Cyprus is compared to Malta and the average of the European Union. The second part of this Chapter contains the proposals for measures that could be implemented in order to secure the successful conversion of Cyprus into an information society, i.e. the response to the fourth research question.

Chapter Six contains the conclusions and implications for future research.

Chapter 2: BACKGROUND LITERATURE

2.1 Introduction

Having defined the framework of my research area, the next step was to review the literature. The main aim was to find out what is already known in the area of measuring the information society as well as to learn about the relevant theories and concepts. As a result of the literature review, I have identified significant controversies as well as inconsistencies. Moreover, there seems to be a research gap regarding the measurement of the information society in small countries, as this group of countries is not of high priority amongst researchers and international organisations.

The discussion is organized into three sections, each section corresponding to a concept subject as follows: the concept of information society, measurements of the information society, Cyprus and the European Union.

2.2 The concept of Information Society

In the first part of this section there is a review of the definition of the concept of the information society and in the second part the background literature on measuring the information society is examined.

2.2.1 Definition

In recent years numerous definitions have been given in the scientific literature to the concept of the information society, but despite this there seems to be a consensus among the researchers (Blaug, 1982; Crawford, 1983; Jonscher, 1983; Menou, 2004) that the first attempts to define the concept of the information society go back to 1962. In this year, the economist Dr Fritz Machlup published the book “The production and distribution of knowledge in the United States”, in which he investigates in statistical terms the knowledge production in the United States. Crawford summarized the workflow of Machlup’s work on the production of knowledge in the United States as follows: Study of monopoly and competition in a free society, e.g., patent system - Cost of the patent system and its relation to R&D - Cost of R&D and education - Comprehensive study of the production of knowledge in the United States. The

whole research lasted for around thirty years and the results were published in his book in 1962. In general the book was praised but at the same time his critics blamed him for calling the university a “knowledge factory” as part of the knowledge industry.

In 1969, Peter Drucker published his best-selling book “The age of discontinuity” (Crawford, 1983; Jonscher, 1983) which included a section on “Knowledge Society” based on Machlup’s data and projections. Drucker argued about the significance of knowledge and its implications for education, work and leadership (Zand, Freedman, & Rogers, 2006). He claimed that by the late 1970s the knowledge sector would account for one half of the Gross National Product. That triggered the birth of knowledge/ information society. The term information society began to appear in the scientific literature and moreover, in 1970 the theme for the annual meeting of the American Society for Information Science was “The Information-Conscious Society”.

In the book “The Coming of the Post-Industrial Society” published in 1973, Daniel Bell claimed that agriculture and manufacturing are replaced by services and that central to the post-industrial society are knowledge, information and planning. Edwin Parker claimed in 1976 that the upcoming social revolution will be at least as important as the industrial revolution of the nineteenth century. Another milestone in defining the concept of the information society was the work of Mark Porat who in 1977 completed a doctoral dissertation on the “information economy”. Porat quantified the concepts of Machlup by analysing the U.S. Department of Commerce data on national income and product accounts in terms of the cost of information activities (Crawford, 1983; Jonscher, 1983; Menou, 1985a).

Ricci (2000, p. 142) claims that the information society remains an ambiguous, multi-faceted concept. He argues that “each definition is the result of the dialectics between the two fundamental research approaches in social sciences: the qualitative approach and quantitative approach”. The former approach follows philosophical and conceptual approaches to the analysis of the effects of the new technologies on our societies whereas the latter approach either refers to the actual amount of information channelled to the masses or to the emerging social scenarios such as the effects on the economy and employment. The many sided concept of the information society is supported by

the approach followed by researchers in its measurement. For example, Feijóo, Gómez-Barroso, & Karnitis (2007) through their analysis for the development of the information society in the European Union adopt Webster's (2006) definition of information society which states that information society can be approached from a technological, economic, occupational, spatial and cultural point of view. However, Webster adds a sixth parameter which is the theoretical knowledge/ information at the core of how we conduct ourselves these days. However, as stated by Webster, regardless of which parameter is used, it is very difficult to determine what constitutes the information society and how to distinguish this kind of society.

Despite the availability of many theoretical approaches the fundamental question on whether industrialized societies have entered a new age or not, has not yet reached a generally accepted answer. For instance, on one hand Machlup, Porat and Bell argue that after World War II we shifted from an industrial to a service economy and now we have become an information economy or knowledge economy (Hargreaves, 2000). On the other hand Cooper (1983) claims that although the concept of information economy is new, it is not clear that there has been a shift from services to an information economy. Similarly, while Bose (1986, p. 92) states that "whether we resist it or support it, we are living in an information society for the simple reason that the economy has transformed from an industrial economy to an information economy", scepticism is expressed by Black, Muddiman & Plant (2007) who argue that the information society is not so new or significant as we may think and they express the view that such grand transformative assessments of social change need to be treated with considerable care. Webster (2006) separates social thinkers into two categories. In the first category there are those who believe that a significant change has occurred with the advent of the information society and that the present era is special and different, marking a turning point in social development, i.e. endorsers, while in the second category belong those thinkers who argue that the central feature of the present is its continuities with the past. For the first group of theorists who proclaim that a new sort of society has emerged from the old, Webster makes specific reference to post-industrialism (Daniel Bell), postmodernism (e.g. Jean Baudrillard, Mark Poster, Paul Virilio) and the informational mode of development (Manuel Castells)

whereas for the second group, i.e. those who place emphasis on continuities, he refers to neo-Marxism (e.g. Herbert Schiller), Regulation Theory (e.g. Michel Aglietta, Alain Lipietz), flexible accumulation (David Harvey), reflexive modernisation (Anthony Giddens) and the public sphere (Jürgen Habermas, Nicholas Garnham). Van Dijk (2006) can be classified in the first category as he argues that it is the intensity of information processing that allows considering the information society as new. He defines the information society as a society in which the information intensity of all activities is so high that the organisation of society is based on science, rationality and reflexivity, all sectors of the economy are characterized by information production, the labour market is based on tasks of information processing requiring knowledge and higher education and finally, a culture is dominated by media and information products. Webster positions himself in the latter category as he argues that we have not entered a completely new type of society and that the adoption of the term information society is misleading as it emphasizes that the contemporary society has nothing in common with previous societies. Another sceptic is Michel Menou who questions whether the ICT has brought a revolution like the one brought by the industrial revolution. He argues that the dramatic changes in the economic and social structure are yet to be seen (Menou, 2004).

As there has been no universally accepted definition of the information society, throughout the years several definitions of the information society have been provided. Some examples are given in Table 1. From these examples, the relation of the information society to technology, economy and society is obvious.

Table 1: Definitions of the Information Society

SN	Description	Source	Reference
i	The information society is synonymous with what is meant by "new information and communication technologies" (ICT). Since the beginning of the 90s, the new ICT have been booming. The universal use of electronic exchanges of information, convergence towards digital technologies, the exponential growth of the Internet and the opening up of telecommunications markets are all signs of this change.	Europa	(Europa: Glossary)
ii	An information society can be defined as one which makes extensive use of information networks and information technology, produces large quantities of information and communication products and services and has an industrial structure with diversified contents.	Census and Statistics Department, Hong Kong	(Census and Statistics Department, Hong Kong, 2012)
iii	Information Society is a term for a society in which the creation, distribution, and manipulation of information has become the most significant economic and cultural activity. An Information Society may be contrasted with societies in which the economic underpinning is primarily Industrial or Agrarian. The machine tools of the Information Society are computers and telecommunications, rather than lathes or ploughs.	Whatis.com	(Whatis.com Target search: Information Society)
iv	A society that makes extensive use of information networks and information technology, produces large quantities of	United Nations Educational, Scientific and	(United Nations Educational, Scientific and

	information and communication goods and services, and has diversified content industry	Cultural Organization	Cultural Organization (UNESCO), 2003, p. 13)
v	A society characterised by a high level of information intensity in the everyday life of most citizens, in most organisations and workplaces; by the use of common or compatible technology for a wide range of personal, social, educational and business activities, and by the ability to transmit, receive and exchange digital data rapidly between places irrespective of distance	National Working party on Social Inclusion in the Information Society	(National Working Party on Social Inclusion in the Information Society (INSINC), 1997, p. 3)

Instead of providing a definition, there is at least one case where the concept of the Information Society is defined by describing its elements (Statistics Denmark, 2004). According to this definition the elements comprising the Information Society are the following: infrastructure, the supply side (the ICT sector), use of ICT in enterprises, by individuals and in the public sector. There is a clear distinction between the supply side i.e., the economic activities producing ICT products and ICT services, and the demand side, using the products, i.e. in households, at working places, in the enterprises and the public sector. According to this framework the link between supply and use exists not only in the shape of technology itself, but also in the shape of the labour force and its competences.

The definitions list is by no means exhaustive. The fact that the term information society remains an ambiguous and multi-faceted concept is further supported by the lack of a definition of the term from the websites of several international organisations such as the Statistical Office of the European Communities (EUROSTAT) and the Organisation for Economic Co-operation and Development (OECD). Furthermore, it is very interesting to observe that there is no definition provided by EUROVOC[1] thesaurus where instead, the following description is provided: “Only to be used for documents of a very

[1] http://europa.eu/eurovoc

general nature, otherwise choose a more specific descriptor." (Commission of the European Communities, 2009a)

From the above description it is clear that the term information society is related to several other terms. For example, the EUROVOC relates the information society to knowledge economy which in turn is related to digital technology, economic growth, intellectual capital, knowledge management, new economic order and research policy. According to the scientific literature, the information society is also related, amongst others to Information Age (Crawford, 1983), Knowledge Society (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2003) and Network Society (Van Dick, 2005).

Information and Knowledge are two concepts used to describe societies and economies. In the quest to define and measure the information society, in this study it is important to also examine in more detail the meaning of the words information and knowledge. The relation of the two terms is described by the definition provided by the UK Department of Industry and Trade:

> "Knowledge is more than just information. An ever-expanding amount of information is being produced and made available. This does not necessarily mean that we are all more knowledgeable. The information available in a book or on the Internet becomes knowledge only when it has been read and understood. How the information is interpreted and used will be different for different readers depending on their previous experience, expertise and needs. To understand the role of knowledge and information in the wider economy, it is important to distinguish two types of knowledge: "codified" and "tacit". Knowledge is codifiable if it can be written down and transferred easily to others. Tacit knowledge is often slow to acquire and much more difficult to transfer. Examples include the knowledge built up during an apprenticeship, understanding of how a particular market works, or familiarity with using a particular technology or language. This difference in transferability means that codified and tacit knowledge need to be managed and rewarded quite differently. Because of its nature, tacit knowledge is often a source of competitive advantage." (UK Department of Trade and Industry, 1998, p. 2)

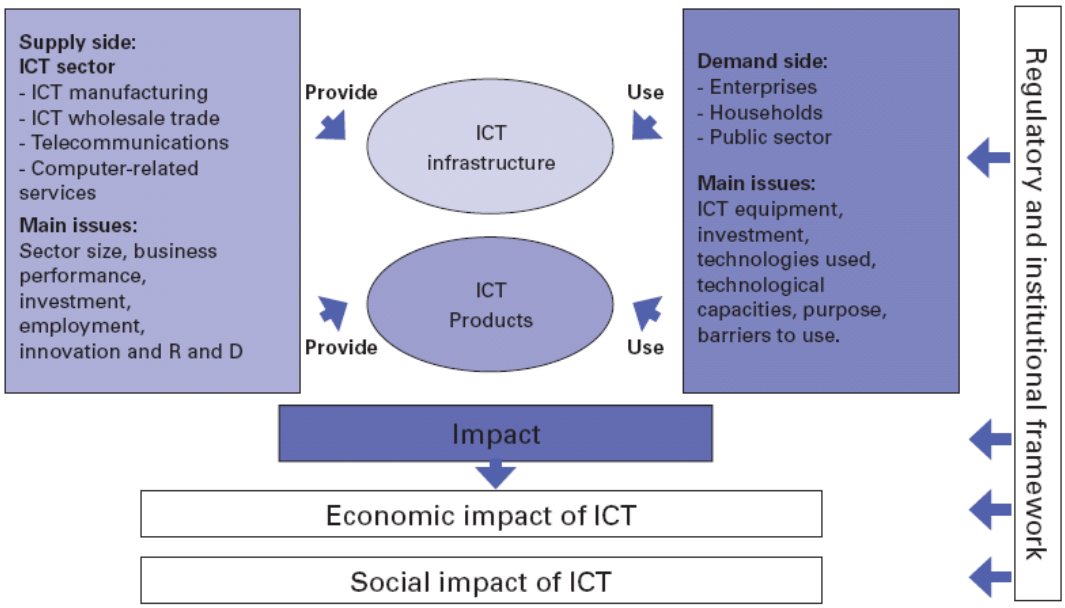
The distinction between the two terms is also provided by Castells (2000, p. 17) who cites Bell (1976) for the definition of knowledge and Machlup (1962) and Porat (1977) for information. In particular, Bell defined knowledge as “a set of organized statements of facts or ideas, presenting a reasoned judgement or an experimental result, which is transmitted to others through some communication medium in some systematic form. Thus, I distinguish knowledge from news and entertainment”. Machlup defined information as “Communication of knowledge” and Porat as “data that have been organized and communicated”. A distinction between the two terms was proposed by Boisot (1998, p. 20) where he defined information as: “Data that modifies the expectations or the conditional readiness of an observer. The more those expectations are modified, the more informative the data is said to be”, and knowledge as: “The set of expectations that an observer holds with respect to an event. It is disposition to act in a particular way that has to be inferred from behaviour rather than observed directly”. According to Callioni (2002) knowledge is a capacity based on information and it is knowledge that provides a competitive advantage or creates economic or social value whereas information has no power of action, motion or resistance. In order to become useful, information should be combined with belief. Mansell & Tremblay (2013) argue that there are diverse definitions of information and knowledge and they classify information in four levels where at the fourth level information is converted to knowledge. In particular, at the first level information refers to signals measured in bits, at the second level information may mean data that may or not be related, at the third level information is interpreted or mediated through events reported by the media and finally, at the fourth level information may be combined and interpreted to constitute knowledge.

Whether studying the information or knowledge society there is a relationship with the economy. From the literature review four main concepts have been identified all related to the economic aspect of the information society as follows: Information Economy, Knowledge Economy, Digital Economy and New Economy. All four concepts are briefly explained below.

Information economy is the economy which is based on information. The technological development has played a significant role in the rapid distribution of information. A major characteristic of the Information Economy is the

extensive use of ICT by businesses for all the stages of information processing, i.e. collection, storage, processing and transmission, with the aim of improving productivity (United Nations Conference on Trade and Development (UNCTAD), 2009). The concept of Information Economy is described by a conceptual framework originally proposed by the OECD (United Nations Conference on Trade and Development (UNCTAD), 2009, p. 13). The framework is based on two blocks, the supply side and the demand side (Figure 2). For measuring the information economy, from the supply side statistics can be collected about the ICT sector, i.e. ICT manufacturing and services industries that supply ICT infrastructure, goods and services. For the demand side, the access to and use of ICT by business, households and government can be measured.

Figure 2: The building blocks of the information economy



The United Nations Conference on Trade and Development (UNCTAD) and the Organisation for Economic Co-operation and Development (OECD) are two international bodies that deal with the measuring of the information economy. UNCTAD's work on measuring the information economy focuses on how businesses access and use ICT, as well as the role the ICT sector plays in the development process. Following a request by the World Summit on the Information Society (WSIS), UNCTAD is also developing indicators to monitor

progress in the use of ICT for development. UNCTAD's annual Information Economy Report (former E-Commerce and Development Report) points to the relevance of ICT business statistics for policy making and comparative analysis among developing countries. Since 2004, the Report includes data obtained from an annual questionnaire on ICT use by businesses sent to the national statistical offices of selected developing countries. The OECD has been examining the concept of the information economies since the 1970s when organised the workshops on the economics of the information society which aimed at developing data, research and analysis under the aegis and direction of the Committee for information, computer and communications policy as the precursor to policy discussions within the Committee. The workshops focused on providing leading edge research on the economics of the information society. In 2002, the OECD published “Measuring the information economy” (Organisation for Economic Co-operation and Development (OECD), 2002) which included relevant indicators for international comparisons. Those indicators concerned the resources devoted to new information technologies in terms of consumption, investment, innovative efforts or human resources as well as the size, growth and contribution of the ICT sector to economic activity.

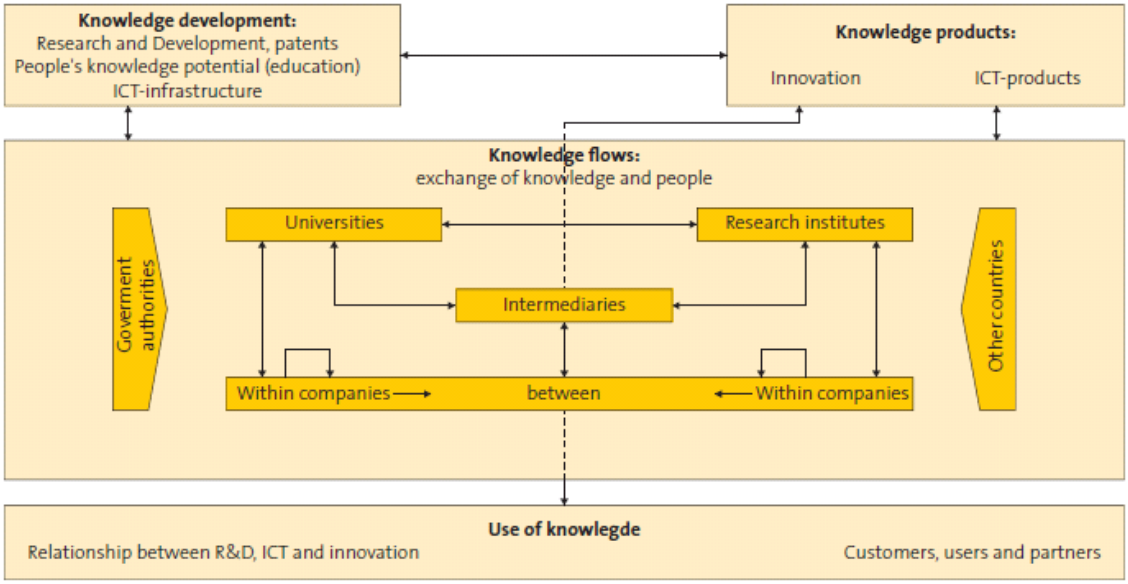
Ricci (2000, p. 145) states that “the fundamental postulate of the economic approach is that we are living in “information economies” which are largely founded on the production, manipulation, storage and transmission of information”. Callioni (2002, p. 22) defines the information economy as follows: “The new tools, based on the acquisition and exchange of information that enable new business models, industry structures and forms of organisation”. In this framework Callioni (p. 22) argues that “it is valid to assume that a concern with the information economy is implicitly and inevitably also a concern with the knowledge economy or at least for the issues that underpin and define the knowledge economy”. Therefore, when referring to the economic aspect the terms information and knowledge are closely related.

Houghton & Sheehan (2000) argue that although the importance of knowledge in an economy has been known since the era of agricultural economy, the explosion of the information and communication technologies in the recent years as well as the increased globalisation of economic affairs have led to the creation of a tremendous amount of knowledge incorporated into

economic activity. This significant change in the economic structure has implications for government policies, the strategies of the firms and the bodies who are responsible for regulating economic behaviour. Houghton & Sheehan classify the differences between the emerging knowledge economy and its predecessor, the industrial economy, in thirteen categories as follows: information revolution, flexible organisation, knowledge skills & learning, innovation and knowledge networks, learning organisations and innovation systems, global competition and production, strategy and location, clustering in the knowledge economy, economics of knowledge, systems of creation, production and distribution, convergence or divergence, divergence and concentration.

A knowledge economy is defined either by providing a definition or describing a conceptual framework. In the first category there is the definition provided by Tripathi (2006, p. 140) who cites the United Kingdom's Secretary of State for Trade and Industry (1998) for defining the concept of a knowledge economy as follows: "A knowledge-driven economy is one in which the generation and exploitation of knowledge play a predominant part in the creation of wealth". Tripathi argues that nowadays we experience the creation of the knowledge society where knowledge is the main production source. Within the knowledge society the quality of life of the citizens can be significantly improved. In the book "Korea and the Knowledge-based Economy" (Organisation for Economic Co-operation and Development (OECD); World Bank, 2000, p. 32) the knowledge based economy is defined as "one where knowledge (codified and tacit) is created, acquired, transmitted and used more effectively by enterprises, organisations, individuals and communities for greater economic and social development". In the second category, i.e. description of conceptual framework, there are the frameworks proposed by Statistics Netherlands (2011), Statistics Denmark (2004) and the UK Department of Trade and Industry (1999). The model proposed by Statistics Netherlands consists of four parts: knowledge development, knowledge products, knowledge flows and use of knowledge (Figure 3).

Figure 3: Model for the knowledge economy



The framework by Statistics Denmark defines eight conceptual areas which are related to knowledge-based economy as follows: knowledge-based activities, innovation, globalisation, research and development, competence and skills, information society, economic impacts and social impacts. The framework proposed by the UK Department of Trade and Industry consists of 39 indicators grouped under four categories as follows: business environment, resources, innovation process and results. In both contexts, the difficulty of defining and measuring knowledge is emphasized. However, a common denominator of all definitions is that the term knowledge economy emphasizes the role played by know-how and competencies in the economic sphere (Archubugi & Coco, 2005).

If it is accepted that there is a clear distinction of the concepts of information and knowledge society in that the former is associated more with early data processing (transaction processing) whereas the latter depends more on the analysis and synthesis of information, the difference of those two concepts with the concept of digital economy is by no means obvious. Moreover, there seems to be confusion in the real meaning of this term. For instance, Statistics Netherlands published from 2002 to 2010 an annual report on the digital economy. Although every year - at least during the years 2007 to 2010 - the title and more or less the contents remain the same, the aim of the

publication as explained in the preface section varies without making any explicit explanation of the concept of digital economy:

> “The aim of this publication is to describe ICT use in society in some detail. Apart from information about companies and households, the description focuses on the ICT sector.” (Statistics Netherlands, 2007a, p. 7)

> “In this publication Statistics Netherlands describes how Dutch society is becoming an information society. The core is formed by the widespread use of information and communication technology (ICT) ... This publication also provides information about the use of ICT in companies and households, and about the ICT sector itself. The way in which ICT has made its entry in the public sector is highlighted as well.” (Statistics Netherlands, 2008, p. 5)

> “In this publication Statistics Netherlands describes how Dutch society is changing into a digital society. The focus is on the widespread use of information and communication technology (ICT)... This publication also provides information about the ICT sector and the relation between ICT and the economy. This edition introduces a separate chapter that focuses on ICT knowledge. The chapter includes data on Research and Development, ICT patents, ICT education and the ICT skills of the Dutch population.” (Statistics Netherlands, 2009, p. 5)

> “Statistics Netherlands publishes The digital economy annually to give an extensive update of the digitisation of the Dutch society. The series focuses on the widespread use of information and communication technology (ICT)... ICT is increasingly penetrating the public sector: for central and local government services, in schools, and in the care sector. The book also presents information on the ICT sector and the economy, where possible taking the present economic situation into consideration, as well as the role of ICT in this.” (Statistics Netherlands, 2010, p. 5)

So, does the digital economy refer to the ICT use or to the information society or to the digital society or to the digitization of the society? In 2011 onwards the title of this publication changed to “ICT, Knowledge and the Economy” in order to describe the Dutch knowledge economy through a focus on the pillars of research and development, innovation and ICT. Although a model for describing the knowledge economy is provided no explanation is given for the transition from the digital economy to the knowledge economy.

The digital economy is a term adopted in 2010 by the Economist Intelligence Unit (EIU) instead of “e-readiness” in order to reflect the increasing influence of ICT in economic (and social) progress. This change is based on the assumption that all countries under investigation have the e-readiness state and thus the current challenge is to maximise the use of ICT. According to the EIU “the digital economy rankings assess the quality of a country’s ICT infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit” (Economist Intelligence Unit; International Business Machines, 2010, p. 1). In this report the EIU assess the situation in 70 countries (Cyprus is excluded) and its model consists of 121 indicators classified in 6 categories as follows: Connectivity and technology infrastructure, Business environment, Social and cultural environment, Legal environment, Government policy and vision and Consumer and business adoption.

The failure to clearly distinguish the concepts of information and digital economy is clearly pointed out by Ricci (2000, p. 145) “... is far from providing to the average scholar (or policy maker) a clear taxonomy of the activities (or the technologies) which should be accounted as constituting elements of the ``information'' or ``digital'' economy''. Along the same lines Grigorovici, Schement, & Taylor (2004) ague that different researchers use the same concepts to mean different terms, use different ones to mean the same concepts and this results to the usage of various poorly defined terms such as “digital economy”, “information society”, “information economy” and “knowledge economy”.

The concept of the new economy - described also as internet age, information technology revolution and digital economy (Landefeld & Fraumeni, 2001) - firstly appears in the 1990’s when at that time, the USA’s economy displayed a very strong growth. The significant expansion of the USA’s

economy was linked to the rapid technological advances which caused the change in the structure of the economy. The new cluster of innovations, information and communication technologies and productivity growth leads towards the new economy which delivers an increase of employment and an improved standard of living (Archubugi & Coco, 2005). Similarly to other concepts related to the information society, there is no common definition for the new economy. Statistics Netherlands (2007b)(2007) argue that the new economy is not just a matter of technology but it interferes with how economic processes are organised, innovation is set up and new markets are being approached. Along the same lines Godin (2004) does not provide a definition but points out the significance of information and communication technologies in growth and productivity. The concept of new economy and in particular the role of investment in information and communication technologies and innovation in growth performance, was examined by the OECD which concludes that such growth needs a range of complementary factors that support the innovation intensive growth exemplified by the new information and communication technologies like the internet and internet applications (Organisation for Economic Co-operation and Development (OECD), 2000). Castells (2000) argues that the new economy that emerged is informational, global, and networked. Informational because the productivity and competitiveness of firms, regions or nations depend upon their capacity to generate, process and apply efficiently knowledge-based information. Global because the core activities of production, consumption and circulation are organised on a global scale and networked because productivity is generated through and competition is played out in a global network of interaction between business networks.

Manuel Castells and Jan Van Dijk may be considered as the two most important theorists of the network society (Fuchs & Horak, 2008). In an interview by Harry Kreisler from the University of California Castells defined network society as “society where the key social structures and activities are organized around electronically processed information networks. So it's not just about networks or social networks, because social networks have been very old forms of social organization. It's about social networks which process and manage information and are using micro-electronic based technologies" (Kreisler, 2001). He used the term of network society for the first time in his

book “The rise of the network society” published in 1996 which is the first part of his trilogy “The information age”. The second version published in 2000 was heavily revised (The Rise of the Network Society. The information age: economy, society and culture., 2000). According to Castells the network society is made up by economic, cultural and political factors. Modern societies are not only defined by technology. Van Dijk (2006, p. 20) defines the network society as “social formation with an infrastructure of social and media networks enabling its prime mode of organization at all levels (individual, group/organizational and societal). Increasingly, these networks link all units or parts of this formation (individuals, groups and organizations)”. According to Van Dijk in a network society the social networks of face-to-face communications are replaced by relationships in media networks, i.e. the personal communication is replaced by digital technology. For Castells, the networks have become the basic units of the modern society whereas, for Van Dijk the basic units are individuals, groups, organizations and communities.

As seen from the various definitions given to the concept of the information society, the focus is on the technological and economic aspect whereas the social and human aspects do not seem to be of particular interest. UNESCO (2003) claims that the mere creation of an information society is insufficient to address human development issues. Knowledge is a fundamental requisite for human progress and for this reason, knowledge societies should provide access to information and knowledge for educational and cultural purposes and emphasis should be given to the different cultures and languages. Knowledge societies go beyond information societies by ensuring that all citizens are empowered to create, receive, share and utilize information and knowledge for their economic, social cultural and political development. UNESCO (2005, p. 27) claimed that knowledge societies are “about capabilities to identify, produce, process, transform, disseminate and use information to build and apply knowledge for human development”. The idea of an information society is limited to the information flows only which is not sufficient to grasp the opportunities for development offered by knowledge. The concept of an information society is based on technological developments whereas knowledge societies contain social, ethical and political dimensions. For this reason there cannot be a single, ready-made model for all societies because

such a model would not take into account the different population characteristics such as culture and language (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2005).

Having examined several definitions of the information society as well as the various concepts which are related to it, although there are different views there seems to be a consensus among social thinkers that although information was in some sort available throughout the years, a major change has been taking place since the last quarter of the twentieth century as regards the use of information and communication technologies and this change impacts the economy and society. The core of the information society has been the advent of the information and communication technologies and in particular, the internet and wireless technologies. The significance of ICT in the development of information society is high as they facilitate the rapid transfer of information in all layers of the society. The progress towards an information society needs to be measured by defining and measuring relative indicators.

2.2.2 Measuring the information society

The measurement of the information society is a topic which has been dealt with by international organizations, the academic community and governments. Due to the lack of a theoretical framework for the information society the literature contains numerous measurements not only for specific elements which comprise the information society, such as telecommunications and information technology, but also the information society as a whole.

Researchers argue that the quality of the available information society measurements is poor (Menou & Taylor, 2006; Albright, 2005), the vast majority of the measurements are technology-centric and are concentrated on measuring the information but not the society (Gómez-Barroso, Feijóo, & Karnitis, 2008; Pruulmann-Vengerfeldt, 2006). Critics of the currently available information society measurements claim that in many cases, data are not comparable due to the lack of common definitions and in addition, the selection of indicators is subjective. They argue that there is a need for the research community to be more active in this area with the aim of connecting the measurement of the information society to social theories (Grigorovici, Schement, & Taylor, Weighing the intangible: towards a framework for

Information Society indices, 2004). Along the same lines is the view that when defining the national information policies the local idiosyncrasies should be taken into account (Feijóo, Gómez-Barroso, & Karnitis, 2007; Gómez-Barroso, Feijóo, & Karnitis, 2008).

There is a debate among researchers (Barzilai-Nahon, 2006; Organisation for Economic Co-operation and Development (OECD); Joint Research Centre (JRC), 2008) on whether a composite index would be more appropriate to use in the measurement of the information society rather than a framework of several monotopical indices. Composite indices are used in comparing countries and are considered to be useful tools for policy makers (Engelbrecht, 2007; International Telecommunication Union (ITU); United Nations Conference on Trade and Development, 2007a; Mohammad, Saghaei, & Hanafizadeh, 2009). Critics of composite indices argue that these present an over simplified and possibly misleading interpretation of the extent to which a society or an economy are information based (Trewin, 2002; UK Department of Trade and Industry, 1999; United Nations Educational, Scientific and Cultural Organization (UNESCO), 2003). Avgerou & Madon (2005) provide as an example the high scoring of India in the calculation Network Readiness Index regardless of the fact that within this country there is a big variation and the vast majority of the population lives in poverty.

The composite indices are mainly products of the international organizations due to the fact that their interest is in the in-between countries and regions comparisons. The ITU has been very active in measuring the information society and its long term objective is to develop a single ICT index (International Telecommunication Union (ITU); United Nations Conference on Trade and Development, 2007a). In this framework there is a continuous development and refinement of composite indicators based on previous experiences and future trends. For example, the ICT Development Index is based on the Digital Access Index (DAI), Digital Opportunity Index (DOI) and ICT-OI and the ICT-OI is a merger of DAI and infostate conceptual framework. A detailed description of all the measurements from the international organizations and others related to the information society which were identified during the review process is provided in Chapter 4.

Several international organizations such as the OECD, ITU, UNCTAD and EUROSTAT having recognized the importance of having reliable data on ICT in order to measure the progress, initiated procedures for the collection of statistical data on ICT. For this reason, and consequently to enable countries to produce harmonized ICT measurements, the international organizations published manuals for the collection of data. The manuals are mainly targeted to the National Statistical Offices (NSOs) with the aim of producing official statistics. Moreover, the interest in ICT for development has instigated several initiatives related to the information society such as the World Summit for the Information Society of the United Nations and the ITU and the Digital Opportunity Task Force of the eight major industrial nations, G-8.

Although it is desirable to have the concerted efforts of the international organizations for gathering harmonized data through the manuals, I argue that there are also important gaps and drawbacks. The coverage is not complete, for instance, the OECD and EUROSTAT gather data for their members only (a few exceptions exist). Moreover, the suggested data to be collected is not comprehensive as the international organizations´ aim is to examine specific topics of their particular interest. Sometimes the national needs for data collection may do not coincide with those of the international organizations and thus there is the danger for countries to give priority to satisfying the international needs first in order to receive funding. Despite the efforts of the international organizations there is still the problem of harmonization between international organizations.

An alternative framework for measuring the knowledge-based economy and society was proposed by the Australian Statistician in 2002 (Trewin, 2002). The Australian Statistician, who is the Head of the Australian Bureau of Statistics (ABS), argues about the disadvantages of composite indices and instead, he proposes a framework based on five dimensions, three core dimensions (innovation and entrepreneurship, human capital and information and communication technology) and two supporting (context, economic and social impacts). Within each dimension are characteristics. Indicators are chosen to provide measures of the characteristics. As stated, the proposed framework does not cover all knowledge in economy and society as this would be very ambitious and would also be misleading if it implied that all knowledge

was measurable. The proposed “descriptive” framework has a broad scope and does not deal with concepts such as definitions or classifications. Although a framework is not defined, Tripathi (2006) follows a similar “descriptive” approach when examining the transformation of India into a knowledge economy through information and communication technologies. Similar to the aspect of dimensions defined by the ABS, Tripathi examines several topics for which he evaluates various indicators. A similar approach is followed by the University of Harvard in proposing a framework for measuring the readiness for the networked world. The framework consists of 19 categories of indicators classified in five groups: network access, networked learning, networked society, networked economy and network policy (section 4.3.2).

Grigorovici, Schement, & Taylor (2004) propose the construction of an “e-readiness” index based on a structural equation modelling. Their proposal is based on the idea that an information society index should be produced from a multi-stage, multi-factor procedure and the issue of whether the weighted factors (sub-indices) should be combined into a single one, should depend in the country studied or level of analysis chosen. The model includes both economic and social indicators that are able to explain and predict the impacts of ICT on development at various levels.

The Information Utilization Potential (IUP) is a different type of measurement of the information society which was proposed by Menou (United Nations Educational, Scientific and Cultural Organization (UNESCO), 1983). Although at the time of the proposed approach the concept of information society was not popular, the scientific, socio-economic and technical information was considered as a potentially important factor to hasten development. According to Grigorovici, Schement, & Taylor (2004, p. 21) “The IUP model (and tested for the first time in the pilot project developed at the Brazilian Institute for Information in Science and Technology – IBICT) prove to be the most exhaustive attempt to construct an information index to date. Even if for unknown reasons it has not been used as a model for other indices, the main advantage of the IUP is its modular structure: not only does it have two composite indices (a structural one and a functional one), but it attempts to use the “information situation” or context as unit of analysis, thus being able to account for more than an information product-based measure”. There have

been only two applications of the IUP model, first in Brazil and then in Saudi Arabia (Menou, 1985b). The reason for not using the IUP model is its complexity. Most of the time, politicians and policy makers are interested in indices which are easy to construct and to understand and in addition, their priority is to have fresh data as the ICT and the information society in general, are evolving and changing in a fast pace. For instance, the European Union in the framework of the European Regulation 808/2004 has decided to publish the results of the ICT usage surveys in enterprises and households/individuals in the same year of data collection.

As argued by several authors (Gómez-Barroso, Feijóo, & Karnitis, 2008; Pruulmann-Vengerfeldt, 2006; Menou & Taylor, 2006), the majority of information society measurements concern technological developments. Emphasis is given to measuring the changes in technology and from these data the progress towards the information society is concluded. However, society is not driven by technology, thus, in order to understand the changes towards an information society we must not look into the information technology figures only, but examine the social context within which the changes are taking place, taking into consideration social and cultural indicators. An example of this approach is the method applied by Pruulmann-Vengerfeldt (2006) where the information society is measured through various levels of society by using Layder´s domain theory. This approach is based on examining how people's life is changing from the introduction of new technologies. By using the case of Estonia, Pruulmann-Vengerfeldt demonstrates that the information society can be measured in a different - and at least of the same importance - perspective from the traditional measures.

As the concept of the information society encompasses several topics, this has intrigued the interest of many researchers and thus the scientific literature contains a vast amount of related research. Over the years, the topic of the digital divide has been very popular among researchers, international organizations, politicians and policy makers. Similarly, the topic of ICT impact has been dealt with extensively. Other topics of interest are the New Economy, E-commerce, mobile phones, broadband and relation between ICT and national development. Both the digital divide and the ICT impact are briefly explained below.

The concept of digital divide has drawn much discussion and debate among researchers. According to Barzilai-Nahon (2006, p. 269), “there has been much discussion and debate about the definition of the digital divide and of the empirical analyses of its components”. Fuchs & Horak (2008) cite Manuel Castells, Jan van Dijk, Pippa Norris, Ernest J. Wilson III and James who all provide definitions of the digital divide. Despite these efforts there is neither a conceptual framework for measuring the digital divide (Vehovar, Sicherl, Hüsing, & Dolnicar, 2006) nor a consensus regarding the appropriate policy to implement in order to tackle the digital divide (Mariscal, 2005). Based on her research, Barzilai-Nahon (2006) states that in the 90s, when the first definitions of the digital divide came up, the focus was on infrastructure access (e.g. availability of internet access or any other ICT) whereas, later the focus moved to the users (e.g. skills and experience). The digital divide can be classified in several ways. For instance, according to the UNCTAD (2005) the digital divide can be classified into domestic and international. Domestic refers to a digital divide in a country or a region and international refers to a gap between regions, countries or continents. Moreover Norris (2001) categorises the digital divide into three constituent elements: the global divide between advanced industrialised countries and developing countries, the social divide between information rich and information poor within advanced industrialised countries, and the democratic divide between those within the online community who do and do not use digital resources to engage, mobilise and participate in public life. In a recent study Montagnier & Wirthmann (2011) claim that digital divide refers to different concepts of inequality leading to technological, immaterial, material, social and educational dimensions. The critics of the current available measures (Barzilai-Nahon, 2006) claim that most of the indicators are monotopical, i.e. they examine just one aspect of the digital divide. Instead those indicators should have been comprehensive in order to take into consideration several facets of the digital divide. Similarly to the concept of the information society the digital divide is a multi-faceted issue for which numerous studies and research have been carried out by international organizations (e.g. (Organisation for economic co-operation and development (OECD), 2001) and researchers (as already cited in this paragraph). Despite the importance of the

concept of the digital divide the focus of this thesis is the information society which is already a huge topic on its own.

The OECD (2007) refers to the definitions of impact provided by *dictionary.com* and *Merriem-Webster's online dictionary* to deduce that impact can be a strong or weak concept. In the same paper it is stated that impact can be classified in several ways such as narrow or broad, economic or social, positive or negative, short or long term, intended or unintended, direct or indirect and intermediate or final. Measuring impacts in any field is not easy but for ICT there are added complications because of its diversity and rapidly changing nature (United Nations Conference on Trade and Development (UNCTAD), 2011). International organisations such as the OECD and the UNCTAD have been active in measuring the impact of ICT in various domains. For instance, the OECD in its 2004 report (Organisation for Economic Co-operation and Development (OECD), 2004) provides an overview of the impacts of ICT on economic performance and the ways through which these impacts can be measured. This report shows that ICT has substantial impacts on economic performance and the success of individual firms in particular when it is combined with investment in skills, organisational change and innovation. Other examples of related areas examined by the OECD are the impact of internet (Organisation for economic co-operation and development (OECD), 2012) and the impact of the crisis on ICT and ICT-related employment (Organisation for economic co-operation and development (OECD), 2009). In 2008 the UNCTAD published a report on the measuring the impact of ICT use in business, the case of manufacturing in Thailand (United Nations Conference on Trade and Development (UNCTAD), 2008). The report is one of the first studies to use official developing-country data to measure the productivity impact of ICT use in business. Another example of UNCTAD's related work is the publication of the report on measuring the impacts of information and communication technology for development (United Nations Conference on Trade and Development (UNCTAD), 2011). In this report the UNCTAD explores why measuring the impacts of information and communication technology is important for development and why it is statistically challenging.

2.3 Cyprus

In this section some specific characteristics of Cyprus are examined such as the main demographic characteristics of the country, the education and political system, the comparative advantages and disadvantages and finally, the history of the information society in Cyprus. One important aspect that is missing from this section is the economy which however is examined thoroughly in section 5.2.1 as there it is considered to be of more relevance.

2.3.1 Main demographic characteristics

Since the division of the island in 1974 all official data of Cyprus concern only the government controlled area. As regards the population in the occupied part, the Statistical Service of Cyprus (CYSTAT) provides annual estimates based on population projections which are in turn based on assumptions of fertility and mortality similar to those of the rest of the Cyprus population. The vast majority of official statistics of Cyprus are comparable to those of the rest of the European Union countries due to the application of the same methodologies. Statistics for all the European Union countries are disseminated by the Statistical Office of the European Union (EUROSTAT).

According to the latest available data, at the end of 2014, the population of the government controlled area is estimated at 847.000 (Statistical Service of Cyprus, 2015a). The Greek Cypriot community comprises of 694.700 persons and the remaining 152.300 are foreign residents. It is estimated that the Turkish Cypriot community residing at the occupied part comprises of 91.400 persons. The population figures do not include illegal settlers from Turkey. Cyprus has the third lowest population ranking of the 28 European Union countries ranking only above Luxembourg (562.958) and Malta (429.344). At a global perspective, Cyprus has one of the smallest population in the world, ranking 162nd out of 233 countries (United Nations, 2015).

In 2014 the density of the population was 93 capita per square kilometre. Although it is lower than the EU average (117 capita per square kilometre), it cannot be considered low in absolute terms as the world average density is about 56. However, density cannot be considered as a useful indicator since the population distribution is highly uneven in Cyprus. Most of the Cypriots live in an urban area (67,2%) and only 32,8% of the population lives in the rural areas.

Until 2011 Cyprus had positive annual growth rate but this changed due to the financial crisis started in 2012. Since then the annual population change is negative which is explained by the negative net migration balance (i.e. out-migration is higher than in-migration). In 2014, the crude rate of population change was -12,9% which is the biggest decrease in all EU countries. In addition, in 2014 Cyprus had the second highest rate of natural increase (4,7 per 1.000 population) which is well above the EU27 average (0,4 per 1.000 population). The total fertility rate which describes reproductive behaviour unaffected by changes in the age composition of the population indicates a continuing declining fertility trend. The abrupt decrease of fertility in Cyprus recorded during the nineties and the increase of the fertility indicator in some European countries in the last few years, resulted in placing the total fertility rate of Cyprus below the average of the European Union countries.

The age structure of the population follows a normal pattern, i.e. the proportion of the old is lower than the proportion of the young. The age structure of population is relatively younger than the average for Europe. In particular, the proportion of old aged persons 65 and over is among the lowest, while at the same time the proportion of children below 15 is among the highest. However, comparing the age structure of the population in 2011 with that of 2001 the aging process is obvious as the proportion of children below 15 decreased from 22,3% to 16,1% and the proportion of persons 65 and over increased from 11,3% to 13,1%.

2.3.2 Education

The education in Cyprus is provided through pre-school and pre-primary schools, primary schools, secondary general and secondary technical/ vocational schools and tertiary University and Non-University educational public and private institutions (Ministry of Education and Culture, 1999).

Public schools are mainly financed from public funds while the private schools raise their funds primarily from tuition fees. At secondary level of education private schools receive a small state subsidy. Private schools are owned and administered by private individuals or bodies but are liable to supervision by the Ministry of Education.

Pre-primary education is offered either in state kindergartens or private pre-schools for children aged below 5 and 2/3 under the jurisdiction of the Ministry of Education. Primary education is compulsory and free at public schools. Children begin their primary education at the age of 5 and 2/3 and leave when they have completed the prescribed six-year course. There are no entrance requirements. The small number of private primary schools charge fees and cater foreign national and Cypriots who opt for a particular foreign language.

There are two types of secondary schools, Secondary General and Technical/ Vocational. Secondary General is pursued mainly at public schools but there are also a few private ones. It is compulsory up to the third grade and for public schools it's free for all six grades. Entrance at the public schools is open to all primary school leavers without any examinations. Technical/ Vocational schools aim at providing local industry with technicians and craftsmen. Pupils are accepted at the 4th year. Technical schools put emphasis on theory and practice in science and technical knowledge and skills whereas Vocational schools provide training for craftsmen and various service trades.

Finally, tertiary education is provided in two levels, University level and Non-University level. Both are provided by public and private institutions. There are three public and four private universities. The public universities are: University of Cyprus, Open University of Cyprus and Cyprus University of Technology which admitted their first students in 1992, 2006 and 2007 respectively. The private universities are: European University Cyprus, University of Nicosia, Frederick University and University of Neapolis. The first three universities were established in 2007 and the fourth in 2009. The Non-University level is offered by Public Educational Institutions and Private Colleges.

According to the data of the Statistical Service of Cyprus (Statistical Service of Cyprus, 2015b) in 2012/2013 there were 175.733 pupils/students and 16.460 teachers giving a pupil/teacher ratio of 10,7 distributed at different levels of education as follows: 11,4% in primary education, 8,1% in secondary education and 16,5% tertiary education.

According to the official statistics the pupils from both the public and private secondary schools who enrol in grade 1, 97,6% successfully complete

grade III three years later, and, 94,3% succeed in graduating six years later. In 2012/2013, 36% of the secondary school leavers continue their studies beyond the secondary level in tertiary educational institutions in Cyprus.

In 2012/2013 there was a total enrolment of 31.965 students in Cyprus, 23.590 Cypriot and 8.375 foreign students. It is worth noting that the academic year 2009/2010 is the first time that the number of Cypriot students in Cyprus exceeded the number of Cypriot students abroad which is 20.051. Over the years there has been an annual increase in the number of Cypriot students in Cyprus while in the last two years there is a decrease in the number of Cypriot students abroad.

Cyprus compared to the rest of the EU countries in 2013 had the 6th highest share of the population aged 30-34 years who have successfully completed the tertiary-level of education (47,8%). This indicator measures the Europe 2020 strategy's headline target to increase the share of the 30-34 years old having completed tertiary or equivalent education to at least 40% in 2020. Cyprus has already achieved this target.

In 2012 the public expenditure on all levels of education, amounted to €1.251,4 million and accounted for 15,3% of the government budget and 6,4% of the Gross Domestic Product. In 2011 Cyprus had the second highest annual expenditure on public and private educational institutions per pupil/student compared to GDP per capita, for all levels of education combined (40,3%) from all the EU countries. The annual expenditure on public and private educational institutions per pupil/student compared to GDP per capita relates the resources (e.g. expenditure for personnel, other current and capital expenditure) being devoted to education in public and private educational institutions to the overall economic welfare of a country. It is based on full-time equivalent enrolment. The use of GDP per capita allows the comparison of levels of economic activity of different sized economies (per capita) irrespective of their price level.

2.3.3 Political System

Legislative power is held by unicameral Parliament, the House of Representatives. The House of Representatives is made up of 80 seats, with 56 seats assigned to Greek Cypriots and 24 to Turkish Cypriots. Since the withdrawal of the Turkish Cypriots from the Republic’s institutions (1963), the

House of Representatives has functioned only with Greek Cypriots parliamentarians. Members are elected by obligatory universal suffrage for a five-year term.

The executive branch is headed by the President, who serves as both Head of State and Head of Government. The President is elected by popular vote for a five-year term. It is noted here that the post of vice president, reserved under the 1960 Constitution for a Turkish Cypriot, is currently vacant. The Council of Ministers is appointed jointly by the President and Vice-President and is responsible for the governance of the Republic of Cyprus, coordinates and supervises the public services, supervises and allocates the fortune of the Republic and process the budget and bills before they are presented to the House of Representatives. Today there are 11 Ministries: Ministry of Defence, Ministry of Agriculture, Natural Resources and Environment, Ministry of Justice and Public Order, Ministry of Commerce, Industry and Tourism, Ministry of Foreign Affairs, Ministry of Labour and Social Insurance, Ministry of Interior, Ministry of Finance, Ministry of Education and Culture, Ministry of Communications and Works, and Ministry of Health.

The administration of justice is exercised by the island's separate and independent judiciary. The Judicial Power is vested in the Supreme Court and Inferior Courts established by the Law. Under the 1960 constitution and other legislation in force the following judicial institutions have been established: The Supreme Court, The Assize Courts, District Courts, Family Courts, Industrial Disputes Court, Rent Control Courts, and Military Court.

Under the provisions of the Constitution of the Republic of Cyprus the following Services are independent and do not come under any Ministry: Attorney General's Office, Auditor General, Central Bank of Cyprus, Public Service Commission, Educational Service Commission, Planning Bureau, Treasury, Ombudsman, Cyprus Securities and Exchange Commission, Cyprus Radio Television Authority, Tax Tribunal and Complaints against the Police.

In Cyprus there is a number of common utility organisations which provide essential services. The most important organisations are: Commission for the Protection of Competition, Office of the Commissioner of Electronic Communications and Postal Regulation, Cyprus Energy Regulatory Authority, Cyprus Agricultural Payments Organisation, The Office of the Commissioner for

Personal Data Protection, Co-operative Societies' Supervision and Development Authority, Internal Audit Service, Office of the Commissioner for State Aid Control, Tenders Review Authority and the Cyprus National Bioethics Committee.

2.3.4 Comparative advantages and disadvantages

According to the scientific literature there are mainly three approaches to measure the size of counties (Crowards, 2002): a) population size, b) land area and c) income. The most commonly applied criterion has been the population size. Various cut-off levels have been used from 15 mn in the 1950s to 1,5 mn in the 1990s. Crowards claims that the decline over time is due to the increase in the number of states, mainly smaller states, the general acceptance that the economic characteristics of small size apply more comprehensively to a narrower range of very small countries and finally, the increase of the size of countries which consequently makes those countries unsuitable to be classified as small. The land area provides an indication of natural resource variety and abundance. Finally, income is used as a measure of the size of the economy most often expressed in terms of the GDP.

Crowards classified the size of the countries based on the various observed breaks for population, land and income (GDP). He identified five groups of sizes as shown in Table 2. In the case where a country was classified differently in the three parameters then a decision rule was applied which stated that the size of the country is determined by the smallest size-category that includes two of the three parameters for that country. Based on Crowards classification system Cyprus is classified as a small country. In his paper Crowards presents a comprehensive list of definitions of small size used in the literature during the period 1957-1999.

Table 2: Country size classification based on observation of breaks in size parameters

Size	Population (mn)	Area (km^2)	Income (US$bn)
Micro	<0,5	<7.000	<0,7
Small	<2,7	<40.000	<2,5
Medium-Small	<6,7	<125.000	<7,0
Medium-Large	<12	<250.000	<19,0
Large	>12	>250.000	>19,0

According to Streeten (1993) there are several characteristics that separate small countries from their larger counterparts such as:

- Small countries typically have limited markets, scarce physical resources, shortages of technical skills and a weak bargaining power for inter-state agreements.
- Government and the public sector play a dominant role in the economy.
- Small and medium size firms are the predominant units of commercial activity in the economy.
- The most important activity in the national innovation system of small economies (even industrialized ones) is often technology diffusion, in the form of absorption and adaptation of foreign technology (usually from industrialized countries), and not the indigenous development of new technology.
- The 'high tech' sector is invariably underdeveloped or non-existent and the main issue is the application of high technology in existing sectors.

Despite the similarities that exist between the small countries there are also significant differences due to diverse cultures, social and economic environments and historical paths of development. Avgerou (2000)

acknowledges that information technology adoption and economic performance of a country are related to the local culture and political regimes. Smallness is both an advantage and disadvantage. Ylä-Anttila & Lemola (2003) argue that smallness may be beneficial for creating and diffusing new knowledge in specific areas, e.g. ICT. In the period of rapid technical change this could be a competitive advantage over larger countries. Armstrong, De Kervenoael, Li, & Read (1998) identify some characteristics of small countries that although they are generally not possible to quantify they put them in an advantageous position: greater social homogeneity and cohesion; greater flexibility and decision-making efficiency; greater openness to change and the gains from international trade. In his paper Briguglio (1995) argues that the special problems faced by small island developing countries was first raised during UNCTAD III in 1972 where the focus of attention was the disadvantages associated with insularity and remoteness. Other fora within UNCTAD identified additional disadvantages and by 1988 a wide array of disadvantages were recognised. Briguglio classifies the disadvantages of small island countries into five categories: small size, remoteness and insularity, disaster proneness, environmental fragility and other factors. Ylä-Anttila & Lemola (2003) argue that there is some evidence in the economic literature that smallness as such might retard economic growth. Small countries have less scope for utilizing scale economies in production and marketing. Armstrong, De Kervenoael, Li, & Read (1998) argue that a major challenge of small countries concern the small size of the domestic market and as a result of this they experience generally higher prices of intermediate inputs and of finished goods than larger countries. Moreover Armstrong, De Kervenoael, Li, & Read claim that small countries possess a small and/or poor domestic resource base because the natural resource endowment will be both limited and relatively undiversified as well as the small population of a country means that there is a critical domestic supply constraint on labour even during the process of economic development. In their paper Armstrong, De Kervenoael, Li, & Read raise also the issue of the narrow range of exports and export markets as well as the high transportation costs.

A different perspective is provided by Easterly & Kraay (2000) who argue that small states are no different from their large counterparts and consequently they should receive the same policy advice that large states do. In their study

they test whether small states are any different from other states in terms of income, growth and volatility outcomes. The results showed that small states have on average higher income and productivity levels than large states and do not grow more slowly than large states. To support their conclusion that small size might not be a disadvantage, they refer to additional advantages of small states such as good natural resources, small and cohesive population that adapts better to change and that small may also be beautiful.

In his study Briguglio (2014) examines the economic vulnerability and resilience of small states and he also proposes a revised vulnerability/ resilience framework following his previous work on the subject. Economic vulnerability is used to refer to a country's susceptibility to being harmed by external economic forces as a result of exposure to such forces. Economic resilience refers to the extent to which an economy can withstand or bounce back from the negative effects of external shocks. Based on his literature review Briguglio concludes that there is a controversy about whether or not economic vulnerability is a disadvantage for small economies. At the same time it is generally agreed that the special characteristic of small countries include a high degree of economic openness and a high rate of export concentration. During the 1990s various vulnerability indices were developed indicating that small countries, particularly island ones, tend to be more economically vulnerable than larger countries. The Commonwealth Secretariat has been very active in this area in collaborated with the University of Malta for the development of the Vulnerability and Resilience framework. In his 2014 version of the Vulnerability Index, which is the outcome of commissioning this study from the Commonwealth Secretariat, Briguglio proposes four components: a) trade openness, b) export concentration, c) dependence on strategic imports and d) proneness to natural disasters. Each component is assigned a weight of 25%. The results show that there is a negative relationship between country size and Vulnerability Index and that the majority of highly economically vulnerable countries are small island countries with relatively high scores with respect to all or most components of the Vulnerability Index. The Resilience Index proposed in the study comprises of five components: a) macroeconomic stability, b) market flexibility, c) political governance and institutions, d) social development and e) environmental management. These components are classified in three groups

each carrying equal weight (33,3%): a) macroeconomic stability, b) market flexibility and c) political, social and environmental governance index. The results show that there is a tendency for smaller states to exhibit a higher degree of economic resilience than larger states. There is a high degree of correlation between the Resilience Index and GDP per capita and thus, the most resilient countries tend to be the economically developed. The study covered 183 countries including Cyprus. Based on the estimates for the two indices Cyprus is classified in the group with low vulnerability and medium resilience and thus, belonging to a group not originally expected. Actually four groups were originally foreseen: a) low vulnerability score and high resilience score (large developed countries with good economic governance), b) low vulnerability score and low resilience score (large developing countries with weak economic governance), c) high vulnerability score and high resilience score (small countries with good economic governance) and d) high vulnerability score and low resilience score (small countries with weak economic governance).

In addition to all the advantages and disadvantages described above and are common to the small countries, Cyprus's specific characteristics provide significant comparative advantages (Ministry of Finance, 2005; Ministry of Energy, Commerce, Industry, and Tourism, 2016; Planning Bureau, 2006): a) EU and European Monetary union Member State; b) Strategic geographical location at the crossroad of three continents – ideal for expansion in new markets; c) Broad range and international quality of financial and business services - legal, tax, accounting, investment and brokerage; d) Highly educated, qualified and multilingual talent; e) Stable and pleasant business environment, accompanied by simple administrative procedures; f) Low set up and operating costs; g) Advanced transport and telecommunications network; h) Renowned international shipping centre and i) Simple, low Taxation. Adding to all these is the prolonged period of mild weather. At the same time Cyprus faces specific challenges such as its strong dependence on tourism, the very high percentage of non-performing loans and the influence of external geopolitical factors such as the Syrian crisis and the economic situation of Greece. Undoubtedly the up to now unsolved Cyprus political problem should not be underestimated as this maybe a negative factor for foreign investments in the island.

2.3.5 Strategic Directions for the Information Society in Cyprus

The aim to build an information society in Cyprus started to materialize in 1989 when the Council of Ministers approved the Government Computerization Plan (Commission of the European Communities, 2016a). In this Plan 80 priority projects were identified such as batch applications, revenue collection and payment systems. Due to the rapid technology changes, the increased demands from users and the EU accession requirements a revised version was approved in 1998. In the framework of the revised strategy, the so called "Information Systems Strategy" (Ministry of Finance, 2005), a Government Internet Node was established to provide the gateway between Government Systems and the public network, a Government Data Network (GDN) was developed, and several information systems were developed to support the internal operations of Ministries and Departments.

The strategic aim of developing the information society in Cyprus started to appear in the 2000's in several policy documents (Ministry of Finance, 2004a; 2004b; Planning Bureau, 2006). An official document (Ministry of Finance, 2006) even makes reference to a national information strategy which at that time was under review giving also January 2007 as the expected release month. At least two official documents (Ministry of Finance, 2005; Commission of the European Communities , 2015) claim that in 2004 a national strategy for the development of the information society was drafted by the Cyprus Planning Bureau following the structure of the guiding priorities proposed by the European Commission in the "i2010" Initiative. However, this strategy was never made public. Moreover in its 2010 report (Commission of the European Communities, 2010c) the European Commission claimed that Cyprus was in the process of formulating a comprehensive National Strategy for the Information Society in order to implement the i2010 policy and achieve digital convergence.

No specific action took place until February 2009 when a significant decision towards the development of the information society in Cyprus was taken by the Council of Ministers. The Minister of Communications and Works was appointed as the responsible Minister for Information Society and the Department of Electronic Communications (part of the Ministry of Communications and Works) as the executive arm of the Minister to develop and implement a National Information Society Strategy (Planning Bureau,

2009). In addition, the Council of Ministers approved the establishment of an Advisory Committee chaired by the Permanent Secretary of the Ministry of Communications and Works and having as members, representatives of all relevant Ministries, industry and academia. Also, the Council of Ministers requested every Ministry to appoint an information society coordinator who shall liaise with Department of Electronic Communications to implement the actions undertaken by his Ministry.

The vision of the information society strategy, which is the first step in the development of the strategy, was first presented in 2010. According to Chimonas (2010, p. 3) the vision is: “Digital technologies to become the catalyst for accelerating the economy and provide citizens with new higher-value jobs and new creative possibilities”.

However no information society strategy was ever released but instead in February 2012 the Council of Ministers approved the “Digital Strategy for Cyprus” (Ministry of Communications and Works, 2012a). The strategy was prepared by the Department of Electronic Communications under the guidance of the Advisory Committee for Information Society and covers the period 2012-2020. The plan aims at the development of an information society in Cyprus and the uptake of ICT, and is in line with the objectives and actions proposed in the Digital Agenda for Europe. The vision of the Digital Strategy for Cyprus is different from the one that was announced in 2010 and states the following (Ministry of Communications and Works, 2012a, p. 2): "information and communication technologies to support the development and the competitiveness of the economy, and citizen participation in the social, cultural and political domains”. The strategy sets six main objectives. Specific actions are specified within each objective. The actions are classified under different measures. There are 22 measures and 117 actions. The measures under each objective are as follows:

Objective 1: Connect Cyprus

- Measure 1 - Promotion of a stable regulatory framework
- Measure 2 - Licensing of wireless networks
- Measure 3 - Promote competition and decrease broadband prices
- Measure 4 - Establish Fibre to the Home network (FTTH)

Measure 5 - Network and information security

Objective 2: Modernize public administration and provide public electronic services

Measure 6 - Network and information security

Measure 7 - Paperless Government and eGovernment Services

Measure 8 - Electronic Local Authorities

Measure 9 – eHealth

Measure 10 - eID and signatures

Measure 11 - Use of ICT to promote cultural heritage

Measure 12 –Use of ICT to promote tourism

Measure 13 –Knowledge park (Smart City)

Objective 3: Inclusion of all (including vulnerable groups) into digital Cyprus

Measure 14 –Promote digital literacy

Measure 15 –National program for broadband penetration

Objective 4: Education and Learning

Measure 16 –eEducation

Objective 5: Digital Entrepreneurship

Measure 17 –Promotion of Digital Entrepreneurship

Objective 6: ICT for the environment

Measure 18 –National Strategy for the Use of Intelligent Transport Systems (ITS)

Measure 19 –Water management system

Measure 20 –Teleworking framework

Measure 21 –Communication Plan

Measure 22 – Strengthening coordination body

According to its supplementary methodology paper (Ministry of Communications and Works, 2015) the Digital Strategy is a comprehensive plan. It includes actions relating to the creation of suitable digital environment, the "preparation" of society to exploit digital technology possibilities and opportunities offered by a powerful digital environment, strengthening society's knowledge and skills to use ICT and the impact assessment from its implementation. Moreover, the Digital Strategy adopts all European objectives

and is fully consistent with the Digital Agenda for Europe. The implementation of the actions is carried out through triennial Action Plans, which are formed based on the document "Hierarchy of Goals-Measures-Actions" (Ministry of Communications and Works, 2013a) as well as from the results of the Progress Reports. The Action Plans include a specific timetable and budget and are approved by the Council of Ministers. The first Action Plan was published in 2012 and covered the period 2013-2015 (Ministry of Communications and Works, 2012b) whereas the second was published in 2014 covering the period 2015-2017 (Ministry of Communications and Works, 2014). The drafting of current ongoing Action Plan was based on the results of the 2012 Progress Report (Ministry of Communications and Works, 2013b) which contains an analysis of the progress achieved in the six strategic objectives of the Digital Strategy. The progress report identifies weaknesses that exist and make recommendations to address them, either by creating new activities or focusing on implementation of existing actions. It is worth noting that although in the 2012 Progress Report it is mentioned that the progress reports are annual, until now there has only been one such report published.

eGovernment is “the use of ICT and its application by the government for the provision of information and public services to the people” (United Nations, 2004, p. 15). More broadly, e-government can be referred to as the use and application of information technologies in public administration to streamline and integrate workflows and processes, to effectively manage data and information, enhance public service delivery, as well as expand communication channels for engagement and empowerment of people.

The first strategy of eGovernment in Cyprus, the eGovernment Vision (2002), was set up in 2002 and covered the period 2002 – 2011 (Commission of the European Communities, 2016a). Although as its name implies it concerns the eGovernment the strategy is considered to be as an update of the “Information Systems Strategy” (Commission of the European Communities , 2015). The main target of the strategy was to establish one-stop-shop services either via web or other channels, namely, kiosks, call centres, citizen support centres and other channels. The outcome of this strategy was the provision of services such as the electronic submission of tax returns, the renewal of road tax licences using credit cards, the payment via direct debit of social

contributions and other related services. All government ministries and departments have maintained their own websites, which are either informative and provide downloading of forms and other documents, or support user interaction. Another achievement was the development of the Government Data Network (GDN), which currently interconnects all government information systems and organisations.

The second eGovernment strategy covers the period 2014 – 2020 and applies to all ministries, departments and services of the Cyprus government. It focuses on technical, operational and organisational aspects of the provision of eServices to citizens and businesses. The objectives of the strategy are the enhancement of public sector capacity while reducing operational costs, the delivery of eServices and the facilitation of cross-border collaboration at European level. Interventions at the back-office systems or government ICT infrastructures are also foreseen by the eGovernment Strategy, provided that they assist the Cyprus government to achieve its objectives up to 2020, whilst being in line with the EU policies and directives. From the implementation of the eGovernment strategy, the following objectives are set out to be achieved:

- Enhancement of public sector capacity while reducing operational costs;
- Delivering additional eServices, which will be flexible, accessible, complete, easy and secure;
- Facilitate cross-border collaboration at European level.

As described above eGovernment is encompassed within the second of the six objectives of the Digital Strategy for Cyprus. As stated in the strategy, the government through the use of ICT aims to become smart, sustainable and innovative, more effective and efficient and more friendly to citizens and businesses. By using ICT for its internal functioning, the government aims to become paperless and therefore decrease bureaucracy and cost and increase civil servant productivity. Furthermore, by providing public services electronically the government will offer better services to businesses and citizens and reduce business costs. The strategy contains 8 measures and 48 corresponding implementing actions (Appendix 8).

The Department of Information Technology Services (DITS) is the responsible government body for the promotion and implementation of eGovernment within the public sector. DITS implement the programs and the respective EU action plans. Since 2002 many projects have been completed successfully such as the Electronic Office Automation system (2005), social insurance web-enabled system (2006), eProcurement system (2011) and the government open data portal (2014). The European Commission through its collaborative platform JoinUp publish annually the eGovernment factsheet for all the member states. The factsheet presents an overview of the eGovernment status in each country.

In summary, the first strategic direction was given in 1989 with the Government Computerization Plan followed by the Information Systems strategy in 1998. In 2002 the first eGovernment strategy was published which was then updated in 2014. An information society strategy was never published and instead, in 2012, the government announced the Digital Strategy for Cyprus. Unfortunately, until today, it has not been possible to locate both the original and the revised Government Computerization Plans (i.e. the information systems strategy). Similarly, I haven't managed to obtain a copy of the information society strategy which according to some official documents was prepared in 2004 (Ministry of Finance, 2005; Commission of the European Communities , 2015).

Having examined all the available documents I came to the conclusion that first, due to the lack of a coordinated effort for the development of an information society in Cyprus, at least until the release of the Digital Strategy for Cyprus in 2012, and second, due to the priority given to fulfil the commitments of the various EU plans, e.g. Lisbon Strategy, i2010, Digital Agenda etc, Cyprus has failed to utilize the advantages that the ICT adoption and usage has to offer in the various domains such as the economy, the society and the environment. Before its EU accession Cyprus had developed the Government Computerization Plan and the Information Systems strategy both of which were focused on the national needs. However, after the accession there was a continuous effort to comply with the EU plans and that changed the development of an information society strategy. As explained before some documents even refer to completed information society strategies but those

were never made public. There also seems to be confusion in the use of terms which are related to the information society. For instance, in the framework of the Europe 2020 Strategy for Smart, Sustainable and Inclusive Growth, Cyprus prepared the Cyprus National Reform Programme (Planning Bureau, 2011). Under Chapter 6 Digital Society (refers to the current situation as regards the fourth guideline of the Europe 2020 strategy “Optimising support for research, development and innovation, strengthening the knowledge triangle and unleashing the potential of the digital economy”) there is a comment on the absence of a comprehensive National Action Plan for ICT.

Although the decision to have a sole entity responsible for the information society is with no doubt correct, I argue that the selection of an existing government department for this task was not the best option as there will be problems with the coordination. For instance, the responsibility for the development and implementation of the e-government strategy still remains under another government department, the Department of Information Technology Services (DITS), and the strategy of e-Health under the Ministry of Health. There are also several smaller projects which are not under the umbrella of the Minister of Communications and Works, like for example, e-Inclusion (DITS) and lifelong learning (Planning Bureau). Moreover, I argue that the decision to assign the task of the information society to an already existing body may not be correct as with this arrangement the information society will be just an additional task and thus, the issue of information society is consequently undervalued. Instead, there should have been a decision to create a new agency with the task of developing and coordinating the implementation of the National Information Society Strategy. Another drawback of the current system/procedures on the decisions taken at national level related to the development of the information society has to do with who is the decision maker. For instance due to the participation of government employees to EU working groups/ task forces etc, several decisions are taken by those employees without any guidance from the top level management especially because the national strategy has just recently been introduced without any procedure taking place for its promotion. Therefore, several decisions are taken depending on the personal judgment of the employees.

From the examination of the literature, I conclude that there has been limited research on topics which are related to the information society in Cyprus but not on the information society as a whole. Some of the related topics studied are: innovation (Dickson & Hadjimanolis, 1998), e-commerce (e-MINDER, 2002), e-learning (Kleanthous & Frances, 2006), e-skills (Empirica, 2014), e-Inclusion (Commission of the European Communities, 2010c), digital literacy (Cyclotron Ltd., 2007), use of computers and internet in schools (Empirica, 2006) and entrepreneurship (Ellinas & Kountouris, 2004). It is important to observe that there is no reference in the literature on how to measure the progress towards the information society specifically for Cyprus. Apart from the statistics that Cyprus is obliged to produce due to EU regulations there has been no other effort to measure the progress towards the information society. This is reflected in the various government reports which contain basic ICT statistics such as internet penetration, broadband coverage, use of online public services and the number of computers in the various levels of education (Ministry of Finance, 2006; Planning Bureau, 2007; Planning Bureau, 2009). So, either the available statistics are considered to satisfy the national needs or the issue of measuring the information society in Cyprus has not been thoroughly examined.

Having a long experience in producing the official ICT usage statistics in Cyprus I believe that the reason is the lack of interest in examining this issue thoroughly. Being a small country and member of the EU, statistics are produced in order to comply with the regulations without taking into consideration the national needs first. This can be justified from my personal experience in the Statistical Service of Cyprus where it is estimated that 90% of the work is carried out to fulfil EU Regulations. Moreover, several projects are implemented in order to receive funding from the EU without examining the suitability of these projects for Cyprus by taking into consideration the unique characteristics and needs of the country. For instance, the Ministry of Trade, Industry and Tourism announced in 2009 the EU sponsored initiative (eΔραση) to financially support small and medium enterprises in the development of websites in order to improve e-commerce. Although this initiative can be considered as positive towards the development of e-commerce, I argue that at this time this initiative perhaps should not had been a priority as in Cyprus the

ICT usage amongst enterprises is still low, especially compared to the rest of EU countries. Instead, the responsible authorities should had first investigated the reasons for the low ICT usage by citizens and enterprises and then to make an investment in e-commerce. It is noted that until 2015 Cyprus continues to rank low in e-commerce indicators compared with the rest of the EU countries.

The first coordinated effort for the development of an information society in Cyprus was in 2012 with the publication of the Digital Strategy for Cyprus. As mentioned before the Strategy is in line with the objectives and actions included in the Digital Agenda for Europe. Despite the delay this is the first and a major step in having a comprehensive strategy for Cyprus. However, this strategy must be implemented in order to gain the benefits of having an information society. Unfortunately the economic crisis which started in 2012 had a negative impact on its implementation. Annual progress reports have not been published as it was originally foreseen and the only development was the preparation of the action plan in 2014 covering the period 2015-2017.

2.4 European Union

According to (Feijóo, Gómez-Barroso, & Karnitis, 2007, p. 11) the first reference to the term Information Society in an official European Commission paper was in 1979. In a document prepared by the Information Technologies Task Force created within the Commission Davignon and presented to the Dublin Council in November 1979, the reference to the Information Society was as follows: “Modern European society is already an “Information Society”, in which scientific and intellectual activity, economic transactions and the whole pattern of daily life (rely) on a subtle network of information”. It is generally accepted (Feijóo, Gómez-Barroso, & Karnitis, 2007; Gómez-Barroso, Feijóo, & Karnitis, 2008; Goodwin & Spittle, 2002; Servaes, 2000, 2002) that the first European Union´s reflection on the information society was the 1993 Delors White Paper in which the development of a Pan-European information infrastructure is emphasized with the aim of creating new markets and jobs. Another important EU report was the Bangemann Report in 1994. In this report, emphasis was given to the liberalization of the telecommunications and the important role of the private sector. According to Kaitatzi-Whitlock (2000) the three most important strategic EU papers were the following: APEWIS (Commission of the

European Communities, 1994), the Rolling Action Plan of 1996 (Commission of the European Communities, 1996) and the Green Paper on convergence of 1997 (Commission of the European Communities, 1997).

In 1995, the first G7 on the information society was organised in Brussels. This major event was the first organised to discuss globally issues and the potential of a scientific data transposed into a concrete public policy. Following this event it was decided to launch the first pan European telephone survey on the information society. In the framework of the survey 7.582 telephone interviews were carried out in the 15 member states and the survey covered population aged 15 and over. The results were very interesting as they showed a divided European information society as regards gender gap and usage in northern and southern countries of the European Union.

Being a member of the European Union since 2004, the development of the information society in Cyprus was influenced by the EU directions, in particular the eEurope+, eEurope 2002, eEurope 2005, i2010 and the Digital Agenda. Therefore, for the purpose of my thesis it is considered as relevant and important the examination of those actions in more detail. Servaes (2000, 2002), Ricci (2000) and Kaitatzi-Whitlock (2000) provide detailed descriptions and assessment of all the policies and actions carried out in the EU for the development of the information society in the period before the eEurope 2002 action plan. Gómez-Barroso, Feijóo, & Karnitis's (2008) assessment covers a longer period, starting from the 1990s up to 2005.

2.4.1 European Union policies 2000 - 2020

eEurope 2002

The political decision to bring forward the eEurope action plan was based on the experience of the U.S.A which showed that new technologies can drive growth and create jobs. Although in 2000 the quantitative implications of the new technologies were not yet fully understood, the analysis of the development of the "new economy" and its impact was taken as given. Having observed the economic divergence with the USA, the European Union decided in 2000, to launch the eEurope initiative (Commission of the European Communities, 2000a). The eEurope action plan was a political initiative to ensure the

European Union fully benefits for generations to come from the changes of the Information Society. It was expected to have a significant impact on European employment, growth and productivity for the following years. The action plan was focused on solutions and concentrated on what should be done, by whom and when.

The European Council held in Lisbon on March 2000 set the ambitious objective for Europe to become the most competitive and dynamic economy in the world. In this framework the eEurope 2002 Action Plan was endorsed by the Feira European Council in June 2000 (Commission of the European Communities, 2000b). The Action Plan included 11 action areas, clustered around three main objectives, in which there were a total of 64 targets to be achieved before the end of 2002. The objectives were: a) a cheaper, faster, secure internet; b) investing in people and skills; c) stimulate the use of internet. For achieving the eEurope targets it was decided to accelerate the set up of an appropriate legal environment, to support new infrastructures and services across Europe and to apply a method of co-ordination and benchmarking.

The intermediate measurements of the indicators were included in two reports, the Progress Report (Commission of the European Communities, 2001a) and the Benchmarking Report (Commission of the European Communities, 2002b).

The final report for eEurope was published in 2003 (Commission of the European Communities, 2003) and according to this report the Action Plan was a major success as most of the 64 targets were achieved. As indicated in the report, the goal of a competitive knowledge based economy has not been reached however eEurope 2002 has laid solid foundations. eEurope has achieved bringing the businesses and citizens online as well as setting up a framework within which the knowledge economy can grow. Due to the short duration of the plan it was not possible to demonstrate high economic benefits, higher productivity, improved quality of service, greater social inclusion and non-inflationary growth. These gains can only be achieved in the long run by restructuring economic behaviour, modernising practises and undergoing organisational change to exploit the new technology. eEurope 2002 has reshaped the regulatory environment for communications networks, services and e-commerce and opened the door to new generations of mobile and

multimedia services. It has provided opportunities for people to participate in society and has helped the workforce to acquire the skills needed in a knowledge driven economy. Finally, the eEurope 2002 Action Plan has brought the computers and the internet into schools, has brought the governments online and focused attention on the need to ensure a safer on-line world.

eEurope 2005

In 2002, the Commission launched the eEurope 2005 Action Plan (Commission of the European Communities, 2002a). The eEurope 2005 covered the period 2003 – 2005 and it was the next stage in the development of the information society in the European Union. According to the official texts, despite the achievements of the eEurope 2002 Action Plan, by the end of 2002 there was no evidence of more jobs and services. Moreover, no increase in productivity had been observed. Connectivity was there, but use was lagging behind. Thus, the eEurope 2005 Action Plan focused on stimulating use and creation of new services. The overall aims were that by the end of 2005 Europe should had a modern online public services (e-government, e-learning, e-health) as well as a dynamic e-business environment based on the widespread availability of broadband access at competitive prices and a secure information infrastructure.

In 2004, the European Commission published a mid-term review report (Commission of the European Communities, 2004) in order to access the progress in the implementation of the eEurope 2005 Action Plan and if needed, to re-adjust the initiatives and to strengthen the implementation procedures. According to this report, there had been important developments in the areas of broadband and e-government at both national and EU level. The report confirmed that the targets of eEurope 2005 remained valid. However, there are three important conclusions from this report. First, as regards e-government it is concluded that although the supply of services is growing, the demand lags behind, thus, the factors that will drive demand need to be better understood. Efforts should be made to measure the social and economic impact of e-government as well the drivers of demand for e-government. Second, although at the time there were many good initiatives on e-business, e-government, e-health and e-learning, the online services provided seem not to produce really effective services, thus the ways to bring forward effective online services

should be further explored. Finally, the impact of e-services in terms of efficiency or productivity gains and quality of work and life should be measured taking into account effects of citizenship and governance.

In a report published in 2005 by the European Commission (Commission of the European Communities, 2005b) (it is neither a communication nor a working document) it was stated that the new member states (10) were generally lagging behind. However, evidence showed that some countries were catching up and their intensity of use was as high as that of EU15. Although the broadband connectivity was in general a success there was a big variation amongst the member states. The internet take up increased rapidly due to increased competition and lower prices. The main access device to the Internet was the PC, however, an increase in the use of mobile phones was observed. The use of ICT by business and e-commerce grew very slowly and Europe lags behind in the use of advanced e-business applications. Availability and use of online public services continued to grow. Feijóo, Gómez-Barroso, & Karnitis, 2007 (2007, p. 15) claim that “The triumphalist tone has disappeared, giving way to a much more ambiguous vision”.

The eEurope 2005 final report was published in 2007 (Ramboll Management AB, 2007). According to this report, eEurope 2005 has been very important in promoting a dialogue between countries with different cultural and institutional set ups as well as level of performance. In addition, the action plan has enabled the member states to set up operational policy programmes and to improve internal coordination. Five different kinds of impacts of the eEurope Action Plan have been identified as follows: platform to exert influence, a major initiator and driver of national Information Society policy, reference point for national Information Society policy, push factor for particular areas of the Information Society and an incentive to better coordinate national Information Society policy. In this report it is stated that Cyprus belongs to the group of countries that have experienced the third kind of impact, i.e. the use of eEurope as a reference point for national Information Society policy. In general, the countries of this group had an Information Society policy in place prior to the eEurope 2002 and eEurope+, with a medium Information Society performance and with a low to medium political support. I argue that although the last two characteristics might sound reasonable I doubt about the first one, i.e. about the

existence of an Information Society policy in Cyprus. As discussed in section 2.3.5 an information society strategy for Cyprus was never published.

eEurope+

In parallel to the eEurope Action Plan, the central and eastern European countries agreed in 2000 to launch the eEurope+ initiative (European Union Candidate countries, 2001). This initiative mirrored the objectives and targets of eEurope but provided for actions which tackled the specific situation of the Candidate countries. In February 2001, the European Commission invited Cyprus, Malta and Turkey to join the other candidate countries in the Action Plan. The aim of eEurope+ was to accelerate reform and modernization of the economies in the candidate countries, encourage capacity and institution building, improve overall competiveness and provide for actions which address the specific situation of the candidate countries. All the actions were clustered around the same three objectives of eEurope and the same indicators were used for comparison purposes. The only difference was the inclusion of an additional objective aiming to assist in putting in place the fundamental building blocks of the information society. The candidate countries set as a deadline the year 2003 in order to meet the eEurope+ objectives.

The eEurope+ actions were undertaken by the candidate countries on the basis of political commitments. It was underlined that eEurope+ should in no way be perceived as a substitute for, or an interference of, the on-going *Acquis* Communautaire negotiating process.

A first picture of the progress was made available with the progress report published in 2002 (European Union Membership Candidate Countries, 2002). The European Union Acceding and Candidate countries published in 2004 the final eEurope+ report (European Union Acceeding and Candidate countries, 2004). According to this report all acceding and candidate countries made significant efforts towards the implementation of a knowledge based society. However, the report showed that there is a significant difference between the accession and candidate countries with the EU15 as regards the availability and use of the ICT. Major achievements of the initiative were the increase in the use of the internet, the liberalization, the improvement of the fixed line networks and the adoption of ICT in schools.

i2010

The next phase of the development of the information society in Europe covers the period from 2005 to 2010. The strategy called “i2010 – A European Information Society for Growth and Employment” was published in 2005 (Commission of the European Communities, 2005a). Its aim is to serve as a framework for addressing the main challenges and developments in the information society and media sectors up to 2010. It promotes an open and competitive digital economy and emphasizes ICT as a driver of inclusion and quality of life. In particular the strategy encompasses three priorities for Europe’s information society and media policies: a) Establish a European Information Space; b) Reinforce innovation and investment in ICT research given that ICTs are a principal driver of the economy; c) Promote inclusion, public services and quality of life, i.e. extending the European values of inclusion and quality of life to the information society. Within the framework of the strategy each Member State should define information society priorities in line with the strategy guidelines which stress the importance of ICT uptake, ICT infrastructure and ICT for jobs and education. The strategy and actions are reviewed and updated through the i2010 Annual Reports. In particular, the annual reports contain analysis of the developments in the ICT sector and assess the Member States’ progress in implementing their ICT objectives. For this reason, each Member State has defined National Information Society Priorities in their National Reform Programmes.

In 2008, the European Commission published the i2010 mid-term review report (Commission of the European Communities, 2008). According to this report much progress has been achieved. Some examples are the new regulatory framework for audiovisual media services, new R&D and innovation funding initiatives are up and running and new e-Inclusion initiatives are on track. Europe is among the leaders in the development of the digital economy. In Europe there is the highest percentage of broadband subscribers and half of European citizens use the internet on a regular basis. A few member states (Denmark, Finland, Netherlands) are world leaders in broadband take-up, mobile penetration and data traffic. However, there is a big divergence among member states and in addition, Europe is investing less compared to other industrialized regions and there is a growing competition from China and India.

All EU counties have strengths and weaknesses, with indicators both below and above the EU average. The i2010 has produced many tangible results (Commission of the European Communities, 2009b) such as the increase of regular internet users, the establishment of Europe as world leader in broadband internet and mobile penetration, high usage of advanced services, fast progress in the supply and use of eGovernment services, the significant role of EU funded ICT research in Europe's industrial development and finally, the integration of national ICT strategies with objectives similar to those of the i2020 strategy. It is important to note here that the last claimed achievement justifies my conclusion described in 2.3.5 that national strategies are influenced by the various European strategies.

Digital Agenda

In 2010 the European Commission launched the Europe 2020 strategy with the aim to achieve high levels of employment, a low carbon economy, productivity and social cohesion, to be implemented through concrete actions at EU and national levels. The Digital Agenda for Europe (Commission of the European Communities, 2010a) is one of the seven flagship initiatives of the Europe 2020 Strategy which is set out to define the key enabling role that the use of ICT will have to play in order to achieve the goals of the Europe 2020 strategy.

Having identified the seven most significant obstacles in the exploitation of the ICT in Europe, the Commission set the Digital Agenda for Europe in which specific actions are described in order to tackle them. These obstacles concern the fragmented digital markets, the lack of interoperability, the rising cybercrime and risk of low trust in networks, the lack of investment in networks, the insufficient research and innovation efforts, the lack of digital literacy and skills and the missed opportunities in addressing societal challenges. As a result of these obstacles Europe was lagging behind its industrial partners. For instance, in 2010 there were four times as many music downloads in the US as in the EU because of the lack of legal offers and fragmented markets; 30% of Europeans had still never used the internet; Europe had only 1% penetration of fibre-based high-speed networks whereas Japan was at 12% and South Korea is at 15%; and EU spending on ICT research and development stand at only 40% of US levels.

The progress on the Digital Agenda is followed by the release of an annual scoreboard. The indicators included in the scoreboard are mainly drawn from the Benchmarking framework 2011 – 2015 which is a conceptual framework for collection of information society statistics as well as a list of core indicators for benchmarking

eGovernment

The importance of the role that the eGovernment initiatives have to play is reflected in both the European and international initiatives. At the European level Joinup[2] is a collaborative platform created by the European Commission and funded by the European Union via the Interoperability Solutions for Public Administrations (ISA) Programme. It offers several services that aim to help e-Government professionals share their experience with each other. Joinup involves eGovernment and interoperability professionals from all over Europe. Joinup offers relevant content and insight in various areas of interest, including among others:

- Cross-border and cross-sector interactions between public administrations;
- Pan-European electronic public services;
- Legal information on usage and development of open-source software within public administrations;
- Interoperability impact of EU regulations and actions;
- Access to a repository of reusable interoperability solutions;
- Methodologies and practice aids on the development of interoperability solutions;
- Pan-European eGovernment projects

The first European eGovernment Action Plan was drawn in 2006 in the framework of the i2010 initiative for jobs and growth in the information society (Commission of the European Communities, 2006). The implementation of the first European eGovernment Action Plan resulted in a number of large-scale pilot projects which are developing concrete solutions for rolling out cross-

[2] https://joinup.ec.europa.eu

border eGovernment services. Moreover progress was made in the re-use of public sector information and an electronic public procurement platform developed to allow companies from across Europe to offer their services to governments outside their home country. Following the positive outcomes of the first action plan, on the 15th December 2010 the European eGovernment Action Plan 2011 – 2015 was launched (Commission of the European Communities, 2010b). The aim of this second plan on eGovernment was to realise the vision of the 5th Ministerial eGovernment Conference on 18 November 2009, in Malmö, Sweden (the 'Malmö Declaration') (Commission of the European Communities, 2010b, p. 3): “by 2015 European public administrations will be recognised for being open, flexible and collaborative in their interactions with citizens and businesses. They use eGovernment to increase their efficiency and effectiveness and to constantly improve public services in a way that caters for user's different needs and maximises public value, thus supporting the transition of Europe to a leading knowledge-based economy." The 2011 – 2015 action plan identifies four political priorities as follows:

i. Empower citizens and businesses
ii. Reinforce mobility in the Single Market
iii. Enable efficiency and effectiveness
iv. Create the necessary key enablers and pre-conditions to make things happen.

Throughout the years the overall progress made on the eGovernment Action Plans is measured by using mix of instruments such as benchmarking, bench-learning and self-assessment. Various methods are also applied e.g., web research, public data analysis, user testing, interviews etc. An eGovernment Benchmark study has been carried out by the European Commission since 2001 and its aim is to monitor the development of eGovernment in Europe, based on specific indicators. Currently these indicators are clustered within four main top-level benchmarks namely:

i. User Centricity – indicates to what extent a service is provided online and how this is perceived.
ii. Transparent Government – indicates to what extent governments is transparent

iii. Cross Border Mobility – indicates to what extent EU citizens can use online services in another country
iv. Key Enablers – indicates the extent to which 5 technical pre-conditions are available online. There are: Electronic Identification (eID), Electronic documents (eDocuments), Authentic Sources, Electronic Safe (eSafe), and Single Sign on (SSO).

The first "Web-based Survey on Electronic Public Services" took place in 2001 (Commission of the European Communities, 2001b) and it was part of the eEurope programme which aimed to bring the benefits of the information society to all Europeans. The objectives of the benchmark were to enable member states to compare performance, and to identify best practices in order to stimulate progress in the field of eGovernment. A list of twenty common online public services was drawn up by the Commission and the member states. Twelve of the twenty services aimed at individual citizens and eight at businesses.

2.4.2 Review of the assessment of the policies

Although the EU self evaluation of its action plans transmits a positive note (Commission of the European Communities, 2003; 2005c; 2008; Ramboll Management AB, 2007), over the years there have been voices who raised doubts about the claimed successes of the various EU policies, initiatives and strategies.

Garnham (1997, p. 324) claims that "European Community telecommunications and information technology policy has been characterised from the start by a number of conflicting policy problems and objectives and related interest groups". (Servaes, 2000) argues that the EU strategy is not sustainable in the medium and long term and he justifies this argument on the basis that there is an imbalance between productive and consumptive functions due to the assignment of the transition to the digitized information economy to market forces. Servaes (2002) argues that during the 1980s most of the R&D programmes embedded the ideas of the information society and although a lot of research was carried out and billions of Euros were spent, the first generations of large scale R&D projects in integrated communications were not

successful. According to Servaes this failure alongside the announced “information highway” policy by the Clinton-Gore administration, initiated the digital “gold fever” that got into the discourse and policy of the EU. Servaes calls for an examination of the assumptions underlying the EU information society policies. Others, (Kaitatzi-Whitlock, 2000) examine the EU 1990’s strategies and policies for the development of the information society and argue that those strategies and policies were “naive” and not sustainable in the medium and long term. The failure is mainly attributed to the exclusion of the political and social forces in the decision making process and the complete freedom given to the market forces.

A more recent study is by Gómez-Barroso, Feijóo, & Karnitis’s (2008) where in addition to the 1990s policies it covers also the eEurope action plan. The authors claim (Gómez-Barroso, Feijóo, & Karnitis, 2008, p. 787) that “Despite the satisfaction shown in certain official appraisals, the picture resulting from consulting different classifications globally measuring the adaptation of countries to the information society is not that optimistic”. The authors adopt a different to the EU methodology approach to assess the progress of the EU member states towards the development of the information society. In particular they use four indicators developed by international organisations: Infostates (Orbicom), Digital Access Index (ITU) (adjusted by the authors to the EU countries), e-Readiness Ranking (Economist Intelligence Unit) and the Networked Readiness Index (WEF, INSEAD). Cyprus is not included in the e-Readiness Rankings. The authors conclude that only the Nordic countries significantly improved as a result of the EU policies and the improvement of the new members (those who joined the EU in 2004) was not the one expected (including Cyprus). This was a result of the approach followed in the design of the strategies as those were shaped by bureaucrats and industrial corporate interests instead of maintaining contacts with public interest groups. Furthermore the authors claim that the decision to leave each country responsible to define the information society policies was counterproductive

A different approach in examining the European Union’s policies on the information society is followed by Goodwin & Spittle (2002). In this study the authors analyze the information society in respect of the language used within the EU institutions. They perform a critical discourse analysis by identifying four

major discourses: threat/ opportunity, technological determinism, market dominance and citizen vs consumer. Goodwin & Spittle examine in detail the debate over the social, cultural and economic impact of the information society within the European Union and they conclude that the economic parameters become privileged compared to the social and cultural factors.

Cawley & Preston (2007; 2008) examine how broadband applications and services can be the key drivers of the future growth of broadband instead of the technology or infrastructure. The authors argue that the EU policies on broadband have been focused on the infrastructure rollout and bandwidth whereas the area of development innonative applications and services has been overlooked. In general, the EU policies did not take into the consideration demand-side applications, users and uses.This approach was based on the assumption that once the infrastructure is in place and there is a significant amount of users then applications and services will follow. However, Cawley & Preston argue that the experience in Europe shows that this assumption was invalid not only as concerns innovative content services but also online transaction of e-governemt and e-business applications.

2.5 Summary

In light of my findings and the literature search, I can confirm that the concept of the information society is multi-faceted and complex (Feijóo, Gómez-Barroso, Karnitis, & Ramos, 2007; Gómez-Barroso, Feijóo, & Karnitis, 2008; Ricci, 2000). As regards the definition of the concept of the information society, until today there hasn't been a universally accepted definition and the use of other closely related terms, such as knowledge society, information age etc, makes the situation even more complicated. In some cases, the difference in the definitions of terms is so narrow that makes the selection of the "appropriate" definition very difficult.

A similar situation occurs in the measuring of the information society. For simplicity, I propose the classification of the available measures into three categories. The first category contains those measures which produce just a single value for the whole information society, for instance the IUP model. The second category contains those measures which use a framework, i.e. several indicators for different aspects, for instance the model proposed by the

Australian Statistician and the framework applied by the Joint Research Centre (JRC) of the EU in the study of the factors and impacts of the information society in Cyprus. Finally, the third category contains those measures which refer to the different facets of the information society e.g., the composite indicators produced by the international organizations. In this third group, there can be further classifications according to the topic of measurement, i.e. ICT impact, digital divide, e-commerce etc. As expected, the vast majority of measurements are included in the third category

The vast majority of the papers refer to cases of developed countries. However, in the recent years, there has been an increased attention on the issue of digital divide between developed and developing countries thus the international organizations as well as the researchers have produced a significant amount of literature on this topic. Despite of the fact that some researchers argue about the significance of including several characteristics of countries (e.g. culture, history etc) in the different measurements, the available produced measures do not include a different group of countries, the small countries. I argue that the main reason for this is the fact that the small countries do not have big economies thus their contribution to the global economy is negligible. Nevertheless, from the small countries' point of view the ICT adoption and use should be considered as part of their strategic planning for all those reasons and benefits described in the scientific literature and concern both the economy and society. On the other hand, even if some policy makers and researchers are sceptical about the positive impacts of the ICTs, the countries should adjust their strategic aims on technology as nowadays with the widespread use of ICTs there is no alternative way to follow. I argue that as soon as the benefits of ICTs are clarified and accepted by the policy makers in the small countries, the initiatives for the adoption and use should come from them. Each country should lead their own way in the setting up of strategies and in the implementation. In this way, every country should decide on the most appropriate conceptual framework and must not depend on the decisions and plans of other countries.

Cyprus is an example of a country in which a comprehensive information society strategy has only recently been introduced and for which the only available framework for measuring the information society is the one applied to

all member states of the EU. Being part of the EU, Cyprus is obliged to produce several indicators. Although the statistics produced by the twenty eight member states of the EU are comparable and useful, I argue that the availability of just these statistics in measuring the progress towards information society in each country is not satisfactory. First, a conceptual framework must be defined for the country taking into consideration the environment and culture and then, to decide on how to monitor the progress. Although the rankings of EU countries based on common indicators are useful and indicative of differences, the comparisons may have no real meaning for some countries. For example, the results of the ICT usage survey in enterprises – the survey is carried out annually in all EU member states - concern those enterprises with 10 or more employees only. But in the case of Cyprus those enterprises represent only the 7% of the total number of enterprises. So, are the results of this survey representative of the situation in Cyprus regarding ICT usage by enterprises? Clearly, the answer is a definite No.

From the contents of the progress reports of all EU action plans it can be deduced that there have been significant improvements in the development of the information society in the EU. However, some authors express different views on the claimed success of the action plans. It is argued that only the Nordic countries have improved, broadening the gap with the rest and that it is uncertain that Europe is really progressing in the adaptation of its citizens and territories towards the information society. It is not the aim of this thesis to evaluate the results of the various EU strategies and actions, however, it is accepted that the implementation of the strategies by the member states has positive results, in some countries more than others. I argue that in the case of Cyprus, the EU strategies are the main drivers for the development of the national strategies and in many cases the national needs and idiosyncrasies are not taken into consideration.

Chapter Three will describe the methodology applied in order to fulfil the requirements of this research.

Chapter 3: METHODOLOGY

3.1 Introduction

This Chapter describes the rationale behind the plan of action for carrying out this research and the methodology adopted. The decision on the methodology for this research was based on the goals of the research questions described in Section 1.3.

3.2 Plan of action

As described in Section 1.3 the broad research problem of this research is framed as "**What are the key factors in the development of the information society and how can these factors facilitate the information society in Cyprus?**" In order to identify those key factors the first two research questions had to be answered quantitatively:

1. **Which are the available information society measurements? Do those measurements include Cyprus?**
2. **Do the available information society measurements take into consideration the different sizes of the countries?**

However, a major goal generated from the research questions concerns the definition of the information society. As the topic of this thesis is about the information society it is necessary to investigate how the term information society is defined in the scientific literature in order to apply, if possible, a definition for the purpose of this thesis.

Although the topic examined is being researched as a PhD thesis, it is with no doubt of great interest to politicians and policymakers in Cyprus. As already described in Chapter 2 a strategic aim of Cyprus should be to become an information society. Furthermore, due to the political situation in Cyprus and in particular the division of the island, this thesis may provide a guide in obtaining an information society of the same level between the two parts of the island after a possible reunification. Consequently, a sound methodology should be applied in order to assist politicians and policymakers in their evidence-based decision making.

The exploratory nature of the first two research questions prompts the survey of the state of knowledge on the information society measurements. At this stage the aim is not to develop or evaluate theories but to pull together what is known on the research area. An additional objective is critical evaluation in order to reveal problems, weaknesses, contradictions, or controversies both in the definition of the information society and in its measurement.

Bearing in mind the aim and nature of the first two research questions it has been decided to use a narrative review approach to research synthesis. Although narrative overviews are one of the weakest forms of evidence to use for making decisions, primarily because they deal more with broader issues than focused problems and additionally, there is a higher degree of bias involved in overviews than some other research designs, narrative overviews constitute an important component in the literature base (Green, Johnson, & Adams, 2006). Baumeister & Leary (1997) argue that narrative literature review is not only valuable when a researcher attempts to link together many studies on different topics, either for purposes of reinterpretation or interconnection but narrative literature reviewing is a valuable theory building technique, and it may also serve hypothesis-generating functions.

Petticrew & Roberts (2008) distinguish “narrative”, “traditional review” and “systematic literature review”. Narrative review, sometimes used to refer to a systematic review, is an approach that synthesizes the individual studies narratively (rather than by means of a meta-analysis). This involves systematically extracting, checking, and narratively summarizing information on their methods and results. A traditional review is a term that sometimes used to refer to a literature review that does not use systematic review methods. Systematic literature review aims to comprehensively identify all relevant studies to answer a particular question, and assesses the validity (or ‘‘soundness’’) of each study taking this into account when reaching conclusions. The difference between the systematic literature review and traditional review is that in the former approach the methods are set out in advance and in detail. The systematic review is more ‘‘fit for the purpose’’ for answering specific questions and testing hypotheses than the traditional review and in addition, the application of a systematic approach limits the bias.

Okoli & Schabram (2010) and Rousseau, Manning, & Denyer (2008) consider “systematic” as a qualitative adjective that is a spectrum upon which all reviews fall to more or less degree. Along the same line is the view of (Bryman, 2008, p. 94) who brings as an example the Glasby and Lester’s (2005) narrative review of mental health inpatient services in the UK. The authors followed procedures aligned with those of systematic review, but Glasby and Lester rejected the use of tight quality assessment criteria because too few studies end up being included in a review. Bryman comments that the inferences the authors make from the literature are not necessarily damaged because of this, as they were able to generate those inferences from a larger number of studies.

Systematic reviews are prominent in the health sector (Kitchenham, 2007; Petticrew & Roberts, 2008; Urquhart, 2010). Despite the different knowledge base of the health sector and other disciplines such as social science, software engineering, information systems, library and information science, systematic review has been applied to those areas as well. The advantages of applying systematic reviews in any discipline that are described in the literature are the following (Kitchenham, 2007; The Cochrane Collaboration, 2011):

i. The risk of obtaining biased literature results is minimised due to the well defined methodology.
ii. The methods used are explicit, systematic and reproducible. In particular, a systematic review has clear inclusion/ exclusion criteria, an explicit search strategy and facilitates systematic coding and analysis of included studies.
iii. Information about the effects of a phenomenon can be provided across a wide range of settings and empirical methods. In case the results are consistent then the systematic reviews provide evidence that the phenomenon is robust and transferable. Otherwise the sources of variation can be analysed.
iv. As regards quantitative studies, meta-analytic techniques can be applied to combine data. In this way, the ability to study the consistency of results is improved.

At the same time the use of systematic reviews encompasses the danger of obtaining biased literature results when the primary studies are biased and in addition, even small biases may result in an ‘apparent’ effect. For example, systematic reviews often need to consider the possibility that research that has negative effects is less likely to be published than research which found a positive effect of an intervention. Another criticism of this approach is that the emphasis is given to the procedures followed rather than to the analytical interpretations generated by it. In addition, the systematic approach assumes that articles should be evaluated in terms of methodological criteria and this is not always the case as some researchers measure the quality of published research based on what they find interesting. Finally, systematic reviews require a significant amount of time to be completed compared to traditional methods.

After a thorough examination of the literature on the various alternatives on the carrying out of research synthesis it was decided that the narrative review which includes the element of systematic review would be the most suitable approach to follow for the purpose of answering the first two research questions. This is in line of the statement made by Killic & Taylor (2009) that a rigorous review should include a logical and explicitly defined process of synthesis as well as selection and appraisal. Moreover, it satisfies Fink’s (2005) definition which states that a rigorous stand-alone literature review must be systematic in following a methodological approach, explicit in explaining the procedures by which it was conducted, comprehensive in its scope of including all relevant material, and hence reproducible by others who would follow the same approach in reviewing the topic.

Although the systematic review was developed to satisfy primarily the needs of medical researchers this method has been applied in other areas too, such as social science, software engineering and information systems. Several guidelines for carrying out systematic review in the various fields – the vast majority being in the medical field - have been developed and some examples are the following:

Field: Health

Title	Author
Cochrane Reviewers' Handbook (The Cochrane Collaboration, 2011)	The Cochrane Collaboration
Guidelines prepared by the Australian National Health and Medical Research Council (Australian National Health and Medical Research Council, 2000)	Australian National Health and Medical Research Council
Guidelines for those carrying out or commissioning reviews (Centre for Reviews and Dissemination, University of York, 2009)	Centre for Reviews and Dissemination (CRD)
Joanna Briggs Institute Reviewers' Manual (The Joanna Briggs Institute, 2011)	Joanna Briggs Institute

Field: Education, Crime, Justice, Social Welfare

Title	Author
The Campbell Collaboration (The Campbell Collaboration)	The Campbell Collaboration

Field: Social Science and Public Policy

Title	Author
EPPI-Centre Methods for Conducting Systematic Reviews (EPPI-Centre, 2009)	EPPI-Centre
Systematic reviews in the Social Sciences: A Practical Guide (Petticrew & Roberts, 2008)	Petticrew & Roberts

Field: Software Engineering

Title	Author
Guidelines for performing Systematic Literature Reviews in Software Engineering (Kitchenham, 2007)	Kitchenham

Field: Information Systems

Title	Author
A Guide to Conducting a Systematic Literature Review of Information Systems Research (Okoli & Schabram, 2010)	Okoli & Schabram

Following the decision on the method for research synthesis I had then to decide on the most appropriate procedure to follow in order to reduce the bias and to secure reproducibility. Budgen et al (2006) examined the similarity between software engineering research practices and those of other domains such as Clinical Medicine, Primary Care, Empirical Psychology, Nursing & Midwifery, Organic Chemistry and Education. Their research showed that software engineering is much more similar to the Social Sciences than the traditional medical arena in which systematic reviews were first developed. The reasons concern the experimental practices, subject types and blinding procedures. Kitchenham (2007) developed guidelines for carrying out systematic literature reviews adapted to reflect the specific problems of software engineering research. The guidelines were derived from three existing guidelines used by medical researchers, two books produced by researchers with social science backgrounds and discussions with researchers from other disciplines who are involved in evidence-based practice. Three broad phases of a systematic literature review are covered: planning the review, conducting the review and reporting the review. It is important to recognise that although the stages may appear to be sequential, many of them involve iteration. In particular, many activities are initiated during the protocol development stage, and refined when the review properly takes place.

Kitchenham concludes that existing guidelines for systematic reviews have slightly different suggestions about the number and order of activities and that the medical guidelines and sociological text books are broadly in agreement about the major stages in the process. Taking onboard Kitchenham's conclusion and taking also into consideration first, that the topic of this thesis does not involve any experimental design and second, that the aim at this stage is to summarize the existing evidence on the information society, it was decided to apply the three major stages. A more detailed description of the applied methodology is provided in Section 3.3.

The major part of this thesis has been the research on the concept of the information society and the availability of the numerous types of its measurement. To provide an answer to the third research question (How can the development towards the information society of a small country like Cyprus be measured?) there were two options, either to construct a new model or use

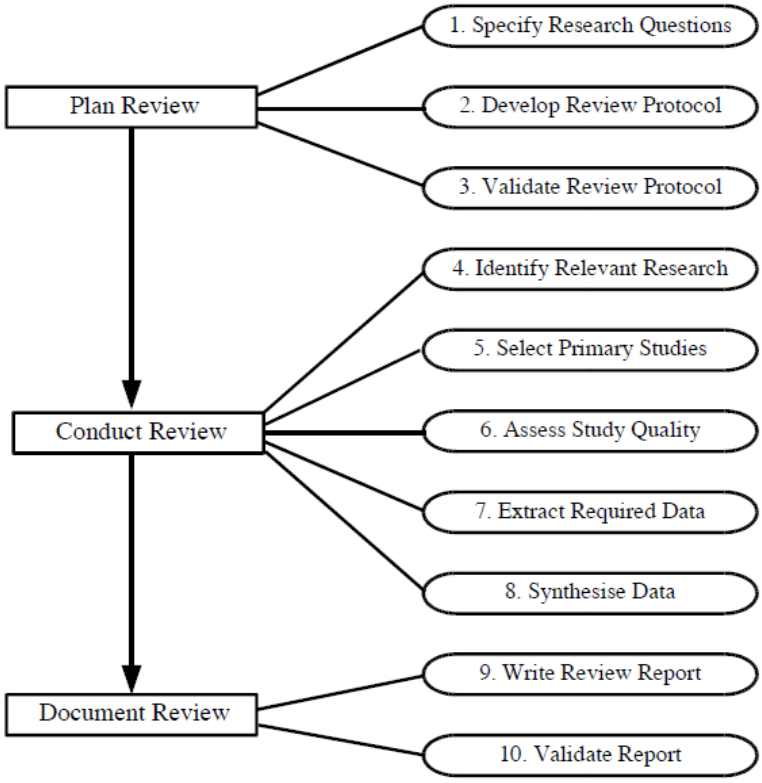
an existing one. As explained in Chapter 5 it has been decided to choose the second option since the selected model has already been applied to other countries and thus it is generally accepted and satisfies its purpose. However the development of a new and perhaps more suitable framework can be the topic of a future research. Finally, the fourth research question (What further measures should be implemented in order to secure the successful conversion of Cyprus into an information society?) is answered by first evaluating the results of measuring the information society in Cyprus and second by examining the best practices in other countries.

3.3 A systematic narrative review for the information society

By applying the method of systematic narrative review the aim is threefold. First, to summarize all pertinent evidence on the area of information society, second, to identify the range and diversity of the available literature, and third to determine gaps as regards the measurement of the information society in small countries.

According to Kitchenham (2007) systematic literature review includes three main phases: Planning the Review, Conducting the Review, Reporting the Review. Each phase involves a sequence of specific steps as illustrated in Figure 4 (Budgen, Charters, Turner, Brereton, Kitchenham, & Linkman, 2006). The “heart” of the systematic literature review process is the review protocol. The review protocol is a key element of systematic review and for this reason it should be of high quality. For the purpose of this research and in order to ensure its quality, the protocol was first approved by the supervisors.

Figure 4: Systematic Literature Review Process



Review Protocol

The research area is about the measurement of the information society with a special focus on small countries and Cyprus. Thus, the review of the literature should cover any material on the concept of the information society and its measurement. Moreover, as this research focuses on Cyprus, it is important to examine other aspects, in addition to the information society, such as history, culture, economy, infrastructure, policies etc. Being a member of the European Union since 2004, it is interesting and relevant to find out about those EU policies that have been implemented or planned to be implemented and had or expected to have an impact on the development of the information society in the member states and particularly on Cyprus.

This section is divided in three parts. The first part describes the various sources of information which are classified in four clusters. For each cluster a description of the corresponding sources is provided and in addition, the applied search method, the inclusion criteria and the quality assessment process. The

second part describes the data abstraction method and finally, the last part concerns the limitations of the approach followed.

3.3.1 Sources of information

At the outset, a stepwise approach is applied for gathering the documentation. In particular, four clusters are defined, each one representing a different group of sources. Then all relevant documentation is identified within each cluster. The four clusters defined are the following:

i. International organisations,
ii. Cyprus government,
iii. European Union,
iv. Databases, search engines.

The procedure for searching and reviewing documents was continuous and was completed in June 2013. The documents examined and selected for review are not only articles from peer-reviewed and non peer-reviewed journals but consists of conference papers, books, literature from a range of public and private sector bodies, research reports and presentations.

3.3.1.1 International organisations

During the last decade several international organisations put a significant effort in the development of information societies. International Telecommunication Union (ITU), Organisation for Economic Co-operation and Development (OECD), United Nations Conference on Trade and Development (UNCTAD) and United Nations Educational, Scientific, Cultural Organization (UNESCO) have an important role in defining and measuring the information society and in particular, they have been dealing with the definition of the information society, the development of methodological manuals, the collection and publication of statistical data etc. A complete list of international organizations including a description of the location of the relevant documents on their website is provided in Appendix 1a. The aim was to identify all the documents prepared by the international organisations on the information society.

All international organizations have websites and the vast majority of information is provided free of charge. Consequently, the source for gathering all information from international organisations has been their websites. All documents that were referenced elsewhere were located within each website either by using the websites' search engine or through browsing. In the latter case additional documents were retrieved that had not been known beforehand. The completeness of documents availability online is stipulated on the websites of ITU, OECD and UNESCO whereas in the case of UNCTAD all the publications are available on the website by theme.

As the topic of information society is relatively new and the work of the international organisations started mainly at the dawn of the 21st century and moreover, in order to satisfy both needs being first the trace of the historical development and second the focus on the recent developments, the review included all documents published until December 2012. Consequently the included documents reflect all the work carried out in the field. The search is limited to English language publications. In case of regional content then those documents with specific geographic focus in Europe are selected.

The search terms used in the literature searches in the websites of the international organisations included keywords such as: information society, knowledge society, information economy, ICT, Cyprus + information society, Europe + information society. Although the concept of information society is very broad and is related to other terms it was decided to narrow the search by using only those keywords so as to review the documents focused on those topics. In order to achieve completeness and to determine gaps or to critique published information of the international organisations, all types of documents are included. Those documents are mainly methodological, statistical or analytical.

In some cases it was possible to use the web services offered from the websites of the international organisations. For instance, in order to be immediately informed about the availability of new documents on the OECD's website, it is possible to subscribe to the e-mail alert system which offers the possibility to registered users to be notified via e-mail, whenever a new document is uploaded on the website. Even if an international organisation had offered alert services, the search process was continuous.

An initial screening to determine whether the documents returned by the searches met the inclusion criteria was carried out from the title and the short description of the contents as provided by the search results. If there was enough information to assess inclusion, the full documents were downloaded and stored. When the title and the short description did not provide sufficient information to determine inclusion, the full document was retrieved for further examination. Documents that met the inclusion criteria were reviewed by applying the data abstraction method whereas those that didn't were dismissed. Moreover, in order to achieve completeness, the bibliographies of all included documents were examined for meeting the inclusion criteria.

3.3.1.2 Cyprus government

The second cluster concerns those documents that are related to the development of the information society in Cyprus. Those are mainly policy reports prepared throughout the years by the government. The source for locating those documents has been the websites of ministries and other government departments (a complete list of the national websites visited including a description of their contents is provided in Appendix 1b). In addition, due to my professional involvement in the production of the official statistics on the information society for Cyprus, I have been in the advantageous position to be well aware of all the developments on the subject and consequently about the availability of related documents, due to the participation in the various national committees and from personal contacts with colleagues from other government departments (Department of information technology services, Department of electronic communications and Office of electronic communications and postal regulation).

Considering that the aim is to trace the history of the development of the information society in Cyprus, there has been no restriction on the selection of the documents as regards publishing years. A document was selected based on its focus. In particular, as the term information society is related to several other concepts (such as digital divide, e-commerce, e-government) in order to obtain a spherical view of the situation in Cyprus, a document was selected for review if its focus was related to any of those concepts and Cyprus. Despite the fact that all government websites are bilingual, not all documents are available in

both languages. Therefore the documents selected were either in Greek or English.

As the structure of the different government websites is based on the same format the location of the relevant documents was easy and there was no need for additional searching within those websites. An initial screening was performed from the title, the abstract, if available, and from a brief review of the document itself.

In order to achieve completeness an internet search had additionally been carried out by using Google. The search terms used in combination with "Cyprus" were: digital divide, digital economy, digital literacy, e-commerce, e-government, e-inclusion, e-learning, ict, information economy, information society, information systems, innovation, knowledge society and new economy.

3.3.1.3 European Union

The third cluster concerns those documents that are related to the European Union policies on the information society. Being a member of the European Union since 2004, it is important to examine the influence of the EU policies on the corresponding national policies.

Until the first half of 2012 the responsibility for the information society policies was laid on the European Commission Directorate General for the Information Society which hosted an information society portal[3] that provided information on all EU information society policies, documents, research and conferences. Afterwards the Directorate was replaced by the European Commission Directorate General for Communications Networks, Content and Technology or simply DG Connect. The DG Connect helps to harness information & communications technologies in order to create jobs and generate economic growth; to provide better goods and services for all; and to build on the greater empowerment which digital technologies can bring in order to create a better world, now and for future generations. As a result of this change the information society portal has been replaced by the digital agenda portal[4].

All the documents that were used for the purpose of this research have been transferred to a new website namely Digital Strategy, i2010 Strategy,

[3] http://ec.europa.eu/information_society
[4] http://ec.europa.eu/digital-agenda/

eEurope Action Plan, Digital Strategy Programmes[5]. The documents originally selected from the information society portal concerned the various EU policies on the information society such as the eEurope 2002, eEurope+, eEurope 2005, i2010 and finally, the digital agenda for Europe. Any other more technical documents were discarded for further reviewing. Due to the transfer of all the documentation to the new website for the sake of completeness a final check for the inclusion of all relevant documentation was carried out in October 2013.

The source of all the statistics on the information society in the EU has been the website of statistical office of the European Union (Eurostat)[6]. In addition, being a member of Eurostat's information society working group since 2004, has enabled me to follow closely the development of the information society in the EU mainly because the decision on which topics to include in the annual surveys was largely dependent on the various EU policies. In this way it was possible to have access to some additional material such as minutes, presentations, conference papers, in room documents etc which were also screened for reviewing.

3.3.1.4 Search engines

The first three clusters cover the literature generated by the international organisations, the Cyprus government and the European Union. Those documents cover the more "practical" side of the information society whereas the fourth cluster attempts to identify the literature of the "theoretical" side. Moreover the databases are used to achieve completeness by identifying documents not retrieved in previous searches.

The main source for those documents has been the peer-reviewed and non peer-reviewed journals. The University of Aberystwyth provides to the students several tools for enabling their search for research material. Two such tools have been used extensively, E-journals@Aberystwyth and Primo tool (former e-Library).

E-journals@Aberystwyth was the first e-resource that was used either to locate cited articles, thus the information was known beforehand in order to perform the search, or to search in all available issues of a journal for an article

[5] http://europa.eu/legislation_summaries/information_society/strategies/index_en.htm
[6] Http://ec.europa.eu/eurostat

which was related to my research area. It is possible to search for an article with the CitationLinker when the citation for an article is known. The search within journals was carried out either to locate articles of a particular author or to find articles related to my research area. All the journals that had cited articles were manually searched by examining the title/ author/ abstract.

In order to achieve completeness the Primo tool was also used. The tool became available about one year after the commencement of the literature review. Primo provides access to peer and non-peer reviewed articles, to CADAIR the open access repository to Aberystwyth University higher degree theses and research, to databases and finally, to university's library catalogue. As Primo provides access to all major databases such as Web of Knowledge, Science Direct and Web of Science, there has been no need to seek access to other metadata tools. The search facilities of Primo were used to locate articles published until December 2013 concerning the definition or measurement of the information society. The review was limited to articles in English. The search terms used in the literature searches included the keywords: information society, knowledge society, information economy and ICT. Abstracts returned by literature searches were screened to determine whether they met the inclusion criteria and if so, full documents were retrieved. When the abstract did not provide sufficient information to determine inclusion, the full article was retrieved for further examination. Articles that ultimately met the inclusion criteria were reviewed using the data abstraction method; those that didn't were discarded.

In order to achieve completeness, the bibliographies of all the included articles were examined for meeting the inclusion criteria. In case an article from a bibliography was considered as a candidate for review then in order to locate it an internet search was carried out by using Primo, Google and Google Scholar. Then the same method for screening was applied.

Although the computerized literature search provided information on articles contained in journals, hand searching was also applied and it was effective in tracing papers.

3.3.2 Data Abstraction

A significant part of a systematic review is the process of data abstraction. Having decided on the sources of information and the inclusion criteria, the next step is to determine what information should be collected for each included study.

An electronic data abstraction form was used to review each article that was selected for inclusion. The form was prepared in MS-Excel and the worksheet “List of documents” in the file “Sources.xlsx”, contained the following attributes: Serial Number, Category, Sub-category, Title, Type of Author, Author, Publishing Year, Type of Document, Format of Document, File Name, Journal/ Periodical/ Website/ Newspaper, Volume, Issue, Pages, Digital Object Identifier, Summary, Keywords (authors), Keywords (reviewer), Importance, Relevance and Quality. The type and description of each attribute is provided in Table 3. Snapshots from the file are available in Appendix 2a.

As explained before, this research is based on three main pillars: Information Society, Cyprus and the European Union. Consequently the classification of the documents reflects those pillars. In the case where the topic of a document concerned any two or more of the above categories the decision on classification was based on the focus of the document. For example, the document “The information society in Cyprus” was classified in category “Cyprus” as the research topic examines the situation in Cyprus whereas the category “Information Society” should contain any material on the information society in general which hasn’t got Cyprus as the main topic. Those documents which could not be classified in any of the first three categories were allocated to the category “Other”.

Each category encompasses several topics and therefore it is necessary, for a better and a more effective management of all information, to have sub-categories. However, those sub-categories could not be pre-determined but they were decided during the review process. The first category, Information Society, is sub-divided into twenty-one sub-categories as follows: Broadband, Definition, Development, Digital Divide, Digital Economy, Digital Inclusion, e-Commerce, e-Government, Entrepreneurship, Impact, Information Age, Information Economy, Information Systems, Innovation, Knowledge

Economy, Measuring, Mobile Phones, Network Society, New Economy, Policy and Social Inclusion.

The second category, Cyprus, is sub-divided into the following 21 sub-categories: Broadband, Characteristics and Data, Digital Divide, Digital Economy, Digital Literacy, e-Commerce, e-Government, e-Inclusion, e-Learning, e-Skills, Entrepreneurship, Information Systems, Innovation, Legislation, Libraries, Measuring, New Economy, Policy, Press releases/Articles, Reports and Telecommunications.

The third category, European Union, is sub-divided into 20 sub-categories as follows: Broadband, Countries, Critics, Data, Digital Divide, Digital Inclusion, Discourse Analysis, e-Government, e-Inclusion, e-Skills, ICT Expenditure, Intellectual Property Rights, Internet Banking, Knowledge Economy, Legislation, Methodological Manual, Minutes, Policy, Articles and Telecommunications.

Finally, the category Other, is sub-divided into the following 6 sub-categories: Composite Indicators, Impact, Research Design, Small Countries, Meta-synthesis and Other.

Table 3: Type and description of attributes

Attribute	Type	Description
Serial Number	Positive whole number with the prefix SN	E.g.: SN1, SN2, SN3...
Category	Closed	Information Society/ Cyprus/ European Union /Other
Sub-category	Closed	Information Society: 21 sub-categories, Cyprus: 17 sub-categories, European Union: 21 sub-categories, Other: 6 sub-categories
Title	Text	
Type of Author	Closed	European organisation/ Government/ International Organisation/ Journalist/ National Organisation/ Politician/ Private Firm/ Research Institute/ Researcher(s)/ Website

Attribute	Type	Description
Author	Text	
Publishing Year	Year	
Type of Document	Closed	Action Plan/ Book/ Book review/ Bulletin/ Communication/ Dissertation/ Editorial/ Guidelines/ Handbook/ Legislation/ Magazine/ Manual/ Methodological Note/ Minutes/ Paper/ Presentation/ Press release/ Speech/ Website
Format	Closed	Paper/ Electronic/ Paper + Electronic
File Name	Hyperlink	Hyperlink to a copy of the document/ website
Journal/ Periodical/ Website/ Newspaper	Text	
Volume	Positive whole number	Where applies
Issue	Positive whole number	Where applies
Pages	From <page> To <page>	Where applies
Digital Object Identifier	Digital Object Identifier	Where applies
Summary	Hyperlink	Hyperlink to a MS-Word file where there is a summary of the corresponding reference, e.g.: SumSN1, SumSN2
Keywords (authors)	Text	If those are provided
Keywords (reviewer)	Text	
Importance	Text	As judged by the reviewer
Relevance	Text	As judged by the reviewer
Quality	Text	As judged by the reviewer

For the better management of all the information an additional MS-Excel file was created and named “Map.xlsx”. The aim of this file is to provide an easy way to keep track of the classification of each document to the different categories and sub-categories. However, during the review process it was decided to add two more levels for classification, namely sub-sub-category and sub-sub-sub-category and thus, four classification levels were defined. Each row of the worksheet, corresponding to a different classification, contains a list

with the serial numbers of all the documents belonging to that group. Those documents that could not be classified to the fourth level were classified to the third level and in turn, if that was not possible they were classified to the second level, i.e. sub-category. A snapshot of the file is available in Appendix 2b. The hierarchical tree structure of the classification is provided in Appendix 2c.

During the review process it was possible to determine that a document was not relevant to the research topic. In this case both the attributes of the document contained in the file “Sources.xlsx” and the reference from the file “Map.xlsx” were not deleted but they were highlighted in red, so that to keep track of the work done. Too technical documents were excluded for the review.

3.3.3 Limitations

As this research is part of a doctorate thesis, there are some elements of the systematic review that cannot be applied. For example, neither it is possible to have two or more independent reviewers for recording the information and assessing the quality of the studies, nor it is feasible to assemble a panel of experts in methodology and theory to meet regularly and discuss the boundaries of the review. However, following the guidelines of Kitchenham (2007) a test – retest process was used, in which the researcher performs a second extraction from a random selection of primary studies to check data extraction consistency. In this case a random sample of 5% from all the documents examined was double screened. The sample was selected by applying systematic random sampling. This is in line with the approach followed by Bennett, Lubben, Hogarth, & Campbell et al (2005) in which a 5% sample of studies was double screened and an inter-screener agreement coefficient was calculated. In addition, the supervisor’s knowledge of the subject was invaluable and finally, the whole procedure followed in the literature review is transparent and there is an audit trail of all the work that has been carried out.

Although every effort was made to systematically and comprehensively review the export literature and select the relevant studies, systematic literature review inherently risk excluding some pertinent publications.

Although the majority of documents are available free of charge a few documents required a fee payment. The first consideration was examination of the title and description of the contents of the paid publications, to check

whether there was any significant relevance to the topic under investigation (none passed this check), second, the total number of those documents (small), third, the fact that there has not been a need subsequently to locate such a document, i.e. there was no citation to those from other documents and fourth, the budgetary constraints. It was decided, therefore, to exclude this group from the review. Therefore, the scope of this research concerns only the free publications of the international organisations.

Another limitation is the inclusion of only the English and Greek language publications which results in reviewing fewer publications. However, taking into consideration that the topic of this research, in particular the fact that this topic has been explored extensively by international organisations, only a very limited relevant documentation is expected to be available in languages other than English.

3.3.4 Results

The search results are presented for each type of producer respectively. As indicated in section 3.3.1.1 all the relevant documentation of the international organisations dealing with the measurement of the information society has been retrieved from their websites. The major players at the world scene in measuring the information society are the ITU, OECD, UNCTAD and UNESCO and the search results for each organisation are presented in section 3.3.4.1. Sections 3.3.4.2, 3.3.4.3, 3.3.4.4 and 3.3.4.5 present the search results from Cyprus government, European Union, databases/ search engines and other sources respectively.

3.3.4.1 International Organisations/ Partnerships/ International Cooperation

Several international organisations have been dealing with the concept of information society. However, each organisation focuses on different aspects of the information society. For instance, the International Telecommunication Union's (ITU) contribution is on measuring the Information Society in general whereas the work of the Organisation for Economic Co-operation and Development (OECD) is focused around the Economy. Although that was known beforehand in order to safeguard completeness the same keywords

were applied in the search carried out in the websites of the international organisations. Consequently a number of search results returned zero results. A more detailed description on how the search was carried out in the website of each international organisation is given in the following subsections. The search for documents in the different websites was carried out several times throughout the duration of the thesis. The results described in the thesis concern the final search that was performed in the period April – June 2013.

The document identification process from the websites of the international organisations resulted to a total of 268 documents (161 different titles). Table 4 displays the total number of documents selected from each international organisation.

Table 4: Number of documents selected from international Organisations

Source	Documents Selected*
ITU	40 (21)
OECD	163 (116)
UNCTAD	28 (17)
Website for measuring the information society	10 (10)
UNESCO	13 (13)
IFAP Information Society Observatory	14 (14)
Total	**268 (161)**

* The number in parenthesis denotes the number of different titles

International Telecommunication Union (ITU)

The International Telecommunication Union (ITU) is the United Nations specialized agency for information and communication technologies. ITU has three main areas of activity organized in 'Sectors' which work through conferences and meetings. First is the Radiocommunication Sector (ITU-R) which coordinates the vast and growing range of radiocommunication services, as well as the international management of the radio-frequency spectrum and

satellite orbits. Second is Telecommunication Standardization Sector (ITU-T) which assembles experts from around the world to develop international standards known as ITU-T Recommendations which act as defining elements in the global infrastructure of information and communication technologies (ICTs). Third, the mission of the Telecommunication Development Sector (ITU-D) is to foster international cooperation and solidarity in the delivery of technical assistance and in the creation, development and improvement of telecommunication/ICT equipment and networks in developing countries.

The information society is one area that the ITU has been dealing with and has been active in developing international definitions, standards and methodologies to measure the information society. ITU publishes regional and global statistical reports, including the Measuring the Information Society Reports which include the ICT Development Index (IDI) and the ICT Price Basket (IPB). ITU also produces statistical manuals and framework documents to help guide countries in their data collection efforts.

The ITU has set up two expert groups, one on Telecommunication/ ICT indicators and another on ICT household indicators. The former group was created in 2009 with the mandate to revise the list of ITU supply-side indicators as well as to discuss outstanding methodological issues and new indicators. The latter group was established in 2012 to review the statistical indicators for measuring ICT access and use by household and individuals. Both groups report to the World Telecommunication/ ICT Indicators Symposium.

The document selection process involved two stages. In the first stage a manual search was carried out in the ICT statistics publications section and in the second stage, a search was carried out by using the Advanced Search Tool. By applying this selection process a total number of 40 documents (21 different titles) were selected from the ITU website. Below there is a more detailed description of the results at each stage.

In the ICT statistics publications section the documents are classified in three categories: analytical publications, statistical publications and methodological publications. The initial screening returned a total number of 25 documents as follows: 18 analytical, 1 statistical and 6 methodological publications. It is noted that from those 25 documents the actual titles are 10 because for some of them there are several versions.

At the second stage, a search was carried out in the ITU website by using the Advanced Search tool. The tool facilitates customization in order to allow the user narrowing the search. Three parameters are available for customization: Scope, Language and Result Type. For each parameter there are several options available as follows:

Scope: All Sites, Meeting Documents, Publications, Recommendations
Language: English, French, Spanish, Russian, Arabic, Simplified Chinese
Result Type: All Results, Documents, Word Documents, Excel Documents, Powerpoint Presentations, PDF Documents.

In total, eight different searches were carried out. The title and the short description of the contents, as provided by the search engine, were examined for possible inclusion in the review. In case the given information was not satisfactory then the full document was downloaded for further inspection. A total of 316 documents were examined and from those 14 (10 different titles) were selected and saved. The criteria applied and the corresponding results are available in Appendix 4.

The ITU created the portal ICTEYE (http://www.itu.int/net4/itu-d/icteye/Default.aspx) which is a one stop-shop for ICT information that provides telecommunication/ICT indicators and statistics, regulatory and policy profiles. ICT data is collected directly from countries, validated by ITU and made available on the ICTEYE. Being a member of the ITU relevant data for Cyprus is also available. The information is provided by the Office of the Commissioner of Electronic Communications & Postal Regulation.

In addition, the ITU releases bi-annually the ITU World Telecommunication/ICT Indicators Database (WTID) which is considered to be one of the flagship statistical products. The WTID contains time series data for more than 200 economies worldwide and more than 150 telecommunication/ICT statistics. The latest release includes end-2012 data for selected indicators such as fixed-telephone subscriptions, mobile-cellular telephone subscriptions, international Internet bandwidth, fixed (wired)-broadband Internet subscriptions, wireless broadband subscriptions, prices of

different ICT services, percentage of individuals using the Internet, percentage of households with Internet and percentage of households with computer. Several of these indicators are part of the ICT Development Index (IDI). The data included in the WTID are collected through the annual questionnaires that ITU sends to the countries' national statistical office.

Organisation for Economic Co-operation and Development (OECD)

The Organisation for Economic Co-operation and Development (OECD) is the second major international organisation that deals with the topic of the information society. Representatives of the 34 OECD member countries (Cyprus is not a member) meet in specialised committees to advance ideas and review progress in specific policy areas.

The Directorate for Science, Technology and Industry Science develops evidence-based policy advice on the contribution of science, technology and industry to societal well-being and economic growth. In particular the aim is to lead OECD work on the translation of science, technology and knowledge into innovation. In addition, the Directorate manages internationally comparable databases on the links between industry, technology, competitiveness and globalisation to inform research, debate and policy making. There are four Committees that report directly to the Directorate and the work that is being carried out by two of them is related to this research. The first is the Committee for Information, Computer and Communication Policy and the second is the Committee for Scientific and Technological Policy. Moreover, under each Committee there are several Working Parties dealing with specific topics. In particular, under the Committee for Information, Computer and Communication Policy there are two relevant working parties: Working Party on indicators on the information society and Working party on the information economy. The Working Party of National Experts on Science and Technology Indicators and the Working Party on innovation and technology policy.

Similarly to the ITU a two stage procedure was applied in retrieving the relevant documentation. First, by examining the contents of specific sections called Topics and then, by carrying out customised searches with the Advanced

Search facility of the OECD iLibrary[7]. By applying the two stage selection process a total number of 163 documents (116 different titles) were selected.

At the first stage the contents of three Topics were examined. Those are Internet, Science and Technology and Innovation. Each topic is further divided into sub-categories from which the following were selected and examined:

Internet: Broadband and Telecom, Internet Economy, Consumer Policy and Public Sector Innovation and e-government.
Science and Technology: Science and Technology Policy, Innovation in Science, Technology and Industry.
Innovation: Innovation in science, technology and industry, Research and knowledge management and public sector innovation and e-government.

Table 5 displays the results of the manual document search. As it can be seen from the table a total of 110 documents (74 different titles) were selected.

Table 5: Number of documents selected form the OECD website

Topic	Sub-category	Documents (Total)	Documents (Selected)
Internet	Broadband and Telecom	411	52 (20 different titles)
	Internet Economy	514	23 (21 different titles)
	Consumer Policy	73	3 (3 different titles)
	Public sector innovation and e-government	43	8 (7 different titles)
Science and Technology	Science and Technology Policy	231	5 (5 different titles)
Innovation	Innovation in Science, Technology and Industry	187	10 (9 different titles)
	Research and Knowledge Management	158	2 (2 different titles)
	Public Sector Innovation and e-government	43	7 (7 different titles)

The OECD Digital Economy Papers series which can be found under the sub-category Internet/ Broadband and Telecom, covers a broad range of ICT-related issues and makes selected studies available to a wider readership. They include policy reports, which are officially declassified by an OECD Committee,

[7] http://www.oecd-ilibrary.org

and occasional working papers, which are meant to share early knowledge. Those papers concern different topics such as the internet economy, broadband, digital divide, digital economy, e-commerce etc. Twenty eight of the documents selected (9 different titles) are part of this series.

In the second stage of the search process, i.e. the usage of the Advanced Search facility of the OECD iLibrary, specific search criteria were applied to the six different available parameters. Those parameters are: Date, Imprints, Language, Content Type, Theme, Country. From the seventeen available themes only two were considered to be relevant and those were a) Science and Technology and b) Economics. The criteria applied and the corresponding search results are available in Appendix 4. As the search process was sequential most of the documents were identified at the beginning. From the 16 different searches carried out a total of 53 documents (22 different titles) were selected.

United Nations Conference on Trade and Development (UNCTAD)

The United Nations Conference on Trade and Development (UNCTAD) was established in 1964 with the aim to promote the development-friendly integration of developing countries into the world economy. The UNCTAD has evolved as an authoritative knowledge based institution that aims to help shape policy debates and thinking on development. One of its main activities concerns technology and innovation. In this framework the UNCTAD identifies policies to take advantage of new technologies, including the internet and e-business, help governments set up effective policies on science, technology and innovation and help developing countries in gaining access to useful and appropriate technology and knowledge. There are 194 member states of UNCTAD and Cyprus is one of them.

Similarly to the other organisations, the identification of the relevant literature was carried out by applying a two-stage process. First all relevant documents were selected from the Publications section and then, a search procedure was implemented by applying various search criteria to the UNCTAD's website search engine. The two-stage identification process returned a total number of 28 documents (17 different titles).

The documents included in the Publications section are classified in four categories as follows: a) Flagship reports, b) Series, c) Policy briefs and d) Meeting documentation. A total number of 16 documents (5 different titles) were selected in total, 10 (2 different titles) from the Flagship reports and 6 (3 different titles) from the Series section.

From the search process a total of 5.470 documents were examined and from those 12 (12 different titles) were selected and saved. Similarly as before the title and the short description of the contents were examined for possible inclusion in the review and if the given information was not satisfactory then the full document was downloaded for further inspection. The whole process was time consuming but on the other hand, it was not too bad as the search process produced many duplicates and thus, most of the documents were identified at the beginning. Searching like this was like doing a Google search. The most relevant items are likely to come up in the first two pages and after that there is a steep drop in relevancy. The search precision for likely "included relevant items" is consistent with that of a clinical systematic review, where the vocabulary is much more clearly defined than general social and economic literature and the scope of the search narrower, which is estimated to be 3% (Sampson, Tetzlaff, & Urquhart, 2011). The criteria applied and the corresponding results are available in Appendix 4.

Furthermore, during the search process it was found out that the UNCTAD had developed a dedicated website for measuring the information society[8]. The "Measuring the information society" website provides information on the development of ICT statistics and indicators worldwide, with an emphasis on supporting ICT policies and the information economies in developing countries. As indicated, the main objectives of the website concern the provision of information to experts on progress if the field of ICT measurement, the promotion of discussion between practitioners of ICT statistical work, the contribution to the follow-up to the WSIS and finally, the support of the work of UNCTAD on measuring the information economy and of the Partnership on Measuring ICT for Development. The website is maintained by the ICT Analysis Section of UNCTAD. The ICT Analysis Section of UNCTAD works to measure

[8] http://new.unctad.org/templates/Page____623.aspx

ICT in enterprises and the ICT sector through data collection and database development, technical assistance and research. UNCTAD collects annually statistical data from developing countries on the use of ICT by enterprises and on the ICT-related producing sector. The questionnaire is based on the core list of ICT indicators (Partnership on Measuring ICT for Development, 2010). The results are disseminated from the UNCTAD database [9] (UNCTADstat) and published in the annual Information Economy Report. UNCTADstat is a publicly accessible database consisting of all UNCTAD's online statistical information. From the "Measuring the information society" website a total number of 10 documents (10 different titles) were identified.

United Nations Educational, Scientific and Cultural Organization (UNESCO)

The United Nations Educational, Scientific and Cultural Organization (UNESCO) was created in 1945 and aims for the mobilization for education, the building of intercultural understanding, the pursuit of scientific cooperation and the protection of freedom of expression. Nowadays UNESCO is known as the "intellectual" agency of the United Nations as it brings creative intelligence to innovate, expand horizons and sustain the hope of a new humanism. UNESCO has 195 members (Cyprus is one of them) and 8 associate members representing one of the UN system's highest membership.

UNESCO's work is concentrated around seven themes as follows:

i. Education for the 21st century
ii. Fostering freedom of expression
iii. Protecting our heritage and fostering creativity
iv. Learning to live together
v. Building knowledge societies
vi. One planet, one ocean
vii. Science for a sustainable future

[9] http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx

For the purpose of this research only the theme on building knowledge societies was considered as relevant and this theme was further explored. As indicated on the corresponding webpage, the knowledge and information have significant impact on people's lives. The sharing of knowledge and information through ICTs has the power to transform economies and societies. The objective of UNESCO is to create inclusive knowledge societies and empower local communities by increasing access to and preservation and sharing of information and knowledge on all of UNESCO's domains. Knowledge societies must build on four pillars: freedom of expression; universal access to information and knowledge; respect for cultural and linguistic diversity; and quality education for all.

The theme on building knowledge societies is divided in five sections as follows: access to information; internet governance; open solution; ethics of information; and ICT in education. At the first stage of the document identification process each one of the five sections was searched for relevant documents. This process returned just a single document. At the second stage of the identification process the website search engine was used. The website has no advanced search engine available. Each one of the search terms was applied and the results appear in Appendix 4. A total number of 214 documents were examined and 12 were selected and saved and thus, 13 documents were identified in total from UNESCO's website.

In 2001 UNESCO established the Information Society for All Programme (IFAP) with the aim to provide a platform for international policy discussions and the development of guidelines for action in the area of access to information and knowledge for the participation of all in the knowledge societies. The IFAP Information Society Observatory provides access to a range of up-to-date, policy papers and strategies, book reviews, trends and other resources in the IFAP priority areas. As indicated on its website[10] the "Observatory is therefore especially well placed to strengthen international co-operation and the exchange of experiences and knowledge essential for building an information society for all". The Observatory publishes policy papers and strategies, book reviews, trends and other resources in the IFAP priority areas. All the available

[10] http://ifap-is-observatory.ittk.hu/

information is available in thirteen different subjects as follows: Communications, Culture, E-government, Economy, Education, Healthcare, ICT, Information Society, Infrastructure, Open Source, Public Administration, Society and Strategy. A total of 14 documents were considered to be relevant. The number of documents selected from each subject appears in Table 6 below.

Table 6: Number of documents by Subject, Information Society Observatory

Subject	No of documents
Total	**14**
Communications	1
Culture	1
E-government	1
Economy	2
Education	0
Healthcare	0
ICT	3
Information Society	5
Infrastructure	0
Open source	0
Public administration	0
Society	0
Strategy	1

Partnership on Measuring ICT for Development

The Partnership on Measuring ICT for Development was launched in 2004. It is an international, multi-stakeholder initiative to improve the availability and quality of ICT data and indicators, particularly in developing countries. In particular the objectives of the Partnership are threefold: (a) to define and analyse internationally comparable statistical ICT indicators and to develop methodologies to collect these indicators; (b) to assist in building statistical capacity in developing countries; and (c) to set up a global database on core ICT indicators.

The members of the Partnership are: ITU, OECD, UNCTAD, UNESCO, World Bank, the UN Department of Economic and Social Affairs (UN-DESA), the UNEP Secretariat of the Basel Convention, the UN Regional Commissions, EUROSTAT and the United Nations University Institute for Sustainability and Peace (UNU-ISP).

Its members are involved in developing and maintaining a core list of ICT Indicators, the compilation and dissemination of ICT data and the provision of technical assistance enabling statistical agencies to collect data that underlie the core list of ICT indicators. The major output of the Partnership has been the publication of the "Core ICT indicators" in 2010 and 2005 (Partnership on Measuring ICT for Development, 2010), (Partnership on Measuring ICT for Development, 2005). In addition, in 2008 the Partnership published a statistical snapshot of the information society (Partnership on Measuring ICT for Development, 2008).

World Summit on the Information Society (WSIS)

The World Summit on the Information Society (WSIS) was carried out in two phases, first in Geneva (2003) and second in Tunisia (2005). Both were United Nations sponsored conferences about the information society. The conferences brought together governments, civil society and the business sector to discuss a broad range of subjects related to ICT for development and in particular, the global digital divide separating rich countries from poor countries. The WSIS outcome documents concern quantitative review, monitoring and evaluation of progress.

The outcomes from the Geneva conference were first a plan of action (road map) for achieving an information society accessible to all and based on shared knowledge and second a declaration of principles. The plan of action contains ten targets along with numerous recommendations based on different action lines. The targets, to be achieved by 2015, range from connecting villages, schools, health centres, libraries and government agencies to developing content, incorporating ICTs in school curricula and providing broadcasting services to all people in the world. The action lines address the following eleven issues: stakeholder's role, ICT infrastructure, knowledge

access, capacity building, cybersecurity, enabling environment, ICT applications, cultural diversity, media, ethical dimensions, and cooperation.

The Tunis Agenda for the Information Society complemented the list by calling for increased financing of ICTs in the developing world as well as continued discussion of Internet regulatory issues through the Internet Governance Forum (IGF).

The WSIS Stocktaking Process was launched in 2004. Its aim is to provide a register of activities carried out by governments, international organizations, the business sector, civil society and other entities. The WSIS Stocktaking Database has been maintained by the ITU as a publicly accessible system providing information on ICT-related initiatives and projects. WSIS Stocktaking process provides a portal[11] of best practices for stakeholders seeking updated information on the progress of implementation of WSIS outcomes. Regular reporting on WSIS Stocktaking was launched in order to serve as a valuable tool for assisting with the WSIS follow-up. Since 2005, five issues (2005, 2008, 2010, 2012 and 2013) of the WSIS Stocktaking Report have been published. The report is considered to be a key tool for monitoring the progress of ICT initiatives and projects worldwide. The Global Repository, which is a part of the WSIS stocktaking portal, is a unique online collection of publications related to WSIS (World Summit on the Information Society). The Global Repository was created in order to serve as the tool to collect and exchange the information relevant to WSIS.

The Global Repository contains a total of 121 documents classified in eleven categories corresponding to the action lines plus one category “Other” and another on ICTs and the Millennium Development Goals (MDGs). A total number of 8 documents were selected from the Global repository. Some documents are classified in more than one categories but their total number is 121. To avoid duplication documents selected in other searches are not included here.

[11] http://groups.itu.int/stocktaking/HOME.aspx

3.3.4.2 Cyprus Government

The aim of searching the various government websites was to identify all documentation on the development of the information society in Cyprus. The structure of the government websites is based on a standard template and the documents are stored in a dedicated “Publications” section. Consequently there was no need for additional searching within each website. A list of all the websites visited is available in Appendix 1b.

The government websites make available mostly policy papers and those are considered to be important in the examination of the development of the information society in Cyprus. In addition, due to my professional involvement which is related to the production of the official statistics in the ICT usage I have access to documents which are not necessarily published on the government websites. In this way the coverage of the relevant documentation is more comprehensive.

In order to obtain a spherical view of the situation in Cyprus any policy/ strategic/presentation or any other report related to the information society either directly or indirectly was selected. As it can be seen from the table in Appendix 1b, the websites of the following government departments were examined: Ministry of Finance, Planning Bureau, Department of Information Technology Services, Office of the Commissioner of Electronic Communications and Postal Regulation, Department of Electronic Communications and Statistical Service.

As part of this thesis it was relevant to examine the various economic programmes that were prepared in the framework of the EU membership. Those programmes are considered to be relevant as they include direct or indirect measures related to the information society. The source for this documentation has been the websites of the Ministry of Finance and of the Planning Bureau. The Planning Bureau is a Governmental Office in charge with the promotion and co-ordination of the economic and social growth of Cyprus. From the website of the Ministry of Finance 9 documents were retrieved. Five documents concern the Stability Programme and 4 documents the Convergence Programme. From the Planning Bureau website a total of 16 documents were identified. Nine documents concern the National Reform Programme, 3 the National Lisbon Programme, 3 the Cyprus Strategy

Development Plan and 1 document the National Strategy on the Lifelong Learning.

The Department of Information Technology Services (DITS) is the Government body responsible for matters concerning the promotion and application of Information Technology and e-Government in the Public Sector. The mission of the department is to plan, develop, implement, manage and maintain the Information and Communication Technology (ICT) systems which modernize the functioning of the Public Sector. In the framework of its responsibilities DITS is the responsible government body for the promotion and implementation of e-government within the public sector. The Department implements the programs and the respective EU Action Plans. It develops electronic services always taking the public's needs, mentality and culture into consideration. In the website of DITS there is available information on the various national IT projects as well as information on national and EU strategies. For the purpose of this thesis only the documents concerning Cyprus policies and not EU policies were evaluated for inclusion because the EU policies are available from the corresponding EU websites. However only 1 document was selected because the rest are also available in other departments' websites. A total number of 3 documents were selected, 1 on the e-Inclusion in Cyprus and the rest on the Digital Strategy for Cyprus.

The next website visited is from the Office of the Commissioner of Electronic Communications and Postal Regulation (OCECPR). The mission of OCECPR is to promote the interests of consumers with regard to prices, choice, promote innovation and economic growth through the development of effective competition, control of the quality of services and warranty provision of a minimum set of universal service obligations, both in the electronic communications market, and the market for postal services. The annual report of OCECPR was considered as relevant (7 years). In addition, the website has available all the national and EU legislation on electronic communications and postal regulation. Although the files were not downloaded their existence was noted for possible future reference.

The Department of Electronic Communications of the Ministry of Communications and Works has responsibilities in Radiocommunications, Electronic Signatures, Information Society and Space issues. The Department

has been designated as the executive department of the Ministry of Communications and Works to formulate and implement a comprehensive national strategy on Information Society. In this framework a dedicated website, named Digital Cyprus, has been developed by the Department of Electronic Communications for the implementation of the national strategy on the Information Society. After a thorough examination of the website's contents a total number of 5 documents were selected. These documents correspond to the national digital strategy, annual progress report, action plan, the vision for the information society in Cyprus and e-commerce respectively.

The last website which is considered to be relevant to the topic of this research is the Statistical Service of Cyprus (CYSTAT). The Statistical Service is the competent authority responsible for the compilation and the publication of most of the official statistical data in Cyprus. One area for which CYSTAT produces official statistics is the information society. In the framework of a European regulation CYSTAT carries out annually since 2004 two surveys on ICT usage. The former is a survey on ICT usage in enterprises and e-commerce and the latter on ICT usage in households and by individuals. The results of both surveys are available in tables (Excel format) on CYSTAT's website as well as in the annual publication "Information Society". Data is also available for telecommunications and e-learning. Comparable data for all E.U. countries is available on Eurostat's website. On CYSTAT's website data is also available on Research and Development, Innovation as well as economic indicators. From CYSTAT's website a total number of 7 documents (1 title) were selected.

In conclusion, 49 documents (13 different titles) from the Cyprus governmental websites were considered as relevant to the topic of this research. In addition, the websites of CYSTAT and OCECPR were considered as sources for data and legislation respectively. Table 7 summarizes the number of documents selected from each governmental department website.

Table 7: Number of documents by Governmental Department

Department	Number of documents*
Total	**45(13)**
Ministry of Finance	9(2)
Planning Bureau	16(4)
Department of Information Technology Services	1
Department of Electronic Communications	5(5)
Office of the Commissioner of Electronic Communications and Postal Regulation	7(1)
Statistical Service	7(1)

* The number in parenthesis denotes the number of different titles

3.3.4.3 European Union

Since the second half of 2012 all EU policy papers related to the information society have been transferred from the EU's information society portal[12] to the dedicated website "Digital Strategy, i2010 Strategy, eEurope Action Plan, Digital Strategy Programmes"[13]. However not all documentation is available as the papers on the eEurope+ action plan are missing. For the purposes of this research the documents examined on the eEurope+ had been obtained from the information society portal. In total, 50 documents have been identified as relevant to this research and the allocation of the documents in the different action plans is displayed in Table 8.

Since 2010 the Digital Agenda for Europe is one of the seven flagship initiatives of the Europe 2020 Strategy, set out to define the key enabling role that the use of Information and Communication Technologies (ICT) will have to play. As stated in one of the official documents of the EU (Commission of the European Communities, 2010a, p. 3) "*The overall aim of the Digital Agenda is to deliver sustainable economic and social benefits from a digital single market*

[12] http://ec.europa.eu/information_society

[13] http://europa.eu/legislation_summaries/information_society/strategies/index_en.htm

based on fast and ultra fast internet and interoperable applications". ICT and in particular the internet is expected to be enabling factor for the development. Through this initiative it is expected to spur innovation, economic growth and improvements in daily life for both citizens and businesses. The Digital Agenda contains 101 actions, in 7 pillars as follows:

i. Pillar I: Digital Single Market
ii. Pillar II: Interoperability & Standards
iii. Pillar III: Trust & Security
iv. Pillar IV: Fast and ultra-fast Internet access
v. Pillar V: Research and innovation
vi. Pillar VI: Enhancing digital literacy, skills and inclusion
vii. Pillar VII: ICT-enabled benefits for EU society.

The EU Commission has set up a dedicated website on the Digital Agenda[14]. The website provides all the information on the aims and goals of the initiative, description of all the actions and monitoring of the implementation progress for each pillar. In this framework there is available a Digital Agenda scoreboard[15] which assesses progress with respect to the targets set out. In the Digital Agenda dedicated website there are available studies, reports and data as well as country pages. As regards Cyprus there are available data, graphs and six documents. All six documents have been considered as relevant and were downloaded.

Since 2004 Eurostat [16] collects data on the information society conforming to the framework Regulation (EC) no. 808/2004. The regulation contains two modules covering: Enterprises, Households and individuals. As a framework regulation it allows adjustment to newly evolving needs by users and decision makers by annually implementing measures. All the relevant EU legislation is available on Eurostat's website[17]. The surveys are carried out by the National Statistical Offices and data with corresponding metadata are transmitted to Eurostat. For the purposes of the two surveys, since 2006 a

[14] https://ec.europa.eu/digital-agenda/en
[15] https://ec.europa.eu/digital-agenda/en/scoreboard
[16] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home
[17] http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/legislation

methodological manual is prepared annually by Eurostat and the National Statistical Offices and the manuals are all available online[18]. Data on the information society at the European level are available in Eurostat's online database[19] as well as in several publications (Statistics in Focus, Data in Focus) also available online[20].

Table 8: Documents on the EU action plans

Topic	Number of documents
Total	**50**
eEurope	3
eEurope 2002	10
eEurope 2005	17
i2010	11
Digital Agenda	6
eEurope+	3

3.3.4.4 Search engines

The procedure followed in retrieving articles from the E-journals@Aberystwyth tool had as a result the access to fifty different journals. A list of journals that were accessed from E-journals@ Aberystwyth is provided in Appendix 3. A total of 171 articles were selected from those journals.

The search in Primo was carried out in sections: Aber collections, Articles and more and Cadair. The results of all searches are available in Appendix 4.

As the process of searching Primo was carried out simultaneously with the process of locating documents in E-journals, in order to avoid selecting the

[18] https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp
[19] http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/database
[20] http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/publications

same articles twice each document selected was checked for duplication before completing the data abstraction form. Moreover only documents that were available online were considered for inclusion in the data abstraction form.

3.3.4.5 Other sources of information on the information society

During the process of document retrieval a number of different sources related to the topic of information society were discovered and for completeness purposes a short description of them is given below.

Global Information Society Watch (http://www.giswatch.org/)

GISWatch is a collaborative community committed to building an open, inclusive and sustainable information society. GISWatch is a space for collaborative monitoring of implementation of international (and national) commitments made by governments towards the creation of an inclusive information society. It focuses on monitoring progress made towards implementing the World Summit on the Information Society (WSIS) action agenda and other international and national commitments related to information and communications. It also provides analytical overviews of institutions involved in implementation. GISWatch aims to make governments and international organisations accountable for meeting the commitments they make through contributing to building a strong and sustainable global civil society policy advocacy network. The “Global Information Society Watch” report which is published annually since 2007 is available for download from the GISWatch website.

3.4 Summary

The aim of this chapter was to describe the methodological approach applied in order to answer the broad research problem and the specific research questions of this thesis. Chapter Four will present the results of the first two research questions.

Chapter 4: Measurements of the Information society

4.1 Introduction

The aim of this Chapter is to present the findings of the systematic narrative review in the attempt to answer the first two research questions which have been defined as follows:

1. **Which are the available information society measurements? Do those measurements include Cyprus?**
2. **Do the available information society measurements take into consideration the different sizes of the countries?**

A total of eighteen information society measurements were identified during the review process. The measurements are classified in three categories (Table 9). In the first category there are those measurements that produce a single value for the whole information society. The second category contains the proposed frameworks for measuring the information society and the last category includes all the measurements of the different facets of the information society. A description of the measurements falling in each one of the three categories is provided in sections 4.2 and 4.3 and 4.4 respectively. Section 4.5 contains the analysis of the findings. Appendix 5 contains information on the variables used in each measurement and Appendix 5.18 provides a list with relevant measurements but for which no relevant information could be retrieved or were not considered to have a significant input for the purpose of this research.

Table 9: Information Society Measurements

First category: Single value for the whole information society
1. Information Society Index
2. Information Utilization Potential (IUP)
3. eReadiness Index
4. Infometrics 4C model
Second category: Framework
5. Measuring a knowledge/based economy and society
6. Readiness for the Networked World
7. Global diffusion of the internet
8. Infostate Index
Third category: Indices for measuring the different facets of the information society
9. Digital Access Index (DAI)
10. ICT Opportunity Index (ICT-OI)
11. Digital Opportunity Index (DOI)
12. ICT Development Index, ICT Price Basket
13. Network Readiness Index
14. ICT Diffusion Index
15. Technology Achievement Index
16. Knowledge Economy Index
17. E-readiness Index (2000-2009), Digital Economy Index (2010)
18. Digital Economy and Society Index

4.2 Single value for the whole information society

The first group contains those measurements that produce a single value for the whole information society. Four such measurements have been identified. For each measurement information on its producer, the source for information, the years for which the index was produced, whether Cyprus is included or not, a description and finally its limitations.

4.2.1 Information Society Index

Producer: International Data Corporation (IDC)

Source: (International Data Corporation, 2010)

Reference years: 1995 - 2004

Applied for Cyprus: No

Description: The Information Society Index (ISI) was first created in the mid-1990s with the aim to establish a standard by which nations can be measured and compared on their ability to access and absorb information and information technology. The index was based on 15 different variables grouped into four sub-indices, which are then compiled into an overall index. The four sub-indices are as follows: computer, internet, telecom and social. The computer sub-index analyzes the usage and utilization of IT in each country's economy and society. Countries are ranked by measuring PCs per households, IT spending, software and services. The internet sub-index analyzes ecommerce spending alongside home and mobile web users to understand the full impact of the internet and the related technologies. The telecom infrastructure sub-index measures variables related to broadband, wireless services and network infrastructure and finally, social factors are the glue that enables society to fix onto the advantages offered by innovation. Countries are ranked by measuring education, civil liberties, and government corruption. The latest available data is for 2004. More information on the variables used in the construction of the index is available in Appendix 5.1.

Limitations: No criteria are provided for the selection of the variables in each sub-index. Some of the variables are overlapping. There is no weighting system applied for the variables and consequently all variables are considered of equal importance.

4.2.2 Information Utilization Potential (IUP)

Producer: UNESCO

Source: (United Nations Educational, Scientific and Cultural Organization (UNESCO), 1983), (Menou, 1985b)

Reference years: 1980- 1982

Applied for Cyprus: No

Description: Following the proposal by Menou UNESCO/PGI funded a feasibility study followed by a pilot project in 1980 – 1982 conducted by Borko and Menou, aiming at exploring the feasibility of establishing a flexible and reliable system for the monitoring and appraisal of a nation's conditions related to information activities. In the pilot phase a pilot test was carried out for the countries of Latin America and the Caribbean, plus a few industrialized countries as a control group. In this framework the Information Utilization Potential (IUP) model was constructed. The IUP model consisted of a matrix of 230 variables drawn from data available in international statistical collections, standardized by means of Z scores[21]. The data were first organized along structural components and in particular in 3 main categories and 21 basic groups (Appendix 5.2). The same variables were also distributed across 18 functional groups which were derived from the steps in the information cycle. The variables were also allocated as primary and secondary factors depending on their significance.

From the matrix different indices could be calculated such as the general IUP which is derived from the mean of standardized values of all. In addition, it's the structural IUP (mean of standardized values of variables in each group), the intermediate composite structural IUP (mean of the structural group IUP in each of the 3 groups), the single composite structural IUP (mean of the intermediate composite structural IUPs), the general structural IUP (mean of the structural group IUPs), the functional group IUP (mean of standardized values of those variables allocated as primary factor in each group), the intermediate composite functional IUP, the single composite functional IUP and the general functional IUP.

[21] Converts indicators to a common scale with a mean of zero and standard deviation of one.

In addition, an Information factor IUP was also calculated on the basis of a principal component analysis performed of the structural groups. Stepwise regression analyses were conducted in order to better understand the nature of the Information factor IUP.

Limitations: The final sample included in the pilot study consisted of 34 countries. Some small countries were eliminated from the original sample due to data unavailability. However, the elimination of the small countries due to their small influence was not an important reason that would influence the validity or the interpretation of the results (United Nations Educational, Scientific and Cultural Organization (UNESCO), 1983). Although the system includes 230 variables it was only possible to collect data for 187 variables due to data unavailability and inconsistency (United Nations Educational, Scientific and Cultural Organization (UNESCO), 1983). Taking into consideration the appropriateness and quality of the original data at that time, the results should be considered with caution. The IUP can guide and support the questioning and reflection that leads to decision and thus, it cannot be considered to be a decision making tool. The information factor IUP, like other composite indices in the IUP system, suffers from the limitation that the identity of the contributing factors is lost (United Nations Educational, Scientific and Cultural Organization (UNESCO), 1983).

4.2.3 eReadiness Index

Producer: Grigorovici, Schement, & Taylor

Source: (Grigorovici, Schement, & Taylor, Weighing the intangible: towards a framework for Information Society indices, 2004)

Reference years: 2001-2002

Cyprus included in measurement: No

Applied for Cyprus: No

Description: According to Grigorovici, Schement, & Taylor the IUP model provides the theoretical and measurement basis in the construction of their information society index. They also use the Gardin classification of factors related to the complexity and classification of information society indices. According to the hierarchical structure proposed by Gardin the lowest level is “Readiness” followed by “Intensity”, “Impact” and “Outcome”. The “Readiness”

indicators" indicate the potential for use of ICT and describe variables such as ICT infrastructure, access to and availability of Internet, e-mail, PCs and IT-skills. The "Intensity" indicators indicate the actual use and applications of ICT and describe variables such as ICT investments, the extent of use of Internet, e-mail, PCs, e-commerce, for what purpose they are used by different user groups – people and households, businesses and government. The "Impact" indicators relate mainly to the micro level, enterprises and governments, but also to the industry level. They describe new ways of organizing work, referring to the relations between individuals as well as between individuals and the enterprise; of organizing production, which refers to inter-enterprise relations such as outsourcing, joint ventures, licensing etc; knowledge supply/human investment/human resources; mobility; innovation/R&D and spin-offs. The "Outcome" indicators relate mainly to the macro or societal level. They describe economic growth, productivity and competitiveness; employment and the labor market; social inclusion and participation.

The proposed approach starts with the initial theoretical model (IUP) that is tested iteratively against data (Gardin's classification) to assess its goodness of fit via structural equation modelling. Based on the results of the goodness of fit tests, the model is repeatedly "trimmed" until the best fit solution is obtained. First of all from a conceptual level, they start with the classification of Gardin by sectors/contexts, then choose variables of interest based on classification, with differential variables and weights depending on their relevance to each sector/context; following the structural equation modeling terminology, they consider both observed and unobserved/latent variables, and each latent variable.

Limitations: The proposed approach has been tested by using the World Economic Forum's Network Readiness Index as an initial model for departure in the index construction process. A two group full latent variable modelling approach was employed by using data from USA and Italy. A second order confirmatory factor analysis with multiple measures of each observed variable from the NRI sub-indices was included. According to the authors initial results showed that the overall model is not comparable across the two countries. However, final results have not been made public.

4.2.4 InfoMetrics 4C model

Producer: Dan M. Grigorovici, Corina Constantin, Krishna Jayakar, Richard D. Taylor, Jorge Reina Schement

Source: (Grigorovici, Constantin, Jayakar, Taylor, & Schement, 2009), (Constantin, Taylor, Park, & Cho, 2014)

Reference years: 2002-2003

Applied for Cyprus: No information available

Description: The InfoMetrics 4C model is a general, aggregated model followed by applied, disaggregated structural/ sectoral (business, social/policy) and function/ application-based submodels (e-commerce, e-work, e-learning, e-government). The model has been tested at the aggregated level only. The four C's correspond to Connectivity, Capability, Content and Context. Connectivity refers to the physical infrastructure available to a country. Capability is an important complement to connectivity which represents the skills needed for someone to be considered as ICT literate. The dimension of Content refers to content accessibility, cultural sensitivity and language. Finally, Context variables concern contextual, external, socio-political variables that affect the e-readiness relationships between the core variables. In other words Context is comprised of external factors that moderate the effect and relationships between the other factors (C's).

Authors claim (Grigorovici, Constantin, Jayakar, Taylor, & Schement, 2009, p. 16) that "what we need is a fairly complex, multi-layered theoretically driven model that includes direction of causality and takes into account all the relevant variables in the same time". For this reason they applied Structural Equation Modelling (SEM) for developing and testing the InfoMetrics 4C model. The source of the data used was the World Bank's World Development Indicators Database 2003 and ITU World Telecommunications Indicators 2002. A total of 237 countries and regions were included in the analysis. As expected most of the available variables concerned connectivity and capability.

In order to overcome the problem of data unavailability the authors followed a two-step approach. First, they conducted Confirmatory Factor Analysis for all sub-indices, when required and then they formed simple sum composites for the sub-indices, calculated the composite reliabilities and incorporated then in the model. However, due to the low number of

observations (237) the overall model could not be tested and thus, they looked at individual indices and their effects on internet usage. The variables used are available in Appendix 5.3. As suggested by the authors, the model could have been improved if more data were available. For instance, personal evaluations of experience and confidence in using the computers and internet might be better predictors of usage. In addition, additional variables such as number of patents rewarded annually, number of copyrighted online works created annually could form a strong predictor of internet usage. As regards Context more data such as literacy level, GDP variables and additional demographic are needed to test an overall model for Context. The results of testing the model showed that connectivity or infrastructure is not the most important predictor of ICT development whereas capability seemed to be a better predictor. The 4C model indicated the possibility to first differentiate between e-readiness and e-usage and second to predict future e-usage based on current e-usage and e-readiness indices. Moreover the 4C model showed versatility, being suitable for use in specific areas of the information society such as e-commerce and e-learning.

Constantin, Taylor, Park, & Cho expanded the 4C model and method for measuring the digital divide phenomenon over time and developing a more comprehensive framework for comparing digital divide across economies. The results of their study showed that the digital divide does not follow a linear trend as in one year the ICT availability may decrease and in the following year to increase. Constantin et al claim that policymakers and business need a comprehensive framework that includes a set of core indicators as well as a set of domain-specific ones and this model is a first step towards proposing a new, more theoretically informed and reliable model of measurement of the digital divide.

Limitations: The data used are gathered from developed and some developing countries and this might influence the results. In addition, the lack of data for the less and least developed countries is a source of systematic bias. The unavailability of data for several variables has prevented the testing of the full model and in addition, the analyses performed did not include the relationships between the different C's themselves.

4.3 Framework

This section provides information for all the related framework models identified during the narrative review process. A total of four measurements that are classified in this category have been identified. The information provided for each framework concerns the producer, its source, the reference years, whether it has been applied in Cyprus, a short description and the limitations.

4.3.1 Measuring a knowledge-based economy and society

Producer: Australian Bureau of Statistics

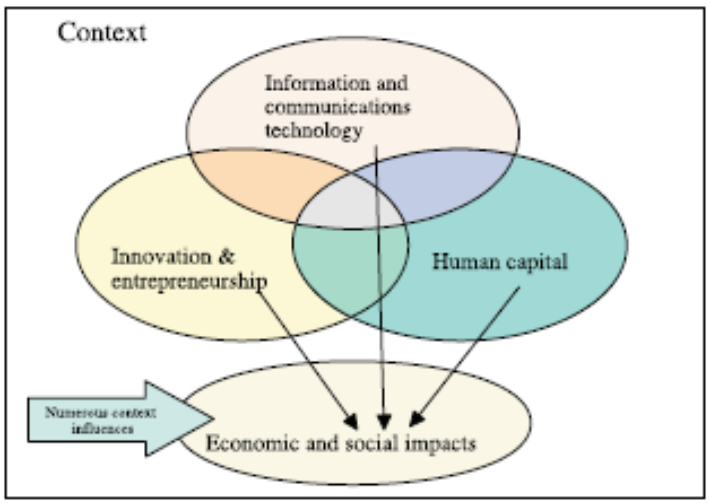
Source: (Trewin, 2002)

Reference years: Not applied for any country

Applied for Cyprus: No

Description: The framework model proposed by the Australian Bureau of Statistics (Figure 5) consists of five dimensions as follows: innovation and entrepreneurship; human capital; information and communication technology; context and finally, economic and social impacts. The first three dimensions are the core of the framework whereas the other two are supporting. The inclusion of dimension on impact is under the assumption that knowledge-based economy and society has an impact on the economy and society. The dimensions are interrelated and there is overlapping as well, for instance, the economic and social impact dimension is related to all other dimensions. The relations between the dimensions can be observed in the diagrammatic representation of the framework (Figure 5).

Figure 5: Knowledge-based economy and society framework



For each dimension a set of characteristics is defined. Each characteristic is used to describe elements of the dimension. The lowest level defined comprises of the indicators which are quantitative measures of each characteristic. All characteristics and their corresponding indicators are described in Appendix 5.4.

Limitations (Trewin, 2002)***:*** The proposed framework does not cover all knowledge in the economy and society and as the author claims not all knowledge is measurable. The framework deals with the social elements that affect economic change or vice versa but does not cover the knowledge-based society as a whole. As regards the availability of indicators, for some characteristics they are not available but nevertheless the characteristics appear in the framework. The proposed framework contains a large number of indicators from which the most important can be selected. The proposed indicators are relevant, reliable, timely, sensitive, intelligible, available for several time periods and available for several countries. The indicators excluded from the framework either don't satisfy the above criteria or better indicators are available for a particular characteristic.

4.3.2 Readiness for the Networked World

Producer**:** Harvard University

Source**:** (Harvard University)

Reference years: 2001-2002

Applied for Cyprus: No

Description: Based on the work by the Computer Systems Policy Project (CSPP) on Global Electronic Commerce Readiness and with the cooperation of IBM, Harvard University developed a framework to access networked readiness. Readiness is defined as the degree to which a community is prepared to participate in the networked world. The framework is targeted at communities (may be country, city, province or village) in developing countries seeking to define a strategy to participate in the networked world. The evaluation is based on several criteria that provide a detailed snapshot of the readiness potential. In particular, the framework examines 19 categories of indicators ranking each by levels of advancement in stages one to four. The categories are classified in five groups: network access, networked learning,

networked society, networked economy and network policy. A detailed description of the indicators and their corresponding characteristics is available in Appendix 5.5.

Limitations: The framework is flexible and thus, it can be applied to any community in the developing world. However, this is a one-size fits-all model and thus, the differences in communities are not taken into consideration. Moreover in each community the strategic priorities may be set by different actors, e.g. government, private sector or academia and thus, the framework could be used differently. Another limitation may be the unavailability of some indicators at the community level. The framework separates the stages for each category but does not advise how to move between stages. It is focused on readiness with a limited analysis of impact.

4.3.3 Global diffusion of the internet

***Producer*:** Mosaic (consortium of universities)

***Source*:** (Wolcott, Press, McHenry, Goodman, & Foster, 2001)

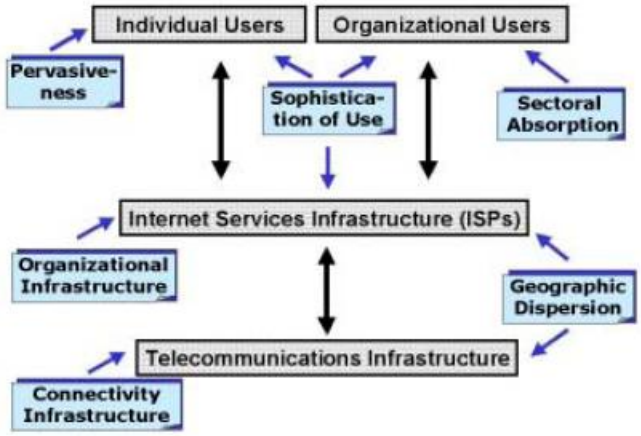
Reference years: 2001

Applied for Cyprus: No

Description: The framework is based on a model of the internet technology cluster which consists of three levels (Figure 6). At the bottom level is the network infrastructure. At the top level are the technologies that are needed by users in order to use the internet and at the middle level is the mechanism needed to bring services from the network infrastructure to the users. The unit of analysis is the nation and the state of the Internet is examined in six dimensions: pervasiveness, geographic dispersion, sectoral absorption, connectivity infrastructure, organizational infrastructure, and sophistication of use (Appendix 5.6). In addition to these dimensions, the framework includes an open-ended list of determinants -- factors which influence the development of the Internet, i.e., the values of the dimensions in a nation. Each dimension has five ordinal values ranging from zero (non-existent) to four (highly developed). The framework also includes determinants for which their understanding on how they influence the dimensions in a given country can lead to prescriptive statements. The results of the analysis of the dimensions are presented on

Kiviat Diagrams with six “spokes” representing each of the dimensions. By 2001 the framework was applied to internet diffusion in 25 countries.

Figure 6: Model of the internet technology cluster



Limitations: No information is available on the application of the framework to additional number of countries and on any updates. There is no justification on the selection of the boundaries of each different level.

4.3.4 Infostate Index

Producer: Orbicom

Source: (Orbicom, 2003)

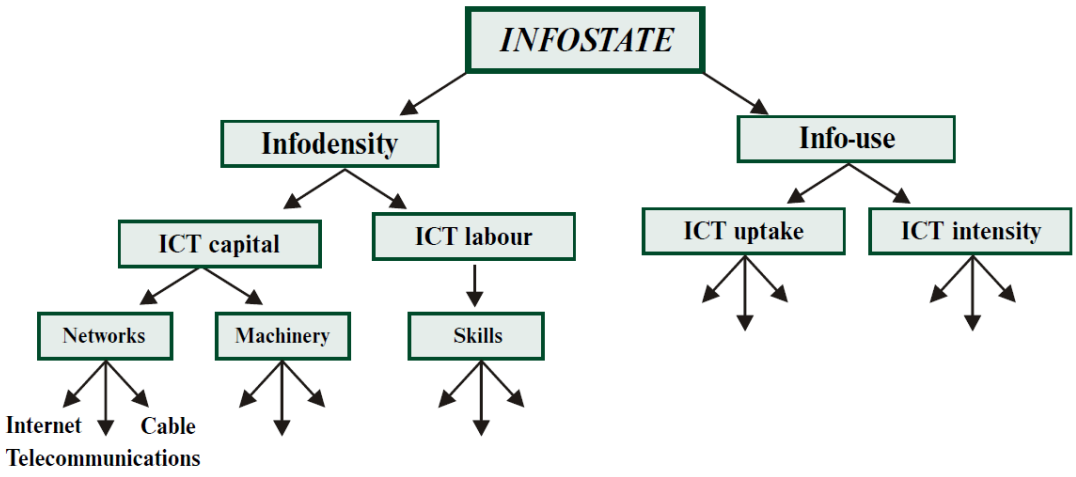
Reference years: 1996 - 2001

Applied for Cyprus: Yes

Description: The aim of Orbicom was to develop a model, grounded on a sound conceptual framework, the empirical application of which would make possible the systematic measurement of the state and evolution of the Digital Divide internationally. The conceptual framework goes beyond connectivity measures and incorporates skills and introduces the notion of a country’s ICTization or Infostate, as the aggregation of Infodensity and Info-use. Infodensity refers to the stocks of ICT capital and labour, including networks and ICT skills, indicative of a country’s productive capacity and indispensable to function in an Information Society. Info-use refers to the uptake and

consumption flows of ICTs, as well as their intensity of use. The differences among countries Infostates constitute the Digital Divide. Infodensity and Info-use as well as their constituent components (ICT capital, ICT skills, ICT uptake and ICT intensity of use) can be measured and examined separately and thus, this structure can offer considerable flexibility and can be adapted to detailed examinations (Figure 7). Each component of the model is populated by suitable indicators that are converted to indices, a method that makes possible their aggregation across different units of measurement. It is worth noting that all data used is quantitative so that subjective bias is avoided. Consistent with the need for policy relevance of the model, as opposed to its business usefulness, Infostates are expressed in relative terms. Thus, a small country like Luxembourg can have a higher level of Infostate than a much larger one, say, India. The results are based on 19 variables (Appendix 5.7) and extend over the 1996-2001 period.

Figure 7: Infostate structure



***Limitations*:** When the Infostate Index was developed in 2003 there was lack of a widely understood terminology, definitions and overall nomenclature. Moreover, there was lack of an adequate number of indicators as well as the quality of some indicators was questionable. As stated one of the objectives was to give emphasis to developing countries so perhaps the methodology might not be appropriate for all countries.

4.4 Indices for measuring the different facets of the information society

As a result of the systematic narrative review, a total of ten indices related to the measurement of the different facets of the information society by international organizations, partnerships and international cooperation have been identified. Information for each index is available below and concerns the producer, the sources of information, the years for which the indicator is available, whether Cyprus is included or not, a description of how the index is constructed and finally, its drawbacks.

4.4.1 Digital Access Index (DAI)

Producer: ITU

Source: (International Telecommunication Union (ITU), 2003)

Reference years: 1998, 2002

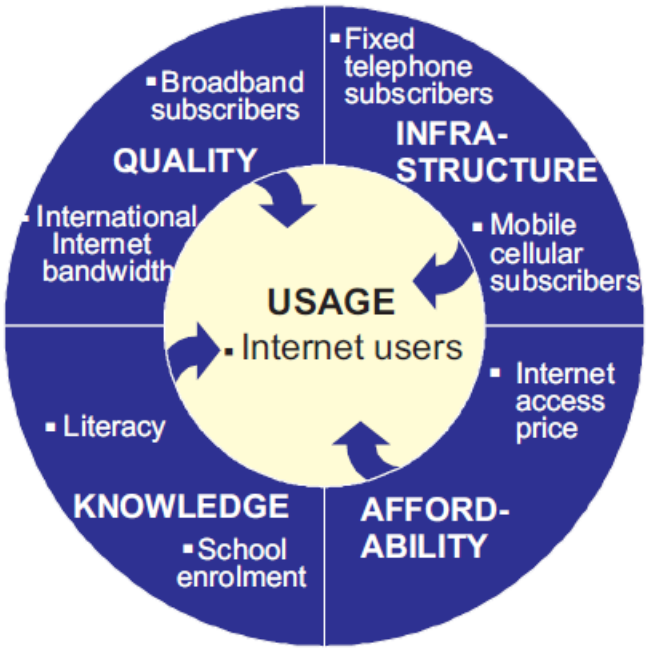
Applied for Cyprus: Yes

Description: The Digital Access Index was the first global index to rank ICT access, covering a total of 178 economies. It was designed to help measure the overall ability of individuals in a country to access and use ICTs. The index classifies countries into one of four digital access categories (high, upper, medium and low) allowing them to see how they compare to peers and their relative strengths and weaknesses. The DAI is built around four fundamental factors that impact a country's ability to access ICTs namely: infrastructure, affordability, knowledge and quality. A fifth factor, actual usage of ICTs, is key in matching the theory of the index with the reality in a country. To cover those five factors the DAI combine eight indicators as shown in Figure 8. Each variable is converted to an indicator with a value between zero and one by dividing it by the maximum value or "goalpost". Each indicator is then weighted within its category and the resulting category index values are averaged to obtain the overall DAI value. Information on the indicators used is available in Appendix 5.8.

***Limitations*:** Time series for Internet access prices and international Internet bandwidth are lacking for many countries. When the former are available, they often have not been calculated using the same methodology as the DAI, making comparisons difficult. The rankings are typically designed to favour a common denominator of widely available indicators, rate high per capita values without

adjusting for methodological discrepancies, and do not include adjustments for qualitative differences. The index is concentrated on international differences and overlooks the more local and micro levels of analysis such as communities (Barzilai-Nahon, 2006).

Figure 8: Indicators making up the Digital Access Index



4.4.2 ICT Opportunity Index (ICT-OI)

Producer: ITU & Orbicom (1995 – 2003), ITU (2001 – 2005)

Source: (International Telecommunication Union (ITU); Orbicom, 2005), (International Telecommunication Union (ITU), 2007b)

Reference years: 1995 – 2003, 2001 - 2005

Applied for Cyprus: Yes

Description: The "ICT Opportunity Index" is the result of the merger of ITU's Digital Access Index and Orbicom's Infostate. The reasons that made the merging possible concerned the global nature of both indicators, the fact that they both measured access to and use of ICT based on quantitative indicators and finally, several indicators used in both indices were common. The focus is

on the digital divide and the overall objective was to develop a model grounded on a sound conceptual framework the empirical application of which would make possible the systematic measurement of the state and the evolution of the digital divide both across economies at a given point in time and within economies over time. The measurements cover the period 1995 – 2003 and include up to 192 countries accounting for 98% of the planet's population. The building blocks of the model are the notions of info-density and info-use and their constituent components: ICT capital, ICT skills, ICT uptake and ICT intensity of use. The reference country facilitates benchmarking, while the reference year makes possible the monitoring of the evolution of each country's infostate components over time. The year 2001 was chosen as the reference due to the availability of additional indicators. Rather than choose a specific country, two useful alternatives that offer immediate and intuitive initial benchmarking were created and included in the calculations: Hypothetica, a country that represents the average values of all economies examined, and; Planetia, whose values are those of the planet as a whole.

In 2007, the ITU published the ICT-OI for the years 2001 – 2005. While the conceptual framework remains the same, the index refers to ICT Opportunity rather than infostate. In addition, the list of indicators has changed and a total of ten indicators are measured (Appendix 5.9). For analytical purposes the 183 countries covered are divided into four categories ranging from high to low ICT Opportunities based on the results of the 2005 data. The ICT-OI was less designed as a tool for benchmarking and ranking countries, but rather for tracking country and group differences across time and in relation to each other.

***Limitations*:** The limitations identified concern the lack of available indicators, lack of adequacy of fit of indicators and finally, insufficient quality of some indicators. Another drawback was that countries could not easily replicate the computation in order to calculate a national index as it was based on values of other countries, which would change for every year.

4.4.3 Digital Opportunity Index (DOI)

Producer: Digital Opportunity Platform

Source: (International Telecommunication Union (ITU), 2006) (International Telecommunication Union (ITU); United Nations Conference on Trade and Development, 2007a)

Reference years: 2004/2005, 2005/2006

Applied for Cyprus: Yes

Description: The Digital Opportunity Index has been developed by the Digital Opportunity Platform, whose members include ITU, United Nations Conference on Trade and Development (UNCTAD), the Korea Agency for Digital Opportunity and Promotion (KADO) and the Ministry of Information and Communication of the Republic of Korea. DOI has been designed to assess progress in creating digital opportunity and bridging the digital divide and it has a focus on the adoption of new technologies, such as broadband and mobile Internet. 180 and 181 economies in total are covered with data for 2004/05 and 2005/06 respectively. The index comprises of 11 separate indicators (Appendix 5.10). These indicators are classified in three categories: Opportunity (people's potential for using ICT, in terms of coverage and affordability (including mobile and Internet price data), Infrastructure (the basic framework for accessing the Information Society, in both fixed and mobile means of access), Utilization (to capture people's participation in the Information Society in their usage of ICTs, including innovative technologies such as broadband and mobile Internet). This classification is sequential, with each category building on the previous. In order to have access to infrastructure, users must be covered by the service and be able to afford it. Utilization depends on having both infrastructure and an access device. Finally, given all the prerequisites for connectivity, users may then aspire to higher levels of quality through broadband. Five of the eleven indicators have a fixed line orientation and the other six are related to mobile. A simple average of these index values is taken to give values for the DOI sub-indices of Opportunity, Infrastructure and Utilization, which are in turn averaged to obtain a country's overall Digital Opportunity Index (DOI) score. Compared to the ICT-OI the DOI was easier for countries to replicate the methodology in order to produce a national index

***Limitations*:** The indicators that are used to compile the ICT-OI and the DOI come from the core set of ICT indicators developed by the Partnership for Measuring ICT for Development. However only one indicator is used in both indices and consequently the two indicators measure different topics. The ICT-OI focuses on more traditional ICTs whereas the DOI on advanced services. Being a composite index the DOI has the limitation of presenting a large amount of information narrowed into a single index value.

4.4.4 ICT Development Index, ICT Price Basket

Producer: ITU

Source: (International Telecommunication Union (ITU), 2009; 2010; 2011; 2012)

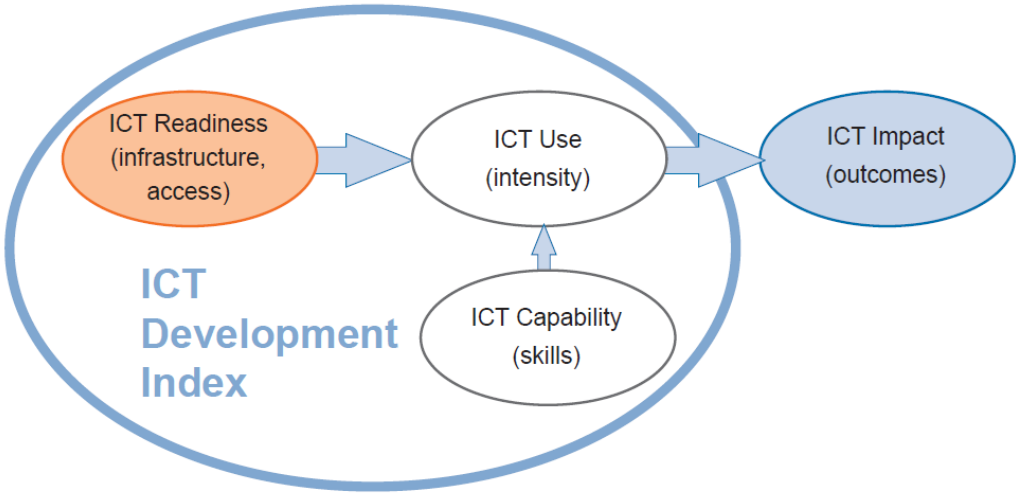
Reference years: 2002, 2007, 2008, 2010, 2011

Applied for Cyprus: Yes

Description: The ICT Development Index (IDI) and the ICT Price Basket metrics were presented for the first time in the 2009 edition of Measuring the Information Society (International Telecommunication Union (ITU), 2009). The aim was twofold, first to measure the level and evolution over time of ICT developments taking into consideration the situations of both developed and developing countries and second to measure the development potential of ICTs or the extent to which countries can use ICTs to enhance growth and development based on available capabilities and skills required to make effective use of ICTs and enhance their impact. The conceptual framework is based on a basic three-stage information society model (readiness-use-impact) (Figure 9). The IDI comprises of eleven indicators covering ICT infrastructure and access, ICT use and ICT skills. As the aim of the index was to capture the development of the information society as it goes through its different stages taking into consideration technology convergence and the emergence of new technologies, the indicators included in each of the three sub-indices may change over time and should be adapted to reflect the technological developments related to ICT. What counts is that the type of indicators included in each of the sub-indices reflects that particular stage – ICT readiness, characterized by relevant infrastructure and access indicators; ICT use, characterized by relevant ICT usage indicators; and ICT capability or skills as

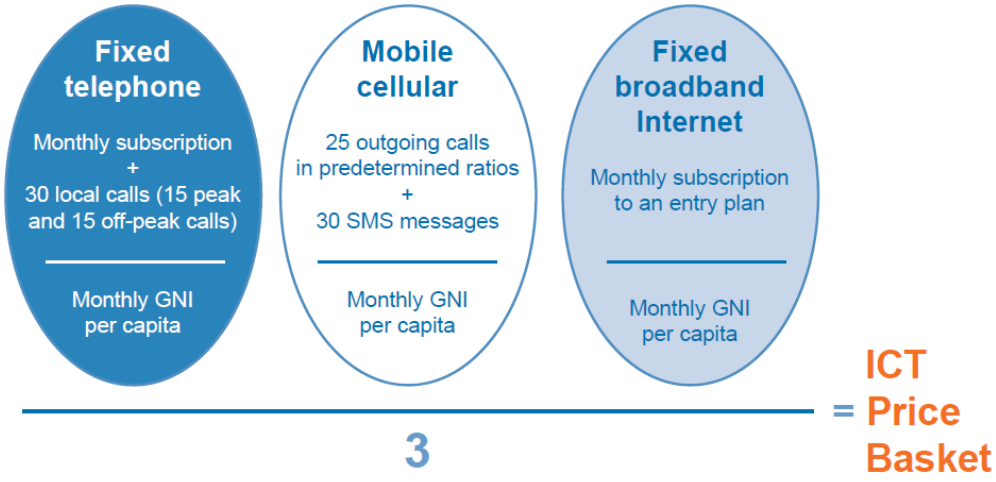
indispensable input indicators (Appendix 5.11). Within each sub-index equal weights were applied to the indicators. Principal Components Analysis (PCA) was used to examine the underlying nature of the data and to explore whether the different dimensions are statistically well balanced. In other words, the use of PCA enabled the elimination of indicators that have less influence on the index calculation. The IDI rankings for 2011 include 155 countries.

Figure 9: Conceptual framework of the IDI



As the conceptual framework does not include the concept of affordability it was decided to construct a specific, standalone ICT Price Basket based on key ICT services. In particular the ICT Price Basket comprises of three tariff sets: fixed telephone, mobile cellular and fixed broadband Internet services. Its aim is to raise to raise awareness of the importance of ICT prices for ICT usage and to allow an evaluation of the cost of ICTs in the countries. The ICT Price Basket is the value computed as the sum of the price of each sub-basket as a percentage of a country's monthly GNI per capita divided by 3 (Figure 10).

Figure 10: Calculation of the ICT Price Basket



***Limitations*:** The IDI is a global index and thus, the results should be produced for as many countries as possible. For that reason the main criterion for selecting the indicators is data availability. Taking into consideration that for the majority of developing countries such data is not available the selection process was not ideal. Another criterion for the selection of indicators is the suitability of an indicator for both developing and developed countries. This is good for comparing developing and developed countries but it is also a limitation in measuring the progress towards the information society for a country. The three indicators included in the skills sub index are proxies because there is no direct data available on ICT skills. Thus there is a doubt about the validity of the results for this sub-index. In measuring the digital divide there is no distinction between large and small countries.

4.4.5 Network Readiness Index

Producer: WEF, INSEAD

Source: (World Economic Forum (WEF), 2002; 2003; 2004; 2005; 2006; 2007; 2008; 2009; 2010; 2011; 2012; 2013)

Reference years: 2001 - 2012

Applied for Cyprus: Yes (included in rankings since 2004)

Description: The Network Readiness Index (NRI) was first presented in the "Global Information Technology Report 2001–2002: Readiness for the Networked World (GITR)" published by the World Economic Forum and it is annually published since then. The aim of NRI is to enhance business leaders' and public policymakers' understanding of the factors contributing to ICT advancement, so that business practice and public policy can be shaped in the most informed manner possible. As the conceptual framework of the NRI has remained stable for more than ten years this has facilitated comparisons through time and created a valuable database of technology metrics. However in order to better reflect the rapid changes of the technology sector there have been some minor adjustments of the variables. Following a two year consultation with academic experts, policymakers, and representatives of the ICT industry, in 2012 the WEF and INSEAD reviewed the framework in order to ensure that it remains aligned with the latest changes in the ICT industry. The updated framework aims to measure and benchmark ICT progress and impacts for the next decade. The original and the updated frameworks are shown in Figure 11 and Figure 12 respectively. The main changes concern the addition of the ICT impact subindex, the redefinition of the pillars in Readiness subindex, the restructuring of the pillars in the environment subindex and the separation of usage from impacts. In addition, several outdated variables are dropped and replaced by other new and more relevant. As shown in Figure 12 the updated framework comprises four subindices that measure the environment for ICTs; the readiness of a society to use ICTs; the actual usage of all main stakeholders; and, finally, the impacts that ICTs generate in the economy and in society. The three first subindices can be regarded as the drivers that establish the conditions for the results of the fourth subindex, ICT impacts. These four subindices are divided into 10 pillars composed of 54 individual indicators (Appendix 5.12). The final NRI score is a simple average of the four composing

subindex scores, while each subindex's score is a simple average of those of the composing pillars. Throughout the years the coverage of economies significantly increased from 75 in 2002 to 144 in 2013.

Figure 11: Network Readiness Index Framework 2002

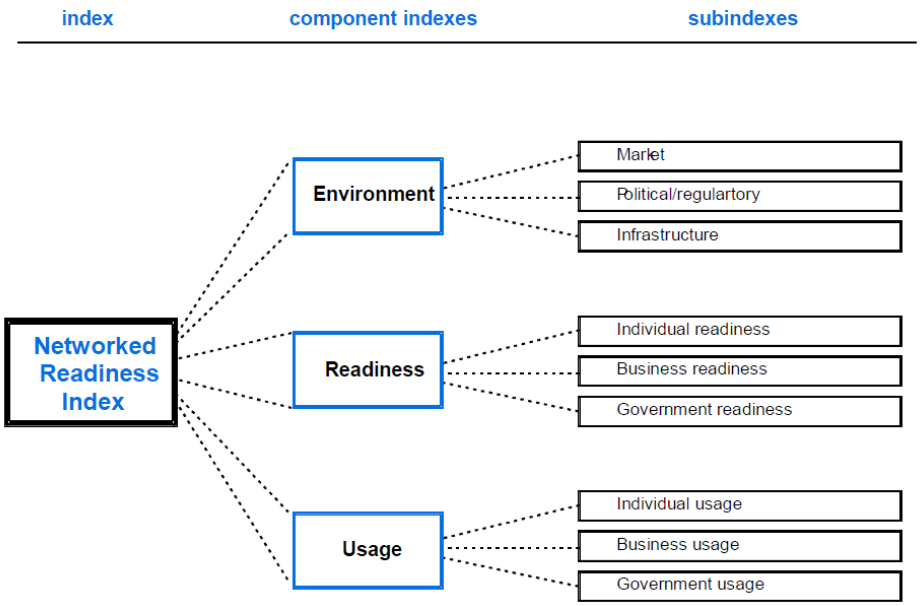
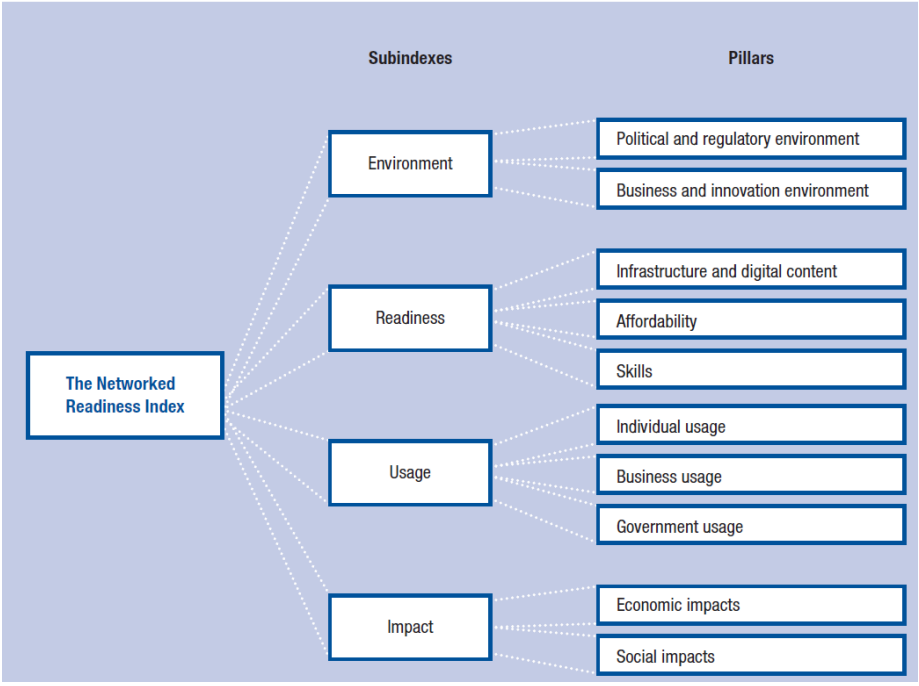


Figure 12: Network Readiness Index Framework 2012



***Limitations*:** The 54 variables that are included in the calculation of the Network Readiness Index concern both quantitative and qualitative data. In particular, 27 of the variables composing the NRI are hard, quantitative data, collected from international organizations such as the ITU, the World Bank, and the United Nations. The remaining 27 variables gauge dimensions that are more qualitative in nature and come from the Executive Opinion Survey (the Survey), which the Forum administers annually to over 13,000 business leaders in all the economies included in the Global Information Technology Report. The fact that half of the indicators used are based on subjective opinion implies data that data are susceptible to respondent bias. The inclusion of too many variables raises issues of definitions, overlapping coverage and the statistical notion of auto correlation where the variables themselves may be inter-dependent. The NRI uses fixed arbitrary weights to assign the importance of the various factors and ignores the context and specific situation in the country or community (Barzilai-Nahon, 2006).

4.4.6 ICT Diffusion Index

Producer: UNCTAD

Source: (United Nations Conference on Trade and Development (UNCTAD), 2006)

Reference years: 1997 - 2004

Applied for Cyprus: Yes

Description: The Index of ICT Diffusion was designed to evaluate ICT development using indicators of ICT diffusion across countries. It measures the average achievements in a country in two dimensions, Connectivity and Access (Appendix 5.13). However, after its first release in 2006 (United Nations Conference on Trade and Development (UNCTAD)) the Index was abandoned in favour of the ICT Opportunity Index. The dimension of Connectivity provides a measure of the infrastructure development and covers the number of Internet hosts per capita, number of PCs per capita, the number of telephone mainlines per capita and the number of mobile subscribers per capita. The aim of dimension Access is to describe the opportunity to take advantage of being connected and covers the number of estimated Internet users, the adult literacy rate, the cost of a local call and GDP per capita (PPP US$). An index score is

calculated for each of these indicators by applying the following formula: value achieved / maximum reference value. Connectivity and access indices are then calculated as an average of index scores of their respective components and index of ICT Diffusion is itself an average of these two dimensions. The ICT Diffusion Index is measured for 180 economies.

***Limitations*:** The methodology of UNCTAD is based on relative rankings rather than absolute values meaning that reference points derive from real world achievements realized by any country. However, this approach has the drawback that reference countries change year on year, thus reducing inter-year comparability, and thus, only country rankings can be compared between years.

4.4.7 Technology Achievement Index

Producer: UNDP

Source: (United Nations Development Programme, 2001), (Nasir, Ali, Shahdin, & Rahman, 2011)

Reference years: 1998 – 2000, 2009

Applied for Cyprus: Yes

Description: Technology Achievement Index (TAI) presents a snapshot of each country's average achievements in creating and diffusing technology and in building human skills to master new innovations. TAI measures achievements, not potential, effort or inputs. The aim of TAI was twofold, first to help policy-makers define technology strategies and second, to be used as a starting point to make an overall assessment, to be followed by examining different indicators in greater detail. In addition to the differences across countries, the index reveals considerable disparities within countries. The statistical analyses reported in this paper uses findings from several regressions in an attempt to predict technology achievement (based on UNDP's "TAI" index) using both the composite human development index (HDI) for the same year, as well as specific variables from the index (educational attainment, income, etc.). The TAI focuses on four dimensions of technological capacity: Creation of technology, Diffusion of recent innovations, Diffusion of old innovations, Human skills (Appendix 5.14). Technology creation is measured by the number of patents granted to residents per capita and by receipts of royalties and license fees

from abroad per capita. Diffusion of recent innovations is measured by the number of Internet hosts per capita and the share of high- and medium-technology exports in total goods exports. Diffusion of old innovations is measured by telephones (mainline and cellular) per capita and electricity consumption per capita. Human skills are measured by mean years of schooling in the population aged 15 and above and the gross tertiary science enrolment ratio. Each of the four dimensions carries equal weight. Each of the indicators that make up the dimensions also has equal weight. The index for each dimension is then calculated as the simple average of the indicator indices in that dimension. The TAI, in turn, is the simple average of these four dimension indices. When the TAI was originally proposed in 2001 it covered 72 countries.

In their 2011 paper Nasir, Ali, Shahdin, & Rahman calculate the TAI for 91 nations using data available for 2009. They also compare the shifting sands of technological capacities and capabilities of 56 countries common to the 2001 and 2009 studies.

***Limitations*:** A nation's technological achievements are larger and more complex than what this or any other index can capture. Many aspects of technology creation, diffusion and human skills are hard to quantify. And even if they could be quantified, a lack of reliable data makes it impossible to fully reflect them. When the TAI was developed there were significant limitations in data availability and thus, the range of appropriate indicators is limited to those with reasonable coverage.

4.4.8 Knowledge Economy Index

Producer: World Bank

Source: (World Bank, 2008),

http://info.worldbank.org/etools/kam2/KAM_page5.asp

Reference years: 1995-2012 (most recent year)

Applied for Cyprus: Yes

Description: The Knowledge Economy Index (KEI) is part of the Knowledge Assessment Methodology (KAM) which was developed by the World Bank Institute's Skills and Innovation Policy Program. The KAM was designed to proxy a country's preparedness to compete in the knowledge economy. The

framework of KAM is based on the four pillars of the knowledge economy as follows: a) Economic and institutional regime, b) Education and skill of population, c) Information infrastructure and d) Innovation System. Each pillar consists of three indicators that were selected on the basis of their ability to proxy the respective knowledge economy pillar (Appendix 5.15). Data are updated throughout the year as they become available. The KAM provides several indices such as the economic and institutional pillar index, the education pillar index, the innovation pillar index, the information and communications technologies pillar index, the Knowledge Index (KI) and finally, the Knowledge Economy Index. The KEI is the most commonly cited of the KAM's indices and is a broad measure of the overall level of preparedness of a country or region for the knowledge economy. The KEI is constructed as the simple average of the normalized values of the twelve indicators, from 0 to 10. A KEI score that is close to 10 implies relatively good development of the four knowledge economy pillars while a score close to 0 indicates relatively poor development. The coverage of KAM improved significantly throughout the years, from 40 countries in 2001 to 146 countries in 2012.

***Limitations*:** The 12 knowledge variables used were selected on the basis of their availability for a large number of countries and for a longer time series. In this way, although a broad coverage is achieved, the "appropriateness" of the indicators for each country separately is doubtful. For different groups of countries, e.g. developed or developing countries, different indicators might have been better to use for in-group comparisons. The accumulation of knowledge as measured by the KEI is highly correlated with levels of economic development as countries with higher KEI values tend to have higher levels of economic development, and vice versa. However, the positive correlation does not imply a causal relationship between the KEI and economic development. This is possible as rich countries are in a better position to invest more in knowledge rather than poor countries.

4.4.9 E-readiness Index (2000 – 2009), Digital Economy Index (2010)

Producer: Economist Intelligence Unit

Source: (Economist Intelligence Unit; International Business Machines, 2002; 2003; 2004; 2005; 2006; 2007; 2008; 2009; 2010)

Reference years: 2000 - 2010

Applied for Cyprus: No

Description: The Economist Intelligence Unit (EIU) published from 2000 to 2009 the e-readiness rankings with the aim to provide a benchmark for harnessing the Internet's potential to spur business efficiency, improve the provision of public services and encourage integration with the global economy. The e-readiness term refers to the extent to which a country's business environment is favourable to Internet-based opportunities. As explained in the annual reports, e-readiness is not simply a matter of the number of computer servers, websites and mobile phones in a country but also such things as its citizens' ability to utilise technology skilfully, the transparency of its business and legal systems, and the extent to which governments encourage the use of digital technologies. Initially the index covered the sixty largest economies and gradually, in 2009, the number increased to 70. During the period 2002 to 2006 the rankings were calculated based on six categories measuring the various components of a country's social, political, economic and technological development, as follows (the number in parenthesis denotes the corresponding weight of the category): connectivity and technology infrastructure (25%); business environment (20%); consumer and business adoption (20%); legal and policy environment (15%); social and cultural infrastructure (15%); and supporting e-services (5%). In 2007, there were major changes in the categories and reassessments of weights as follows: connectivity and technology infrastructure (20%); business environment (15%); social and cultural environment (15%); legal environment (10%); government policy and vision (15%); consumer and business adoption (25%). Around one hundred quantitative and qualitative variables are fed in the six categories. However, the variables were reviewed periodically in order to capture the progress in the rapid technological changes (Appendix 5.16). In 2010 the e-readiness rankings renamed as digital economy rankings in order to reflect the increasing influence of ICT in economic progress. Despite the name change and the usual change in

variables the basic methodology remained the same. However, as I have been informed by the EIU, the 2010 publication was the last due to lack of funding.

***Limitations*:** The methodology has not remained stable throughout the years and thus, only country rankings can be compared between years. Beyond the description of the six categories, their corresponding weights and the variables used, no other information is given on the calculation of the index. As the methodology includes qualitative criteria and in addition, the weights are decided by an ITU experts' panel, consequently the data are susceptible to respondent bias.

4.4.10 Digital Economy and Society Index

Producer: European Commission

Source: (Commission of the European Communities, 2016b)

Reference years: 2014-2016

Applied for Cyprus: Yes

Description: The Digital Economy and Society Index (DESI) consist of five main dimensions, each divided in a set of sub-dimensions. Indicators are defined for each sub-dimension. The main five dimensions are: connectivity, human capital, internet use, integration of digital technology, digital public services and structural changes (Appendix 5.17). As stated in the methodological manual (Commission of the European Communities, 2016b) the main dimensions are not isolated but are in fact interconnected. DESI has been developed in order to measure the progress of EU countries towards a digital economy and society. As the index is applied to all EU countries it facilitates their comparison in the level of digital development, the assessment on whether there is progress over time, the easy identification on which areas the countries are lagging behind and finally a general assessment by observing the overall index score as well as the scores of the main index dimensions. The DESI is a composite indicator developed by following the guidelines of the OECD and JRC (Organisation for Economic Co-operation and Development (OECD); Joint Research Centre (JRC), 2008). The selection of the indicators complies with three requirements. First the indicators are collected on a regular basis, second they are relevant and finally, they are not redundant.

***Limitations*:** The DESI uses fixed arbitrary weights to assign the importance of the various factors and ignores the context and specific situation in the country. Although one of the criteria applied in the selection of the indicators was their availability for some cases data was not available and imputation techniques were applied.

4.5 Synthesis – Comparison of the various indices

A total of 18 measurements have been identified and classified in three categories: a) single value for the whole information society, b) framework for measuring concepts related to the information society and c) indices for measuring the different facets of the information society. Four measurements are classified in the first and second group respectively and ten in the third (Table 10). For all proposed measurements relevant data has been applied. The aim for classifying the measurements into the three categories is to demonstrate the various approaches that can be followed in measuring a complicated concept such as the information society.

With the exceptions of the IUP (section 4.2.2) which was first perceived in the early 1980's and the proposed framework on measuring the knowledge based economy for which no data has been applied, the rest of measurements including both the attempts for a single value for the whole information society and the frameworks are dated from the 1990's (Information Society Index (section 4.2.1), Infostate Index (section 4.3.4)) and 2000's (eReadiness Index (section 4.2.3), Infometrics 4C model (section 4.2.4), Readiness for the Networked World (section 4.3.2), Global Diffusion of the Internet (section 4.3.3)) (Table 10). As regards the various indices for measuring the different facets of the information society those started to develop in the 1990's (Digital Access Index (section 4.4.1), ICT Opportunity Index (section 4.4.2), ICT Diffusion Index (section 4.4.6), Technology Achievement Index (section 4.4.7), Knowledge Economy Index (section 4.4.8)) and the 2000's (Digital Opportunity Index (section 4.4.3), ICT Development Index (section 4.4.4), Network Readiness Index (section 4.4.5), E-readiness Index (section 4.4.9)). The most recent one is the DESI (section 4.4.10) which was first published by the European Commission in 2015. Two of those indices (ICT Development Index (section 4.4.4) and Network Readiness Index (section 4.4.5)) have evolved to their

present status. Therefore it can be concluded that the issue of measuring the information society is kept alive due to the ongoing work of international organizations and the reason for that may be the fact that those organizations deal with both developed and developing countries. However, it is reiterated that the measurements of the international organizations deal with the different facets of the information society and not the whole of the information society.

With the exception of the Infostate Index (section 4.3.4) the rest of measurements from the first two groups have not been applied for Cyprus (Table 10). The picture is completely different as regards the various indices from the international organisations as only the E-readiness Index (section 4.4.9) has not been calculated for Cyprus. The results of the systematic narrative review show that there have been no attempts by the scientific community to deal with the topic of measuring the information society in Cyprus or the small countries/ islands in general. In addition to the work carried out by the international organisations what is available for Cyprus that is related to the information society is in the framework of its European Union membership and the legal obligations thereof. Those measurements are described in the next chapter.

Table 10: Measurements' status

Measurements by category	Reference years	Active 2015	Applied for Cyprus
Single value for the whole information society			
1. Information Society Index (section 4.2.1)	1995 - 2004	No	No
2. Information Utilization Potential (section 4.2.2)	1980 - 1982	No	No
3. eReadiness Index (section 4.2.3)	2001 - 2002	No	No
4. Infometrics 4C model (section 4.2.4)	2002 - 2003	No	Not Available
Framework for measuring concepts related to the information society			
5. Measuring a Knowledge-	Not applied	No	No

based Economy (section 4.3.1)			
6. Readiness for the Networked World (section 4.3.2)	2001 - 2002	No	No
7. Global Diffusion of the Internet (section 4.3.3)	2001	No	No
8. Infostate Index (section 4.3.4)	1996 - 2001	No	Yes
Indices for measuring the different facets of the information society			
9. Digital Access Index (section 4.4.1)	1998, 2002	No	Yes
10. ICT Opportunity Index (section 4.4.2)	1995 – 2003, 2001 - 2005	No	Yes
11. Digital Opportunity Index (section 4.4.3)	2004/2005, 2005/2006	No	Yes
12. ICT Development Index (section 4.4.4)	2002, 2007, 2008, 2010, 2011	Yes	Yes
13. Network Readiness Index (section 4.4.5)	2001 - 2012	Yes	Yes
14. ICT Diffusion Index (section 4.4.6)	1997 - 2004	No	Yes
15. Technology Achievement Index (section 4.4.7)	1998 – 2000, 2009	No	Yes
16. Knowledge Economy Index (section 4.4.8)	1995-2012	No	Yes
17. E-readiness Index – Digital Economy Index (section 4.4.9)	2000 - 2010	No	No
18. Digital Economy and Society Index (section 4.4.10)	2014 - 2016	Yes	Yes

From the four proposed measurements of the first group only the ISI (section 4.2.1) and the IUP (section 4.2.2) provided values for whole of the information society. However, as explained before there are important limitations that affect the quality of the indices such as the availability and quality of data. The other two indices of the same group did not achieve their main aim to produce a single measurement. However, the proposed approaches based on structured equation modelling have set the ground for future research in this area. Therefore it can be concluded that the quest for the development of a single value for the whole information society has not produced any tangible valid results yet.

The ISI (section 4.2.1) is the only measurement of the first group that is easy to use and not based on complicated statistical analysis. The latest available data for the ISI is for 2004. According to IDC the ISI was the world's first measure of the ability of 53 nations to participate in the information revolution. The countries selected account for 97% of the world's GDP and more than 99% of all IT spending. The index and its four sub-indices provide a standard by which the 53 nations are measured according to their ability to access and absorb information and information technology. The dedicated website provides the rankings of the 53 countries for both the total Information Society Index and each one of the four sub-indices. The ISI uses the domains computer, internet, telecom and social in order to assess countries' ability to access and absorb information and information technology. However, a drawback is that the variables selected in each domain carry equal weight and consequently all have the same importance. In addition, no criteria are described for selecting the variables. Perhaps this is related to the selection of the 53 countries, i.e. the availability of data in those countries. Despite its quality deficiencies the ISI is a simple and useful tool to policy makers for benchmarking their countries.

The other three measurements of the first group are based on advanced statistical analysis and they are not easy to construct. The IUP (section 4.2.2) consists of 230 variables classified in structural components in three categories: background conditions, information needs and uses, information activities and services. However, at the time of its first implementation in Brazil only 187 variables were available and consequently included in the model and

additionally there were concerns about the quality of the data. According to the scientific literature the model has also been applied in Saudi Arabia (Namlah, 1984). Although nowadays the availability of good quality data has significantly improved there has been no follow up of this model. The only exception is the eReadiness Index (section 4.2.3) which starts with an initial theoretical model that is tested iteratively against data to assess its goodness of fit via structural equation modelling and based on the results of the goodness of fit tests, the model is repeatedly "trimmed" until the best fit solution is obtained. The aim of its creators was to use as an initial model the IUP and to test this iteratively against data according to Gardin's classification. However, the model was only applied to the World Economic Forum's Network Readiness Index and using data from USA and Italy but the results were not published. Along the same lines is the Infometrics 4C model (section 4.2.4) which it was proposed by the same group of authors as the eReadiness Index and it is also based on structural equation modelling. However, the model could not be tested due to the unavailability of data.

In the quest of a single value to measure the whole information society we see that two paths are followed, one that is simple and another which is more complicated and demands a lot of good quality data. The advantage of the first approach is that the measurement can be produced fast and it is easy to understand. This approach might be more appropriate to be used by policymakers who they usually want quick answers especially in the area of ICT where the developments change rapidly. The latter approach although based on sound methodologies is more difficult to apply and requires a lot of data. However, in the recent years there has been a significant improvement in the availability of harmonised ICT data due to the efforts of the international organisations (e.g., Eurostat publishes harmonised data for all EU member states based on the results of the annual ICT usage surveys carried out in households and in enterprises, OECD and ITU publish on their website harmonised ICT data). Another significant change might be the fact that the technological changes now are not as radical as they used to be in the past. This is reflected in the current discussions at EU level on whether it is necessary to continue to carry out the ICT usage surveys in households and enterprises annually or to carry out every two years alternately, e.g. one year to

carry out the household survey and in the following year the enterprises survey. So, is this the right moment to make a fresh attempt in producing a single value for the whole of information society?

The four frameworks described measure different topics such as the knowledge-based economy, the readiness of the networked world, the diffusion of the internet and the digital divide. Although none of those frameworks aims to measure the information society as such, the reason for including this section is to demonstrate this approach in measuring complicated and perhaps not well defined topics. Nevertheless as concluded in the literature review, information society is a debatable concept with varied definitions and thus, all topics examined by the frameworks can be considered to be relevant to the information society.

The first framework aims to measure the Knowledge-based Economy (section 4.3.1). In his discussion paper the Australian Statistician claims that his proposed framework is different from traditional statistical frameworks because it has a broad scope and it does not deal with classifications, standards or definitions. This type of framework can be viewed as descriptive or presentation framework. The framework consists of five dimensions: a) innovation and entrepreneurship, b) human capital, c) information and communications technology, d) context and e) economic and social impacts. The last two are considered to be supporting dimensions. The dimension of context is broad and includes economic, social, cultural, legal, political, environmental and global factors that may stipulate a successful knowledge based economy. At the time of its proposal there were a limited number of available indicators for the context dimension. The other supporting dimension on impact includes a limited number of indicators. The first three dimensions are the core of the framework. Innovation and entrepreneurship includes the support for, and performance of, innovative and entrepreneurial activities within. In the proposed framework the context dimension is pervasive, the three core dimensions are overlapping and the economic and social impacts are affected by the context and the three core dimensions. Each dimension is broken down into characteristics which are neither mutually exclusive nor intended to provide a comprehensive description of the dimension. In this framework an indicator is defined as a single figure or a small data set showing a broad direction. It is a quantitative measure of a

characteristic. As stated, the framework does not offer a comprehensive treatment of a knowledge-based society.

The second framework examined concerns the Readiness for the Networked World (section 4.3.2). Its aim is to offer a starting point in an ICT planning process through the systematic organization of the assessment of numerous factors that determine the Networked Readiness of a community in the developing world. The framework contains 19 categories of indicators classified in five groups as follows: network access, networked learning, networked society, networked economy and network police. Network access examines the availability, the cost and quality of ICT networks, services and equipment. The aim of the second group is to assess whether the educational system integrate ICTs into its processes to improve learning as well as to find out whether there are technical training programs in the community that can train and prepare an ICT workforce. Networked society examines to what extent individuals are using information and communication technologies at work and in their personal lives. The group networked economy looks into how businesses and governments are using information and communication technologies to interact with the public and with each other. Finally, network policy examines the extent in which the policy environment promotes or hinders the growth of ICT adoption and use. Each category is ranked according to the level of advancement in stages one through four. The framework has no scoring and does not provide any suggestions for improvement.

The third framework examined aims to measure the Global Diffusion of the Internet (section 4.3.3) and it was developed by the MOSAIC Group as part of the Global Diffusion of the Internet Project (GDI). It consists of six dimensions as follows: connectivity infrastructure, pervasiveness, sectoral absorption, organizational infrastructure, geographic dispersion and sophistication. Connectivity infrastructure concerns the technologies needed by users in order to use the internet. Pervasiveness represents the number of individual users in a country whereas sectoral absorption reflects the internet use at an organizational level. Organisational infrastructure is focused on the number and robustness of the organisations that provide these services and geographic dispersion reflects the extent to which these organisations are distributed across the country. Finally, sophistication of use refers to the how the internet is

employed. Each dimension consists of determinants which reflect the causes that lead to the conditions examined. For each dimension a group of five determinants are specified. The results are presented on Kiviat diagrams. Each diagram consists of six spokes representing each of the dimensions. The advantages of the Kiviat diagrams concern first, the easy and quick understanding of the current situation mainly due to the fact that the number of dimensions is small enough so that they can easily be kept in mind and second, it offers the possibility to compare values for one or more countries at one or more times on the same diagram or on side-by-side several diagrams.

The Orbicom's Infostate Index (section 4.3.4) defined the digital divide as the relative difference in countries' Infostates which is made up by two sub-indices: "infodensity" and "info-use". Infodensity represents ICT capital and labour stocks in the productive capacity of the economy and includes ICT networks, machinery and equipment as well as ICT labour skills indispensable for the functioning of information, knowledge-oriented societies. Info-use refers to the uptake of various ICTs by households, businesses and governments and the intensity of their actual use. The model was first tested in nine countries over time (1995 to 2000) and two types of comparisons were carried out. The first was cross-country comparison at any given point in time and the infostates of a country over time. Infostates were expressed in a relative term and thus, the progress made by each country was examined against the reference country which was Canada. Then the model was tested for 192 countries, 21 indicators and 6 years of observation (1996 – 2001). Year 2001 was selected as the reference year to the availability of additional indicators. In addition, instead of choosing a specific country as a reference, a hypothetical reference country called Hypothetica was created. Hypothetica refers to the average value of all countries examined. Moreover, one more benchmark was created. Planetia represent a whole and each country is treated as a region of the planet. The main limitations of this framework are the unavailability of indicators and the insufficient quality of some indicators.

A common element of the frameworks examined is that all of them consist of several groups (or dimensions etc) relevant to the topic examined. Then depending on the framework there are more than one breakdown of each group. Only the first examined framework, i.e. the Measuring of a Knowledge

Based Economy and Society (section 4.3.1), has not been applied or at least there is no information if it has been applied as originally proposed or it has been applied with modifications. The rest of the frameworks have been applied and produced results. From the four frameworks examined it can be observed that there are two approaches followed. With the first one the aim is to produce quantitative results (Measuring a Knowledge Based Economy and Society (section 4.3.1), Infostate Index (section 4.3.4)) whereas with the second the aim is to assess the level of achievement for each group/ dimension separately (Readiness for the Networked World (section 4.3.2), Global Diffusion of the Internet (section 4.3.3)). A common problem for all frameworks is the lack of indicators as well as the quality of some of the available indicators.

As regards the ten indices examined four of those were developed by the ITU (two in cooperation with other organizations) and the remaining six by WEF and INSEAD, UNCTAD, UNDP, World Bank, Economist Intelligence Unit and European Commission respectively (Table 11). The first attempts to construct indices go back to the mid nineties and continue today. A major actor in the development of indices is the ITU for whom the aim is to construct a single aim for the whole of the information society (International Telecommunication Union (ITU); United Nations Conference on Trade and Development, 2007a).

Table 11: Responsible Organisation

Index	Organisation
Digital Access Index (section 4.4.1)	ITU
ICT Opportunity Index (section 4.4.2)	ITU & ORBICOM
Digital Opportunity Index (section 4.4.3)	ITU & UNCTAD
ICT Development Index (section 4.4.4)	ITU
Network Readiness Index (section 4.4.5)	WEF and INSEAD
ICT Diffusion Index (section 4.4.6)	UNCTAD
Technology Achievement Index (section 4.4.7)	UNDP
Knowledge Economy Index (section 4.4.8)	World Bank
E-readiness Index (section 4.4.9)	Economist Intelligence Unit
Digital Economy and Society Index (sec. 4.4.10)	European Commission

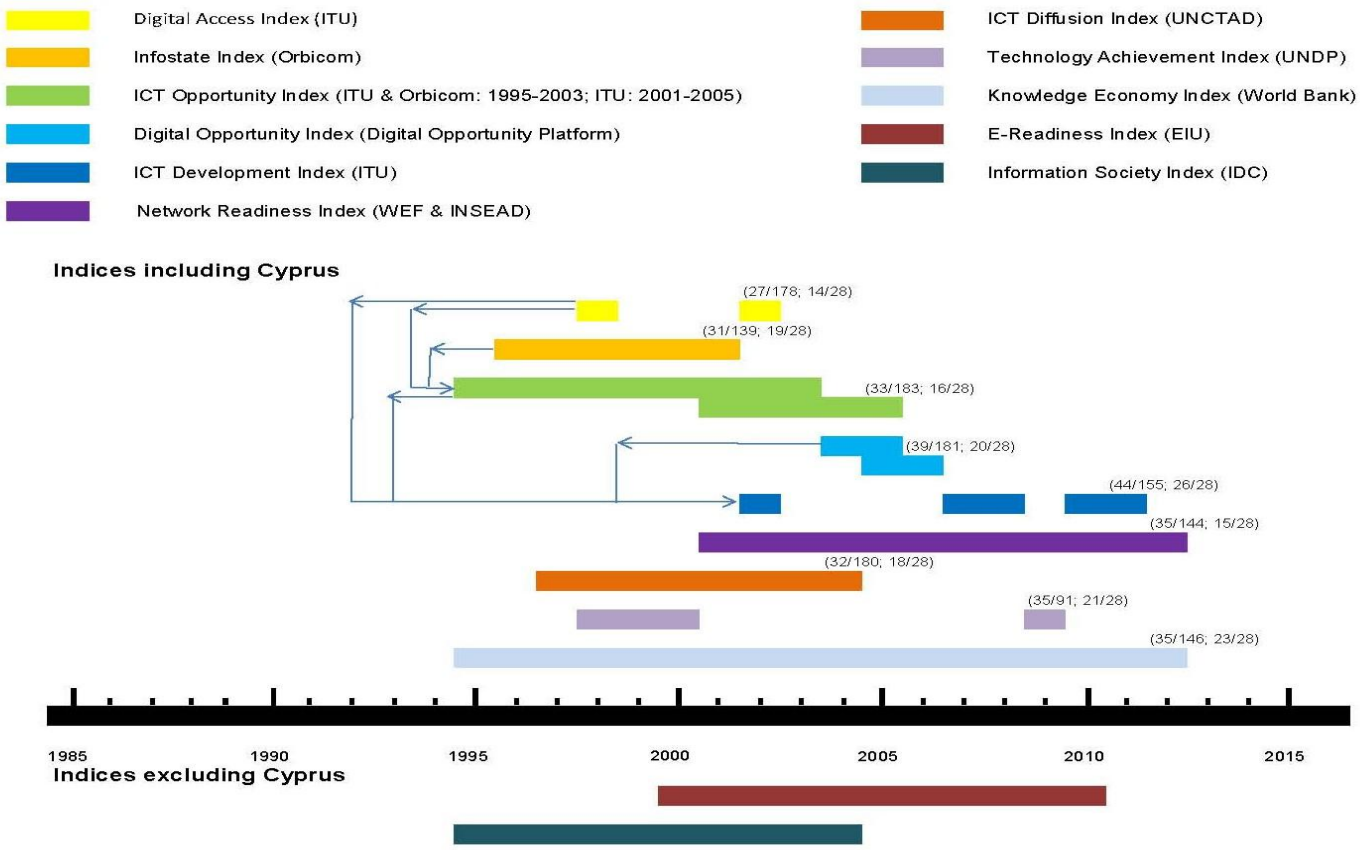
Figure 13 presents a timeline with the historical development of the first nine indicators described in section 4.4. Two more measurements have also been included in the timeline (Information Society Index (section 4.2.1) and Infostate Index (section 4.3.4)) for which data is available. Nine of the total eleven indices included in the timeline have data for Cyprus (indicators above the axis) and thus, comparison with other countries is possible. No data for Cyprus is available for the E-readiness Index (section 4.4.9) and the Information Society Index. For each indicator the latest available data is recorded and the ranking of Cyprus for that particular indicator is displayed compared first, to all the countries examined (first fraction in the parenthesis) and second, to the EU28 countries (second fraction in the parenthesis). The “oldest” composite indicators are the ICT Opportunity Index (section 4.4.2), the Knowledge Economy Index (section 4.4.8) and the Information Society Index for which the first data applied were from 1995. However, this does not imply that chronologically those indicators were constructed first. The ICT Opportunity Index was constructed by joining together the Digital Access Index (section 4.4.1) and the Infostate Index. The ICT Development Index (section 4.4.4) incorporated different aspects and lessons learned from earlier indicators and in particular the Digital Access Index, the ICT Opportunity Index and the Digital Opportunity Index (section 4.4.3). Today only two indices continue to be developed and those are the ICT Development Index (section 4.4.4) and the Networked Readiness Index (section 4.4.5).

Although the eleven indices measure different topics such as Digital Access, ICT and Digital Opportunity, Network Readiness and Knowledge Economy at different reference periods, it is very interesting to observe that there is a consistency in the results. In particular, there is a group of 23 countries for which their ranking is higher than Cyprus in all indices. Those countries appear in green colour in the tables of countries rankings for all indices examined and are available in Appendix 6. Three more countries are ranked higher than Cyprus in all indices except in one (orange colour) and two countries are ranked higher than Cyprus in all indices except in two (red colour). The ranking of Cyprus ranges from 27 (Digital Access Index) to 44 (ICT Development Index). Considering that this group of 23 countries (or even the 28) is consistently ranked higher than Cyprus those countries can be seen as

the leaders. Bearing in mind that the ranking of Cyprus does not have a significant variation it can be deduced that Cyprus belongs to the group of countries that immediately follows the leaders.

It is also interesting to observe the within index variation of ranking. For example, if we take the ICT Development Index (section 4.4.4) for four years that is available (2007, 2008, 2010 and 2011) we observe that there is no significant variation in the ranking of the countries (Appendix 7). Cyprus ranks 40, 39, 38 and 44 in the four years respectively and the 28 countries that are ranked higher than Cyprus in all indices are also higher within the ICT Development Index. Without examining it further it is expected that a similar pattern applies to the rest of indices too.

Figure 13: Historical development, 1995 – 2012



Notes:
- Indicators located above the time axis include Cyprus whereas those below the axis do not.
- The first fraction appearing on top of the bars display the ranking of Cyprus to the total number of economies examined
- The second fraction appearing on top of the bars display the ranking of Cyprus to the total number of the 28 EU countries (e.g., for the Digital Access Index, in 2002 Cyprus is ranked 27th from a total of 178 countries examined and 14th out of the 28 EU countries)

The second research question refers to the size of countries and whether this factor was considered while constructing the various proposed measurements. As shown in Table 12, the Crowards system for the classification of countries has been applied (Section 2.3.4), at least partially, for three of the examined measurements (Information Society Index (section 4.2.1), Information Utilization Potential (section 4.2.2) and Global Diffusion of the Internet (section 4.3.3)) in the first two categories (shown in orange and green respectively). Each category of measurement appears in different colour. Two of the measurements (Infometrics 4C model (section 4.2.4) and Infostate Index (section 4.3.4)) in the first two categories (shown in orange and green) have been applied to a large number of countries. With the exception of the DESI (section 4.4.10) the classification of the indices of the third category, i.e., indices for measuring the various facets of the information society was not necessary as those involve a large number of countries of different sizes. In those cases the variables are normalised with per capita measures in order to adjust the different country sizes.

Table 12: Classification of countries in the various measurements

Measurement	Micro	Small	Medium - Small	Medium - Large	Large	Not classified by Crowards
Information Society Index	0	1	6	3	22	21
Information Utilization Potential	2	5	5	8	9	5
eReadiness Index	Data only for USA and Italy					
Infometrics 4C model	Data for 237 countries					
Measuring a knowledge-based economy and society	Not applied for any country					
Readiness for the Networked World	Can be applied for any country					
Global diffusion of the internet	0	3	6	4	10	2
Infostate Index	Data for 139 countries					
Digital Access Index	Data for 178 countries					

ICT Opportunity Index	Data for 183 countries
Digital Opportunity Index	Data for 181 countries
ICT Development Index	Data for 155 countries
Network Readiness Index	Data for 144 countries
ICT Diffusion Index	Data for 180 countries
Technology Achievement Index	Data for 91 countries
Knowledge Economy Index	Data for 146 countries
E-readiness Index – Digital Economy Index	Data for 70 countries
Digital Economy and Society Index	Data for 28 countries

As it can be seen from Table 13 the measurements can be grouped further into three categories. The first group includes those measurements that have been applied to a small number of countries (<=70); the second includes the measurements applied to a large number of countries (>70) and finally, in the third group are those measurements that have not been applied to any country. Five of the six measurements included in the first group do not contain Cyprus whereas the inclusion of small countries in general is limited. On the contrary nine of the ten measurements of the second group contain Cyprus as well as other small countries. It is noted, however, that eight of the ten measurements concern the indices developed by the international organisations. Therefore, it can be deduced that the measurements are either applied to all countries regardless of their size, mainly the indicators produced by the international organisations, or the priority in the other types of measurements is given to the large countries. Consequently the measuring of the information society in the small countries has not been a topic of specific investigation.

Table 13: Countries sizes in the different measurements

Group	Measurements
Group 1 (<=70 countries)	Information Society Index (53 countries), Information Utilization Potential (34 countries), eReadiness Index (2 countries), Global diffusion of the internet (25 countries) , E-readiness Index – Digital Economy Index (70 countries), Digital Economy and Society Index (28 countries)
Group 2 (>70 countries)	Infometrics 4C model (237 countries), Infostate Index (139 countries), Digital Access Index (178 countries), ICT Opportunity Index (183 countries), Digital Opportunity Index (181 countries), ICT Development Index (155 countries), Network Readiness Index (144 countries), ICT Diffusion Index (180 countries), Technology Achievement Index (91 countries), Knowledge Economy Index (146 countries) ,
Group 3	Measuring a knowledge-based economy and society, Readiness for the Networked World

In order to have an objective comparison between countries scaling of variables by an appropriate measure, such as population or income, is applied. With the exception of the DESI in all the measurements examined, variables are normalized with per capita measures (per capita, per 100 people, per 1.000 inhabitants etc). In addition, some variables are expressed in terms of the total number of households or as a proportion of the GDP. Although the population scaling is widely applied, according to the UNCTAD (2003), it is important to know that averaging measures across per capita population may implicitly work against larger countries, lowering their relative rankings but still remains a good way to adjust for country size.

4.6 Summary

In this Chapter the first two research questions are addressed. A total of eighteen measurements are examined and compared. These measurements are classified in three groups depending on their scope. The first group includes four measurements that their common aim is to produce a single value for the whole information society. The second group contains four frameworks that were proposed for measuring concepts related to the information society. Finally, the third group consists of ten indices that were developed by international organisations with the aim to measure different facets of the

information society. This list of measurements is not exhaustive but provides the main output of the research performed in the last three decades by both individual researchers and international organisations.

As discussed in chapter 2 in the framework of the literature review, the development of information societies in small countries has not been of particular interest to the research community. Instead the majority of the research papers refer to developed countries and in the cases of developing countries these are generally less developed than EU countries. Moreover, the literature review concluded that the available produced measures do not include a different group of countries, the small countries. Similarly, the information society in Cyprus hasn't been a topic for scientific research. The priority is given to the big economies which have more influence to the world economy. This is supported by the fact that from the eight measurements of the first two groups only one has been applied for Cyprus and other small countries and the results are publicly available. For Cyprus and the small countries in general, there are only available the various indices developed by the international organisations.

However, as demonstrated in this chapter, despite the fact that each index examines a different aspect of the information society the ranking of the countries do not differ significantly amongst the indices. So the question that arises is whether the availability of just this kind of indices is enough for Cyprus, and small countries in general, in their quest to develop information societies. I argue that the adoption of just the various available indices is not enough. Each country should base its information society strategy based on a conceptual model that includes a set of measurements for the various components of the information society. The application of such a model would enable the country to set specific targets and monitor the progress. However, the priorities and the strategy in general should take into consideration the idiosyncrasies, specificities, history and culture of the country. Information society strategy is not the case of one size fits all.

In the case of Cyprus the various available measurements are either produced by the international organisations or calculated in order to fulfil the EU Regulations. No other initiative has ever taken place in setting up or applying an already available model for the measurement of the information society in Cyprus. As concluded in the review of the literature, as soon as the benefits of

ICTs are clarified and accepted by the policy makers in the small countries, the initiatives for the adoption should come from them and in this framework national strategies should be developed. The progress should be measured by applying a suitable framework. What kind of framework would be suitable to be applied in the case of Cyprus and the small countries in general?

Policy makers are interested in indices which are easy to construct and to understand. The quality of the indices is an important element as is the timeliness due to the fast evolvement of the ICTs. Information society is a multi faceted subject and thus, for the purpose of implementing a strategy the progress in the different facets should be measured. Thus, taking into consideration the complexity in the production and the multi faceted nature of the information society, the development of a single value for the whole information society would not be the appropriate approach in following the progress for national needs.

The review of the literature concluded that composite indices are mainly products of the international organisations and are produced with the aim to compare countries and regions. Critics of composite indices express concerns on the quality of the indices as in many cases there are no objective criteria for including or excluding variables or for determining the weights. In addition, they claim that these present an over simplified and possibly misleading interpretation and that such indices may provide a static representation of a country in relation to other countries but offer little insight into the problematic aspects. Moreover, the adjustment made in the composite indices variables with per capita measures it may be suitable for comparing countries but is not for national needs. The literature review showed that the ranking of Cyprus in the various measurements is similar and this may imply that the economic factors have the major effect on the ICT measures. Consequently, it can de deduced that single composite indices may don't work well. Although the composite indices are useful tools for supranational policymaking, they are not suitable for policymakers within one country.

The measurements based on framework models are more informative. However, the main challenge in this case is to include components that are available for long period of time in order to assess the progress. In addition, in the case where the aim is to construct an index based on a framework (e.g.

Infostate index) the challenges coincide with those of composite indices and are described in the previous paragraph. Two of the four framework models identified in the literature review aim to produce quantitative results and the other two aim to assess the level of achievement. Taking into account their scope and context none of the four frameworks is considered as appropriate to be applied in the case of Cyprus.

Baumeister and Leary (1997) identify five main goals of literature review as follows:

a. Theory development.
b. Theory evaluation.
c. Survey of the state of knowledge on a particular topic.
d. Problem identification.
e. Provide a historical account of the development of theory and research on a particular topic.

The literature review of this thesis is in line with the second, third and fourth goal of Baumeister's and Leary's classification. In particular, the literature review has pulled together what is known about the definition of the information society as well as its measurement and revealed problems, weaknesses, contradictions or controversies. Based on the results of the review the thesis evaluates the existing conceptualizations and proposes a suitable model for the case of Cyprus. In particular, considering the advantages and disadvantages of each category of measurement it may not be sensible to apply any of those in the case of measuring the information society in Cyprus. Instead, a composite descriptive approach might be more appropriate in order to identify where more emphasis is required or where the gaps are. This can be achieved by using measurement components that make sense and for which there are well developed relationships among them. An additional factor for choosing an appropriate model is the inclusion of components that are related to political or economic levers that are under at least partial control of the government because in this way, it can be easier to explain possible changes and improvements.

The review of the literature showed that there is no agreed comprehensive statistical framework of the information society. However, one possible conceptual model is proposed by the OECD (see p.15, Figure 2, p.33

for some of the background work on the information economy). Unlike the other frameworks identified and reviewed (Section 4.3) the OECD model does have provenance in the previous work of UNCTAD/OECD. This model is broad in its setup and encompasses the widely agreed elements of ICT supply, ICT demand, ICT infrastructure, ICT products and "Content". Moreover, the model includes a "Context" layer where the general national, social and economic developments, political aspects and other contextually relevant developments are taken into account. Education and ICT skills are examined in a separate layer which focuses on ICT related knowledge development. Thus, the OECD model includes the underlying Information Society variables identified in other key measurements such as the Knowledge Economy Index (Section 4.4.8) and the E-Readiness Index (Section 4.4.9).

In addition of being comprehensive, the OECD model is flexible and in this respect the indicators to be included can be selected depending on the set priorities. Moreover it facilitates the identification of gaps in any of its layers by comparing the same indicators with other countries. As discussed in section 4.5, Cyprus's ranking in the various composite indices is similar. In all indices there is a group of 23 countries which are consistently ranked higher than Cyprus. Another group of three countries (Italy, Estonia and Slovenia) are ranked higher in all indices except one and a third group consisting of two countries (Spain and Malta) which are ranked lower than Cyprus in two indices. One of the two countries in the last group is Malta. Malta shares similar characteristics to Cyprus such as they are both small island states situated in the Mediterranean Sea and both became member of the European Union at the same time. Moreover, as discussed in section 2.3.4, small countries are different from their larger counterparts in several ways such as the limited markets, the dominant role of the public sector in the economy, the vast majority of small and medium size firms within the commercial activity and the high economic vulnerability. However, despite the similarities that exist between the small countries there are also significant differences due to diverse cultures, social and economic environments and historical paths of development. Although the similarity of the ranking position needs to be further explored in order to try to work out the reasoning behind it, the consistent higher ranking of Malta is a fact. In the light of this finding and considering the common

characteristics of the two countries and of small countries in general, it has been decided to use Malta as benchmark in the application of the proposed framework in the next chapter. In this way the higher ranking of Malta can be further explored.

In conclusion, the requirements in measuring the information society in Cyprus are fulfilled by the OECD model. The model is described in detail in the next chapter and applied for the first time in the case of Cyprus.

Chapter 5: The information society in Cyprus – State of play

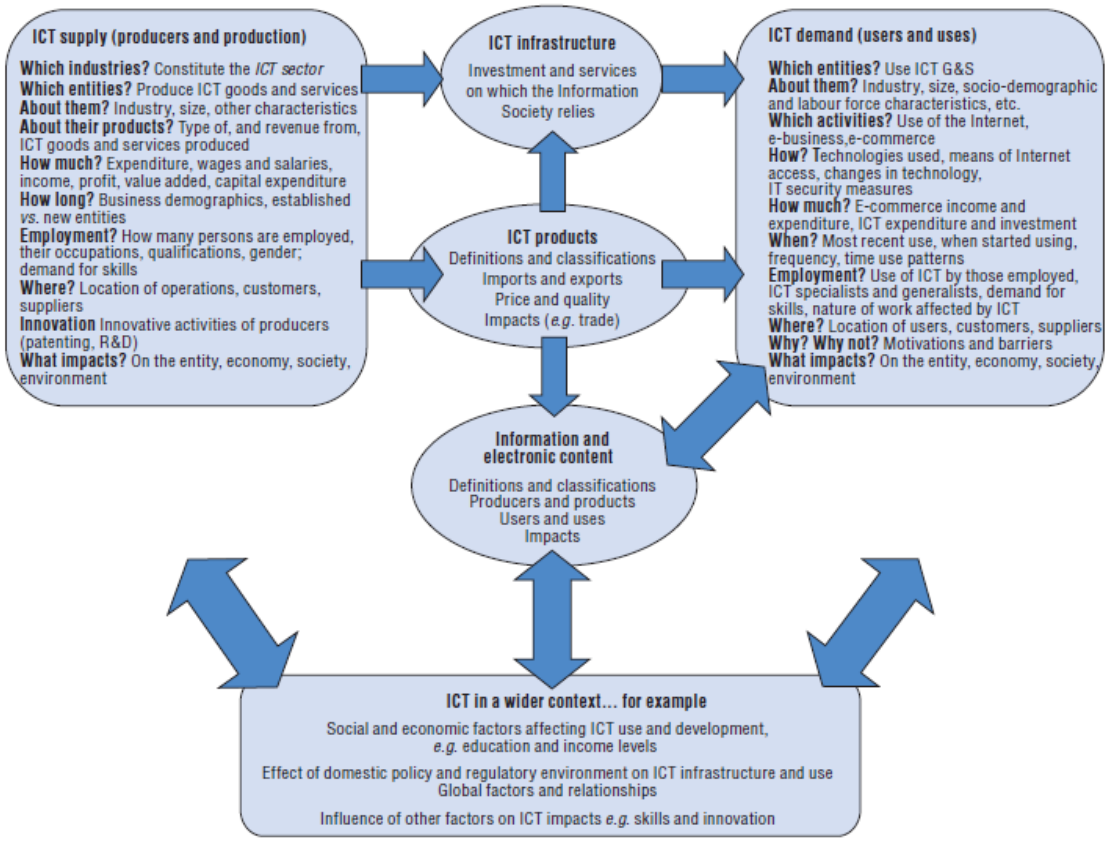
5.1 Introduction

The aim of this Chapter is twofold. First, to provide a measurement of the information society in Cyprus based on the information society statistics conceptual model proposed by the OECD (2011) and second, based on the results of the measurement, to provide the answer to the fourth research question by suggesting measures that could be implemented in order to secure the successful conversion of Cyprus into an information society.

This is the first attempt to produce a comprehensive measurement of the information society in Cyprus based on a conceptual model proposed by the OECD (Organisation for economic co-operation and development (OECD), 2011). The model encompasses the widely agreed elements of ICT supply, ICT demand, ICT infrastructure, ICT products and electronic content. It is based on the supply and use of ICT, in which the ICT sector and ICT infrastructure play an important role. The model (Figure 14) depicts the interface between supply and demand. On the one side is the supply of ICT, i.e. includes the ICT sector of the economy, and the other side consists of ICT use in enterprises, households and the public sector. The top level represents ICT infrastructure, i.e. investment and services on which the information society relies. The second level is ICT products and includes imports and exports, price and quality. The next level refers to the actual information which is transferred via the electronic networks. Finally, the bottom level, namely context, shows that any related national, social and economic developments or political factors should also be taken into consideration. This model can be used to answer questions like:

a) What kind of internet activities are relevant in Cyprus?
b) Which technologies do users use?
c) How often and how intensively do the various groups use ICT?
d) How much employment does the supply of ICT generate?

Figure 14: OECD Information statistics conceptual model



The OECD has been publishing the “Guide to measuring the Information Society” (2011) in order to assist countries to start or further develop information society measurement programmes. The aim of OECD is to establish this Guide as a standard reference for statisticians and others working in the field. As already discussed in Chapter 2 of this thesis, there is no agreed comprehensive statistical framework of the information society. However there can be no doubt that the elements of ICT supply, ICT demand, ICT infrastructure, ICT products and electronic content are related to the concept of information society. In this respect the inclusion of those elements in the proposed OECD model provides a sound basis for the definition of the model which can be applied to any country regardless of its characteristics like the size. Moreover the model has been defined and accepted by the OECD which is an international organisation with a large number of member states and that proves its wide acceptance. By applying this model in its “Guide to measuring the Information Society” the OECD, and consequently a large number of countries, accept that this model is

fit for its purpose. Consequently the OECD model could provide the necessary framework for measuring the information society in Cyprus.

This model has also served as the basis for defining a definition framework for the Information Economy as well as for the impact of ICT on society. As discussed in Section 2.2.1 of this thesis the UNCTAD used the concepts of the 'building blocks' of supply and demand based on the OECD model in order to define and measure the concept of information economy. Moreover, the OECD used its information society model to measure the impact of ICT on society (Organisation for Economic Co-operation and Development (OECD), 2007).

By applying the OECD model, the measurement of the information society in Cyprus, which is included in the first part of this Chapter, focuses on the relationship between ICT and the economy and the ICT sector, the ICT use in society and the role of ICT knowledge. The Cyprus economy is the context in which ICT is developed and thus, section 5.2.2 describes the history of the economy in Cyprus and also examines the role of the ICT sector in the economy. Section 5.2.3 examines the telecom sector, i.e. the infrastructure, and in particular the internet and telephone. Sections 5.2.4 to 5.2.6 follow with a description of the main ICT users namely enterprises and households. Similarly to enterprises and households, the public sector is also subject to the continuing process of digitalisation. ICT is used to improve services in respect to quality and efficiency. Thus this section examines also the topic of e-government. Finally section 5.2.7 looks at ICT related knowledge development in Cyprus and in particular the R&D expenditure by the ICT sector as well as the ICT education and skills. ICT has brought together information, communication and knowledge. ICT research contributes to the development of new knowledge and in this respect it is important to look into the R&D expenditure by the ICT sector. ICT education is an important factor in the diffusion and expansion of ICT knowledge. Finally, the technological developments have made ICT skills an important factor in the quest to benefit from the information on the internet.

As the OECD model suggests there is the second level which refers to the actual information that is transferred via the electronic networks as well as the domain of ICT products. However both aspects are not examined in this research mainly for two reasons. First, no relevant data is available and second,

the measurement of the content can be examined at a later stage. Already the adopted model provides a significant input into the information society and serves adequately the needs of this research.

As Figure 14 suggests the measurement and analysis are applicable to every aspect of the information society but the statistical information and methodologies involved are diverse. In this respect, a pragmatic approach has to be applied for which the priority and statistical feasibility will determine the order in which the various information society issues are examined. Having set this framework the criteria set for the selection of the indicators for this research concern the availability of well defined and relevant harmonised data, data of high quality and thus accurate and timely and finally, the ease of understanding. All the indicators included in the model of this research are displayed in Appendix 9.

The provision of data only for Cyprus is not enough as there should be comparison with other countries. Benchmarking is important for comparing Cyprus with other countries so as to put Cyprus in a broader perspective. The most recent available data is included and where applicable time series are provided. The reference countries selected are Malta and the EU28 average. As Cyprus is a member of the European Union the comparison with the EU average shows the position of Cyprus in the EU scale. Although sometimes this comparison may not be the most representative as it does not take into account the differences of the countries such as the size, culture etc, it is used by policy makers, analysts the media etc. Malta is chosen as a reference country due to the common characteristics of the two countries such as membership of the European Union and both being small island countries located in the Mediterranean Sea. In line with this approach Cuervo & Menendez (2006) refer to the various measurements of the information society (such as the information society index, the technology achievement index, the infostate index and the digital access index) and claim that these indices have two main limitations. First, they give a simplistic picture of country situations and second, rankings depend both on which variables are included and which are excluded. Cuervo & Menendez adopt UNESCO's approach in that it is more sensible to group countries of similar economic status and attempt analyses within these groups. Dickson & Hadjimanolis (1998) argue that Cyprus and Malta share the following

characteristics: relative geographical isolation, limited local market size, few firms per sector with small firm sometimes as the sector leader, limited technological knowledge and relatively short value-added chains.

Considering that the reference countries selected are Malta and the EU-28 average, the sources of the data used for the purpose of this thesis are mainly Eurostat and European Union's reports. Both sources provide harmonized data for all EU member states. Eurostat produces harmonized data on ICT usage since 2004 and all data are available free of charge on its website. Other sources are the OECD, the ITU, the World Bank and the UNCTAD. It is noted that the population data from the ITU includes estimates of the population of the occupied part of the island and thus the indicators per capita are misleading. In this respect all per capita indicators produced by the ITU and included in the model are adjusted to the estimated population of Cyprus as published by the Statistical Service of Cyprus. These estimates exclude the occupied part of the island.

5.2 Measurement of the information society in Cyprus

5.2.1 Background to Cyprus and Malta

Cyprus and Malta are island-states situated in the Mediterranean. Cyprus is situated in the eastern Mediterranean close to the Middle East, Turkey and Egypt. Malta is located in the middle of the Mediterranean Sea. Both gained their independence from Britain in the 1960s and are members of the British Commonwealth. Since their independence both countries had experienced self-government and democracy. Cyprus and Malta joined the European Union in 2004 and adopted the Euro as their currency in 2008. However the cooperation of both countries with the EU has a long history since Malta and the European Community signed an Association Agreement in 1970 while Cyprus signed the agreement in 1972.

In ancient times Cyprus was part of the Hellenic world and the predominant culture had always been Hellenic. The religion in Cyprus is Greek Orthodox and the main spoken language is Greek. The Turkish Cypriot minority residing in the occupied northern part of the island is Muslim and the spoken language is Turkish. In Malta there are no ethnic minorities, the spoken language is Maltese and the main religion is Roman Catholicism.

Cyprus and Malta with populations of 847.000 and 429.344 (Table 14) respectively are considered small countries. Cyprus is 30 times the size of Malta and thus, their population densities differ significantly. Malta with 1.311 persons per km^2 ranks 175^{th} while Cyprus with 127 persons per km^2 is at the 158^{th} place. Malta is wealthier than Cyprus as its GDP per capita in PPS compared with the EU average is 88% while Cyprus's is 82% (EU28=100). Being small economies they are both dependent on trade and tourism as a major source of national income. Camilleri & Falzon (2013) in their assessment of the economic performance of Cyprus and Malta discuss that whilst the Cypriot economy is larger than the Maltese the countries have similar economic structure. The resemblances occur when considering the significance of each sector comprising the total economy. Camilleri & Falzon conclude that there are various commonalities in the economic structure of the two economies and thus, these commonalities can serve as a basis for these countries to learn from each other's expierences.

Table 14: Comparison indicators for Cyprus and Malta

	Cyprus	Malta
Population (2015)	847.000	429.344
Population Rank (2015)	158	175
Surface Area (km^2)	9.243	320
Population Density (P/km^2) (2015)	127	1.311
GDP Per-capita in PPS (2015)	82	88
GDP by Economic Activity (2015) (main sectors)		
- Wholesale and retail trade, transport, accommodation and food service activities	29%	23%
- Public administration, defence, education, human health and social work activities	20%	19%
Employment (% of total employment) (2014)		
- Agriculture	4%	2%
- Industry	15%	19%
- Services	81%	79%

5.2.2 ICT and the economy

In the first part of the Section the development of the economy of Cyprus is examined in detail and in the second part a detailed analysis of the ICT sector is provided.

5.2.2.1 History of the economy of Cyprus

Since the establishment of the Republic of Cyprus in 1960 there have been four important milestones in the history of the country, the division of the island in 1974, the EU accession in 2004, the adoption of the euro in 2008 and the economic crisis of 2013.

Before the establishment of the Republic of Cyprus in 1960, the economy exhibited most of the structural weaknesses of underdevelopment. Agriculture was the dominant sector in economic activity and accounted for 16% of GDP and 45% of gainful employment. The main export products were minerals and agricultural products constituting 53% and 32% of the total domestic exports respectively. On average only 43% of children between 12 and 17 years old attended secondary schools. Moreover only 28% of houses in the countryside had electricity and only 7% had in-house water supply. For the first time, in 1960, the newly formed government adopted the basic principles of indicative planning in order to overcome the structural weaknesses of the economy. Five-year development plans were prepared. The plans contained the strategy, objectives, targets and economic policies/ programmes. The government had the responsibility for the implementation of the plans and the private sector remained the driving force of the economy. As a result of the measures taken the economy exhibited by sustained growth. GDP grew at an average annual rate of 7%, agricultural production doubled and the industrial production and exports of goods and services more than tripled. Tourism became the largest single foreign exchange earner. Unemployment was contained to a low level, inflation was modest and the Balance of Payments was mostly kept in surplus.

The Turkish invasion of 1974 and the consequent occupation of more than one third of the island by Turkey brought total catastrophe to the Cyprus economy. The occupied part was the most developed and productive part of Cyprus, especially for agriculture, mining and quarrying and tourism. In addition, important infrastructures such as the International Airport of Nicosia and the

Port of Famagusta have remained inactive since then. Despite the severe economic and social problems caused by the Turkish invasion and occupation the economic policies applied immediately after proved to be successful and the economy exhibited rapid reactivation. This economic turnaround was characterised as “the Cyprus economic miracle”. The driving forces of growth were the construction and manufacturing sectors. Construction was boosted by various schemes of the government for the housing of refugees and the manufacturing sector by the successful penetration of Cypriot enterprises in the Arab markets. Consequently unemployment dropped from 30% of the economic active population in 1974 to 2% in 1978. At the end of the 1970s due to the success in reactivating the economy the Government policy changed. The aim was to reduce the inflationary pressures and the imbalances in the Balance of Payments. Moreover the Government set as targets technological upgrading, the restructure of all sectors of the economy in order to adjust the economy to the emerging conditions of intense competition, in the context, firstly, of the Customs Union Agreement between the EU and Cyprus and later, the commitments of Cyprus towards the World Trade Organisation and the accession course of Cyprus in the EU. Cyprus continued to exhibit a satisfactory performance during the period 1979 – 1993 as the annual average rate of economic growth fluctuated around 6% in real terms and the unemployment rate fluctuated at around 2,7%.

The Strategic Development Plan of 1994 – 1998 set as objectives the achievement of the highest possible rate of growth taking into account the various endogenous and exogenous constraining factors, the maintenance of full employment conditions and the consolidation of conditions of external and internal macroeconomic stability. The progress achieved during this period was in general terms satisfactory despite the partial divergence of some magnitudes from the targets set in the Plan. The rate of economic growth reached 4,2% surpassing the target of 4%. The economic growth has been driven by the private sector services activities, with the most dynamic sectors being, financial, business and community services. Unemployment rate reached 3%, on average, complying with the target of the Plan.

The main objectives of the Strategic Development Plan 1999 – 2003 were the completion of the harmonisation process and the creation of the

necessary institutions for the effective implementation of the acquis communautaire as well as the preparation of the economy in view of the accession of Cyprus to the EU, the parallel attainment of the three-fold goal of growth, macroeconomic stability and social cohesion, the restructuring of all sectors of the economy, the modernisation of business units, the utilisation of Cyprus' comparative advantages, the enhancement of its competitiveness and its adaptation to emerging conditions within the context of globalisation, the upgrading of the role of Cyprus as a regional and international services centre of excellence, the adaptation to the information society and the reform of the public sector. Progress in the implementation of the Plan was in general satisfactory despite the deviations observed in partial objectives set by the Plan. The annual growth rate reached 4% complying with the Plan's target of 4%. The tertiary sector of services, in particular, telecommunications, as well as financial, business and social services and to a lesser extent restaurants and hotels, were the driving force of economic growth. The agricultural sector exhibited an increase of its production during the period affected positively by the favourable weather conditions that prevailed. The conditions of almost full employment continued to prevail with the unemployment rate fluctuating at around 3,3% while at the same time employment of foreign workers continued to increase. Another positive development was the satisfactory expansion of gross fixed capital formation in general and in machinery and equipment, in particular, as well as the partial diversification of the structure of investment in favour of machinery and equipment reflecting the intensified efforts for the restructuring of the business units in the context of intensified competition. However, the events of the 11th of September in the USA in 2001 preserved the climate of uncertainty during 2002. As a result the further enhancement of the positive performance was prevented. Growth was based mainly on domestic demand and particularly private consumption and to a lesser extent on external demand, deviating in this way from the provisions of the Plan for a more decisive contribution of external demand to growth. This deviation was mainly attributed to the reduction of tourist demand in 2002. In 2002 the current account deficit exhibited deterioration to 5,3% of GDP a development primarily attributed to the significant decrease of tourist flow to Cyprus. The public debt as a percentage

to GDP reached 59,7% in 2002 and the fiscal deficit to 3,5% of GDP making the achievement of the target for a deficit of 2% not possible.

Since its accession to the EU in 2004, Cyprus has undergone significant economic and structural reforms that have transformed its economic landscape. Tariffs and quantitative restrictions have been eliminated for all manufactured goods and agricultural products originating in Cyprus and other EU countries. Trade and interest rates have been liberalised, while price controls and investment restrictions have been lifted. Private financing has been introduced for the construction and operation of infrastructure projects and the monopoly in the telecommunications sector has been abolished. Firmly committed to sound fiscal policies essential for preserving macroeconomic stability and ensuring the sustainability of the convergence process, the government adopted concrete measures that strengthened economic performance and met the required Eurozone targets by mid-2007. The Cyprus economy in 2007, exhibited conditions of relatively strong economic activity, mainly due to the strengthening of domestic demand and in particular due to private consumption, and investment demand in construction works. The rate of economic growth fluctuated at 4.4% in real terms in 2007, as compared to 4.1% in 2006. The unemployment rate was 3.9% in 2007. The rate of inflation fluctuated at 2.2% in 2007.

On 1st January 2008, the euro became the monetary unit of Cyprus replacing the Cyprus pound. Euro banknotes and coins are circulating and are the legal tender in the Republic of Cyprus. This was one of the most important achievements for Cyprus, integrating it even further into the EU. This success was made possible despite the uncertainty in the international economy. The international economic crisis which started in 2008 had a major impact on the Cyprus economy. As a result, the government adopted a series of measures to support the real economy and bring about economic recovery and growth as well as structural reforms. Primarily because of the recapitalization of Cypriot banks, the government in 2012 was compelled to apply for assistance to the support mechanism provided by the EU Commission, the European Central Bank and the International Monetary Fund. Cyprus is currently implementing the loan agreement concluded in the spring of 2013.

The violent restructuring of the Cypriot banking sector, the continued negative external environment and the fiscal consolidation measures adopted by the Government of Cyprus, negatively affected the growth of the economy in 2013. The capital restrictions imposed by the Government also had a negative impact on the economy. However, the recession in 2013 (-5,4%) was significantly lower than the projections included in the macroeconomic programme and the forecasts of International Rating Agencies. From the demand side, the decline in private consumption and investment was lower than predicted, especially towards the end of the year. From the supply side, the relatively satisfactory performance of the tourism sector and professional services, helped to limit the recession. In the labour market, the unemployment rate in 2013 increased significantly to 16%, as a result of the economic downturn. The unemployment rate was contained to some extent by the measures adopted by the Government, the reduction of the foreign labour and the reduction in earnings. For 2013, inflation stood at 0,4%, which largely reflects the adjustment of the labour market and price developments, which are deemed necessary so that to improve the productivity and competitiveness of the economy. The public debt rose significantly (112% of GDP), reflecting the sharp decline in GDP.

5.2.2.2 The ICT Sector

According to the definition adopted by Eurostat the ICT sector consists of all enterprises/units (including both natural and legal persons) which principal activity (principal activity contributes 50 and more percent to the value added) belongs to following divisions and groups (classes) of NACE rev. 2 classification:

1. ICT manufacturing industries:
    - Manufacture of electronic components and boards – group 26.1
    - Manufacture of computers and peripheral equipment – group 26.2
    - Manufacture of communication equipment – group 26.3
    - Manufacture of consumer electronics – group 26.4
    - Manufacture of magnetic and optical media – group 26.8

2. ICT trade industries:
    - Wholesale of information and communication equipment – group 46.5
3. ICT services industries:

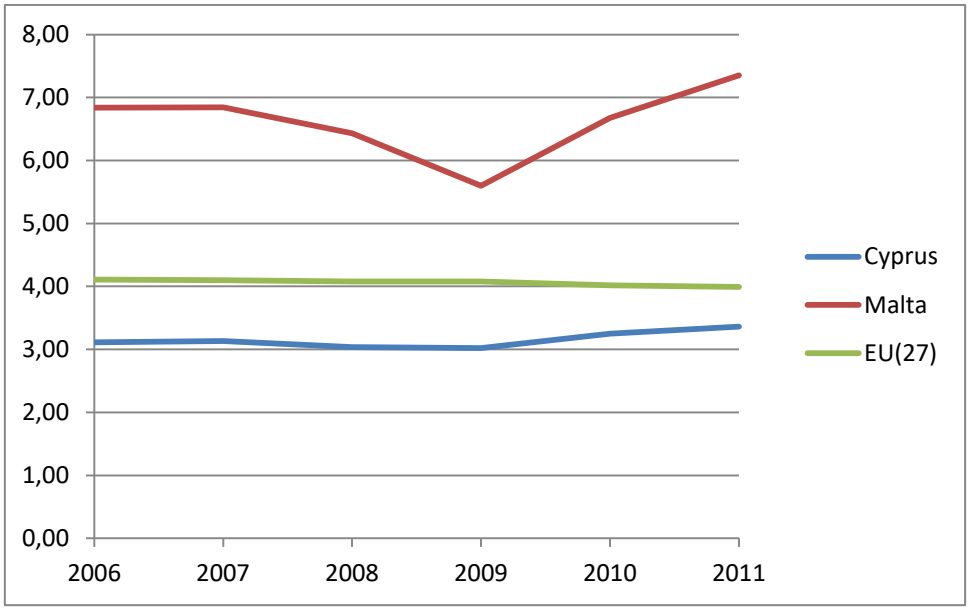
    Telecommunications – division 61:
    - Wired telecommunications activities – group 61.1
    - Wireless telecommunications activities – group 61.2
    - Satellite telecommunications activities – group 61.3
    - Other telecommunications activities – group 61.9

    - Software publishing – group 58.2
    - Computer programming, consultancy and related activities – division 62
        - class 62.01 – Computer programming activities
        - class 62.02 – Computer consultancy activities
        - class 62.03 – Computer facilities management activities
        - class 62.09 – Other information technology and computer service activities
    - Data processing, hosting and related activities; web portals – group 63.1
    - Repair of computers and communication equipment – group 95.1

The data presented in this section are based on the 2014 Predict Report (Mas & Radoselovics, 2014). The report provides a detailed descriptive analysis of the state of the Information and Communication Technologies (ICT) sector and its Research and Development (R&D) in the European Union and beyond. The sources of data are Eurostat and the OECD. It is noted that on Eurostat's website relevant data for Cyprus is flagged as confidential and thus, the only available source is the Predict report. According to the procedures applied in the European Statistical System data are flagged as confidential in order not to disclose the identity of enterprises. If any group contains less than three enterprises then this group and the total are flagged as confidential.

The ICT Sector Value Added in Cyprus in 2011 was 604,66 million euros accounting for 3,36% of the GDP. Figure 15 shows an increase in this share from 3,02% in 2009 to 3,36% in 2011 whereas in Malta the increase in the same years was bigger, from 5,60% to 7,35%. In the EU the share was slightly decreased, from 4,08% in 2009 to 3,99% in 2011.

Figure 15: ICT sector value added share of total value added

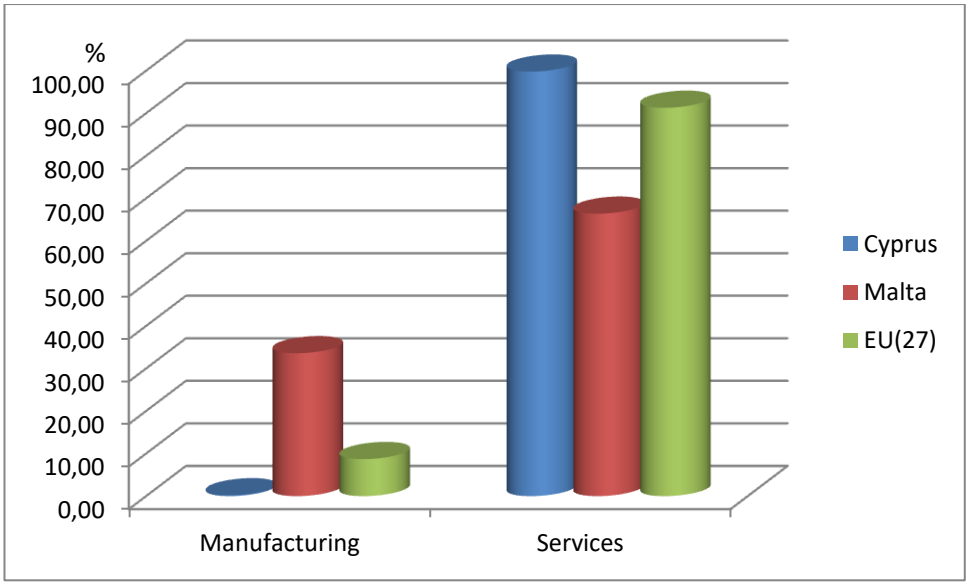


The ICT sector Value Added consists of the ICT Services and the ICT Manufacturing (Figure 16). For Cyprus, during the period 2006 to 2011 nearly 100% of the Value Added originates from ICT Services (98,9% in 2006 to 99,8% in 2011) in contrast with Malta for which the contribution of ICT Manufacturing is far more significant (30,1% in 2006 to 33,6% in 2011). In the EU27 the ICT Services contribute the most with the share reaching 91,3% in 2011 (from 87,8% in 2006).

The total ICT sector employment in Cyprus increased slightly from 6.390 persons in 2006 to 7.220 in 2011 and the ICT sector employment share of total employment in the respective years increased from 1,71% to 1,84%. The share of ICT Services on total employment ranged from 97% to 98%. In the case of Malta the ICT sector employment share of total employment was 3,9% in 2011

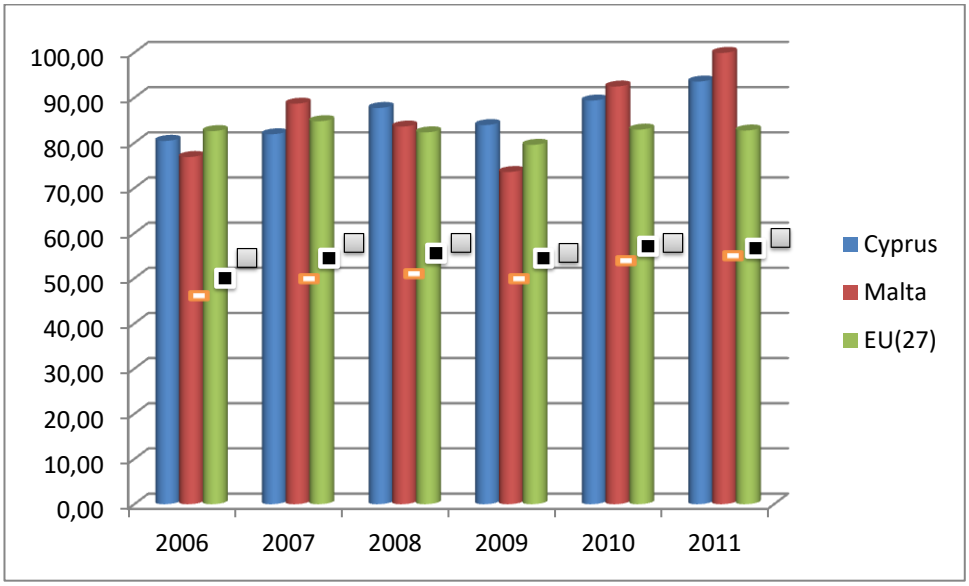
compared to 4,4% in 2006. In the EU27 the corresponding percentages were 2,7% (2011) and 2,6% (2006).

Figure 16: Distribution of VA shares for ICT manufacturing and ICT services, 2011



With the exception of 2009 there has been a steady annual increase of the labour productivity in the ICT sector of Cyprus during the period from 2006 to 2011. In 2011 the labour productivity in the ICT sector of Cyprus reached 93,59 thousand euros per person compared to 80,45 in 2006 (Figure 17) while the total labour productivity increased from 44,35 to 51,15 in the corresponding years and thus, in 2011 the ICT sector labour productivity was 83% higher than the total sector. In Malta, the labour productivity in the ICT sector reached 99,9 thousand euros per person in 2011, 88% higher than the total labour productivity. Comparing with the previous years it is observed that in 2009 there was a significant drop in both the total and the ICT sector labour productivity. However, in the next two years there has been a significant increase of the labour productivity. Comparing Cyprus with Malta the total labour productivity of the latter is consistently higher. As regards the labour productivity of the ICT sector during 2009 and 2011 an increase is observed in both countries, however, for Malta the increase is higher resulting to a bigger productivity during 2010 and 2011.

Figure 17: ICT Sector and Total Labour productivity in thousands of current euros in PPS, 2006 - 2011



5.2.3 Telecommunications

5.2.3.1 Background

The liberalisation of the telecommunication markets in the EU in the eighties and nineties had broken the decades long monopolies of the incumbent providers. The newly established alternative providers had to find ways to attract customers from the incumbents i.e. the traditional telephone companies that were generally state owned. History followed a similar pattern in the domestic telecommunication market of Cyprus in 1995 when the first internet service providers entered the market and in 2003 when the telecommunication market was officially liberalised. Alternative providers are following expansion strategies. Initially they targeted home users and small companies. Gradually they enriched their clientele with medium and large corporate organisations.

Since 2004, the competition between the providers had expanded into the pay TV market. Although competition is intense, the providers today have a very small penetration in the market. Hence there is plenty of ground for expansion.

Cyprus Telecommunications Authority or CYTA is the traditional incumbent telecommunications provider. It is a semi-governmental organisation that offers its customers a complete range of telecommunications services

adapted to market needs and uses the equipment, tools, and applications that modern technology offers. Its governing board comprises not more than seven members who serve for a five-year term and are appointed by the Council of Ministers. CYTA had enjoyed a monopoly on the Cyprus telecommunications market until the sector was liberalised in line with EU policy and requirements and private firms and companies were allowed to compete in the market. The Republic of Cyprus undertook all relevant necessary initiatives in order to complete the liberalisation process in the electronic communications sector and harmonisation with the acquis communautaire within the period 2002 and 2003. The procedure was primarily instituted in Cyprus by the establishment of the Office of the Commissioner of Telecommunications and Postal Regulations (OCTPR) in 2002.

The fact that it is state owned makes CYTA bureaucratic and slow to react to market demands. Furthermore it has strong unions that influence decision making to a great extent within the organisation. Despite the above negative points, it is generally accepted that CYTA is a forward looking and competitive organisation. This can be attributed to the fact that throughout the years it has been operated by entrepreneurial management. Since the eighties CYTA's overall strategy focused on two main goals. The first was to invest in building a reliable and technologically advanced network. The second was to establish itself as a telecommunications node in the eastern Mediterranean utilising its geographical position. The result of that strategy is a technologically advanced network within the country and a thorough fibre and satellite network linking the country with its three adjacent continents and beyond. It can be said that the choice of strategy of the eighties, as well as its implementation have been successful and is still paying dividends in today's national and global competitive environments.

The first wave of alternative providers appeared in the pre 2003 liberalisation era. Six main internet providers were established towards the end of the nineties offering internet connections and internet related services. Their target market ranged from home users to medium enterprises without a clear focus on particular market segments. Their effort was clearly to establish a customer base. Apparently, the domestic market was too small and demand for internet services too low for so many providers to survive.

The second wave of alternative providers appeared after January 1st 2003 when the market was officially liberalised. They seem to have learned from the experiences of the past and are more focused on their expansion strategy. They offer an enriched range of services including internet, fixed telephony and two of them offer pay TV.

CYTA has a significant market power in the following markets: voice telephony, land public networks, mobile telephony, mobile telephony networks, interconnection and leased lines.

In 2004 the regulator was renamed as the Office of the Commissioner of Electronic Communications and Postal Regulation (OCECPR). The OCECPR is headed by the Commissioner of Electronic Communications and Post who is appointed by the Council of Ministers for a period not exceeding six years. As the National Regulatory Authority in Cyprus the OCECPR is responsible for the ex-ante regulation of electronic communication matters apart from spectrum management which is regulated by the Department of Electronic Communication of the Ministry of Communication and Works.

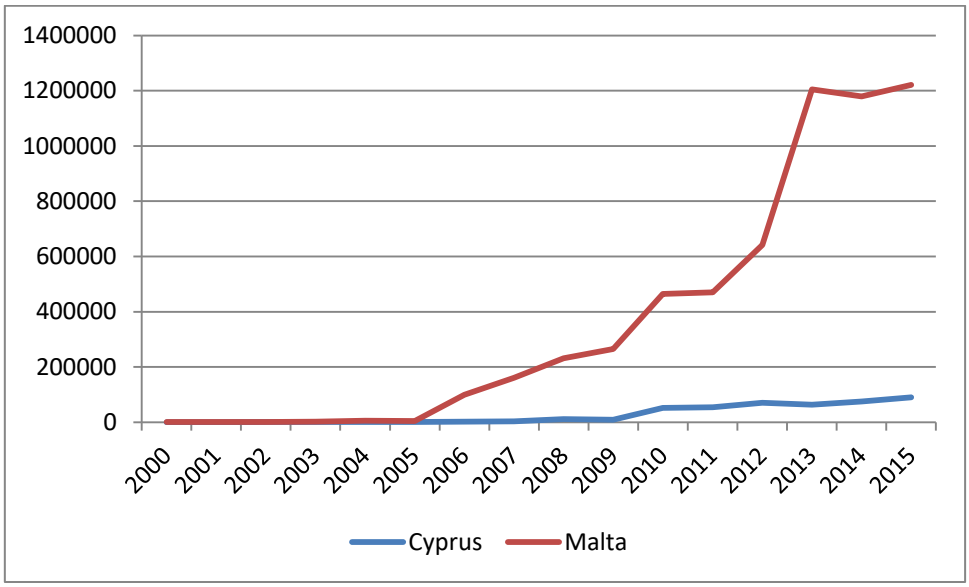
The Department of Electronic Communications, part of the Ministry of Communications and Works, is the regulatory authority for spectrum management and the implementation of the framework of electronic signatures. The Department advises the Minister of Communications and Works on all electronic communications matters and represents Cyprus in international organisations and EU committees. It also represents the Cyprus government in relevant international and regional telecommunications organisations and is the responsible authority for managing and implementing international obligations under conventions or other legal instruments of such organisations on technical, regulatory, management, and other related issues. Amongst others these organisations include the International Telecommunications Union, the European Conference of Postal telecommunications Administrations and the European Telecommunications Satellite Organisation. Since 2009, the Department of Electronic Communications has been responsible for the formulation and implementation of a comprehensive national strategy for the information society.

5.2.3.2 Internet

Internet access was introduced in Cyprus in September 1995 (e-MINDER, 2002). Since then the volume of internet traffic has been increasing rapidly. This increase is important as it reflects the increase of both the amount of data generated as well as the number of internet users.

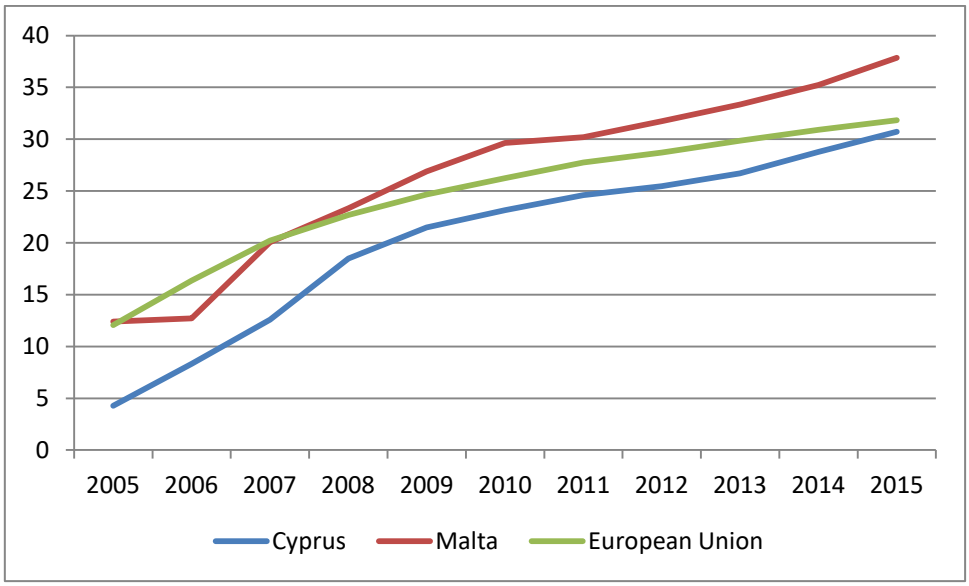
International Internet bandwidth per internet user is an important indicator that shows the total used capacity of international Internet bandwidth, in bits per second per Internet user. It is measured as the sum of used capacity of all Internet exchanges (locations where Internet traffic is exchanged) offering international bandwidth. Figure 18 shows the international Internet bandwidth per Internet user for both Cyprus and Malta. While in Cyprus a steady growth is observed throughout the years, in Malta the volume of internet traffic started to rose sharply in 2005. In 2015, there was a significant difference of the volume of internet traffic in the two countries. In Malta the volume reached 1.220.570 bits/s compared to just 89.791 bits/s in Cyprus. Various reasons can explain the continuing surge in internet traffic such as the availability of broadband connections, the continuous increase of maximum speeds and the usage of applications that need a great deal of bandwidth, for example streaming video.

Figure 18: International Internet bandwidth (bit/s) per Internet user, 2000 - 2015



Broadband has become the most common type for Internet access at home. According to Eurostat's glossary [22] broadband refers to telecommunications in which a wide band of frequencies is available to send data. Broadband telecommunication lines or connections are defined as those transporting data at high speeds, with a speed of data transfer for uploading and downloading data (also called capacity) equal to or higher than 144 kbits/s (kilobits per second). The technologies most widely used for broadband internet access are Digital Subscriber Line (DSL) and its variations (xDSL), or cable modem (connects the computer to a local television line). Figure 19 shows the number of fixed broadband subscriptions per 100 inhabitants. In 2015, the number of fixed broadband connections per 100 inhabitants in Malta reached 38 compared to 31 in Cyprus and 32 in the European Union. Since 2009 Malta has a higher number of fixed broadband connections per 100 inhabitants compared to both Cyprus and the EU.

Figure 19: Fixed-broadband subscriptions per 100 inhabitants, 2005 - 2015

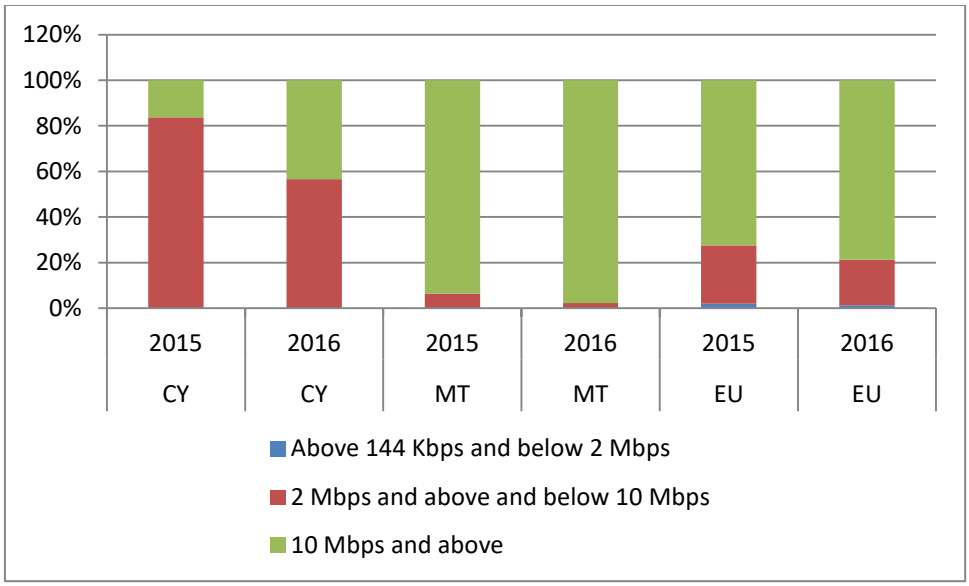


[22] http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Broadband

Everyone in the European Union can have access to broadband services, when considering fixed, mobile and also satellite technologies. Normally these technologies provide more than 2 Mbps. According to the data published by the DG Connect, the broadband connections in Cyprus are slow. Figure 20 shows the fixed broadband subscriptions by speed in 2015 and 2016 for Cyprus, Malta and the EU. Malta is currently the leader of fast broadband speed within the European Union. In particular, in 2016 98% of the fixed broadband connections had speeds of at least 10 Mbps. On the contrary Cyprus has the third lowest percentage (43%) from all the EU countries while at the same time the EU average is at 79%. In Belgium, Romania, Malta, Latvia, Portugal, Lithuania, Ireland, the Netherlands and Sweden, already more than 50% are at least 30 Mbps, while the same ratio is less than 10% in Italy, Greece, Cyprus and Croatia.

In 2015, there were 75 active mobile broadband subscriptions per 100 inhabitants in Cyprus. In Malta, this number was 63 while the EU average stood at 84%. Mobile broadband is often combined with a mobile telephony subscription especially for smartphones. There are also mobile broadband subscriptions that do not comprise mobile telephony that are best suited for use on laptops or tablets.

Figure 20: Fixed broadband subscriptions by speed, 2015 - 2016



According to the broadband internet access cost report for Cyprus (Van Dijk Management Consultants, 2015), in February of 2015 the large majority of broadband subscriptions were in the speed range 2 – 10 Mbps, which is slower than the EU28 average. Similarly, take-up offers with a speed of at least 30 Mbps is 5 times lower than the EU average with only 4,4% of the total number of subscriptions. Most popular bundles offers are triple play and double play including TV, which represent together around 45% of the Cypriot broadband market. The report concludes that the cheapest offers are generally more expensive than in the EU on average. The broadband prices have decreased between 2012 and 2015. Comparing with Malta the most popular offers are in the speed range 30-100 Mbps which is faster than the EU average and the most popular product on the Maltese broadband market is the triple play. The price of the least expensive offers in Malta is systematically higher than the corresponding EU average price. The price of the popular offers with speeds 30 and 100 Mbps have generally decreased between 2012 and 2015.

5.2.3.3 Telephone

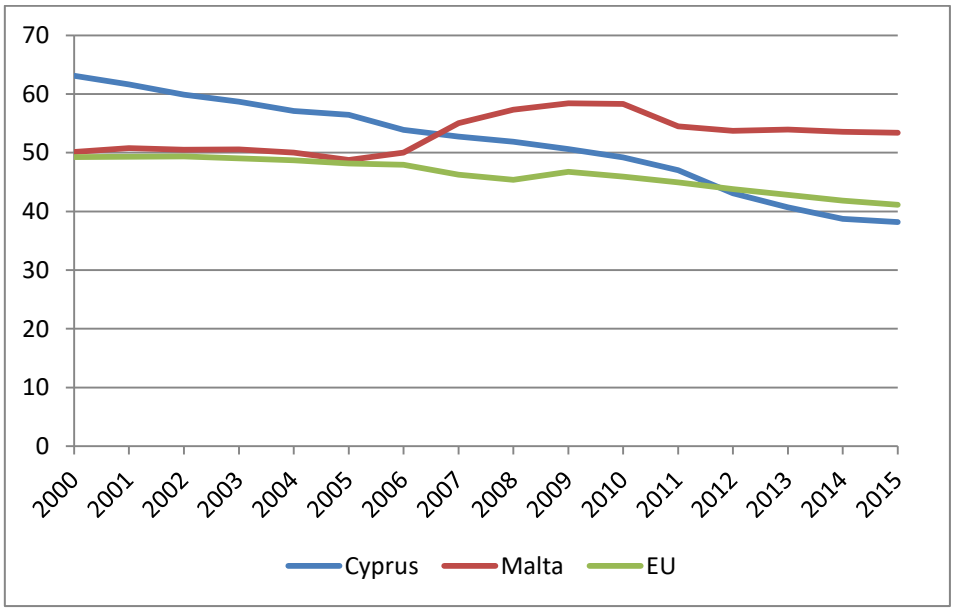
Cyprus' excellent telecommunications infrastructure has played a vital role in transforming the island into an internationally recognised commercial centre. The island has a fully digital network with reliable high-speed international connectivity via eight fibre optic submarine cables, including the world's longest optical submarine telecommunications cable, SEA-MEWE-3, which links directly with South East Asia, the Middle East and the rest of Western Europe. Cyprus' network boasts 100% broadband coverage, with DSL network capacities of at least 2Mbps.

Although the industry complies with the regulatory framework of the European Union, CYTA remains the main provider, offering a full range of telecommunications services. The other three main providers of fixed telephony are MTN, Cablenet and Primetel. CYTA has over the years maintained a dominant position in the fixed voice telephony sector. However, its market share is in constant decline, from 89% in 2010 to 77% in 2015. All four companies also offer mobile telephony, which is available throughout Cyprus.

Similarly to many other countries the telephone market in Cyprus has changed. The number of traditional analogue telephone connections has

decreased in favour of other technologies such as mobile phones and internet telephony. All households in Cyprus can be connected to the fixed telephone network which has national coverage. In 2015, Cyprus had 323.707 fixed telephone connections compared to 440.091 in year 2000. Figure 21 shows the number of connections per 100 inhabitants in Cyprus, Malta and the EU for the period from 2000 to 2015. In 2000 there were 63 fixed connections in Cyprus for every 100 inhabitants. The decrease that has occurred since then has also occurred in most of the EU countries. A different trend exists in the case of Malta where the number of fixed telephone subscriptions per 100 inhabitants not only decreased but increased from 50 in 2000 to 53 in 2015.

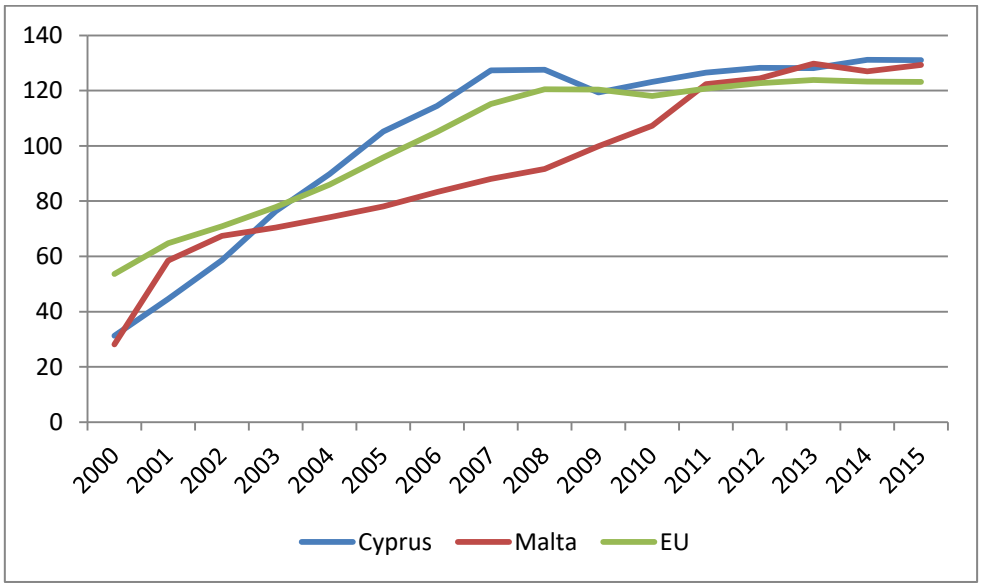
Figure 21: Fixed telephone subscriptions per 100 inhabitants, 2000 - 2015



In 2015, there were 1.111.123 mobile phone subscriptions in Cyprus. Since 2005 the total number of mobile connections exceeds the number of inhabitants, however, the market is not yet saturated as some people use multiple mobile telephones, for example, one for business use and one for personal use. Similarly to the rest of the EU countries, Cyprus has relatively many mobile telephone connections. Figure 22 shows the number of mobile telephone subscriptions per 100 inhabitants for Cyprus, Malta and the EU. Cyprus had 131 mobile telephone subscriptions per 100 inhabitants in 2015 which is slightly higher than in Malta (129) and the EU (123). In Cyprus,

however, there was a rapid increase in the use of mobile telephones until 2007 while in Malta the adoption of mobile telephony was at a slower pace. The mobile telephone subscriptions started to converge in the two countries from 2011 onwards. Since then the growth of mobile telephone subscriptions has been marginal to all the EU countries.

Figure 22: Mobile-cellular telephone subscriptions per 100 inhabitants, 2000 - 2015



5.2.4 ICT use by enterprises

Almost all enterprises in Cyprus now use basic ICT at least. The difference between the enterprises is not in whether they use ICT, but in how they use it. The decision on how advanced each enterprise should be is a matter of business economics and thus, not all companies should be equal in this respect. For instance, the development of an intranet should not be a priority for a small company whereas the intranet could be profitable for a large company.

The Statistical Service of Cyprus carries out since 2004 on an annual basis the ICT Usage and e-commerce survey in enterprises. The survey conforms to the European Regulation (EC) No. 808/2004 of the European Parliament and of the Council of 21 April 2004 concerning Community statistics on the information society. The objective of this Regulation is to establish a common framework for the systematic production of Community statistics on

the information society. The survey covers enterprises with ten or more employees for whom their main activity falls within NACE Rev. 2 sections C to N excluding section K and division 75 but includes group 95.1: manufacturing; electricity, gas, steam and air conditioning supply; water supply, sewerage and waste management; construction; wholesale and retail trade, repair of motor vehicles and motorcycles; transportation and storage; accommodation and food services activities; information and communication; real estate; professional, scientific and technical activities; administrative and support activities; and the repair of computers and communication equipment. The data is analysed according to enterprise size (in terms of persons employed), with data presented for small (10 – 49 persons employed), medium-sized (50-249) and large (250 or more persons employed) enterprises. As the survey is carried out in all EU member states based on the same regulation there are available comparable figures and thus, Cyprus is compared both to Malta and the EU28. However, a drawback is the fact that the survey do not cover the enterprises with less than 10 employees and as regards Cyprus those enterprises comprise the vast majority (92% of the total number of enterprises). All the figures presented here are retrieved from Eurostat's online databases. It should be noted that although the survey is being carried out since 2004 only the results from 2010 onwards are displayed here because the results of previous years are based on the NACE Rev 1 classification system whereas the latest results are based on the NACE Rev. 2 classification system and thus, comparison is not possible.

At the end of 2014, almost all enterprises with at least 10 employees in Cyprus were using computers, from 92% in 2010 to 97% in 2014. In Malta, the corresponding percentages were slightly higher, 96% and 98%. A similar pattern exists for the percentage of enterprises with internet access. In particular, in Cyprus the percentage of enterprises with internet access increased from 88% in 2010 to 95% in 2015. For both Malta and the EU28 in 2015 the percentage reached 97% compared to 94% in 2010.

The number of employed persons who use a computer with internet access at work is another illustration of computer and internet use. In 2010, 42% of employed persons in Cyprus used the computer at work and 34% used a computer with internet access. The corresponding percentages in 2015

increased to 46% and 39%. In 2015, in Malta 46% of all the employees used a computer at work with internet access compared to 49% to the EU28 average. The increase in the use of the internet can be considered as a growing recognition that the internet is a useful source of information or tool for workers. However, the number of employees who use the internet depends on the kind of work they do.

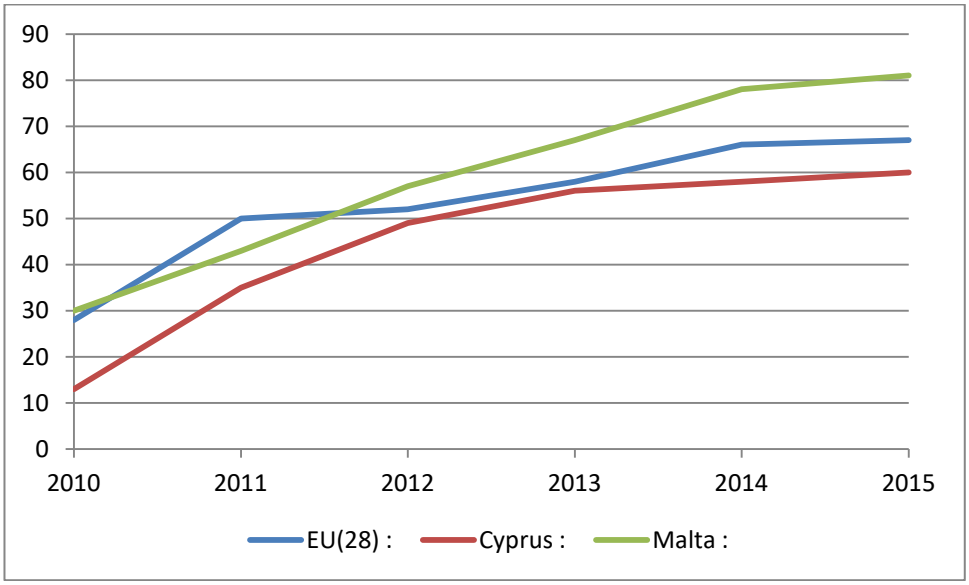
Since 2012 all enterprises in Cyprus and Malta with internet access have fixed broadband connections, 100% and 99% respectively. In 2015, similarly to the EU average, 95% of the enterprises in Cyprus had either a fixed or a mobile broadband access. In Malta the corresponding figure was slightly higher reaching 97%.The evolution of broadband access (fixed or mobile) to the total number of enterprises with ten or more employees in Cyprus, Malta and the EU28 during the period 2010 to 2015 is available in Table 15.

Table 15: Percentage of enterprises with broadband access (fixed or mobile)

	2010	2011	2012	2013	2014	2016
Cyprus	85	89	95	93	96	95
Malta	92	95	95	95	97	97
EU28	85	89	92	93	94	95

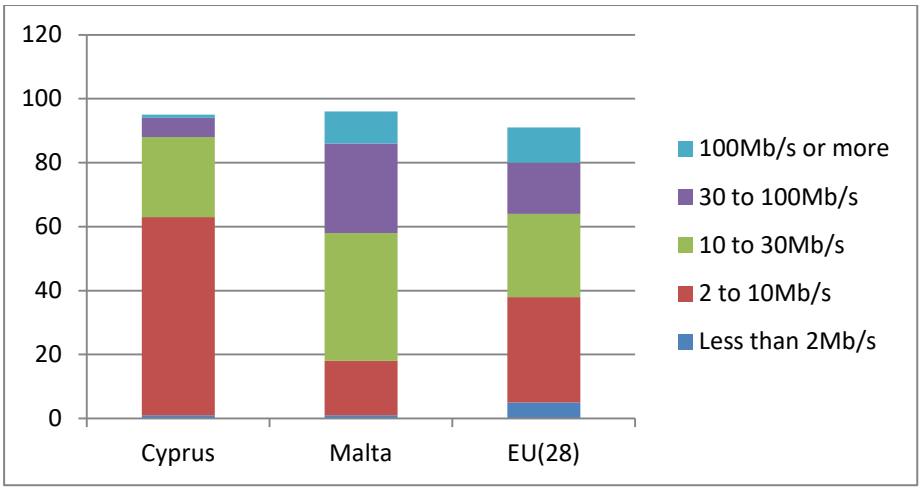
In Cyprus, since 2010 an annual increase is observed in mobile broadband connections (Figure 23). From 13% in 2010 the percentage of enterprises connecting to the Internet via a mobile broadband connection reached 60% in 2015. However, compared to Malta and the EU28 the percentage is consistently lower. In 2015, the percentage for Malta was 81% and for the EU 67%.

Figure 23: Mobile broadband connections in enterprises, 2010 - 2015



Cypriot enterprises have slower internet connections than the average in the EU (Figure 24). In 2015, 7 percent of Cypriot enterprises had an internet connection that was faster than 30 Mbps. The corresponding average in the EU was 27 percent. Maltese is a front runner where 38% of enterprises have a fast internet connection (>=30 Mbps). In Cyprus an internet connection with a speed between 2 and 10 Mbps is the most common (62%) whereas in Malta the most common speed is between 10 and 30 Mbps.

Figure 24: Maximun speed of fastest internet connections in enterprises, 2015



Three quarters (75%) of all enterprises in the EU28 had a website in 2015. Comparing with previous years it is observed that there has been a slow increase in this number, starting from 67% in 2010. In Cyprus, the number of enterprises having a website increased from 52% in 2010 to 72% in 2015. For Malta, the percentage in 2015 was higher than the EU28 average and reached 83% compared to 66% in 2010. As regards Cyprus the internet presence varied in 2015 from 68% for the small enterprises (10-49 persons) to 98% for the largest companies (employing 250 persons ad more). In Malta the corresponding percentages were 80%, 91% and 96%. The design and development of a website needs time and money. It requires more resources to operate and maintain a website than to maintain an internet connection. This may explain the fact that small companies do not yet have their own website.

For the purposes of the EU ICT Usage and e-commerce survey in enterprises e-commerce refers to the placement of orders (an order is a commitment to purchase goods or services) via computer networks. E-commerce may be effectively done via websites (which allow for online ordering or reservation or booking, e.g. shopping cart) or an exchange of electronic messages, EDI-type messages. EDI-type (Electronic Data Interchange) e-commerce refers to structured transmission of data or documents between enterprises by electronic means allowing automatic processing using for example EDI format or XML format. Orders via manually typed e-mails, however, are excluded. Delivery or payment via electronic means is not a requirement for an e-commerce transaction.

In 2015, 19% of enterprises in the EU28 have received orders via computer mediated networks. Comparing with 2010 when the percentage was 15% it can be deduced that there has been only a marginal increase. In Cyprus, the corresponding figure increased from 7% in 2010 to 11% in 2015. Comparing with the rest of the EU countries Cyprus has the seventh lowest percentage from all the 28 EU countries (for 2015). The percentage of enterprises in Malta that sold goods or services through e-commerce has remained relatively constant and close to the EU28 average, from 17% in 2010 to 19% in 2015. The share of enterprises with provisions to receive electronic orders depends largely on the sector of industry and the position of this sector in the economy. For

instance, investing in ICT development in the construction sector is less profitable than other sectors.

More enterprises purchase products than sell products electronically. In 2015, 40% of the enterprises in the EU28 have purchased via computer mediated networks compared to 37% in 2009 and thus, there has been no significant change. Similarly for Malta the percentage remained constant, from 23% in 2010 to 26% in 2015. A downward trend is observed in Cyprus for the enterprises that made e-commerce purchases, from 26% in 2010 to 22% in 2015. In the EU perspective, Cyprus had in 2015 the fifth lowest percentage of enterprises purchased via computer mediated networks.

5.2.5 ICT use by households and individuals

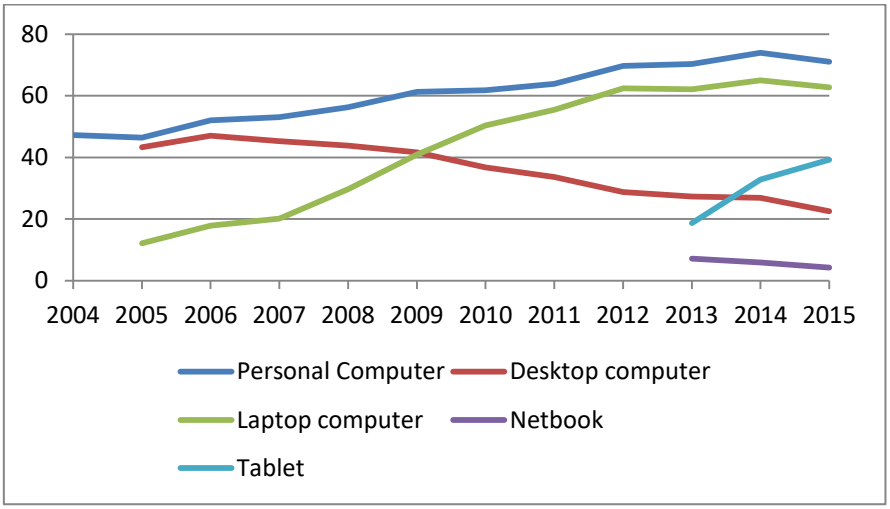
The Statistical Service of Cyprus carries out since 2004 on an annual basis the ICT Usage survey in households and by individuals. The survey conforms to the European Regulation (EC) No. 808/2004 of the European Parliament and of the Council of 21 April 2004 concerning Community statistics on the information society. The reference period for this survey is the first quarter of each year.

The household survey covers those households having at least one member in the age group 16 to 74 years old. Internet access of households refers to the percentage of households that have an internet access, so that anyone in the household could use the internet at home, if so desired, even simply to send an e-mail. Internet users are defined as all individuals aged 16–74 who had used the internet in the three months prior to the survey. Regular internet users are individuals who used the internet, on average, at least once a week in the three months prior to the survey.

The increasing digitalisation of society leaves its mark in the households (Table 16). Households own more and more information and communication media and are using them to an increasing extent. In 2004, nearly half of Cypriot households owned a PC (47%), by 2015 this had risen to 71% (Figure 25). During the period from 2004 to 2015 a change in the use of electronic equipment can be observed. In particular, the percentage of households with a desktop or a laptop is decreasing while the ownership of tablets is increasing significantly. In Malta the access to personal computers is broader. In 2015, 81% of Maltese households had access to a personal computer compared to

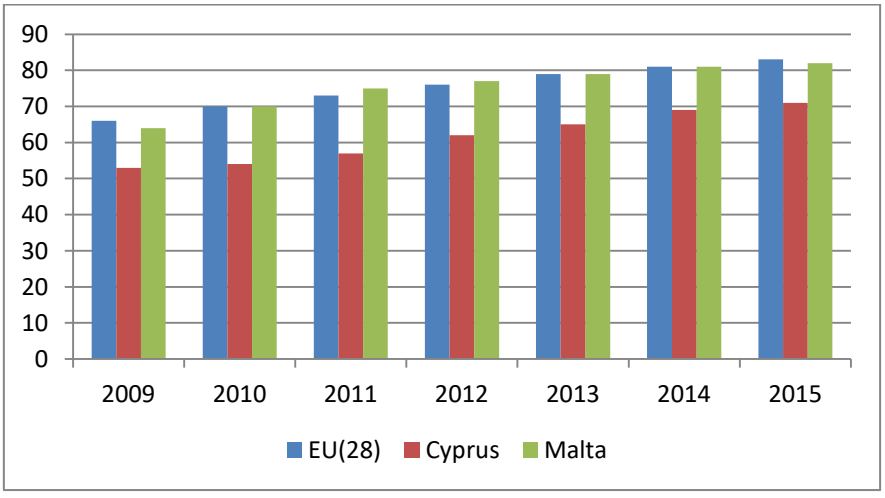
72% in 2009. Comparing the two countries it is worth noting that the level of access to a computer reached in Cyprus in 2015, in Malta was already reached in 2009. The percentage of Malta is close to the EU28 average, in 2015 reached 82%.

Figure 25: Households with a computer, 2004 - 2015



Internet access from the Cypriot households is about the same level as PC ownership, as all PC owners have an internet connection. Some 53% of households in Cyprus had access to the internet in 2009 (Figure 26). This had increased to 71% in 2015. The proportion of households in the EU28 with internet access continues to increase year by year and reached 83% in 2015 compared to 66% in 2009. In Malta, the proportion is consistently around the EU28 average, from 64% in 2009 to 82% in 2015%.

Figure 26: Households with internet access, 2009 - 2015



Broadband is currently by far the most common form of internet access in all EU Member States. 80% of the households in the EU28 had a broadband access in 2015 compared to 56% in 2009 (Table 16). In Cyprus there has been a continuous increase in the broadband connections which reached 71% of the households in 2015 compared to 47% in 2009 and thus, all connections are now broadband. A similar pattern is observed in Malta where the proportion increased from 63% to 82% in the corresponding years. The proportion of households in Malta with broadband access is consistently higher than both the EU28 and Cyprus average. Figure 27 shows the percentage of broadband internet connections as a percentage of households with internet access.

Figure 27: Broadband internet connections from households, 2007-2015

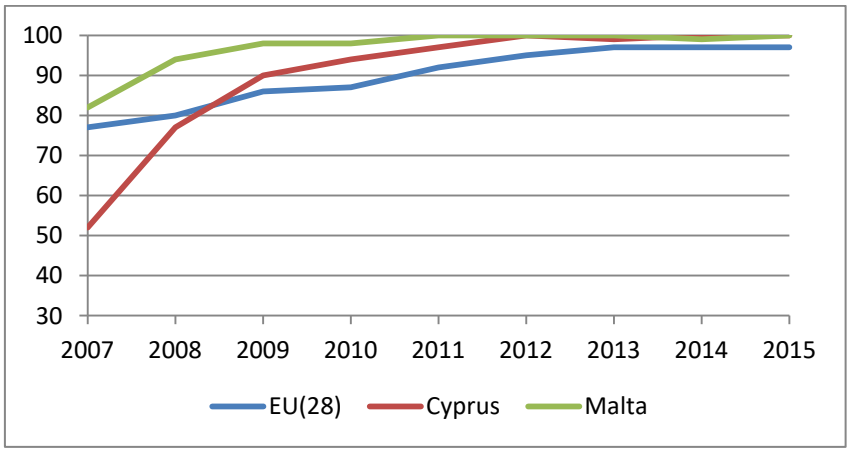


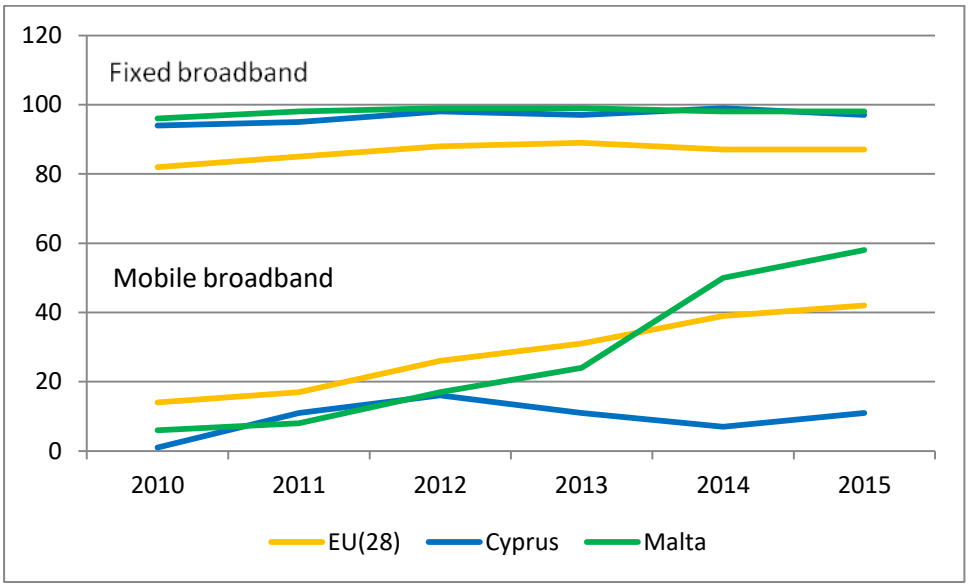
Table 16: ICT provisions of households, 2009 – 2015 (%)

		2009	2010	2011	2012	2013	2014	2015
PC	Cyprus	61	61	64	70	70	NA	71
	Malta	67	73	76	78	80	NA	81
	EU28	72	74	76	78	80	NA	82
Internet access	Cyprus	53	54	57	62	65	69	71
	Malta	64	70	75	77	79	81	82
	EU28	66	70	73	76	79	81	83
Broadband internet connection	Cyprus	47	51	56	62	64	69	71
	Malta	63	69	75	77	79	80	82
	EU28	56	61	67	72	76	78	80

NA: Not available

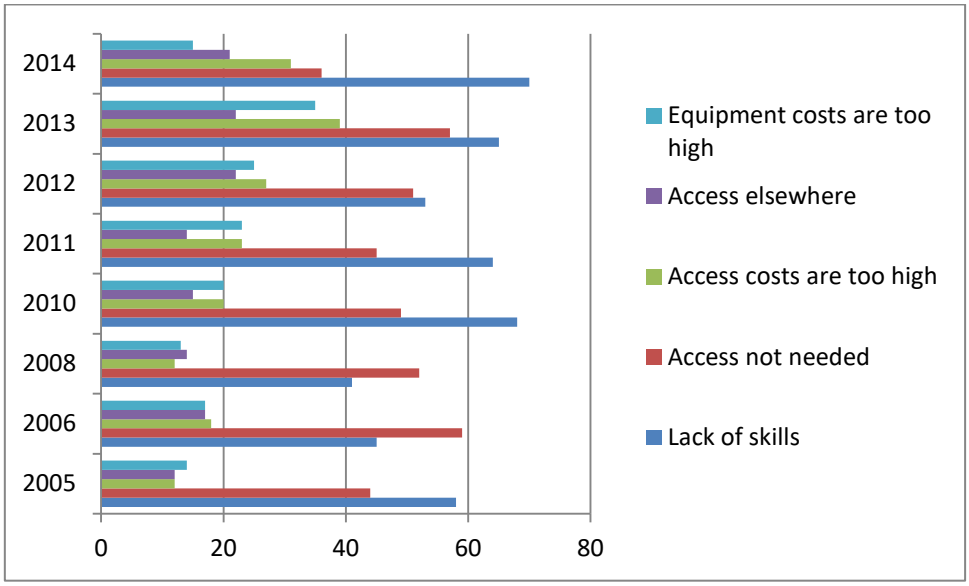
The vast majority of internet connections in the European households are fixed broadband connections (Figure 28) which include DSL, ADSL, VDSL, cable, optical fibre, satellite, public WiFi connections. With mobile broadband the connections are via mobile phone networks, at least 3G, e.g. UMTS, using SIM card or USB key, mobile phone or smart phone as modem. In 2015, the difference between Malta and Cyprus in using these kinds of connections is at its peak. Nearly six out of ten households in Malta use mobile broadband connections compared to just 11% in Cyprus. The corresponding EU28 average stands at 42%.

Figure 28: Fixed Vs Mobile broadband, 2010 - 2015



In Cyprus, the main reason or barrier for not having access to the Internet at home since 2010 has been the lack of sufficient knowledge to use or get access to the Internet and the perception that Internet access is too complicated (Figure 29). The second reason has been that people do not need the Internet maybe because they don't find it useful or interesting and the third reason relates to the high access costs which include the telephone charges, subscription fees for broadband etc. Other reasons concern the possibility of Internet access from other places such as workplace, and the high cost of equipment. Similar to Cyprus, in Malta the major two reasons for not having internet at home is the lack of skills and the belief that people don't need it.

Figure 29: Reasons for not having internet access at home, 2005 - 2014



The percentage of internet users in Cyprus is amongst the lowest in Europe. In 2015, the percentage of individuals aged between 16 and 74 years who used the internet in the last 12 months was 72% while the EU28 average was 81% and in Malta 77%. Since 2006 Malta has a higher percentage of internet users than Cyprus but both countries are below the EU28 average. The proportion of the EU28's total population that had never used the internet was 16% in 2015 down from 37% in 2007. The "Digital Agenda" had set a target that by 2015 not more than 15% of the EU population should have never used the internet and thus, this target is considered as accomplished. In Cyprus, the corresponding proportion was down to 26% in 2015 compared to 56% in 2007 and in Malta the proportions were 22% and 51% in the corresponding years.

In 2015, a significant increase is observed in the percentage of individuals in Cyprus who used internet every day in the last three months, from 81% in 2014 to 88% in 2015. This is higher than the EU28 average which was at 85% but lower than Malta (91%). In recent years the percentage of daily internet users has been consistently lower than the EU28 average. In 2015, 76% of individuals in the EU28 were regular users of the internet (at least weakly), a level of use meeting the digital agenda target of 75% that was set for 2015 (and met already from 2014). The corresponding proportion for Cyprus

reached 70% in 2015 compared to 35% in 2007. In Malta, the corresponding proportions were 74% and 43% in the respective years.

The proportion of individuals aged 16 to 74 in the EU28 who ordered goods or services over the internet for private use reached 53% in 2015, an increase of 23 percentage points compared with 2007. Thus, the digital agenda target to have 50% of the population buying online by 2015 has already been achieved a year earlier. In Cyprus, the online shopping is not popular. In 2015, the proportion of individuals who ordered goods or services for private use was 23% which is the third lowest percentage from all EU countries. In 2005 the proportion was just 10%. In Malta, the proportion is consistently close to the EU28 average and reached 51% in 2015 compared to 20% in 2007.

5.2.6 eGovernment

In 2014, 41% of Cypriots contacted or interacted with public authorities and public services for private purposes over the internet; this figure is below the EU28 average of 47% (Table 17). However comparing the values of Cyprus and the EU annually since 2008 it is observed that the difference has decreased to just 6 percentage points compared to 17 in 2008. A significant increase in the interaction with the public authorities is observed in Cyprus during 2014. In particular, the percentage of individuals who obtained information from public authority websites reached 41% compared to 29% in 2013 and 17% in 2008. The percentage of individuals who downloaded official forms reached 29% compared to just 12% in 2012. Finally, the percentage of the individuals who submitted completed forms was doubled in 2014 compared to the previous year and reached 19%. A similar positive trend is observed in both Malta and the whole of the EU28.

Table 17: eGovernment in Cyprus, Malta and the EU28, 2008 - 2014

Indicator (in % of all individuals)		2008	2009	2010	2011	2012	2013	2014
Citizens' use of eGovernment services, last 12 months	Cyprus	18	24	25	29	30	30	41
	Malta	25	34	37	37	41	32	40
	EU28	35	37	41	41	44	41	47
Citizens who obtained information from public authorities web sites, last 12 months	Cyprus	17	24	24	28	29	29	41
	Malta	23	32	35	28	36	27	38
	EU28	33	35	37	35	39	37	41
Citizens who downloaded official forms, last 12 months	Cyprus	12	18	19	21	24	20	29
	Malta	16	24	28	27	29	23	31
	EU28	23	24	26	25	27	25	29
Citizens who submitted completed forms, last 12 months	Cyprus	8	12	13	13	15	10	19
	Malta	9	16	15	16	17	13	20
	EU28	17	18	21	20	22	21	26

The development of eGovernment in Cyprus and Malta compared to the EU28 average score based on the latest available eGovernment State of Play report[23] is shown in Figure 30 and Figure 31 respectively. The first top-level benchmark, i.e. user centricity, consists of four indicators: online availability, usability, ease of use, and speed of use. A significant difference between the two countries is observed in all four indicators and consequently in the overall score of user centricity which in Malta reached 95 compared to 61 in Cyprus. The EU28 average as regards user centricity is 73. A similar situation occurs for the second benchmark which concerns the transparent government comprising of three indicators as follows: service delivery, public organisations and personal data. While Malta in all three indicators is very close to the saturation level Cyprus scores are very low and much less than the EU28 average. In Malta, the overall score on transparent government is 97 compared to just to 39 and 51 in Cyprus and the EU28 respectively. The third top-level benchmark is the cross border mobility. In this case four indicators are examined as follows: online availability, usability, ease of use and speed of use. Similarly to the first two Malta's scores are much higher. Malta's average reached 87 compared to

[23] https://joinup.ec.europa.eu/community/nifo/og_page/egovernment-factsheets#eGov2016

59 and 58 in Cyprus and the EU28 respectively. Finally, the fourth benchmark concerns the key enablers and to measure this there are five indicators defined as follows: electronic identification (eID), eDocuments, authentic sources, electronic safe (eSafe) and single sign on (SSO). Malta's average score is very close to the saturation level, i.e. 97, while in Cyprus and the EU28 the averages are 49 and 50 respectively.

Malta's performance in all the sixteen indicators on eGovernment is outstanding as all the scores are higher, and in some cases significantly higher, than the EU28 average. In contrast, Cyprus's performance is not so impressive as its scores are higher than the EU28 average in just six indicators. However, the overall score of Cyprus in all four top-level benchmarks is lower than the EU28 average.

Figure 30: eGovernment performance across policy priorities, Cyprus

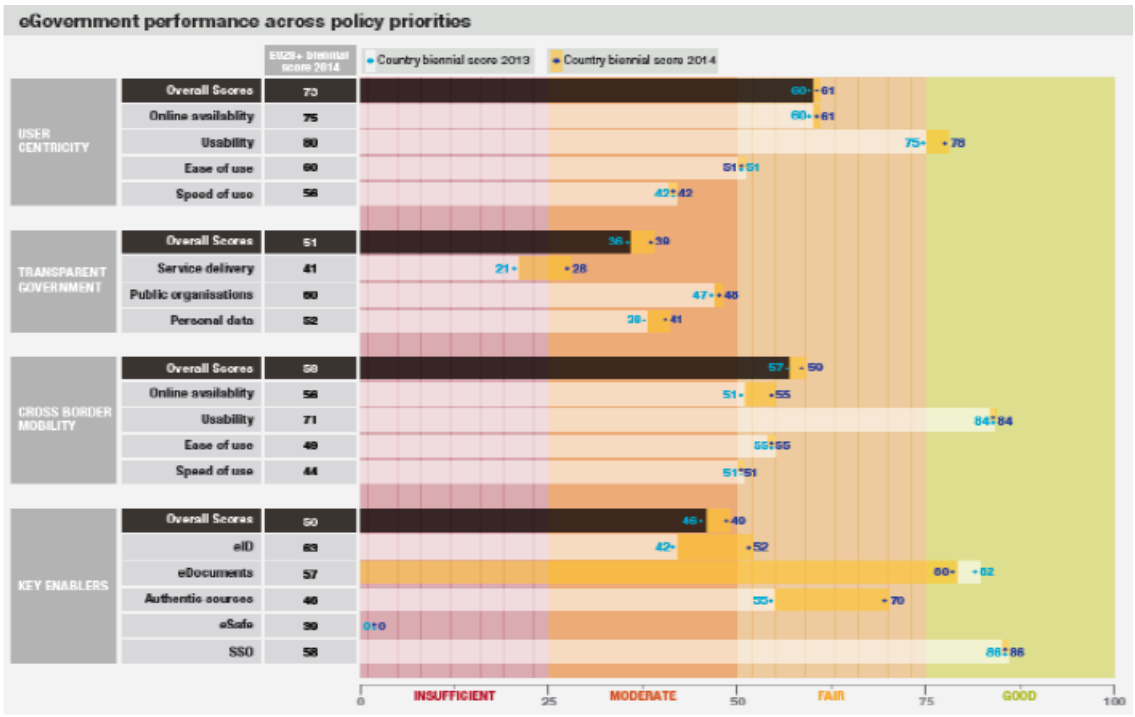
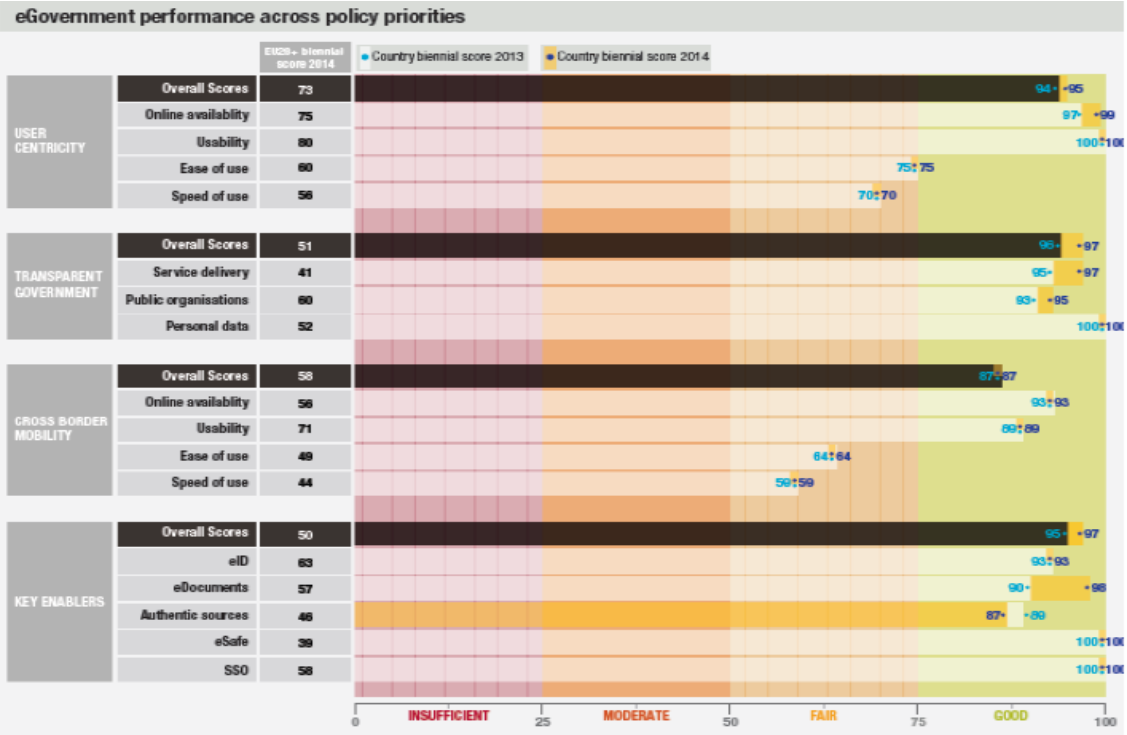


Figure 31: eGovernment performance across policy priorities, Malta



On the international scene the United Nations have been active in the area of eGovernment since 2003 when the conceptual framework on measuring the eGovernment developments was first developed (United Nations Department of Economic and Social Affairs, 2003). The methodological framework has remained consistent across survey periods while carefully updating its components to reflect evolving successful eGovernment strategies, pioneering practices and innovative approaches to tackling common challenges for sustainable development. The framework follows the developments based on three dimensions:

i. availability of online services
ii. telecommunication infrastructure
iii. human capacity.

The survey is carried out every two years and assesses the eGovernment development of all the UN member states. It is considered as a useful tool for decision makers to identify the areas of strength and challenges in eGovernment and to guide eGovernment policies and strategies. The

eGovernment Development Index (EGDI) is a composite indicator aimed to measure the willingness and capacity of national administrations to use information and communication technologies to deliver public services. Although the basic model has remained consistent, the exact meaning of the values varies between the various editions of the survey because both the potential of eGovernment and the underlying technology change. The EGDI is a weighted average of three normalized scores on the following dimensions: scope and quality of online services (Online Service Index), development status of telecommunication infrastructure (Telecommunication Infrastructure Index) and inherent human capital (Human Capital Index). Each one of these indices is in itself a composite measure that can be extracted and analyzed independently. The EGDI is used as a benchmark to provide a numerical ranking of eGovernment development across the UN member states. It is noted that before 2010 the indicator was named as eGovernment Readiness Index. The term development was introduced in the 2010 survey because it describes how far governments have actually advanced in the field instead of how ready or able they might be to do so.

Table 18 shows the evolution of the eGovernment Development Index for Cyprus and Malta from 2003 to 2014. From the creation of the index in 2003 until 2008 a continuous increase in the ranking of Cyprus is observed (51st in 2003, 35th in 2008). However from 2010 onwards this trend changed and in 2014 the ranking of Cyprus fall to 58 out of 193 countries. This may be attributed to the fact that the United Nations Department of Economic and Social Affairs introduced significant changes to the 2010 survey, focusing more on how governments are using websites and Web portals to deliver public services and expand opportunities for citizens to participate in decision making. The number of questions increased from 86 in 2008 to 95 in 2010. Twenty five questions were added and 16 questions removed from the questionnaire and twenty nine questions were modified. A similar pattern is also observed for Malta however, the ranking of Malta has been consistently higher compared to Cyprus.

Table 18: eGovernment Development Index for Cyprus and Malta, 2003 – 2014*

	2003	2004	2005	2008	2010	2012	2014
Cyprus	51/173	49/178	37/179	35/182	42/183	45/190	58/193
Malta	27/173	21/178	21/179	29/182	30/183	35/190	40/193

* The first number denotes the ranking and the second the total number of countries in the corresponding year

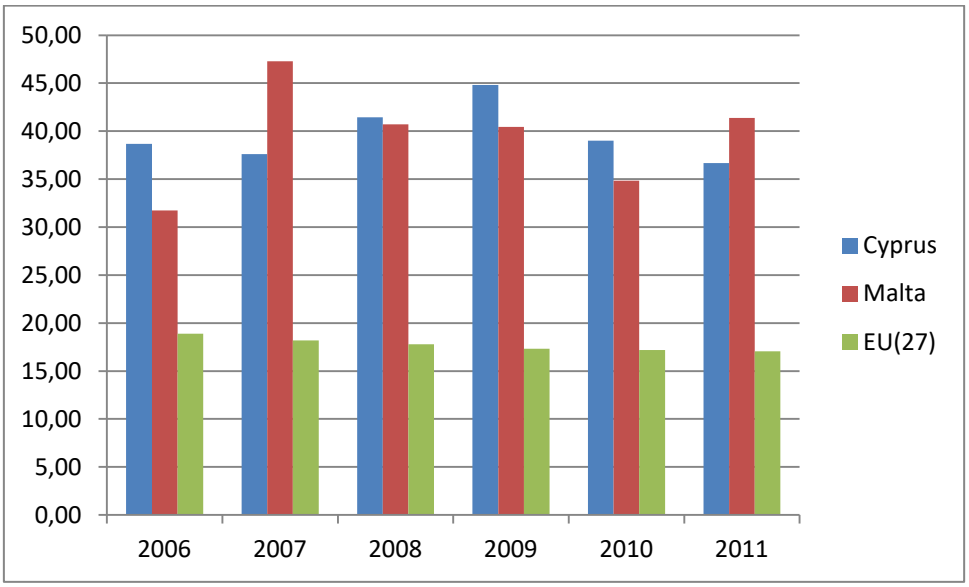
5.2.7 ICT related knowledge development

This section addresses the relationship between ICT and knowledge by examining three different aspects. First, is the Research and Development expenditure by the ICT sector. What does research and development at Cypriot ICT companies entail? The answer to this question provides insight into the development of new ICT knowledge. ICT education is the second issue discussed while the third section describes the ICT skills of the population which can be seen as one of the many expressions of ICT knowledge.

5.2.7.1 R&D Expenditure by the ICT sector

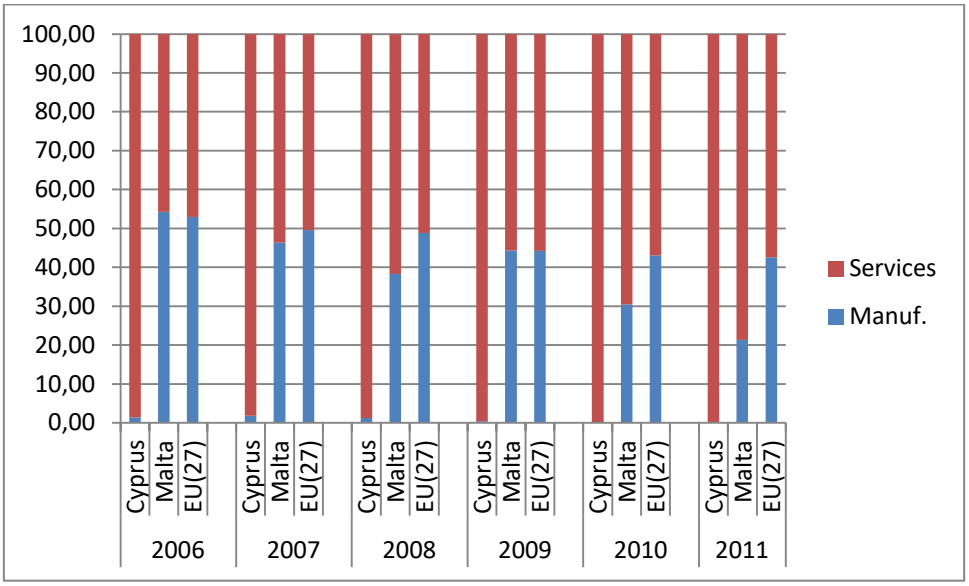
Similarly to Section 5.2.2.2 the data presented in this section are based on the 2014 Predict Report (Mas & Radoselovics, 2014). In 2011, Cyprus ICT sector Business Enterprise Expenditure on R&D (ICT BERD) amounted to 4,7 million euros, 19% less than in 2010 (5,8 million euros). This represented 36,7% of the total Cyprus BERD in 2011. At Malta, the ICT BERD in 2011 was 13 million euros, significantly higher than the 9,1 million euros of the previous year. The ICT BERD share of total BERD was 41,4% in 2011. As regards the EU27 the share of ICT BERD was significantly lower compared to the two countries as it reached 17%. In absolute terms, in 2011 the ICT BERD for Malta amounted to 13 million euros while for the EU27 to 27,9 billion euros. Figure 32 shows the development of ICT BERD share of total BERD for Cyprus, Malta and the EU27 during the period 2006-2011.

Figure 32: ICT BERD share of total BERD, 2006-2011



As regards the contribution of ICT BERD in manufacturing to the total ICT BERD in Cyprus it is nearly nonexistent. In 2010 and 2011 the contribution of the manufacturing sector was zero while in the previous years has never exceeded the 2% (Figure 33). For Malta the ICT BERD in manufacturing decreases every year and as a result it reached 21% in 2011 compared to 54% in 2006. A similar trend is observed in the case of the EU27 for which the contribution of the ICT BERD in manufacturing reached 42% in 2011 compared to 53% in 2006. In 2011, only four EU countries recorded more ICT BERD in manufacturing than in services. Finland led with a share of 85,6%, followed by Sweden (83.5%), Germany (52.4%) and Austria (50.6%). Figure 33 shows the distribution of ICT BERD between ICT manufacturing and ICT services during 2006 and 2011 for Cyprus, Malta and the EU27.

Figure 33: Distribution of ICT BERD between ICT Manufacturing and ICT Services, 2006 - 2011



ICT BERD intensity is defined as the ratio of ICT BERD to ICT VA. In Cyprus in 2011 the ICT BERD intensity amounted to 0,77%. Compared to Malta the ICT BERD intensity was higher and reached 2,7%. The average figure for the EU27 was 5,5%. As shown in Table 19 Cyprus had a significant drop of 0,25 percentage points in 2011 compared to 2010 while for Malta an increase of 0,53 percentage points is observed in the same period. As regards the EU27 there is not much variability in the ICT BERD intensity during the period 2006 to 2011.

Table 19: ICT BERD intensity, 2006 - 2011

	2006	2007	2008	2009	2010	2011
Cyprus	1,20	1,22	1,33	1,45	1,02	0,77
Malta	1,84	2,59	2,27	2,44	2,14	2,67
EU27	5,37	5,22	5,28	5,27	5,31	5,51

In 2012, the public funding of ICT Research and Development in Cyprus amounted to 1,38 million euros which is lowest amount spent during the period from 2006 to 2012.The share of public funding of ICT R&D to the total Cyprus public funding was 1,98% in 2012 which again is the lowest for the period under examination. However for Malta the share is consistently very low and the maximum percentage was observed in 2008 when it reached 0,78%.For the EU27 the share is stable ranging from 6,09% in 2012 to 6,37% in 2006.

In 2011, ICT sector R&D personnel (including both researchers and R&D supporting staff) made up 1,47% of total ICT sector employment in Cyprus. This share has been the lowest between 2006 and 2011. The highest percentage reached 2,17% in 2009. Comparing with Malta, the shares of which are throughout this period consistently higher, in 2011 the share reached its highest value at 6,39% while the lowest share was observed in 2006 when the value was 2,61%. As regards the EU27 not much variability is observed, the highest share recorded in 2011 at 4,30% while the lowest in 2008 at 3,94%. In terms of ICT R&D personnel over total R&D personnel both Cyprus and Malta have higher percentages compared to the EU27. In 2011, the shares in Cyprus and Malta reached 39,55% and 41,81% compared to 19,21% of the EU27. As regards the distribution of ICT sector R&D personnel between ICT manufacturing and ICT services in 2010 and 2011, for Cyprus 100% of the personnel were working in the ICT services sector while for Malta around 90% were recorded in this sector. In the EU27 around 69% of the personnel were working in the services sector.

5.2.7.2 ICT Education

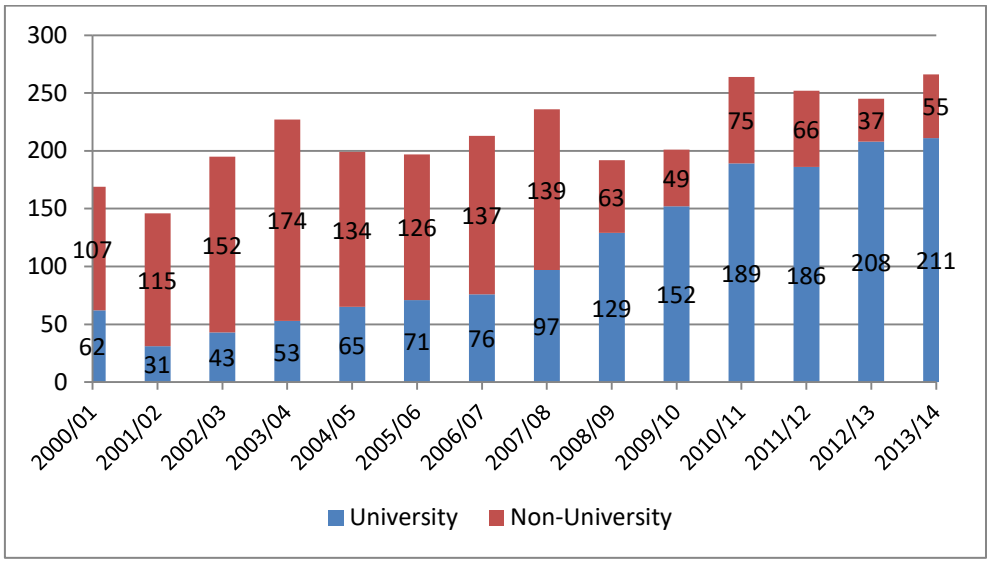
National performance in education gives an indication of the country's knowledge supply. A higher degree of education in a country means that more people in that country have attained a certain level of education. In this respect the educational system of Cyprus is examined with a focus on higher education, the number of first year ICT students and the ICT graduates.

The goal of higher education is primarily to increase the number of highly qualified people on the labour market. There have been major developments in higher education in the last twenty years. In 2015 the percentage of the Cypriot population aged 30-34 who have successfully completed tertiary studies

reached 55% compared to 28% and 39% in Malta and the EU28 respectively. Early leavers from education and training as a percentage of the population aged 18-24 was 5%, 20% and 11% in Cyprus, Malta and the EU28 respectively. In 2012 there were 25.500 students studying in another European country compared to just 7.500 students in 2001. In the case of Malta in 2012 there were just 1.400 students studying in another European country. Since joining the EU in 2004, the number of foreign students studying in Cyprus has doubled and today 30% of students are foreigners. The widespread use of English, the application of EU standards, a safe environment and good weather, all make the island an ideal place for foreign students seeking a rigorous, value-for-money education.

In study year 2011/12, from a total of 11.344 students in public university institutions 730 of them (6,4%) followed a Computer Science field of study while in private institutions the percentage is significantly lower as there were 458 students in Computer Science from a total of 23.305 students (1,9%). In study year 2010/2011 there were 102 graduates in Computer Science from a total of 1.909 (5,3%) graduates in public university institutions and at the same time there were 87 (0,2%) graduates in Computer Science from a total of 3.570 students in private university institutions. Figure 34 shows the number of graduates in the field of Computer Science at both university and non-university level for the period 2000 to 2013. Since study year 2008/2009 the number of graduates at university level has exceeded the number at non-university level and this is due to the functioning of private universities. In total the number of graduates in the field of computer science at both university and non-university level has reached 266 in the study year 2013/14 and this number represents the 3,9% of the total number of graduates in all fields of study. It is noted however that the number of graduates refers only to universities in Cyprus and does not contain the graduates from universities abroad as this information is not available. Compared to Malta's corresponding figure which stands at 9% Cyprus's number of graduates in the field of computer science is much lower.

Figure 34: Graduates in Computer Science, 2000-2013



5.2.7.3 ICT Skills

Computer and internet skills are important to be able to use ICT effectively. In the framework of the annual ICT use survey by households and individuals the computer skills are measured by asking the respondents about their activities on the computer. The computer activities measured are:

- Copying or moving a file or folder;
- Copying and pasting information in a document;
- Using simple formulas in a spreadsheet;
- Compressing folders or files;
- Installing new hardware such as printer or model;
- Writing a computer program in a programming language.

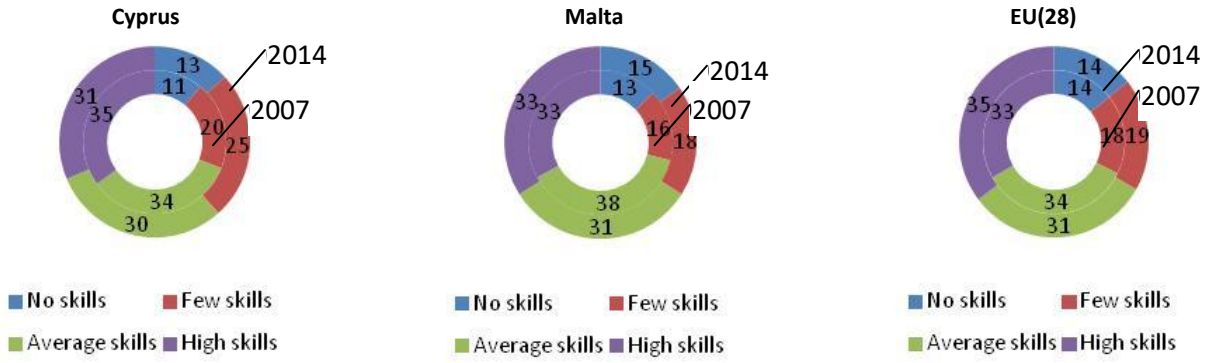
Based on the number of activities they perform the respondents are classified into four categories as follows:

i. No skills: not done any of the listed activities;
ii. Few skills: done one or two of the listed activities;
iii. Average skills: done three or four of the listed activities;
iv. High skills: done five or six of the listed activities.

Comparing 2007 to 2014 it can be observed that for Cyprus the percentage of computer users with average or high computer skills decreased from 69% to 61% (Figure 35). A decrease was also observed in the case of Malta where the percentage in the two years dropped from 71% to 64%. However the number of computer users with high or average skills in Malta is consistently higher than the number in Cyprus. As regards the EU28 there has been no significant change, 67% in 2007 and 66% in 2014.

In 2014, most computers users in Cyprus were able to copy or move files and folders (85%), a percentage which is higher than in Malta (76%) and the EU28 (79%). 80% of the computer users in Cyprus cut and paste information, 50% use formulas in a spreadsheet and 48% installed new hardware such as printer or modem.

Figure 35: Computer skills of all computer users, 2007 - 2014



Based on the EU survey on ICT by households the internet skills are measured on the basis of activities respondents undertook on the internet. The activities examined are the following:

- Using a search engine to find information;
- Sending an e-mail including documents;
- Leaving messages in chat rooms, news groups or forums;
- Using the internet to make phone calls;
- Sharing files to exchange music, films etc;
- Designing a web page.

Respondents are classified into the following categories:

- No skills: not done any of the listed activities;
- Few skills: done one or two of the listed activities;
- Average skills: done three or four of the listed activities;
- High skills: done five or six of the listed activities.

In 2014, 65 percent of internet users in Cyprus appeared to have an average or high level on internet skills. The remaining 35 percent of internet users had few or no skills, but this share is smaller than in previous years. For Malta the corresponding figure was 60 percent and for the EU28 59%.

5.2.8 Analysis of the results

Based on the model proposed by the OECD, the information society in Cyprus is measured by using several available well defined and measured indicators (Appendix 9). The indicators are classified in four groups. The first group concerns the ICT supply, the second is about the infrastructure, the third group examines the ICT use and finally, the fourth group looks into the ICT related knowledge development. The first three groups correspond to the components of the OECD model while the fourth, ICT related knowledge development, has been included due to the importance of diffusion and expansion of ICT knowledge.

The analysis of the ICT supply side contains the examination of the ICT sector value added share of total value added, the distribution of Value Added shares for ICT manufacturing and ICT services, the ICT sector employment and the ICT sector labour productivity. From the analysis of the ICT supply side it can be deduced that Cyprus is lagging behind Malta and the EU28. In Malta the contribution of the ICT sector to the GDP is almost double than in Cyprus and significantly higher than in the EU28 which in turn is consistently higher than in Cyprus. A significant difference between the two countries is that in the case of Cyprus nearly 100% of the value added comes from the ICT services whereas in Malta there is a significant contribution, around 33%, from the ICT manufacturing. Similar to Cyprus, in the total of EU the major contribution comes from ICT services which accounts around 90% of the total ICT sector.

Due to the fact that in Malta there is a significant contribution of ICT manufacturing, the ICT sector employment is far more significant compared to Cyprus (and the EU). While in Cyprus the ICT sector employment lies around 1,8% of the total employment in the case of Malta the share is around 40%. As regards the ICT sector productivity in Malta is consistently higher than in Cyprus.

The Cyprus economy faced a major challenge in the recent years and the international economic crisis of 2008 had a major role to play for that while Malta was not significantly affected. Cyprus economy is more susceptible to external factors as it is mainly based on services. Malta has invested in ICT manufacturing and this might be a reason for its better and more stable economic performance.

The solid infrastructure is a vital prerequisite for the efficient utilization of the information and communication technologies. In this respect the assessment of the telecommunications infrastructure is essential and in this framework the focus of this research is on the internet and telephony. The first indicator examined that is related to the internet is the international bandwidth per internet user. The higher the value is the more usage of internet is implied. While in Cyprus a small annual growth is observed, in Malta a significant annual increase is observed since 2005. The divergence of the two countries was at its peak in 2015. Not only Malta has more fixed broadband connections per 100 inhabitants than both Cyprus and the EU28 but Malta has become the leader of fast broadband speed within the European Union. Compared to the rest of the European Union countries Cyprus has very slow internet connection speeds. As regards the prices of broadband subscriptions in both countries the costs are higher than the EU average. The only indicator from all examined that Cyprus performs better than Malta is the active mobile broadband subscriptions per 100 inhabitants. This may be attributed to the offers made by the service providers in the two countries.

The way in which the Cypriot citizens are using telephony is changing rapidly. Fewer households have a fixed telephone connection and at the same time the number of mobile subscriptions is growing. However in Malta the number of fixed telephone subscriptions per 100 inhabitants is higher than Cyprus since 2008 and stable since 2011 while in Cyprus the number has been

declining since 2000. Since 2011 the mobile cellular telephone subscriptions per 100 inhabitants in the two countries started to converge. In the previous years the adoption of mobile phones in Malta was lower compared to Cyprus.

The third pillar of the model examined concerns the ICT use side which includes enterprises, households and the public sector. Nearly all enterprises with at least ten employees in Cyprus and Malta are using computers with internet access. Difference is observed between the two countries in the number of employees who used a computer with internet access. While in the EU and in Malta nearly half of all the employees are using the internet, in Cyprus the proportion is limited to nearly four out of ten employees. All enterprises in Cyprus and Malta with internet access have fixed broadband connections. However a significant difference is observed in the speed of internet connections. In Malta, nearly four out of ten enterprises have fast internet connections (i.e. >30 Mbps) and in Cyprus only seven out of one hundred. Mobile broadband connections in enterprises are more common in Malta than in Cyprus. Eight out of ten Maltese enterprises offer to the employees mobile broadband connections while in Cyprus only six out of ten enterprises have this type of connection. The Maltese enterprises soon realised the benefits of having a website. Since 2010 the percentage of enterprises in Malta having a website has been consistently higher than in Cyprus and the EU28. Although in general e-commerce is not yet very popular amongst the EU countries, throughout the recent years the enterprises in Malta are utilizing more the benefits of e-commerce compared to Cyprus. Two and one out of ten enterprises in Malta and Cyprus respectively have received orders via computer mediated networks. However, more enterprises purchase products than sell products electronically. In 2015, 26% and 22% of the Maltese and Cypriot enterprises respectively have purchased products via computer mediated networks.

A change in the use of electronic equipment by the households is observed in the recent years. Desktops and laptops are becoming less popular while the use of tablets is increasing significantly. In Malta the percentage of households with internet access is consistently higher than in Cyprus despite the fact that every year the percentage increases in both countries. In 2015, 83% of the households in Malta had internet access and in Cyprus the

percentage stood at 71%. In the EU, nearly all internet connections from the households are now broadband. However Malta was one of the first European countries to invest in broadband technology and thus, already in 2005 the percentage of households with broadband access was close to 60%. Cyprus and Malta are near to saturation levels as regards the fixed broadband connections whereas the EU average is lower. While in Malta there is a continuous growth in mobile broadband connections, in Cyprus this type of connection is not very popular and instead, since 2012 the percentage of households using mobile broadband connections is decreasing. The Maltese people are more familiar to the internet than the Cypriots. In 2015, 77% of Maltese used the internet compared to 72% in Cyprus. However, the percentage of Cypriots who use the internet daily (88%) is higher than the EU average and close to Malta (91%). In Cyprus, the online shopping is not popular and as a result the percentage of individuals who ordered goods or services is one of lowest in the EU (23%). On the contrary, for Malta the percentage is consistently close to the EU average and reached 51% in 2015, i.e. one in two individuals make orders online.

As regards the third category of ICT use, i.e. the public sector, Malta's performance is exceptional in both the European and the international perspective. Although in the case of Cyprus some progress can be observed its performance is not as impressive as in the case of Malta. With the exception of year 2014, the percentage of citizens in Malta who used eGovernment services was consistently higher than in Cyprus. Malta's performance in the development of eGovernment as assessed by the European Union and presented in the eGovernment State of Play report has been impressive and can be considered as an example of best practice. The success of eGovernment in Malta is also reflected in the eGovernment Development Index compiled by the United Nations. According to this index Malta's ranking has been consistently higher than Cyprus.

The fourth pillar of the information society statistics conceptual model that has been applied in measuring the information society in Cyprus concerns the relationship between ICT and knowledge. Research and Development is a fundamental aspect of an economy's innovative capacity. Business Enterprise Expenditure on Research and Development (BERD) is considered important for

innovation and economic growth. A way to examine the importance of ICT investment in the economy is to look at the percentage of ICT BERD as a percentage of total BERD. In both Cyprus and Malta the ICT BERD over the total BERD is more than double the corresponding EU27 average and thus, it can be deduced that the development of new ICT knowledge is important for the firms in the two countries. During the period 2006 to 2011 in all but two years (2007 and 2011) Cyprus had a higher ratio of ICT to total BERD compared to Malta. R&D in ICT's can be split into two categories: manufacturing and services. As explained earlier, in Cyprus, there is no contribution from ICT manufacturing sector and thus, the contribution of ICT BERD in manufacturing to the total ICT BERD in non-existent whereas in Malta the ratio was 21% and in the EU27 42%. The ICT BERD intensity shows if there is a specialization in the overall ICT sector. In Malta the ICT BERD intensity is consistently higher compared to Cyprus but lower compared to the EU27 average. In Cyprus the share of public funding of ICT R&D to the total public funding is higher in Cyprus compared to Malta.

Cyprus spends around 7% of GDP on education, ranking the country in third place among the EU27 behind Sweden and Finland and followed by Malta (6,9%). More than 50% of Cypriots aged 30 to 34 have university degrees, putting the island well above the EU average and Malta. In general, Cypriots are well educated and major emphasis is given to the investment in education as is the case of Malta. No significant differences are observed in the ICT skills of the people in the two countries under examination.

In this section the results of applying the framework model to Cyprus are being discussed. Cyprus is compared to Malta, a country with similar characteristics, and the EU28. The comparison shows that Cyprus is lagging behind both Malta and the average of the EU countries. Taking into consideration the results of this quantitative analysis as well as the general situation in Cyprus as regards the development of the information society, the next section describes specific measures that could enable the whole process.

5.3 Proposals

In the light of the findings of the literature review and based on the experiences of other countries and in particular of Malta, this section provides five concrete proposals for the successful conversion of Cyprus into an information society and thus, the answer to the fourth research question.

The importance of having a national information strategy has been well acknowledged by countries during the last three decades. For instance, in Singapore, the government set up the National Computer Board (NCB) in 1981 to spearhead Singapore's entry into the Information Age (Arun, 1999). The first national IT plan was launched in 1986 and in 1992 the NCB released the strategic vision for Singapore's IT development in the following 15 years. The strategy was based on three pillars, first to realise the full potential of its small population, second to maintain a world class infrastructure and third, to become a major hub city of the world. Another example is Africa's information society initiative. In 1996, the United Nations Economic and Social Council published an action framework to build Africa's information and communication infrastructure (United Nations Economic and Social Council (UNESCO), 1996). The aim of this initiative was to address the role of information, communication and knowledge in shaping African information society to accelerate socio-economic development. Other examples of countries that have developed information society related strategies are Great Britain (Department for Culture, Media and Sport and Department for Business, Innovation and Skills, 2009), India (Internet and Mobile Association of India, 2009) and Spain (Organisation for Economic Co-operation and Development (OECD), 2010).

According to Falch & Henten (2000) Denmark is an interesting case study because it consistently ranks high in the benchmark indicators of information society development. Denmark was one of the first European Union countries to publish in 1994 an information society strategy, the so called Danish Information Society 2000 report. This report was focused on information services and applications and declared that the implementation of the programme would be led by the public rather than the private sector. In 1999, a new report was published namely Digital Denmark – Conversion to the Network Society. The aim of the new programme was to address policy issues and to achieve general societal goals. The report was prepared by a committee that

was set up by the Minister of Research and Information Technology. Other relevant IT-related policy initiatives were also published by the government.

The role of government in the successful deployment of information society is important. The ITU and the UNCTAD (2007a) claim that government has an important role to play in establishing an enabling environment for investment and market competition, as well as intervening to achieve socio-economic goals in areas where normal market incentives may be insufficient to create balanced growth. Moreover, in the framework of the implementation of the Digital Britain strategy the aim of which was to secure the United Kingdom's position as one of the world's leading digital knowledge economies, the final report published in 2009 (Department for Culture, Media and Sport and Department for Business, Innovation and Skills) states the significant role of the government in the development of digital economy. As indicated in the report, government delivers public services, is a major purchaser of ICT systems, it gathers and stores a huge amount of public and private data and finally, the government acts as a strategic hub for development of the future digital strength.

In the 2003 Plan of Action of the World Summit on the Information Society (WSIS) the significance of government participation in developing the information society is clearly stated. Moreover the action plan encouraged the development of national e-strategies, including the necessary human capacity building, taking into account different national circumstances. Since then the WSIS Stocktaking Platform has served as a global repository for collecting and reporting on ICT-related projects which implement the WSIS Outcomes. It has also proved to be an efficient mechanism for sharing best practices towards advancing development goals. As stated in the 2016 report (International Telecommunication Union (ITU), 2016) the WSIS stocktaking process contributes significantly towards building an inclusive Information Society. The report provides key findings on emerging trends in the development of the information society and refers to major activities implemented throughout the years. As regards Cyprus it is worth noting that the WSIS stocktaking database contains a reference to the 2012 Digital Strategy for Cyprus and the entry was added by the Department of Electronic Communications. Considering the

ongoing work of the WSIS it can be deduced that information society is a topic which continues to be of great importance to many countries around the globe.

The comparison between Cyprus and Malta as a result of the application of the OECD based model showed that Cyprus is lagging Malta in nearly all indicators examined. In this respect it is important to examine and assess the various policies applied in Malta as well as the actors involved. In 2003, the National ICT Strategy 2004 – 2006 was published by the Ministry for Information Technology and Investment (2003). That was the first comprehensive strategy published in Malta, however, in this report there is a reference to the eMalta years (2000 – 2003) during which Malta had started to transform into an information society. In this period the government had pushed far up its priority list the objective of making Malta a regional centre of excellence in the technology sector. The vision of National ICT Strategy 2004 – 2006 was Malta to be amongst the most developed information societies in Europe and the Mediterranean, leveraging upon ICTs to improve the quality of life of its citizens and contribute steadily to its economic growth. The strategy contained thirteen strategic objectives on various aspects of the information society such as the digital divide across all levels of society, the education in ICT, eGovernment, the promotion of ICTs in the industry, the support of ICT entrepreneurship and the promotion of the role and the contribution of the Maltese information society in the global ICT. Malta realized soon enough the potential benefits of the information society and aimed not just to move on with the ICT developments but to be ahead. The compact geography of the country and the small population were considered as a comparative advantage. The outcome was very positive. Malta experienced an impressive economic growth and had been internationally acclaimed for its ICT achievements in the face of stiff global competition. Comparing the situation before and after the implementation of the strategy a significant increase is observed in the use of computers and the internet as well as in the mobile subscriptions. Malta became a leader in eGovernment within the European Union and the consulting firm Capgemini, when commenting about the eGovernment in Europe in its 2006 report wrote (Capgemini, 2006, p. 1): “Malta has achieved the most outstanding progress ever recorded”. Children were introduced to the use of computers at schools and various ICT educational programmes were offered by

the universities. As regards the ICT industry the Maltese government teamed up with leading global ICT players such as Microsoft, HP, Oracle and IBM to promote educational and assistance to industry programmes. In 2006, 36% of the investment projects were in the field of ICT. In 2007, Malta was chosen was one of the world's top 20 smart communities.

In 2007, the Ministry for Investment, Industry and Information Technology launched the National ICT Strategy 2008 – 2010 (Ministry of Investment, Industry and Information Technology, 2007). Under the heading Malta: The smart island, the vision of the strategy is Malta to become one of the top ten information societies in the world by 2010. According to the report, the new strategy is a continuation of the previous one and it maps out the path to make the Maltese society internet savvy and aware of all ICT options, with neither age nor socio-economic background being a barrier to knowledge and accessibility. The strategy addresses the issue of digital divide, the successful application of technologies in the enhancement of quality of life and the target of becoming or remaining a leading ICT industry in the region. The Smart Island takes into consideration the i2010 Action Plan as well as other national strategies. Best practises and the experiences of the various organisations and stakeholders who contributed in the setup of the strategy were taken into consideration. As stated in the report, Malta is keen to share its achievements with other countries by taking part in Commonwealth programmes and initiatives.

In 2014, the government presented Digital Malta, the National Digital Strategy for 2014 – 2020 (Ministry for competitiveness and digital, maritime and services economy, 2014). Digital Malta defines the guiding principles and policy actions of how ICT can be used for socio-economic development as well as how ICT can be applied to different sectors of the economy and society contributing to the welfare of citizens and businesses. It is envisaged that Digital Malta will bring about better employment opportunities, open up new markets for SMEs and encourage a more entrepreneurial and innovative mind-set. Moreover and despite the successful history of eGovernment in the country, Digital Malta sets out how government can be closer to the citizen through the use of technology and become more efficient in the way public services are delivered. The strategy is based on three strategic themes: Digital Citizen, Digital Business and Digital Government. These are supported by three

strategic enablers: Regulation and Legislation, Infrastructure and Human Capital. It is recognised in the report that the Digital Malta vision is very ambitious, however, the strategy allows for refinements through the Programme of Initiatives which complements the strategy. Each year the progress will be assessed by measuring outcomes and targets achieved and a recalibration of the Initiatives will take place, if needed. In this respect, Digital Malta includes performance targets with specific dates, performance indicators, benchmarking measures and qualitative evaluations. Finally, the strategy defines all the stakeholders involved in its implementation with a clear description of the responsibilities of each body involved.

All the Maltese ICT strategies have been drafted by the responsible ministry. As described above the National ICT Strategy 2004 – 2006 was drafted by the Ministry for Information Technology and Investment, the ICT Strategy 2008 – 2010 by the Ministry of Investment, Industry and Information Technology and the Digital Strategy 2014 – 2020 by the Ministry for Competitiveness and Digital, Maritime and Services Economy. There are two public entities that have further contributed to the development of the ICT policies and programmes. These are the Malta Information Technology Agency (MITA) and the Malta Communications Authority (MCA) both falling under the merit of the Ministry for the Economy, Investment and Small Business. MITA was setup in 2008 and is the central driver of government's ICT policy, programmes and initiatives in Malta. MITAS's current role is to deliver and implement the assigned programmes as set out in the Digital Malta National IC Strategy 2014 – 2020. MITA took over the operations of MITTS Ltd which was solely devoted in providing a service for the government. As stated on its website[24] MITA's role is pivotal in the evolution of Malta into a world class information society and economy.

The Malta Communications Authority was established in 2001 with the task of regulating the various electronic communications sectors, including fixed and mobile telephony, internet and TV distribution services. In addition, the MCA regulates the postal services and the eCommerce sector. The MCA's strategic objectives are classified in five categories as follows: Electronic

[24] http://mita.gov.mt/

Communications, eCommerce, Postal Services, Information Society and Business Development and Innovation. MCA's activities in relation to the information society are threefold. First, MCA ensures accessibility to technology and the Internet, second, drives projects aimed at building digital competences amongst citizens, and third, on the business community front, ensure that these recognise the benefits of going digital.

Apart from these two agencies other bodies also contributed in the development of the information society in Malta. In 2001, the eMalta Commission was setup by the government to drive the identification, promotion and coordination of the initiatives required for the attainment of an information society and economy in Malta. In 2004, a National Information Society Advisory Council (NISCO) was set up chaired by the Minister of Investment, Industry and Information Technology to ensure a structured consultative mechanism of key information society policy areas. Malta Enterprise is the country's economic development agency, tasked with attracting new foreign direct investment as well as facilitating the growth of existing operations. The Foundation for Technology Accessibility (FITA) is the principal advocate and coordinator for making information communications technology (ICT) accessible for disabled people in the Maltese islands. In the framework of Digital Malta several other bodies were established such as the ICT Malta, the Digital Society Stakeholder Forum and the Data Governance Council. Each new body has specific objectives. ICT Malta will promote and market Malta to attract ICT investments, the Digital Society Stakeholder Forum will discuss how ICT is impacting society and how it can be used to create better social cohesion and the Data Governance Council will provide strategic direction for data related issues and decisions.

In the case of Cyprus, as described in section 2.3.5, although there have been several references to the availability of a national information society strategy such a strategy has never been published and instead in 2012 the government announced the Digital Strategy for Cyprus. As described above the role of governments in developing information societies is vital. In Cyprus, all the governments set as a priority to satisfy the relevant EU requirements instead of acknowledging the significance of developing an information society based on a national strategy taking into consideration the local specificities,

history and culture. The significance of aiming towards the development of an information society has been undermined by appointing an existing government department as responsible for the information society. The Department of Electronic Communications of the Ministry of Transport, Communications and Works has responsibilities in Radio Communications, Electronic Signatures, Information Society and Space issues. Considering its limited available resources, a common problem to the vast majority of government departments, can the Department of Electronic Communications provide an effective service in the development of information society in Cyprus? By looking the department's website it can be observed that the latest available annual progress report of the implementation of the Digital Strategy for Cyprus concerns year 2012, the year the strategy was made public. Therefore the answer to the question is a definite no.

An additional problem is the lack of coordination at national level. Although the Department of Electronic Communications is the responsible entity for the information society there has been no coordination with other government departments which are responsible for specific aspects of the information society such as the Department of Information Technology Services (eGovernment), the Ministry of Health (eHealth strategy) and the Statistical Service (measuring the information society).

The situation got even more complicated in 2014 with the government decision to set up the Unit for Administrative Reform. Considering the financial crisis of 2013 the government decided to establish this Unit with the mission to implement the Public Administration Reform, as well as to design and implement or coordinate specific actions that will contribute to the recovery of the economy, the improvement of competitiveness and the business climate, the encouragement of investments and the modernization of the state. In this respect, one of the responsibilities of this Unit is to develop a strategy for e-government and to promote e-governance in the public service. Therefore there seems to be no role for developing an e-government strategy for either the Department of Information technology Services or the the Department of Electronic Communications. As regards e-government the Unit for Administrative Reform set as a priority the availability of more government services online. With no doubt this is a correct decision. But from my personal

professional experience and from the discussions I have with the colleagues from the Department of Information Technology Services the quality of those services is overlooked. Important aspects of online systems such as user friendliness, automated procedures etc are overlooked and as seen by the application of the measuring framework their usage is low.

Proposal 1: Information society as a national strategic objective and commitment

Nowadays there can be no doubt about the benefits of information societies. Many countries around the globe, including Malta, have developed and implemented successful national strategies during the last three decades. An excellent source of best practices is available in the WSIS stocktaking database. The role of politicians in developing and implementing such strategies has proved to be vital. In this respect, the first proposed measure is to take the political decision to specify as national objective the development of an information society in Cyprus. Nowadays the benefits of ICTs are known and justified and thus, there can be no hesitation in taking this decision. Instead of considering the issue of ICTs as another obligation to satisfy the EU requirements the real benefits must be assessed and the policy makers should drive the country towards this path.

Malta is an excellent example of a country with similar characteristics to Cyprus which already from the early 2000s had the vision to become one of the best information societies in the world. The commitment at the highest political level that the country is heading towards developing an information society is vital. Is it too late to make such a decision? The effort to develop information societies is continuous. Cyprus will not start from the beginning as the foundation is already there. There is in place already a strategy and several people were involved in its preparation. What is lacking is first, the determination to define the development of information society as a national strategic objective and second, the commitment to implement this strategy. In case of a political settlement of the Cyprus problem the strategic aim to build an information society should be given a high priority. It will be an excellent opportunity to define the vision of the united island based on the development of information society throughout the island.

Proposal 2: Assignment of a dedicated body

The second proposed measure concerns the assignment of a dedicated body for the development of the information society. In the case of Cyprus there has been the designation of the Department of Electronic Communications as the executive department of the Ministry of Transport, Communications and Works to formulate and implement a comprehensive national strategy on Information Society. However, the absence of the reference to the information society in the name of the responsible body results in the lack of visibility of the aim to build the information society. As already examined Malta had a Ministry on Information Technology since the early 2000s. Other countries such as Romania, Former Yugoslav Republic of Macedonia and Montenegro have dedicated ministries to the information society. In other countries such as Lithuania, Estonia and Turkey there are dedicated bodies, as their name suggests, to the information society which fall under the responsibilities of Ministries. Therefore, a dedicated body should be assigned the task to develop and coordinate the implementation of a national information society strategy and the name of this body should be clearly related to the information society. This body should be the reference point for the information society in Cyprus. Given its important role enough resources should be allocated to this body.

Proposal 3: Define a new information society strategy

The third measure concerns the preparation of a new strategy. As soon as this body is established the current strategy should be re-examined and updated. The new strategy must contain specific targets that will have significant impact on the economy and the society taking into consideration the local idiosyncrasies and specificities. The priority should be to identify those actions that will have real benefit on Cyprus. Although the 2012 Digital Strategy for Cyprus is comprehensive and a lot of effort has been put in place for its preparation, its implementation has proved to be problematic since neither progress reports have ever been published nor public statements were made in relation to the strategy. Moreover the various related available indicators that are available have not shown any significant progress since then. This may be attributed to the economic crisis which started in 2012 and perhaps to the ambitious goals of the strategy. As soon as this strategy is prepared the

dedicated body should be responsible for its implementation. Due to the multi faceted nature of information society this body should be allowed to coordinate all the related activities. Progress should be systematically assessed and performance indicators should be established. A measurement framework could be applied like for example the one proposed in the framework of this thesis. In this way, the strategy will be measurable and transparent, allowing all stakeholders to track its success. The road to information society involves the cooperation of different bodies and organizations. In this respect, the new strategy should include all the bodies and organizations that will be involved in its implementation by defining the role and objectives of each one separately. In case that is decided to establish new bodies this should be clearly stated and justified.

Proposal 4: Cooperation with other countries

There are numerous countries that have developed and implemented successful information society strategies. The sharing of experiences is an important element in the quest towards the building of information societies. Thus, the fourth proposed measure is to seek cooperation with other countries. Malta is an excellent example of a country that shares similar characteristics to Cyprus and already has been established as an ICT hub. As stated in the National ICT Strategy for Malta 2008 – 2010 Malta is keen to share its achievements with other countries. In this respect, Malta has been sharing its experiences through the Commonwealth programmes and initiatives. Being a member of the Commonwealth, Cyprus could benefit from these programmes as well.

Proposal 5: Produce more relevant statistical data

Throughout my professional career in the official statistics there has never been a request for additional indicators on the information society for national needs. The survey is carried out exactly as decided by Eurostat's Information Society working group without any adjustments for national needs. Moreover, as already pointed out in several internal and other meetings, the ICT usage survey in enterprises carried out annually since 2004 covers only the enterprises employing at least 10 persons in specific sectors of economic

activities. But in Cyprus those enterprises constitute only the 8% of the total number of enterprises in Cyprus and thus, the figures are not representative for the whole economy. Unfortunately until today no funds have been allocated for extending the coverage of the survey. Finally, the availability of indicators on the ICT sector in Cyprus is scarce. Eurostat's online database does not contain any data on the ICT sector in Cyprus as figures are marked either as confidential or not available. Similarly CYSTAT's website does not provide any relevant information. As already seen in the measuring framework the source of data for the ICT sector is a specific report and it is limited. The fifth proposed measure is to encourage a national initiative to produce and publish more data on the ICT Sector and on the impact of ICT in the economy and society. In this way, the progress of developing the information society and the impact this will have on the economy and society will be consistently measured and monitored. This initiative could be part of the new strategy to be defined as specified in the third proposed measure.

For the purpose of this thesis all the proposed measures are mainly related to strategic decisions that should be taken at high political level. No technical suggestions are made because those should be determined by experts in the framework of the preparation of the new strategy.

5.4 Summary

In the first part of this chapter a conceptual model is applied for the first time in measuring the information society in Cyprus. Although this measurement is a snapshot of the situation based on the latest available figures it can serve as a basis to set specific national targets and to systematically assess the progress towards the development of information society. This model may also contribute to the joint effort of the Greek Cypriot and Turkish Cypriot communities in setting up relative targets in the case of a peace settlement of the Cyprus problem.

The applied model which is based on a proposal made by the OECD, consists of four pillars namely, ICT Supply, ICT infrastructure, ICT Demand and ICT Related Knowledge Development. All four elements are widely accepted to be significant components of the information society and thus, it can be applied to any country regardless of its size. For each domain the indicators are

selected based on relevance, availability, quality, accuracy, timeliness, comparability and ease of understanding. Cyprus is compared to Malta and the EU28. Malta is selected because the results of the literature review suggest that the development of the information society is more advanced compared to Cyprus and in addition, it shares similar characteristics to Cyprus. The EU average is selected in order to assess where both countries, i.e. Cyprus and Malta, stand amongst the countries of the European Union.

Table 20 summarises the results of the benchmarking. The comparison presented here concerns only the latest year for which data is available. More detailed analysis and comparison over time is available in the corresponding sections.

Table 20: Comparison of Cyprus, Malta and the EU

Indicator	Cyprus	Malta	EU
ICT Supply			
ICT Sector			
ICT sector value added share of total value added	3	1	2
ICT sector employment share of total employment	3	1	2
Labour productivity in the ICT sector	2	1	3
ICT Infrastructure			
Internet			
International Internet bandwidth	2	1	NA
Fixed-broadband subscriptions per 100 inhabitants	3	1	2
Fixed broadband subscriptions by speed	3	1	2
Active mobile broadband subscriptions per 100 inhabitants	2	3	1
Broadband internet access cost	Both Cyprus and Malta are more expensive than the EU		
Telephone			
Fixed telephone subscriptions per 100 inhabitants	3	1	2

ICT Demand			
ICT use by enterprises			
Enterprises using computers	2	1	NA
Enterprises with internet access	2	1	1
Employees with internet access	3	2	1
Percentage of enterprises with broadband access (fixed or mobile)	2	1	2
Mobile broadband connections in enterprises	3	1	2
Maximum speed of fastest internet connections in enterprises	3	1	2
Enterprises having website	3	1	2
Sell of goods or services	2	1	1
Purchase of goods or services	3	2	1
ICT use by households and individuals			
Households with a computer	3	2	1
Households with internet access	3	2	1
Broadband internet connections from households	3	1	2
Fixed broadband connection	2	1	3
Mobile broadband connections	3	1	2
Internet use by individuals – In the last 12 months	3	2	1
Internet use by individuals – Never used the internet	3	2	1
Frequency of internet use - Daily	2	1	3
Frequency of internet use – At least weakly	3	2	1
Individuals who order goods or services	3	2	1
E-government			
Citizens' use of eGovernment services	2	3	1
Citizens who obtained information from public authorities web sites	1	2	1
Citizens who downloaded official forms	2	1	2
Citizens who submitted completed forms	3	2	1

E-government performance across policy priorities	3	1	2
E-government development index	2	1	NA
ICT Related Knowledge Development			
R&D Expenditure by the ICT Sector			
ICT BERD share of total BERD	2	1	3
ICT BERD intensity	3	2	1
Public funding of ICT R&D	2	3	1
ICT sector R&D personnel	3	2	1
ICT Education			
% population aged 30-34 who completed tertiary studies	1	3	2
% population aged 18-24 who didn't complete their studies	1	3	2
Graduates in Computer Science	2	1	NA
ICT Skills			
% of computer users with average or high computer skills	3	2	1
% of internet users with average or high level of internet skills	1	2	3

*NA=Not applicable/ Not available

As the results of the first three pillars (ICT Supply, ICT Infrastructure and ICT Demand) suggest, Cyprus is lagging both Malta and the EU average. The results of this analysis confirm the findings of the literature review on Malta's higher ranking in various composite indices compared to Cyprus. Actually in 29 of a total of 33 indicators included in the three pillars Malta performs better than Cyprus and moreover, in 18 indicators the value of the indicator is higher than the EU average. As regards the ICT Related Knowledge Management the conclusion maybe that in general, both Cyprus and Malta are below the EU average and that the education level in Cyprus is high.

In the second part five concrete suggestions are made for the development of the information society in Cyprus based on the outcome of the

review of the literature and the results of the application of the model. Experiences of other countries are examined with the aim to identify the factors behind the successful development of information societies and emphasis is given to the strategies implemented in Malta. Based on the experiences of other countries five concrete proposals for implementing measures are for the case of Cyprus. Although in 2012 a comprehensive strategy was published for the first time, its implementation has not progressed as expected. The development of information society is a national target which concerns various bodies and organisations. The commitment of the policy makers for the successful implementation of the strategy is vital. The role of each actor should be clearly described. The current strategy should be re-examined and updated. The new strategy should not be over ambitious and should give priority to those actions that will provide real benefit to the economy and society. Other countries have been successful in their effort to build information societies and thus, the sharing of their experiences will be very beneficial. Finally, national initiatives should be undertaken in order to have available all necessary tools in following the whole progress.

Chapter 6: Conclusions

6.1 Introduction

Being responsible for the production of the official statistics on the information society in Cyprus since the first efforts made at European level in the 2000s and following the slow progress made towards the information society throughout the years, this role prompted me to start this research. Although some progress in the various available indicators is observed, Cyprus's performance has been consistently inferior compared to the European counterparts. At a national level, a comprehensive examination of the progress towards the development of an information society has never been carried out. Similarly, this topic has not been a subject for research by the academic world. In this respect, the novelty of this thesis is that for the first time a comprehensive measurement of the information society in Cyprus that is based on a conceptual model is applied. This model entails the key factors contributing to the development of the information society in Cyprus. A significant part of this thesis and at the same time a major contribution has been the extensive review and synthesis of available information society measurements.

The broad research problem of this study is framed as: "What are the key factors in the development of the information society and how can these factors facilitate the information society in Cyprus?" To address the research problem, the study attempted to answer the following research questions:

1. Which are the available information society measurements? Do those measurements include Cyprus?
2. Do the available information society measurements take into consideration the different sizes of the countries?
3. How can the development towards the information society of a small country like Cyprus be measured?
4. What further measures should be implemented in order to secure the successful conversion of Cyprus into an information society?

In this Chapter, a comprehensive summary of the main research findings of this thesis is provided. Some useful recommendations of measuring the information society are then made taking into account the Cypriot context and suggestions are made for further study.

6.2 Methodological approach

It was expected from the beginning that due to the exploratory nature of the first two research questions, a major part of this thesis would be the review of the literature. By applying the method of systematic narrative review, the aim of summarizing all pertinent evidence on the measurement of an information society has been fulfilled. Moreover, the range and diversity of the available literature, and the gaps in the measurement of the information society in small countries have been identified.

A unique procedure for the implementation of the systematic narrative review was defined from the outset. In this way, it was possible to systematically extract, check and summarize the methods and results of all the sources that were identified. The well-defined methodology applied as well as the large amount of sources identified and examined minimised the risk of obtaining biased results. The method applied is explicit, systematic and reproducible. It consists of clear inclusion/ exclusion criteria, an explicit search strategy and these facilitate systematic coding and analysis of the included studies.

The tools applied for registering the total information extracted from the extensive literature review were custom made files in MS-Excel. Those files which were part of the processes that were specified from the beginning of the research, proved to be invaluable. Considering both the considerable amount of sources that were examined as well as the long duration of this thesis it can be confirmed that the approach applied was very successful as it facilitated the consultation of the various sources at any time.

According to the scientific literature one disadvantage of systematic reviews is that they require a significant amount of time to be completed. Indeed this method is time consuming but considering the goals of this research and its results as well as the fact that this is a part time PhD and thus, enough time is provided, it can be concluded that the method applied was the most appropriate.

6.3 Summary of the thesis

The topic of this research is about measuring the information society in Cyprus and thus, its context entails three main pillars. The first pillar concerns the definition and measurement of the information society, the second is about the country for which there is a particular interest, i.e. Cyprus, and the third is the European Union of which Cyprus is a member of and being a small country many of its policies are influenced or determined by the corresponding European policies and/ or decisions. In Chapter 2 the three main pillars of this research are detailed examined based on an extensive literature review.

Following the extensive literature review the answers to the first two research questions are discussed in Chapter 4. The research questions concern the available information society measurements and their association with the size of countries respectively.

In the first part of Chapter 5 a conceptual model for measuring the information society based on a proposal by the OECD, is applied for the first time in Cyprus. This model provides an appropriate framework for measuring the information society in Cyprus and fulfils the expectations of the third research question. The second part includes five concrete proposals for the successful conversion of Cyprus into an information society and thus, the response to the fourth research question.

6.3.1 Information society, Cyprus and the European Union

6.3.1.1 Information Society

As regards the first pillar, i.e. the definition and measurement of the information society, this research reaffirms that since the birth of the concept of information society in the 1960s there has never been a universally accepted definition. “Information society” is a complex and diverse concept to define however, a common denominator of the various definitions given to the information society during the last six decades is that this concept is based on the Information and Communication Technologies and that it is related to technology, economy and society. Considering its complexity there exists at least one case in which the information society is defined by describing its main elements (infrastructure, supply, and use). This approach has been followed for the purposes of this research for which no single definition of the information society is endorsed but

instead, in order to measure and compare the information society in Cyprus a model that defines its main components is applied. The model is explained in detail in chapter 5.

Has the development of information society created a new type of society or too much emphasis is given to it prematurely? The literature review showed that social thinkers are divided. Some believe that a significant change has occurred and that the present era is special and different whereas others place emphasis on continuities. The fact is that nowadays the amount of available digital data is tremendous. More and more people are connected to the internet and the time spent on the internet by people all over the world increases. The use of mobile devices is growing significantly. The countries that have the internet already are not going to turn it off. Eric Schmidt, Google's CEO (and now Alphabet's chairman), stated in 2010 that there were 5 Exabytes of information created between the dawn of civilization through 2003, but that that much information is now created every two days. This statement resulted in a debate among experts questioning about the accuracy of these estimations. Nevertheless according to Robert J. Moore, CEO of RJMetrics, it's clear that no one really knows how much information is out there or how quickly it's actually being produced, but everyone is certain it's being produced increasingly quickly.

In the context of examining the definition of the information society other closely related and widely used concepts are also examined with the aim to identify the similarities and differences. Information and knowledge are two concepts for which several definitions are provided. However all of those definitions have as a common denominator that knowledge is more than just information. The concepts of data, information and knowledge are thoroughly discussed in the literature. From the statistical perspective data can be referred to all the data that is available, the amount of which nowadays is tremendous and thus, making the establishment of well-defined methodologies for the processing of big data a necessity. The filtering or the processing of the data through the production of statistical indicators can be considered as the information produced from the data. But having just the indicators is not enough. The indicators are analysed in order to make decisions and this is where the information turns into knowledge. Both concepts, i.e. information and knowledge, are related to the economy. The scientific literature refers to several

concepts such as information economy, knowledge economy, digital economy and new economy. Each is defined either by providing a definition or a conceptual framework. In some cases the borderline of each definition is not clear. For example, as described in chapter 2, does the digital economy refer to the ICT use or to the information society or to the digital society or to the digitization of the society? As stated by several researchers the same concepts are used to mean different terms and this result in the use of poorly defined terms.

A valid question to be asked is whether the term information society is now obsolete taking into consideration that this topic has been in place for six decades and in addition, other closely related terms have been emerged. It is true that the situation in each country is different. Some countries are more technologically advanced than others. The national strategies are developed, and if not they should be developed, taking into consideration the specificities, the local idiosyncrasies and the cultures. This thesis examines for the first time the comprehensive measurement of the information society in Cyprus. Cyprus compared to the rest of the EU countries is at the bottom end of the ranking in the various indicators provided by Eurostat. Therefore it is wise to establish a measurement framework of the information society in Cyprus. It is noted, however, that the term information society is still much in use and two recent examples are first the EU-U.S. Information Society Dialogue (ISD) which takes place annually and aims to discuss issues related to ICT and the digital economy and second the ongoing publication of the annual “Measuring the Information Society Report” by the ITU.

Further to defining the information society its measurement is another challenging task. Different views are expressed on the usage of composite and monotopical indices. Composite indices provide an easy and user friendly way to make comparisons mainly between countries, categories or regions and are considered useful tools for policy decisions. Composite indices are mainly produced by international organisations (such as ITU and the European Commission) to rank the performance of the countries. However, composite indices might give an over simplistic and unrepresentative picture of the real situation. The process of constructing a composite index involves several stages for which personal judgement is needed e.g., the weights structure and

the selection of sub-indicators. Thus, uncertainty and sensitivity analysis are needed to test the robustness of results something which complicates their use by the policy makers. Comparisons based on indices are valid if they are made for countries with similar characteristics like income level, geographic, social or regional. In reality this is not the case and countries are compared regardless of common characteristics between them. For instance, the EU indices produced compare all member states regardless of different characteristics. Composite indices are useful in measuring the progress over time as they facilitate comparison in both absolute scores and ranking from one year to the next. In this way policy makers can assess the results of any measures taken based on the assumption that there are no methodological changes in the construction of the indices in the period examined.

The literature review revealed that there are several composite indices which are related to the concept of the information society. Considering the disadvantages of composite indices another approach is applied in the effort to measure complex issues, like the information society, by applying a descriptive framework. A framework contains dimensions for each of which several characteristics are defined. The characteristics are measured by indicators. The calculation of a single information society index is an ambitious task considering the multi-faceted nature of the topic. In addition to the difficulty in calculating such an index, its use by policy makers would be minimal due to the complex methodology. A thorough description of various measurements related to the information society identified during the review process is provided in chapter 4.

6.3.1.2 Cyprus

The second pillar of this research concerns the country Cyprus. Cyprus is a small island situated in the Mediterranean Sea and has been a member of the European Union since 2004. In chapter 2 the main characteristics of the island are examined such as the main demographic characteristics, the education and political system, the comparative advantages and disadvantages and finally, the history of the information society in Cyprus. Small island countries share similar advantages and disadvantages but at the same time significant differences may occur due to diverse cultures, social and economic environments and historical paths of development. Nevertheless main common characteristics concern the

small market size and the limited physical resources, the large public sector, the vast majority of enterprises are of small and medium size and the underdevelopment of the 'high tech' sector. Cyprus's main competitive advantages are related to its geographical position, the excellent financial and business services, the highly educated and qualified labour force and the low taxation.

While the efforts to build an information society in Cyprus commenced in the late 1980s and several reports (mainly produced to satisfy EU requirements) referred to a strategy, this strategy was never prepared or at least it was never published. Instead, in 2012, the "Digital Strategy for Cyprus" was published which according to its authors is a comprehensive plan. This strategy is in line with the objectives and actions proposed in the EU action plan "Digital Agenda for Europe" which is one of the seven pillars of the Europe 2020 Strategy. However since its publication there has not been a systematic follow up as original foreseen. Since 2002 two strategies on eGovernment have been set up, the first covering the period 2002-2011 and the second 2014 – 2020. Significant output has been produced by the implementation of both eGovernment strategies.

The failure in setting up a national strategy for the information society despite the declared willingness by the various governments to do so can lead to the conclusion that the benefits of developing an information society were not well appreciated. Various references to an existence of such a strategy or the declared willingness of developing one were made in order to satisfy the EU requirements. Experiences from other countries show that any initiatives towards the development of information societies in order to be successful should come from inside rather than to be imposed from outside. Emphasis and priority should be given in the design and implementation of such strategies through the appointment of appropriate bodies with specific terms of reference. The implementation of an information society is a multi-domain project involving investment in human resources and cost and thus, the responsible bodies should be allowed to put all their effort in this task and not to consider the information society as just an additional task. In addition, in the case of Cyprus, the academia in co-operation with the policy makers should examine in more detail the benefits of having an information society and identify those areas

where emphasis for investment should be given for the economic development and the improvement of the quality of life of its citizens.

6.3.1.3 European Union

As already discussed several official documents of Cyprus refer to the existence or to plans to develop an information society strategy or they describe priorities. Those documents are mainly prepared in order to satisfy the various EU requirements. In this respect it is important to examine the EU strategies related to the information society and thus, the third pillar of this thesis. Starting with the eEurope 2002 action plan the EU aimed to benefit from the information society. The European Commission evaluated the plan successful as most of the targets set were achieved. However, due to its short duration the implementation of the action plan did not result in significant economic benefits or to a greater social inclusion. eEurope 2005 was the next action plan that was implemented aiming in the stimulation of use and creation of new services. According to the evaluation report Cyprus is classified in the group of countries for which the eEurope action plan has been used as a reference point for national information society policy. The common characteristics of the countries belonging to this group are the existence of an information society policy prior to the eEurope action plan (this is not the case for Cyprus), medium information society performance and a low to medium political support. In parallel to the eEurope action plan the eEurope+ initiative was launched for the candidate countries. Cyprus as a candidate country participated in the implementation of the eEurope+ action plan. The period from 2005 to 2010 was covered by the i2010 strategy with the aim to address the main challenges and developments in the information society and media sectors. In the framework of this strategy each member state defined national information society priorities. In this respect Cyprus defined its priorities in the National Reform Programme. Finally in 2010 the European Commission launched the Europe 2020 strategy and in this framework the Digital Agenda initiative was defined. The initiative focuses on modern technologies and online services that will allow Europe to create jobs and promote economic prosperity. The reports produced by the European Commission evaluate all the action plans and strategies positively. However, there are voices who claim the opposite. From my personal experience, the

objectives that are set by the European Commission are usually very ambitious and difficult to achieve. Some countries perform better than others. In general, the successes and failures can be categorised in different levels.

6.3.2 Information Society Measurements

As regards the first research question on which are the available information society measurements, eighteen measurements were identified and classified in three groups. The first group includes four measurements which produce a single value for the whole information society, the second group contains four frameworks applied in measuring concepts that are related to the information society and in the third group there are ten measurements which are related to different facets of the information society. From the eighteen measurements identified ten include Cyprus but nine of these concern the indices for measuring the different facets of the information society, i.e. they belong to the third group. In fact, nine of the ten measurements of the third group concern a large number of countries (at least 70) while the tenth measurement is applied only to the EU member states. As concluded from the literature review the development and measurement of information societies in small countries has not drawn the interest of the scientific community and thus, the response to the second research question. This may be attributed to the fact that small countries have a minor influence on the world economy. Instead research has been carried out to examine the differences between developed and developing countries. However, the group of developing countries is generally less developed than EU countries and therefore, not useful in this analysis. An additional finding of the literature review is that nowadays from all the eighteen measurements identified only three are still active and all of those concern composite indices. Therefore, if a country decides to invest in building an information society then an appropriate measuring framework should be defined along with the national strategy which in turn should be based on the countries' specificities.

Another important finding that arises from the analysis of nine indicators which include Cyprus covering the period from 1995 to 2012 shows that despite the fact that each indicator measures different aspects, the ranking of Cyprus is consistent between places 27th and 44$^{th.}$ Moreover, there is a group of 23

countries ranked higher than Cyprus in all indicators. The examination of the variation within the index showed that this is small and consequently no significant changes in the ranking takes place from year to year. The reasoning behind the stable ranking needs to be further explored. However, the fact is that one country with similar characteristics to Cyprus is consistently ranked higher in all but two indices and thus, this research has examined in more detail the performance of the Malta and Cyprus as regards the development of information society.

6.3.3 Measuring the Information Society in Cyprus

The OECD framework descriptive model consists of four main pillars: ICT Supply, ICT Infrastructure, ICT Demand and ICT Related Knowledge Development. The model is based on the supply and use of ICT in which the ICT sector and ICT infrastructure play an important role. The framework descriptive model approach is considered as the most appropriate to be applied in the case of Cyprus because it contains the widely accepted elements of the information society which are the ICT supply, ICT demand and ICT infrastructure. Moreover it is not difficult to understand and by including the appropriate indicators the progress over time can be followed. Consequently the model can provide a useful tool for politicians and policy makers. Considering the fact that this model is a product of an international organisation this implies its general acceptance and in this respect the OECD has been providing guidelines in measuring the information society based on this model. Finally, the nature of the model facilitates its usage in any country regardless of its size. Therefore, the adopted model is considered to serve its purpose and consequently, there is no need to develop a different model specifically for the group of small countries. Moreover, looking at the implementation of the model from a different perspective, this can also be applied in the case of a settlement of the political problem of Cyprus. Specifically, the model can be used as a tool for assessing the development of the information society in the unified island.

Having specified the framework the next step was to set the criteria for selecting the most appropriate indicators for each element of the model. As concluded from the review of the literature one of the major problems in the first attempts to measure the information society was the availability of well-defined

and harmonised data. With no doubt the situation today has been significantly improved. International organisations publish a significant amount of data on the information society. The available data by each organisation is well defined and of high quality. For each domain the indicators selected are based on relevance, availability, quality, accuracy, timeliness, comparability and ease of understanding. Considering that Cyprus is a member of the EU the main source for selecting the indicators is Eurostat. In the process of selecting the indicators an effort was made to include those for which data is available for many years in order to observe the progress over time.

As concluded from the review of the literature and in particular from the analysis of the composite indices Malta is a country with higher rankings than Cyprus. Considering the fact that both countries share similar characteristics it was decided to use Malta as benchmark in order to explore further the reasons behind the gap in their performance. In addition, the EU average was used as a second benchmark in order to assess the position of Cyprus in the EU scale. This approach can provide the policy makers with the necessary tools in order to make a better assessment of the current situation with the aim to take those decisions that are necessary for the development of the information society in Cyprus.

6.3.4 Proposals

By applying the OECD descriptive framework model the results confirmed the findings of the literature review. In particular, in the vast majority of the indicators examined, Malta performs better than Cyprus and in many cases even better that the average of the European Union. These results prompted the examination of the strategies applied in other countries with emphasis on Malta. Based on other countries successful stories and taking also, into consideration the specificities and the general situation in Cyprus as turns out from the review of the literature, five concrete proposals are made for the successful development of information society in Cyprus. The first proposed measure is to take the political decision to specify as national objective the development of an information society in Cyprus. As this will be a national objective all the actors involved must be committed to the achievement of this aim. All the parties to be involved should be stated from the beginning and clear

roles should be assigned. In this respect there must a dedicated body responsible for the coordination of all activities and thus, the second measure. Although in 2012 the first strategy was published in Cyprus the follow up has not been as expected. Maybe due to the economic crisis or the shortage of staff or the set-up of other priorities the annual progress report was published only once. Priority is given to fulfill the EU requirements instead of identifying those actions that would be more beneficial for Cyprus. In the light of this development the third measure proposed is to prepare an updated strategy. This strategy should take into consideration the EU objectives but also to identify those areas in which Cyprus could benefit more from the ICTs. The road towards the development of information societies is not new. Other countries have made significant progress and their experiences are valuable. The fourth measure concerns the cooperation with other countries. One example could be Malta, a country with similar characteristics to Cyprus, in which the long term commitment resulted in achieving the national objective to become one of the most developed information societies in Europe. Finally, from my experience in both my profession and in carrying out this research it turns out that there is a lack of availability of important indicators. Thus, the fifth proposal is to take the necessary initiatives by the relevant bodies in order to produce relevant and important statistics on the information society.

6.4 Limitations of the study

The nature of the topic of this research was the main decision factor in choosing the method of systematic narrative review. In this framework, this study has been solely based on desk research as it does not involve any data collection. A contributing factor has been my personal professional experience. Although the applied methodology is considered to be the best option, a limitation may be considered the fact that it is only based on secondary sources. A document contains only the information the author wants to convey. Personal experiences or other information that is not considered to be significant to be included in a document are omitted. However, this kind of information may have some value for other reasons including research studies. If primary data had been collected through structured or unstructured interviews this may had facilitated a deeper insight into the topics under examination.

Another limitation may be considered the time gap between the completion of the systematic searching and reviewing of the documents and the submission of the thesis. In this period new evidence may have emerged. But considering the broad scope of this study the repetition of the whole process would end up in an endless loop. Thus, it was decided to set a deadline for the systematic searching and reviewing and to report in detail the applied procedure.

During the systematic review, in order to evaluate what worked, more emphasis was put on examining the performance of existing indices. However, in the end, the OECD framework descriptive model has been applied for the first time in Cyprus. It is possible, though not very likely, that there may be other theoretical frameworks that could have been considered, but in my work, as I would expect to, I have not come across any since I did the research

Other limitations identified and reported in the study concern the inclusion of only the documents in Greek and English language, the omission of paid documents, the lack of exchanging views on the review process and the access to confidential data.

6.5 Contribution of the study

The extensive review of the literature has revealed that there are significant controversies and inconsistencies related to the definition of information society. Numerous different definitions have been given to the information society and this confirms the ambiguity and complexity of this concept. Despite the different views on what actually the information society and its related concepts are, this study showed that there is a consensus among social thinkers that the growing use of ICTs has a major impact on the economy and the society.

An important contribution of this research is that for the first time the various available information society measurements have been reviewed and synthesized. Despite the lack of a theoretical framework for the information society there is an abundance of related measurements.

Cyprus is a small island sharing common characteristics with other small countries. Despite the similarities there are also differences due to diverse cultures, social and economic environments and historical paths of

development. This study has examined the advantages and disadvantages of small countries compared to their larger counterparts and Cyprus's comparative advantages were identified.

There is a research gap in measuring the information society in small countries. In this respect, the case of Cyprus has not drawn the attention of the scientific community. Due to the lack of a coordinated effort for the development of the information society in Cyprus and due to the priority given to fulfill the commitments of the EU plans, Cyprus has failed to utilize the advantages of ICT adoption. The policy makers and politicians in Cyprus have not seen the development of information society as an opportunity but instead all related activities were initiated due to various EU obligations.

For the first time a model for the measurement of the information society is applied for Cyprus. The model is based on a proposal made by the OECD and has already been applied to several countries. It is easy to understand and can serve as a tool for measuring the progress towards the development of information societies putting emphasis on the major components of the information society which are the ICT Supply, ICT infrastructure, ICT Demand and ICT Related Knowledge Development . Due to its generic nature the developed model can be applied to any country regardless of its size.

. The application of the OECD model helped to explain the differences between Malta and Cyprus. The results of this comparison confirmed the findings of the literature review in that Malta is more advanced compared to Cyprus. Similarly, in general the average of the EU countries is higher than Cyprus.

These findings guided the research towards the identification of the main factors contributing to the development of the information society and in this context, five concrete measures are proposed to be implemented in the case of Cyprus. This research can be used as a basis for setting up the national vision for transforming Cyprus into one of the most advanced information societies. It can be considered as a guiding tool for policy makers to determine the steps that should be followed in order to fulfill the vision. Moreover, this study may contribute to the efforts that will be made for the prosperity of the Cypriot citizens, both Greek and Turkish, in the case of a solution to the Cyprus political problem.

6.6 Directions for further study

The extensive review of the literature of this study has confirmed the complexity of the concept of information society. There has not been any universally accepted definition but instead several descriptions are available. Due to its complex nature measuring of the information society is not a simple task. A response to this challenge is the use of the model applied in this thesis which is based on a proposal made by the OECD. The difference between the applied model compared to the OECD model is that the latter contains a second level which refers first, to the actual information that is transferred via the electronic networks and second, to the domain of ICT products. Due to the scarce availability of high quality data this part has been omitted in the analysis carried out in this research. In this respect, taking into consideration the significance of both topics it is recommended to follow the progress in the availability of relevant indicators and as soon as those are made available to integrate them in the model. Depending on data availability more topics could be included and consequently examined. For instance, in the examination of the relationship between ICT and the economy, the volume of international trade in ICT products would give an indication of the international competition on this market. The analysis of the ICT use by enterprises could also include the use of specific technologies such as the Radio Frequency Identification (RFID). RFID offers many opportunities to improve the production and distribution chain. This technology makes it easier to track and trace products, for example, allowing early detection of distribution errors, such as a wrong delivery address, and earlier rectification. This will result in fewer delays and lower costs. A possible topic for inclusion when examining the ICT knowledge could be ICT patents. Patents provide an insight into a into a country's inventive capacity and into its ability to convert this capacity into potential benefit. In this context, patent-based indicators are widely used to assess the inventive performance of countries. The selection of the topics to be included will be determined according to the priorities that will be defined in the national strategy for the development of the information society.

Society is not driven by technology and thus, in order to understand the changes towards an information society one must not look into the information

technology figures only, but examine the social context within which the changes are taking place, taking into consideration social and cultural indicators. In this respect, the social and cultural aspects could be examined and possibly included in an enhanced framework model. Moreover, the economic aspect of information societies could be further explored as this is an important element for policy decisions. For instance, information economy could be examined by measuring the use of ICTs by businesses in all stages of information processing. As examined in the literature review the concept of information economy has been looked into by international organisations such as the UNCTAD and OECD and thus, there is already available evidence on which to base this research.

The criteria by which the indicators were selected to be included in the model mainly concerned availability and quality. However, due to the fast developing nature of the concept of information society more indicators are becoming available. If considered appropriate more indicators could be included in the model. In some cases indicators reach saturation level and when this occurs those should be excluded from the model.

The available data on ICT usage in enterprises concern those having ten or more employees. In the case of Cyprus these enterprises constitute only the 8% of the total number of enterprises and thus, the whole picture is missing. Thus, every effort should be made in gathering and analysing this data.

The comparison of Cyprus to Malta and the EU average showed that Cyprus is lagging behind. This thesis has identified a few important factors which play a significant role in the development of information societies considering the experiences of Malta and other countries. Despite the significance of those factors a deeper insight into the success of Malta and other countries could be achieved by examining in more detail the various policies applied. This analysis could reveal the reasons behind the success of each applied policy. For instance, this analysis could provide an insight into the factors for low e-commerce use by individuals and by considering the successful policies the necessary adaptations could be applied for Cyprus. Similarly, this analysis could be carried out for any other topic which is considered as significant.

In the framework of this thesis the various EU policies were examined and various assessments were presented. However, all the available literature examines the corresponding successes and/or failures for the whole of the EU. By taking onboard this study more research into the impact of those policies on Cyprus could reveal interesting aspects that could provide an input to the objectives to be specified at national level. In other words this analysis could provide guidance on what might work more or less for Cyprus.

Finally, as the aim of this study is to provide the basis for developing an information society in Cyprus more insight could be provided into the expected impact of this will have on the economy and society. The expected impacts should be quantified in order to assist the policy makers into taking the necessary actions. Again, nowadays due to the experiences of other countries, the availability of sound methodologies and relevant data this type of assessment is possible.

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World Economic Forum (WEF). (2007). *Global Information Technology Report 2006-2007: Connecting to the Networked Economy.* Basingstoke: Palgrave Macmillan.

World Economic Forum (WEF). (2008). *Global Information Technology Report 2007-2008: Fostering Innovation through Networked Readiness.* Basingstoke: Palgrave Macmillan.

World Economic Forum (WEF). (2009). *Global Information Technology Report 2008-2009: Mobility in a Networked World.* Basingstoke: Palgrave Macmillan.

World Economic Forum (WEF). (2010). *Global Information Technology Report 2009-2010: ICT for Sustainability.* Basingstoke: Palgrave Macmillan.

World Economic Forum (WEF). (2011). *Global Information Technology Report 2010-2011: Transformations 2.0.* Basingstoke: Palgrave Macmillan.

World Economic Forum (WEF). (2012). *Global Information Technology Report 2012: Living in a Hyperconnected World.* Geneva: World Economic Forum and INSEAD.

World Economic Forum (WEF). (2013). *Global Information Technology Report 2013: Growth and Jobs in a Hyperconnected World.* Geneva: World Economic Forum and INSEAD.

Ylä-Anttila, P., & Lemola, T. (2003). Transformation of Innovation system in a Small Country – the Case of Finland. *Paper presented at the First Globelics Conference.* Rio de Janeiro.

Zand, D. E., Freedman, R., & Rogers, D. (2006, Spring/Summer). Drucker's Vibrant, Timeless Wisdom. *STERNBusiness* , pp. 12-17.

Appendix 1a: International organisations

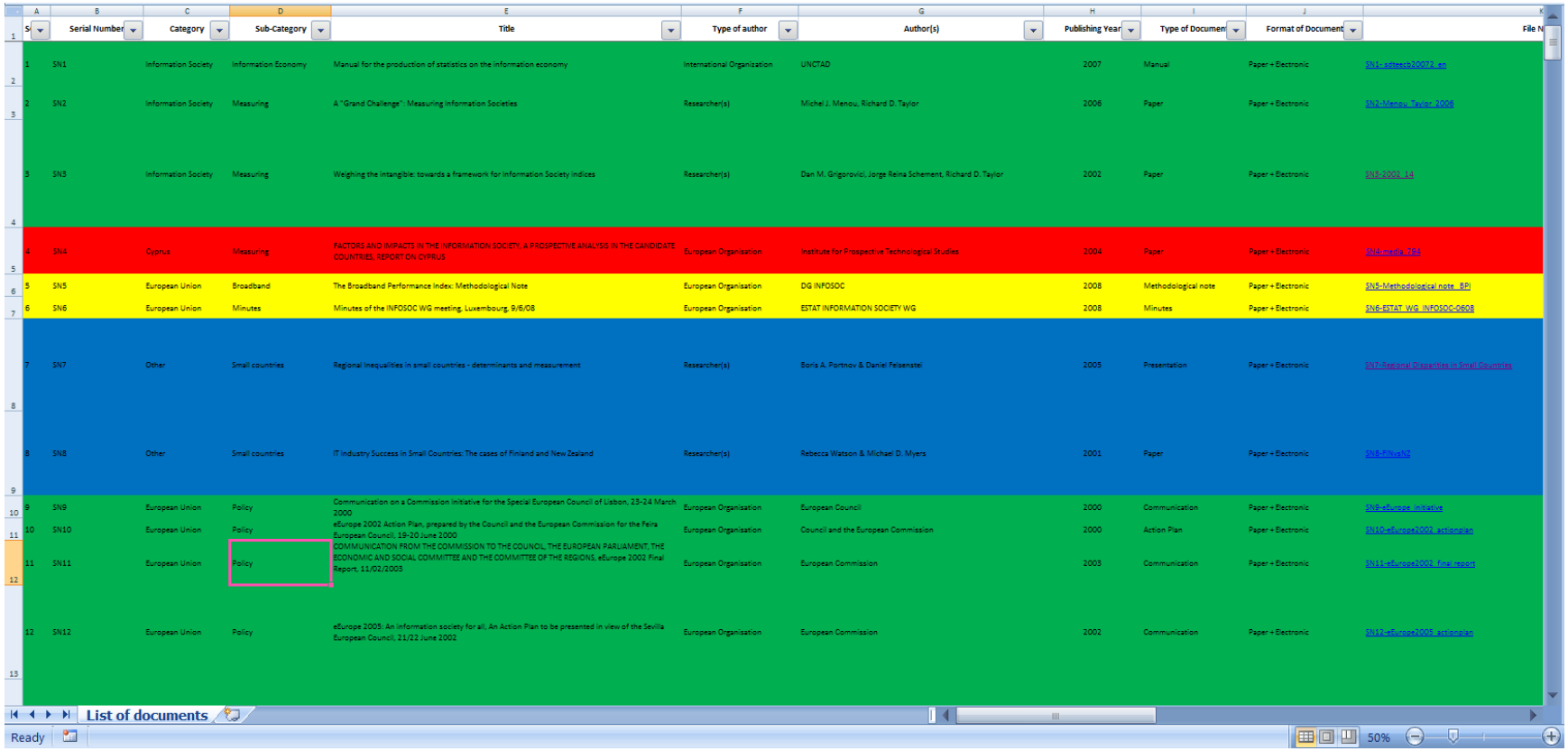
Organisation	Web address	Location of relevant documents in website	Free / Pay	Last Date Visited
ITU	www.itu.int	*Tab:* Statistics/ Publications	Free and Pay	30/6/2013
OECD	www.oecd.org	*Tab:* Topics *Topic:* Internet, Innovation, Science and Technology	Free and Pay	30/6/2013
UNCTAD	http://unctad.org/en/Pages/Home.aspx	*Tab:* Publications	Free	30/6/2013
MEASURING THE INFORMATION SOCIETY WEBSITE	http://new.unctad.org/default___575.aspx	Latest documents, UNCTAD's work on ICT measurement	Free	30/6/2013
UNESCO	https://en.unesco.org/	Theme: Building knowledge societies	Free	30/6/2013
IFAP INFORMATION SOCIETY OBSERVATORY	http://ifap-is-observatory.ittk.hu/	Subjects	Free	30/6/2013

Appendix 1b: National websites

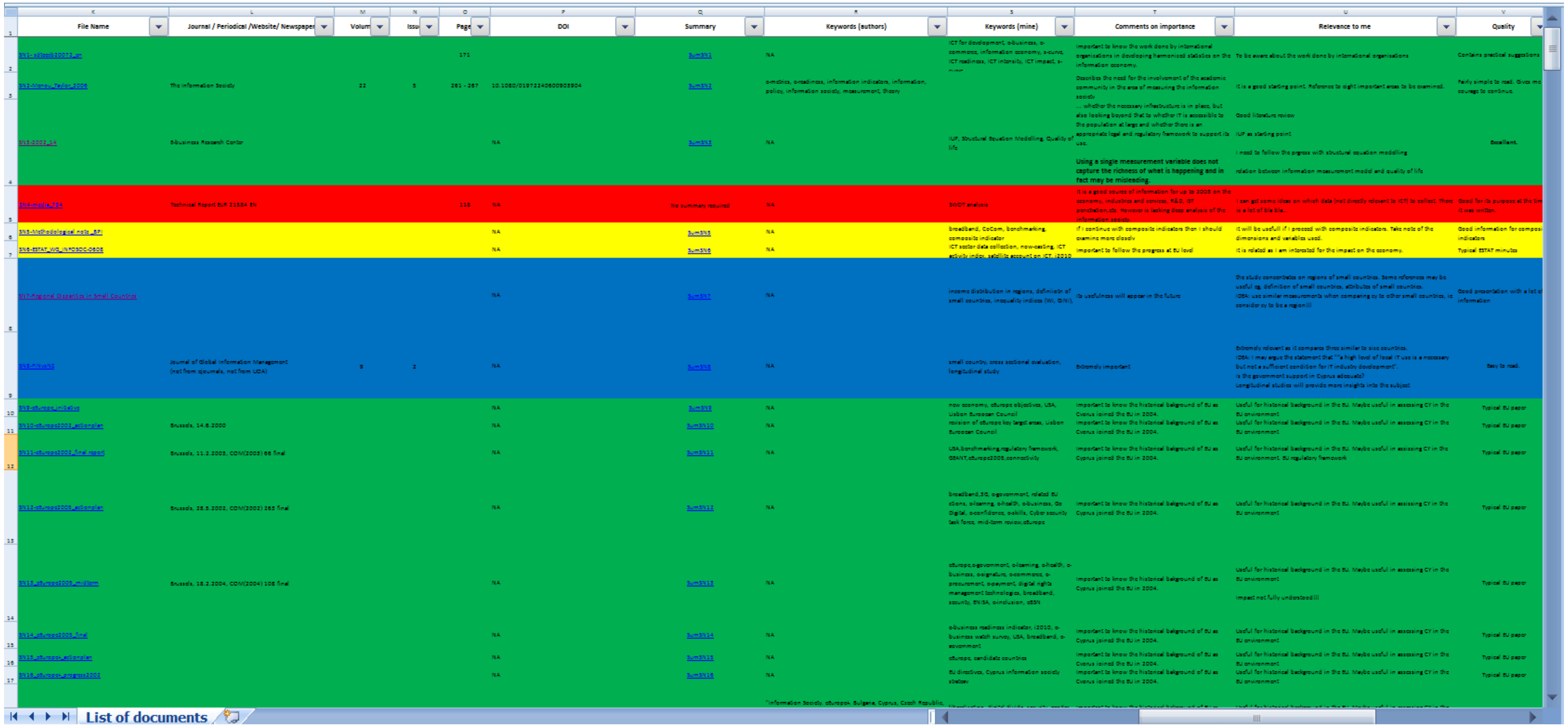
Organisation	Web address	Location and description of related contents	Free / Pay	Last Date Visited
Ministry of Finance	www.mof.gov.cy	**Location:** Regular Publications **Contents:** Stability programme	Free	1/10/2013
Planning Bureau	www.planning.gov.cy/	**Location:** Publications **Contents:** National Reform Programme, National Lisbon Programme, Strategic Development Plan	Free	1/10/2013
Department of Information Technology Services	www.mof.gov.cy/dits	**Location:** IT Projects, E.U **Contents:** IT projects, E.U.and national strategies	Free	1/10/2013
Office of the Commissioner of Electronic Communications and Postal Regulation	www.ocecpr.org.cy	**Location:** *Tab:* English Content **Contents:** Annual Report, Legislation (Greek only)	Free	1/10/2013

Organisation	Web address	Location and description of related contents	Free / Pay	Last Date Visited
Department of Electronic Communications/ Digital Cyprus	http://www.digitalcyprus.gov.cy/	**Location:** All sections **Contents (Greek only):** Digital Strategy, Action Plans, Progress Reports	Free	1/10/2013
CYSTAT	www.cystat.gov.cy	**Location:** Science and Technology/ Information Society **Contents:** Information Society statistics	Free	1/10/2013

Appendix 2a: Snapshots from file “Sources.xlsx”



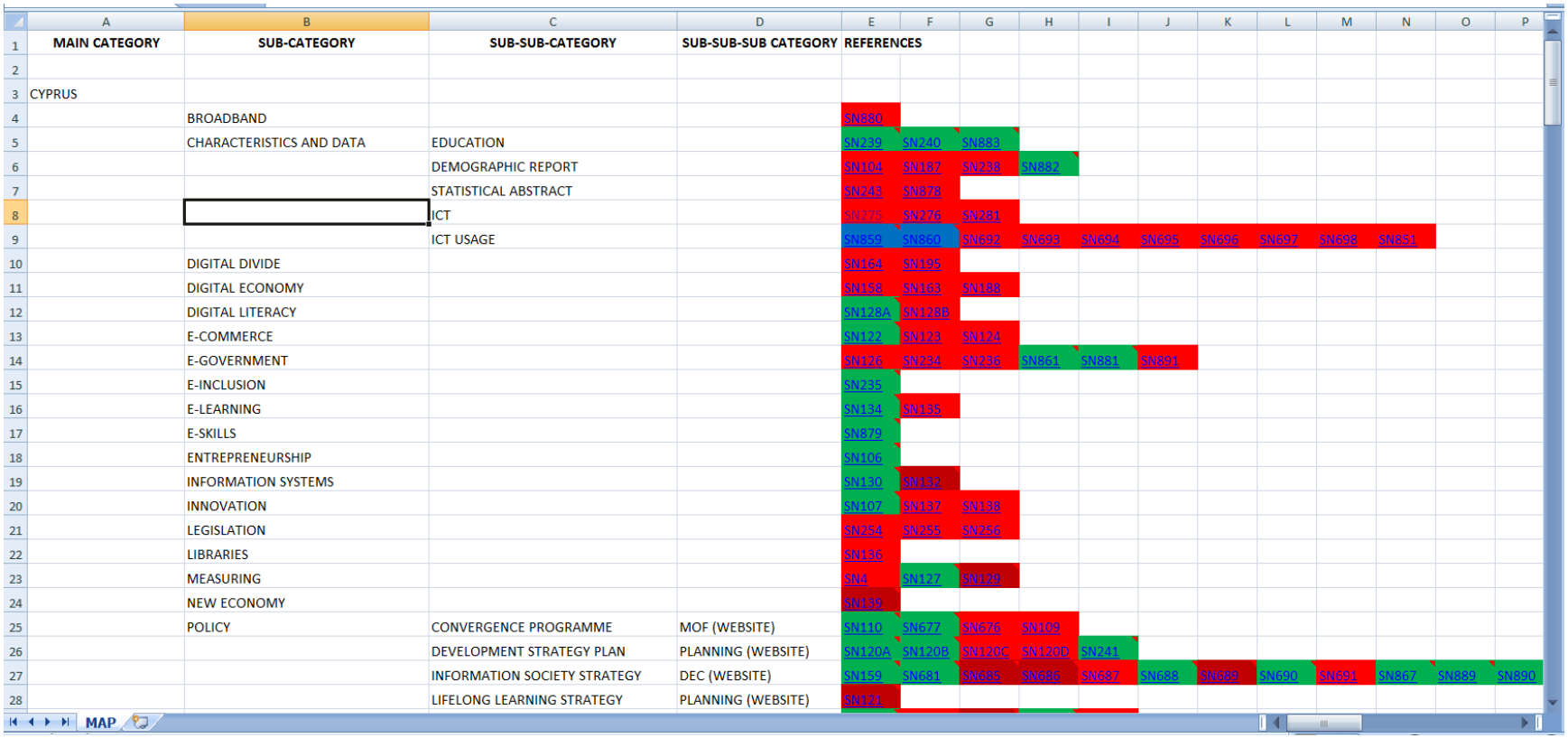
S	Serial Number	Category	Sub-Category	Title	Type of author	Author(s)	Publishing Year	Type of Document	Format of Document	File N
1	SN1	Information Society	Information Economy	Manual for the production of statistics on the information economy	International Organization	UNCTAD	2007	Manual	Paper + Electronic	SN1-sdteecb200712_en
2	SN2	Information Society	Measuring	A "Grand Challenge": Measuring Information Societies	Researcher(s)	Michel J. Menou, Richard D. Taylor	2006	Paper	Paper + Electronic	SN2-Menou_Taylor_2006
3	SN3	Information Society	Measuring	Weighing the intangible: towards a framework for Information Society indices	Researcher(s)	Dan M. Grigorovici, Jorge Reina Schement, Richard D. Taylor	2002	Paper	Paper + Electronic	SN3-2003_14
4	SN4	Cyprus	Measuring	FACTORS AND IMPACTS IN THE INFORMATION SOCIETY, A PROSPECTIVE ANALYSIS IN THE CANDIDATE COUNTRIES, REPORT ON CYPRUS	European Organisation	Institute for Prospective Technological Studies	2004	Paper	Paper + Electronic	SN4-media_294
5	SN5	European Union	Broadband	The Broadband Performance Index: Methodological Note	European Organisation	DG INFOSOC	2008	Methodological note	Paper + Electronic	SN5-Methodological note_BPI
6	SN6	European Union	Minutes	Minutes of the INFOSOC WG meeting, Luxembourg, 9/6/08	European Organisation	ESTAT INFORMATION SOCIETY WG	2008	Minutes	Paper + Electronic	SN6-ESTAT_WG_INFOSOC-0608
7	SN7	Other	Small countries	Regional Inequalities in small countries - determinants and measurement	Researcher(s)	Boris A. Portnov & Daniel Felsenstei	2005	Presentation	Paper + Electronic	SN7-Regional Disparities in Small Countries
8	SN8	Other	Small countries	IT Industry Success in Small Countries: The cases of Finland and New Zealand	Researcher(s)	Rebecca Watson & Michael D. Myers	2001	Paper	Paper + Electronic	SN8-FINvsNZ
9	SN9	European Union	Policy	Communication on a Commission Initiative for the Special European Council of Lisbon, 23-24 March 2000	European Organisation	European Council	2000	Communication	Paper + Electronic	SN9-eEurope_initiative
10	SN10	European Union	Policy	eEurope 2002 Action Plan, prepared by the Council and the European Commission for the Feira European Council, 19-20 June 2000	European Organisation	Council and the European Commission	2000	Action Plan	Paper + Electronic	SN10-eEurope2002_actionplan
11	SN11	European Union	Policy	COMMUNICATION FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, eEurope 2002 Final Report, 11/02/2003	European Organisation	European Commission	2003	Communication	Paper + Electronic	SN11-eEurope2002_final report
12	SN12	European Union	Policy	eEurope 2005: An information society for all, An Action Plan to be presented in view of the Sevilla European Council, 21/22 June 2002	European Organisation	European Commission	2002	Communication	Paper + Electronic	SN12-eEurope2005_actionplan



	File Name	Journal / Periodical /Website/ Newspaper	Volum	Issu	Page	DOI	Summary	Keywords (authors)	Keywords (mine)	Comments on importance	Relevance to me	Quality
2	SN1- sdlcctb20072_en				171		SumSN1	NA	ICT for development, e-business, e-commerce, information economy, s-curve, ICT readiness, ICT intensity, ICT impact, s-curve	Important to know the work done by international organisations in developing harmonised statistics on the information economy.	To be aware about the work done by international organisations	Contains practical suggestions
3	SN2-Menou_Taylor_2006	The Information Society	22	5	261 - 267	10.1080/01972240600903904	SumSN2	e-metrics, e-readiness, information indicators, information, policy, information society, measurement, theory		Describes the need for the involvement of the academic community in the area of measuring the information society	It is a good starting point. Reference to eight important areas to be examined.	Fairly simple to read. Gives me courage to continue.
4	SN3-2002_14	E-Business Research Center				NA	SumSN3	NA	IUP, Structural Equation Modelling, Quality of life	... whether the necessary infrastructure is in place, but also looking beyond that to whether IT is accessible to the population at large and whether there is an appropriate legal and regulatory framework to support its use. **Using a single measurement variable does not capture the richness of what is happening and in fact may be misleading.**	Good literature review IUP as starting point I need to follow the progress with structural equation modelling relation between information measurement model and quality of life	Excellent.
5	SN4-media_794	Technical Report EUR 21584 EN			118	NA	No summary required	NA	SWOT analysis	It is a good source of information for up to 2005 on the economy, industries and services, R&D, IST penetration,etc. However is lacking deep analysis of the information society.	I can get some ideas on which data (not directly relevant to ICT) to collect. There is a lot of bla bla...	Good for its purpose at the tim… it was written.
6	SN5-Methodological note _BPI					NA	SumSN5	NA	broadband, CoCom, benchmarking, composite indicator	If I continue with composite indicators then I should examine more closely	It will be usefull if I proceed with composite indicators. Take note of the dimensions and variables used.	Good information for composi… indicators
7	SN6-ESTAT_WG_INFOSOC-0608					NA	SumSN6	NA	ICT sector data collection, now-casting, ICT activity index, satellite account on ICT, i2010	Important to follow the progress at EU level	It is related as I am interested for the impact on the economy.	Typical ESTAT minutes
8	SN7-Regional Disparities in Small Countries					NA	SumSN7	NA	income distribution in regions, definiiotn of small countries, inequality indices (WI, GINI),	Its usefulness will appear in the future	The study concentrates on regions of small countries. Some references may be useful eg. definition of small countries, attributes of small countries. IDEA: use similar measurements when comparing cy to other small countries, ie consider cy to be a region!!!	Good presentation with a lot of information
9	SN8-FiNvsNZ	Journal of Global Information Management (not from ejournals, not from UCA)	9	2		NA	SumSN8	NA	small country, cross sectional evaluation, longitudinal study	Extremely important	Extremely relevant as it compares three similar to size countries. IDEA: I may argue the statement that ""a high level of local IT use is a necessary but not a sufficient condition for IT industry development"". Is the government support in Cyprus adequate? Longitudinal studies will provide more insights into the subject	Easy to read.
10	SN9-eEurope_initiative					NA	SumSN9	NA	new economy, eEurope objectives, USA, Lisbon European Council	Important to know the historical bakground of EU as Cyprus joined the EU in 2004.	Useful for historical background in the EU. Maybe useful in assessing CY in the EU environment	Typical EU paper
11	SN10-eEurope2002_actionplan	Brussels, 14.6.2000				NA	SumSN10	NA	revision of eEurope key target areas, Lisbon European Council	Important to know the historical bakground of EU as Cyprus joined the EU in 2004.	Useful for historical background in the EU. Maybe useful in assessing CY in the EU environment	Typical EU paper
12	SN11-eEurope2002_final report	Brussels, 11.2.2003, COM(2003) 66 final				NA	SumSN11	NA	USA,benchmarking,regulatory framework, GEANT,eEurope2005,connectivity	Important to know the historical bakground of EU as Cyprus joined the EU in 2004.	Useful for historical background in the EU. Maybe useful in assissing CY in the EU environment. EU regulatory framework	Typical EU paper
13	SN12-eEurope2005_actionplan	Brussels, 28.5.2002, COM(2002) 263 final				NA	SumSN12	NA	broadband,3G, e-government, related EU ctions, e-learning, e-health, e-business, Go Digital, e-confidence, e-skills, Cyber security task force, mid-term review,eEurope	Important to know the historical bakground of EU as Cyprus joined the EU in 2004.	Useful for historical background in the EU. Maybe useful in assissing CY in the EU environment	Typical EU paper
14	SN13_eEurope2005_midterm	Brussels, 18.2.2004, COM(2004) 108 final				NA	SumSN13	NA	eEurope,e-government, e-learning, e-health, e-business, e-signature, e-commerce, e-procurement, e-payment, digital rights management technologies, broadband, security, ENISA, e-inclusion, eESN	Important to know the historical bakground of EU as Cyprus joined the EU in 2004.	Useful for historical background in the EU. Maybe useful in assessing CY in the EU environment Impact not fully understood!!!	Typical EU paper
15	SN14_eEurope2005_final					NA	SumSN14	NA	e-business readiness indicator, i2010, e-business watch survey, USA, broadband, e-government	Important to know the historical bakground of EU as Cyprus joined the EU in 2004.	Useful for historical background in the EU. Maybe useful in assessing CY in the EU environment	Typical EU paper
16	SN15_eEurope+_actionplan					NA	SumSN15	NA	eEurope, candidate countries	Important to know the historical bakground of EU as Cyprus joined the EU in 2004.	Useful for historical background in the EU. Maybe useful in assessing CY in the EU environment	Typical EU paper
17	SN16_eEurope+_progress2002					NA	SumSN16	NA	EU directives, Cyprus information society strategy	Important to know the historical bakground of EU as Cyprus joined the EU in 2004.	Useful for historical background in the EU. Maybe useful in assessing CY in the EU environment	Typical EU paper
18								"Information Society. eEurope+. Bulgaria, Cyprus, Czech Republic, …				

List of documents

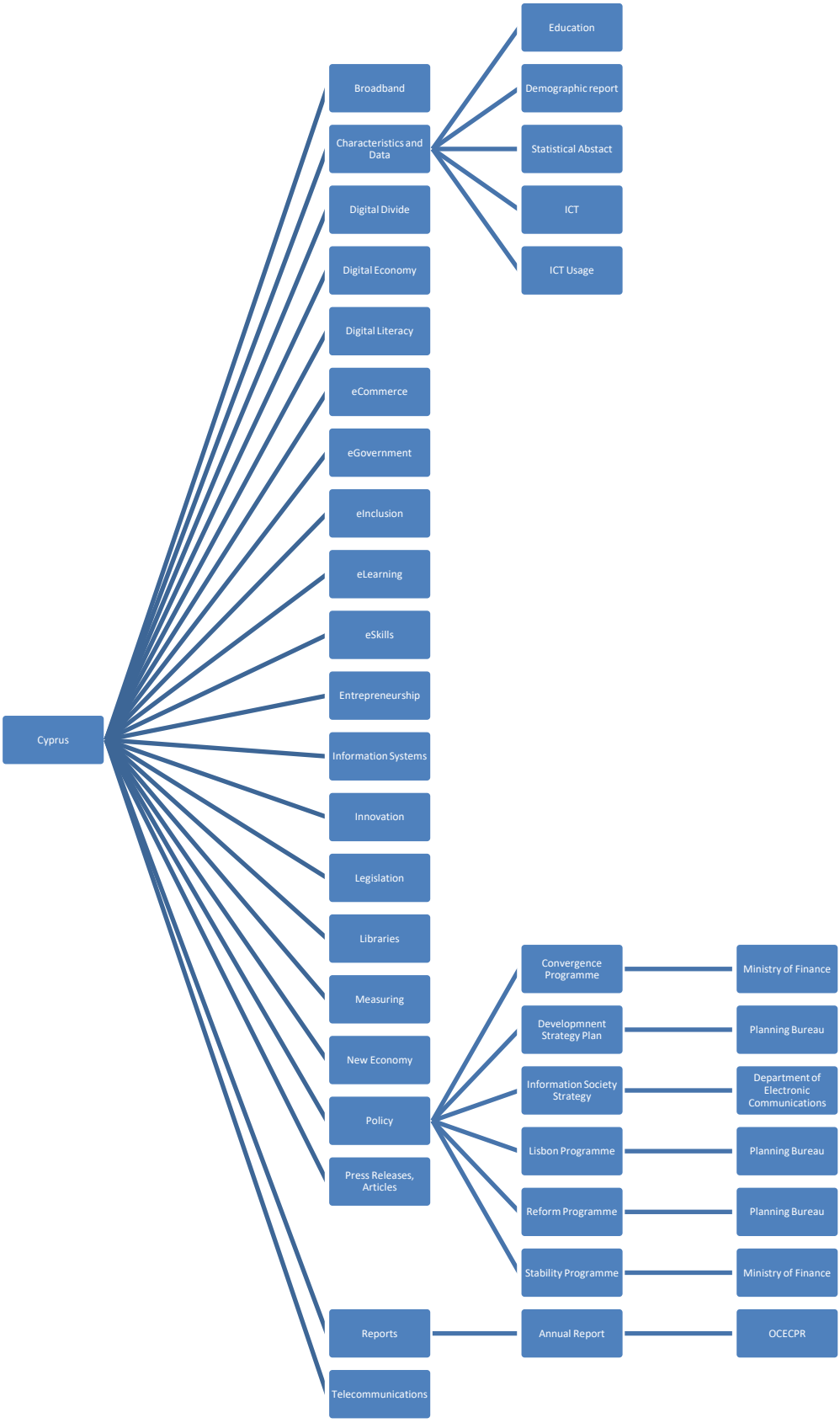
Appendix 2b: Snapshot from file “Map.xlsx”

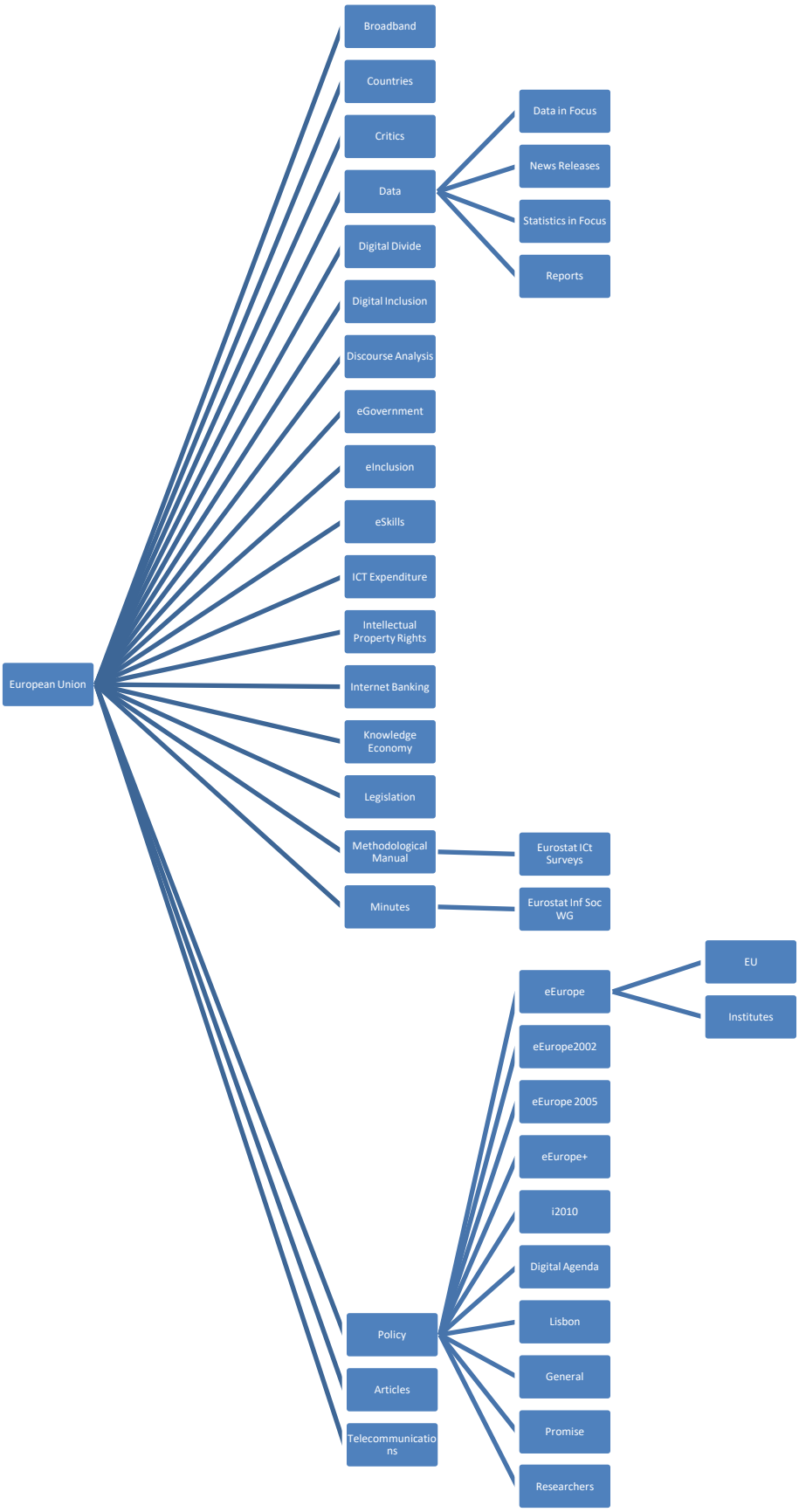


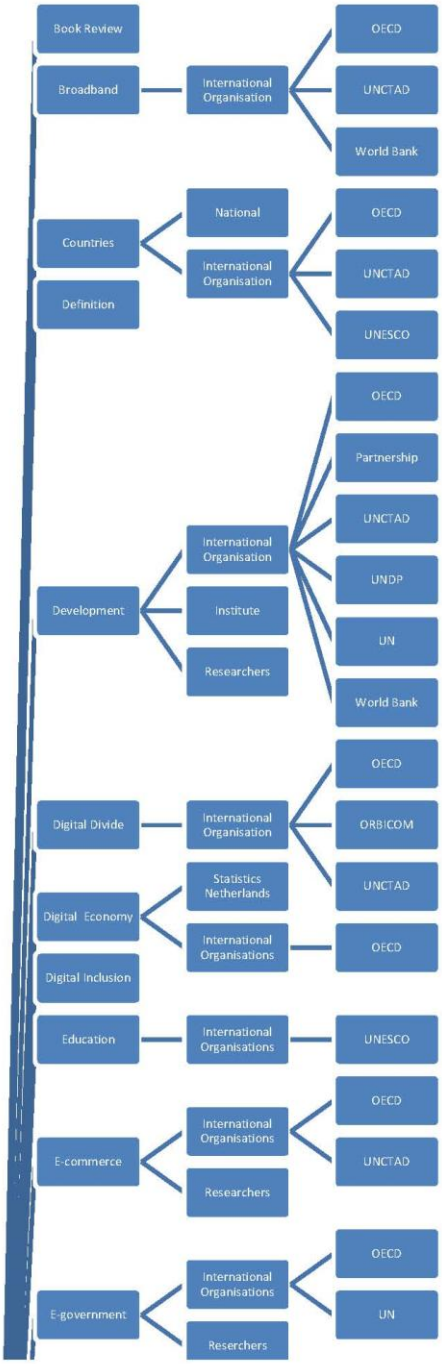
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	MAIN CATEGORY	SUB-CATEGORY	SUB-SUB-CATEGORY	SUB-SUB-SUB CATEGORY	REFERENCES											
2																
3	CYPRUS															
4		BROADBAND			SN880											
5		CHARACTERISTICS AND DATA	EDUCATION		SN239	SN240	SN883									
6			DEMOGRAPHIC REPORT		SN104	SN187	SN238	SN882								
7			STATISTICAL ABSTRACT		SN243	SN878										
8			ICT		SN275	SN276	SN281									
9			ICT USAGE		SN859	SN860	SN692	SN693	SN694	SN695	SN696	SN697	SN698	SN851		
10		DIGITAL DIVIDE			SN164	SN195										
11		DIGITAL ECONOMY			SN158	SN163	SN188									
12		DIGITAL LITERACY			SN128A	SN128B										
13		E-COMMERCE			SN122	SN123	SN124									
14		E-GOVERNMENT			SN126	SN234	SN236	SN861	SN881	SN891						
15		E-INCLUSION			SN235											
16		E-LEARNING			SN134	SN135										
17		E-SKILLS			SN879											
18		ENTREPRENEURSHIP			SN106											
19		INFORMATION SYSTEMS			SN130	SN132										
20		INNOVATION			SN107	SN137	SN138									
21		LEGISLATION			SN254	SN255	SN256									
22		LIBRARIES			SN136											
23		MEASURING			SN4	SN127	SN129									
24		NEW ECONOMY			SN139											
25		POLICY	CONVERGENCE PROGRAMME	MOF (WEBSITE)	SN110	SN677	SN676	SN109								
26			DEVELOPMENT STRATEGY PLAN	PLANNING (WEBSITE)	SN120A	SN120B	SN120C	SN120D	SN241							
27			INFORMATION SOCIETY STRATEGY	DEC (WEBSITE)	SN159	SN681	SN685	SN686	SN687	SN688	SN689	SN690	SN691	SN867	SN889	SN890
28			LIFELONG LEARNING STRATEGY	PLANNING (WEBSITE)	SN121											

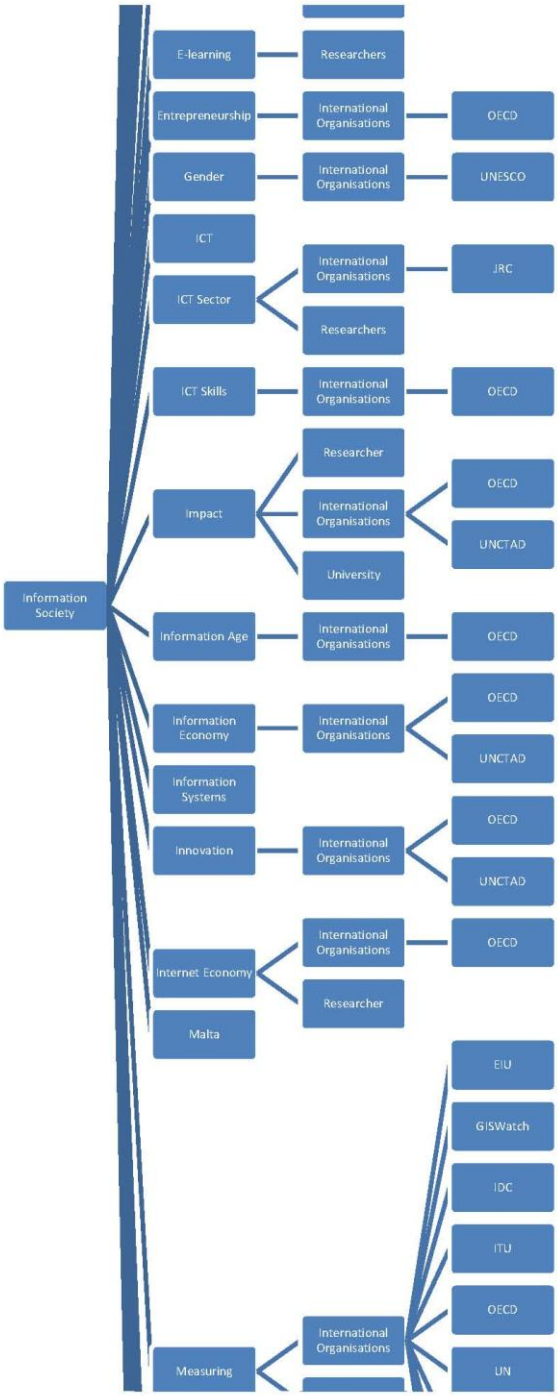
MAP

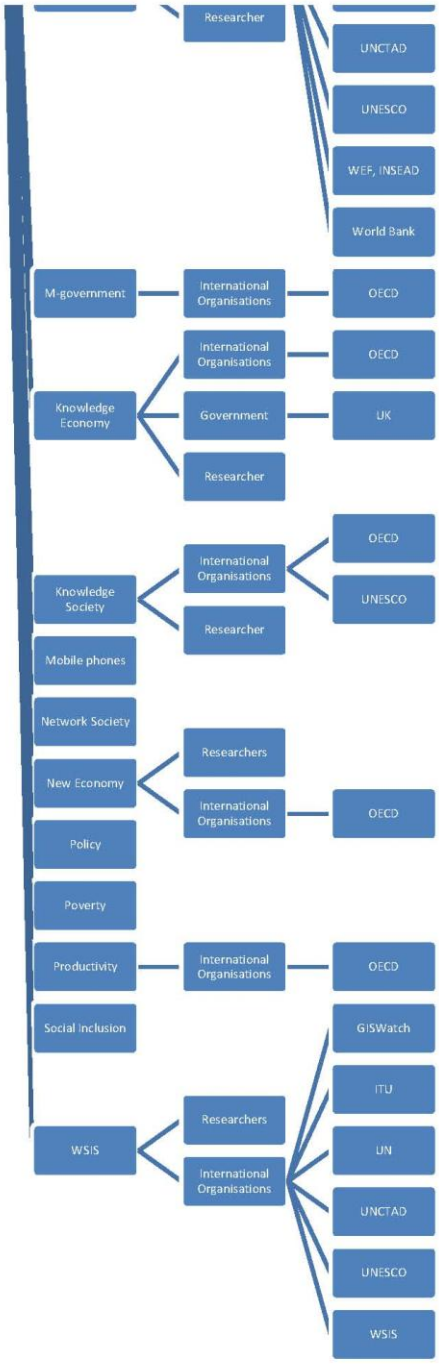
Appendix 2c: Hierarchical Tree Structure

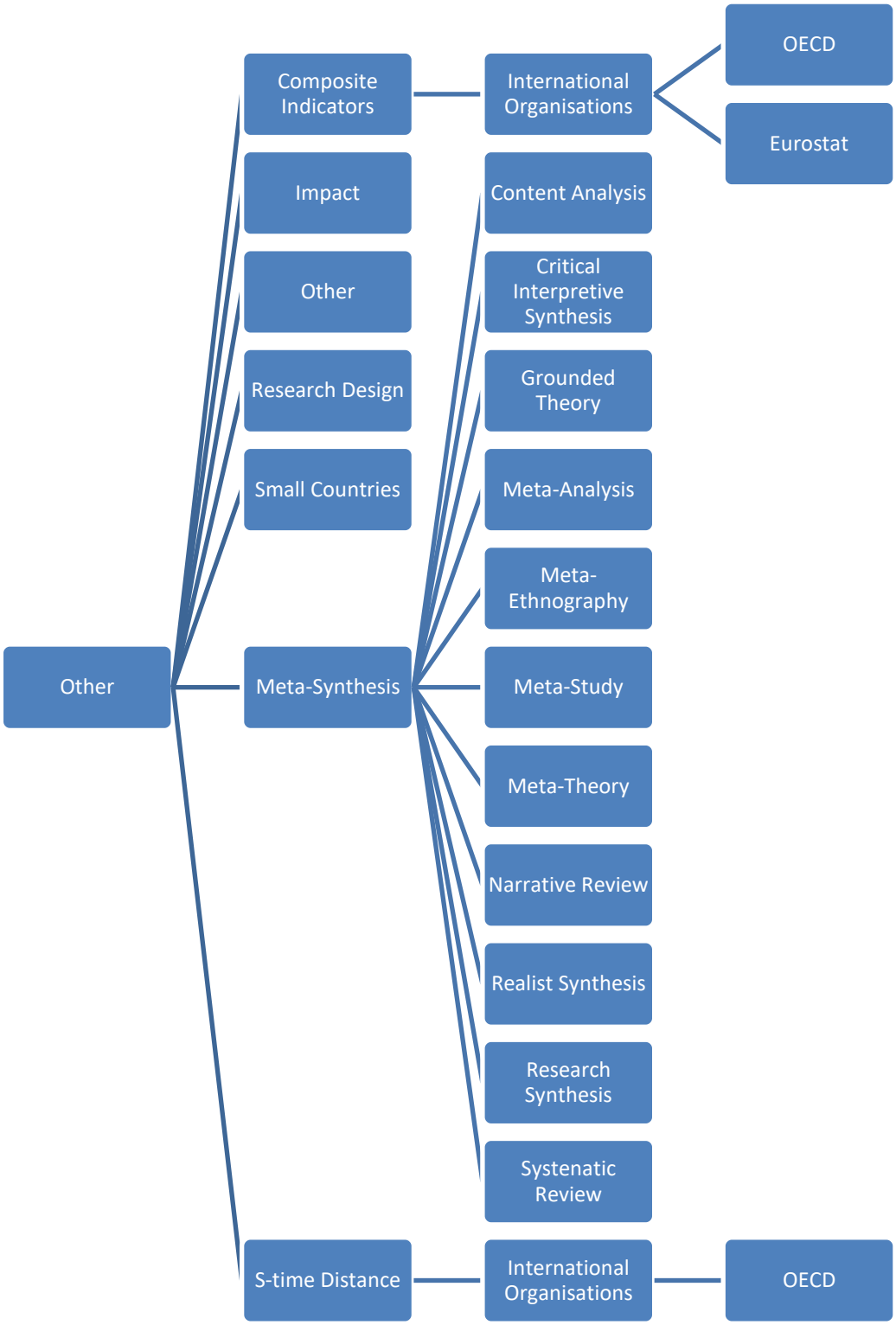



European Union
Broadband
Countries
Critics
Data
Data in Focus
News Releases
Statistics in Focus
Reports
Digital Divide
Digital Inclusion
Discourse Analysis
eGovernment
eInclusion
eSkills
ICT Expenditure
Intellectual Property Rights
Internet Banking
Knowledge Economy
Legislation
Methodological Manual
Eurostat ICt Surveys
Minutes
Eurostat Inf Soc WG
Policy
eEurope
EU
Institutes
eEurope2002
eEurope 2005
eEurope+
i2010
Digital Agenda
Lisbon
General
Promise
Researchers
Articles
Telecommunications


Book Review
Broadband
International Organisation
OECD
UNCTAD
World Bank
Countries
National
International Organisation
OECD
UNCTAD
UNESCO
Definition
Development
International Organisation
OECD
Partnership
UNCTAD
UNDP
UN
World Bank
Institute
Researchers
Digital Divide
International Organisation
OECD
ORBICOM
UNCTAD
Digital Economy
Statistics Netherlands
International Organisations
OECD
Digital Inclusion
Education
International Organisations
UNESCO
E-commerce
International Organisations
OECD
UNCTAD
Researchers
E-government
International Organisations
OECD
UN
Reserchers


Information Society
E-learning
Researchers
Entrepreneurship
International Organisations
OECD
Gender
International Organisations
UNESCO
ICT
ICT Sector
International Organisations
JRC
Researchers
ICT Skills
International Organisations
OECD
Impact
Researcher
International Organisations
OECD
UNCTAD
University
Information Age
International Organisations
OECD
Information Economy
International Organisations
OECD
UNCTAD
Information Systems
Innovation
International Organisations
OECD
UNCTAD
Internet Economy
International Organisations
OECD
Researcher
Malta
Measuring
International Organisations
EIU
GISWatch
IDC
ITU
OECD
UN


Researcher
UNCTAD
UNESCO
WEF, INSEAD
World Bank
M-government
International Organisations
OECD
International Organisations
OECD
Knowledge Economy
Government
UK
Researcher
OECD
International Organisations
Knowledge Society
UNESCO
Researcher
Mobile phones
Network Society
Researchers
New Economy
International Organisations
OECD
Policy
Poverty
Productivity
International Organisations
OECD
Social Inclusion
GISWatch
ITU
Researchers
WSIS
UN
International Organisations
UNCTAD
UNESCO
WSIS


Other
Composite Indicators
Impact
Other
Research Design
Small Countries
Meta-Synthesis
S-time Distance
International Organisations
Content Analysis
Critical Interpretive Synthesis
Grounded Theory
Meta-Analysis
Meta-Ethnography
Meta-Study
Meta-Theory
Narrative Review
Realist Synthesis
Research Synthesis
Systenatic Review
International Organisations
OECD
Eurostat
OECD

Appendix 3: List of Journals

SN	E-Journal	Provider	Availability
1	American Journal of Evaluation	Swetswise	From 1999
2	Applied Economics Letters	EBSCOhost	From 1994
3	BMC Medical Research Methodology	Directory Open Access Journals	From 2001
4	British journal for the philosophy of science	JSTOR Swetswise	From 1950 until 2006 From 1997
5	British Journal of Social Work	Oxford Journals	From 1971
6	Computers in Human Behavior	ScienceDirect	From 1995
7	Educational Researcher	JSTOR Swetswise	From 1972 to 2010 From 2010
8	European management journal	ScienceDirect	From 1995
9	Explorations in economic history	Chadwyck ScienceDirect	From 1949 to 1990 From 1993
10	Futures	ScienceDirect	From 1995
11	Geographical Journal	Wiley	From 2000
12	Government information quarterly	ScienceDirect	From 1995
13	Industrial Management & Data Systems	Emerald Insight	From 1994
14	Information & Management	ScienceDirect	From 1995
15	Information economics and policy	ScienceDirect	From 1995
16	Information processing & management	ScienceDirect	From 1995
17	Information Research	Directory Open Access Journals	From 1995
18	International journal of entrepreneurial behaviour & research	Emerald Insight	From 1995
19	International journal of information ethics	IRIE	From 2004
20	International Journal of Qualitative Methods	Directory Open Access Journals	Since 2002
21	International Journal of Qualitative Studies on Health and Well-being	Directory Open Access Journals	Since 2006
22	International Journal of Science Education	Taylor & Francis	From 1997 to 2008

23	International statistical review	JSTOR Wiley	From 1933 to 2008 From 1997
24	Journal of Business Research	ScienceDirect	From 1995
25	Journal of chiropractic medicine	ScienceDirect	From 2002
26	Journal of common market studies	EBSCOhost	From 1964
27	Journal of computing and information technology	Directory Open Access Journals	From 2009
28	Journal of documentation	Emerald Insight	From 1997
29	Journal of economic surveys	EBSCOhost	From 1987
30	Journal of elder abuse & neglect	Taylor & Francis	From 1997
31	Journal of European Integration	Taylor & Francis	From 1997 to 2010
32	Journal of information technology	Directory Open Access Journals	From 1986
33	Journal of social policy	Swetswise	From 1997
34	Journal of sustainable tourism	Swetswise	From 1996
35	Journal of the American Society for information science Journal of the American Society for information science and technology	EBSCOhost EBSCOhost	From 1950 to 2000 From 2001
36	New media & society	Swetswise	From 1999
37	Nursing in critical care	Swetswise	From 2003
38	Qualitative health research	Swetswise	From 1999
39	Research in nursing & health	Wiley	From 1996
40	Review of general psychology	ProQuest	From 1997
41	Research policy	ScienceDirect	From 1995
42	Research synthesis methods	Wiley	From 2010
43	Sociological Perspectives	JSTOR	From 1958
44	Technovation	ScienceDirect	From 1995
45	Telecommunications policy	ScienceDirect	From 1995
46	Telematics and informatics	ScienceDirect	From 1994

46	The information society	Taylor & Francis	From 1982
47	The international information & library review	ScienceDirect	From 1993
48	The qualitative report	Directory Open Access Journals	From 1990
49	Women in management review	Emerald Insight	From 1994

Appendix 4: Search results

ITU

Search Number	Phrase	Scope	Language	Result Type	Result[1]	Duplicates[2]	Examined[3]	Selected[4]	With fee[5]
1	Information Society	Publications	English	All Results	404	276	128	10(6)	4
2	Knowledge Society	Publications	English	All Results	0				
3	Information Economy	Publications	English	All Results	0				
4	ICT	Publications	English	All Results	707	519	188	4(4)	7(1)
5	Information Society + Cyprus	Publications	English	All Results	0				
6	Knowledge Society + Cyprus	Publications	English	All Results	0				
7	Information Economy + Cyprus	Publications	English	All Results	0				
8	ICT + Cyprus	Publications	English	All Results	0				

[1]: Number of documents returned

[2]: Number of duplicates (as indicated by the search engine)

[3]: Number of documents examined

[4]: Number of documents selected and saved

[5]: Number of documents selected but not saved due to a fee payment

[4]+[5]: The number in parenthesis denotes different titles

OECD

Search Number	Phrase	Date	Imprints	Language	Content Type[1]	Theme	Result											Selected[3]
							Total	Article	Book	Chapter	Data	Graph	Issue	Serial	Table	Table Col.[2]	Working/ Policy	
1	Information Society	1900-2013	All	English	All	Science and Technology	874	8	184	510	0	0	1	0	1	0	170	25(14)
2	Knowledge Society	1900-2013	All	English	All	Science and Technology	710	6	157	424	0	0	0	0	1	0	122	7(7)
3	Information Economy	1900-2013	All	English	All	Science and Technology	1454	17	263	802	0	3	29	3	2	1	334	5(5)
4	ICT	1900-2013	All	English	All	Science and Technology	1116	17	155	598	2	95	24	1	45	0	179	0
5	Information Society + Cyprus	1900-2013	All	English	All	Science and Technology	37	6	7	14	0	0	0	0	0	0	10	1
6	Knowledge Society + Cyprus	1900-2013	All	English	All	Science and Technology	29	6	6	10	0	0	0	0	0	0	7	0
7	Information Economy + Cyprus	1900-2013	All	English	All	Science and Technology	59	6	8	27	0	0	0	0	0	0	18	0
8	ICT + Cyprus	1900-2013	All	English	All	Science and Technology	53	6	7	26	0	0	0	0	0	0	14	0
9	Information Society	1900-2013	All	English	All	Economics	1444	131	305	700	0	10	28	9	41	2	218	3(3)*

Search Number	Phrase	Date	Imprints	Language	Content Type[1]	Theme	Result											Selected[3]
							Total	Article	Book	Chapter	Data	Graph	Issue	Serial	Table	Table Col.[2]	Working/ Policy	
10	Knowledge Society	1900-2013	All	English	All	Economics	656	82	144	307	0	5	18	5	0	0	95	3(3)
11	Information Economy	1900-2013	All	English	All	Economics	265	14	24	47	3	1	65	39	42	0	30	4(4)
12	ICT	1900-2013	All	English	All	Economics	1011	52	160	585	0	24	17	1	56	0	116	5(5)
13	Information Society + Cyprus	1900-2013	All	English	All	Economics	26	8	5	11	0	0	0	0	0	0	2	0
14	Knowledge Society + Cyprus	1900-2013	All	English	All	Economics	16	7	4	4	0	0	0	0	0	0	1	0
15	Information Economy + Cyprus	1900-2013	All	English	All	Economics	110	11	21	43	0	0	18	1	0	0	16	0
16	ICT + Cyprus	1900-2013	All	English	All	Economics	21	1	3	14	0	0	1	0	0	0	2	0

[1]: Content Type: Books, Papers, Statistics, Glossaries, Factbook [2]: Table Collection [3]: The number in parenthesis denotes different titles

*: Two additional documents not selected due to fee payment

UNCTAD

Search Number	Phrase	Date	Thematic Taxonomy	Product Taxonomy	Results	Selected[1]
1	Information Society	All	Any	Any	1300	10 (10)
2	Knowledge Society	All	Any	Any	120	1
3	Information Economy	All	Any	Any	770	1
4	ICT	All	Any	Any	2900	0
5	Information Society + Cyprus	All	Any	Any	87	0
6	Knowledge Society + Cyprus	All	Any	Any	17	0
7	Information Economy + Cyprus	All	Any	Any	66	0
8	ICT + Cyprus	All	Any	Any	210	0

[1]: The number in parenthesis denotes different titles

UNESCO

Search Number	Phrase	Results	Displayed	Selected
1	Information Society	13.600	39	4
2	Knowledge Society	3.670	40	2
3	Information Economy	236	26	3
4	ICT	86.600	44	0
5	Information Society + Cyprus	3.160	19	2
6	Knowledge Society + Cyprus	1.400	13	1
7	Information Economy + Cyprus	7	7	0
8	ICT + Cyprus	8080	26	0

Primo: Aber collections

Search Number	Phrase	Results	Full text online	Books	Journals	Databases
1	Information Society	381	148	141	7	0
2	Knowledge Society	37	22	13	9	0
3	Information Economy	17	6	5	1	0
4	ICT	203	93	76	14	3

Primo: Articles and more

Search Number	Phrase	Results	Full text online	Articles	Books	Conference proceedings	Reviews	Dissertations	Other
1	Information Society	84.286	29.209						
	Topic: Information Society		1.214*	897	14	180	83	57	47
2	Knowledge Society	25.043	10.060						
	Topic: Knowledge Society		345*	280	1	37	7	11	12
3	Information Economy	19.248	6.764						
	Topic: Information Economy		103*	56	0	45	1	1	2
4	ICT	352.139	107.761						
	Topic: ICT		2.559*	1.648	3	536	51	181	176

* Documents may be classified in more than one resource type

Primo: CADAIR

Search Number	Phrase	Results
1	Information Society	4
2	Knowledge Society	0
3	Information Economy	0
4	ICT	8

Appendix 5: Measurements

Appendix 5.1: Information Society Index

Class	Variable
Computer infrastructure	PC's installed per capita; Home PC's shipped per household; Government and commercial PC's shipped per non-agricultural workforce; Educational PC's shipped per student and faculty; Percent of non-home networked PC's; Software vs. hardware spending
Information infrastructure	Cable subscribers per capita; Cellular phone ownership per capita; Cost per phone call; Fax ownership per capita; Radio ownership per capita; Telephone line error rates; Telephone lines per household; TV ownership per capita
Internet infrastructure	Business Internet users per non-agricultural workforce; Home Internet users per household; Education Internet users per student and faculty; eCommerce spending per total Internet users
Social infrastructure	Civil liberties; Newspaper readership per capita; Press freedom; Secondary school enrolment; Tertiary school enrolment

Appendix 5.2: Information Utilization Potential

Structural groups:

Category	Groups	Variables
Background conditions	Physical environment	Geoclimatic homogeneity, territorial continuity, morphological homogeneity, habitability, population density, precipitations, insularity, access to seas, proximity to the 'information pole", climate appropriateness.
	Transportation infrastructures	Density of roads, practicability of roads, density of railroads, density of inland waterways, number of domestic seaways, number of international airways, growth of transportation infrastructures.
	Population	Total population, urban population, concentration, sedentarity, economically active population, young users, elderly users, expectation of life at birth, median age, population growth, median age change.
	Socio-cultural environment	Literacy rate, book history, press history, formal education history, language homogeneity, carrier capacity of the communication language, ethnic homogeneity, religious homogeneity, associations, urbanization, woman's promotion, female participation in labour force, household size, growth of literacy rate.
	General economics	Gross National Product per capita, investments, private consumption expenditure, savings, inflation rate, unemployment, growth of GNP, growth of investments.
	Administrative controls	Central office for science and technology information, regulation of the information sector, stability, urban network, central imports control, central exchange control, convertibility, external debt.
Information needs and uses	Agriculture	Agricultural product, priority level of agriculture, food self-sufficiency, agricultural modernization, agricultural diversification, agricultural employment, change in share of GDP by agriculture, growth rate of agricultural product.
	Industry	Industrial product, priority level of industry, industrial autonomy, steel consumption, energy consumption, mining, manufacturing, construction, industrial diversification, industrial employment, change in share of GDP by industry, growth rate of manufacturing.
	Health	Priority level of health, crude death rate, death rate due to infectious and parasitic diseases, calorie consumption, sanitation, physicians, hospital beds, change in crude death rate.

	Foreign Trade	Foreign trade, share of world trade, exports, imports, concentration of exports, exports of manufactured goods, balance of payments, foreign investments, growth of foreign trade.
	Public administration	Size of the government sector, government history, government diversification, federalism, centralization, income tax, international cooperation, growth of government sector, growth rate of central government consumption.
Information activities and services	Research and Development	Research effort, research manpower, researchers in natural sciences, researchers in engineering and technology, researchers in medical sciences, researchers in agriculture, researchers in social sciences and humanities, research activities in the productive sector, number of research institutions, growth of research effort.
	Education	Educational effort, priority level of education, primary enrolment, vocational enrolment, higher education enrolment, teacher/ pupil ratio, teacher/ student ratio, number of teachers, number of institutions of higher learning, level of primary education, level of secondary education, level of higher education, growth of total enrolment.
	Archive, Library, Information and data services	Number of units, number of numerical data services, number of volumes in library collections, number of current titles of periodical titles held, number of linear Kms of archives, history of the national library, acquisitions, number of indexing and abstracting services, number of registered users, number of subscriptions to 22 data bases, number of subscriptions to 1 on-line service, number of information oriented professional schools, number of information related professional associations, archive library information and data services workers, growth in number of units.
	Other components of the information sector	Tertiary sector, commodity inspection and exploration services, private information services, search coordination and risk industries, communication industries, information processing and transmission industries, consumption and intermediate information goods, investments information goods, wholesale and retail trade of information goods, support facilities and services for information activities, secondary information sector, growth of the information sector, change in share of GDP by the tertiary sector.
	Information manpower	Tertiary sector employment, professional technical and related workers and administrative and managerial workers.

	Primary information	Book production, original book production, book translations, book circulation, scientific/ professional periodicals, circulation of scientific/ professional periodicals, journal articles, journal articles published abroad, theses and dissertations, patents deposited, patents registered, foreign patents, reports production, number of book trade organizations, subscriptions to 33 scientific journals, foreign literature use, number of publishers, book trade balance, scientific/ professional periodicals trade balance, intellectual property royalties balance, number of publishing scientists, growth of scientific/ professional periodicals, growth of journal articles.
	Mass media	Number of newspapers, circulation of newspapers, number of general interest periodicals, circulation of general interest periodicals, number of hours of radio broadcasting, number of hours of TV broadcasting, foreign radio programmes, foreign TV programmes, film production , film trade balance, number of cinema seats, growth of circulation of newspapers, growth of radio and TV hours of broadcasting.
	Inter-personal communication	Domestic mail traffic, incoming international mail, outgoing international mail, domestic telephone traffic, international telephone traffic, domestic telex traffic, domestic telegram traffic, international telegram traffic, international meetings, fairs and exhibitions, participation in international associations, growth of telephone service, growth of telephone service, growth of domestic communications, growth of international communications.
	Travel	Number of cars, number of trucks/ buses, railway traffic, bus traffic, maritime traffic, internal air traffic, incoming international air traffic, outgoing international air traffic, growth of transport and communication sector.
	Information processing goods	Radio stations, TV stations, telecommunication satellites, number of nodes of international data transmission networks, telephones, computers, data transmission networks, radio receivers, TV receivers, paper consumption, paper imports, trade balance of information processing goods, growth of information processing goods.

Functional groups:

Functional group	Number of primary/ secondary factors (In parenthesis x/y: x denotes the number of variables allocated as primary factor and y as secondary factor
Role of central government	Overall control (8/27)
Role of potential users	Intensity of needs (28/21) Diversification of needs (38/18)
Role of authors	Generation of information (33/65)
Role of publishers	Recording of information (2/64) Reproduction and duplication (5/27) Distribution of primary information (21/87)
Role of information services	Acquisition (9/27) Storage (1/15) Organization and control (7/28) Dissemination and access to secondary information (12/33) Access to primary information (4/64) Analysis, consolidation and repackaging of information (0/30) Extension and liaison services (0/24)
Role of users	Use and assimilation of information (40/80) Assimilation of information by education (7/16)
Role of other countries	Exports of information (1/27) Imports of information (16/22)

Appendix 5.3: Infometrics 4C model

Index	Sub-index	Variables
Connectivity	Availability	Number of cable subscriptions, number of telephone subscriptions, number of cell phone subscriptions, number of personal computers available at home, total number of telephone main lines, number of telephone lines per 1000 inhabitants.
	Spending	Cell phone monthly subscription and connection fees, dial-up PSTN monthly subscription and charge, dial-up ISP monthly subscription and charge, overall dial-up charge per hour of use.
	Usage	No variables available.
	Quality	No variables available.
Capability	Experience with computers	Number of personal computers.
	Financial capability	Average wages.
	Secondary education	Level of completion for secondary education.
Content	Secure servers	Overall number of secure servers.
	Internet hosts	Total number of internet hosts, number of hosts per 100 inhabitants.
Context	Media outlets	Number of daily newspapers, radios, TVs.
	ICT	Teledensity, telecom revenues & investments.
	Demographics	Population, population density, rural vs urban population in percent of total population.

Appendix 5.4: Knowledge-based economies and societies

Dimension	Characteristic	Indicator
Innovation and entrepreneurship	Research base and potential for knowledge creation	Total R&D expenditure by sector of performance as a proportion of GDP; Total R&D expenditure by sector of performance; Expenditure on basic research by sector of performance as a proportion of GDP; Expenditure on basic research by broad discipline, as a proportion of GDP; Business R&D expenditure by business size; Number of scientific and technical publications, per capita.
	Knowledge creation with commercial potential	Expenditure on applied research and experimental development by sector of performance, as a proportion of GDP; Business R&D expenditure by broad industry and by technology intensity of industry; Number of Australian resident patents in 'triadic' patent families per million population; Number of international patent applications filed with the World Intellectual Property Organisation (WIPO) by country of origin; Inventiveness co-efficient: number of resident patent applications per capita; Patent applications filed in Australia in particular fields.
	Other knowledge creation	No indicators are proposed
	Knowledge networks and flows	Business funding of R&D performed by other sectors as a proportion of total R&D expenditure; Proportion of Australian business R&D funded from overseas; Proportion of business R&D performed overseas but funded locally; Number of international strategic alliances between firms; Cross-border ownership of inventions, proportion of patent applications; Citation of scientific inventions in United States patents; International co-operation in science and technology: proportion of scientific publications with foreign co-authors; International co-operation in science and technology: proportion of patents with foreign co-inventors; International mobility of human capital: non national human resources in science and technology; International mobility of students: enrolled tertiary students who are not Australian citizens, proportion of total enrolment.
	Innovation	Proportion of manufacturing businesses which are innovative by business size, industry and broad type of innovation; Expenditure on technological innovation by manufacturing businesses by business size, industry and type of innovation.
	Entrepreneurial activity	Number of business start-ups; Proportion of small and medium enterprises by industry (in growth industries defined in terms of both employment and output).
	Support for innovation	Government funded expenditure on R&D, as a proportion of GDP, by level of government; Government budget appropriations or outlays for R&D, as a proportion of GDP; Federal government financial support for science and innovation, by type of activity and theme; Value of venture capital provided as a proportion of GDP.
Human capital	Stock of skilled people	Highest completed level of educational attainment of the population, by age and sex; Educational attainment of the labour force, by occupation and highest educational attainment; Knowledge workers as a proportion of the labour force; Researchers as a proportion of the labour force; Labour force

		status of those with science and technology qualifications; Stock of human resources in science and technology, proportion of population.
	Flow of skilled people	Literacy and numeracy rates for children under 15 years; Participation in secondary and tertiary education, proportion of relevant age group; Graduates in science, IT and engineering as a proportion of total graduates; Graduate outcomes by qualification, employment status, field of study and occupation; Proportion of labour force in vocational training and apprenticeships; Immigration and emigration of skilled adults; Net change in stock of skilled workers.
	Investment in human capital	Total expenditure on education, as a proportion of GDP, by source of funding; Expenditure on education by government, as a proportion of GDP, by education sector; Government expenditure per capita on government schools, by level of education and government; Income and expenditure of non-government schools, by level of education; Business expenditure on training and vocational education; Private expenditure on education.
	Lifelong learning and access to education and training	Adult literacy levels: proportion of the population at International Adult Literacy level 3 or above; Proportion of population aged 15–64 in formal education, by field of study and age; Proportion of population aged 15–64 undertaking work-related training; Expected number of years spent in education and training; Proportion of undergraduate university applicants not receiving an offer through state admission centres; Unmet demand for education, by labour force characteristics; Visits to public library facilities, per capita.
Information and communications technology	ICT infrastructure and access	Internet services: number of Internet Service Providers, POPs and access lines by broad region; Number of Internet hosts (computers connected to the Internet) per capita; Broadband penetration rates (number of DSL and cable modem lines) per capita; Proportion of subscribers with broadband access (DSL and cable modem); The price of Internet access and use, compared to other countries; Proportion of households reporting particular barriers to access to computers and the Internet; Access to the Internet via public libraries, proportion of individuals accessing the Internet; Public libraries offering technology facilities; Number of telecommunication access paths (total fixed access lines and mobile subscribers) per capita; Household expenditure on ICT goods and services.
	Household and individual use of ICT	Proportion of households with access to a computer by type of household, income, broad region; Proportion of households with access to a mobile phone by type of household, income, broad region; Proportion of households with access to the Internet by type of household, income, broad region; Number of household ISP subscribers by broad region; Volume of data downloaded by household ISP subscribers; Proportion of individuals accessing a computer by age, sex, occupation, level of education and broad region; Proportion of individuals accessing the Internet by age, sex, occupation, level of education and broad region; Proportion of individuals using the Internet for particular activities and purposes, including accessing government services; Proportion of children using a computer or the Internet at school, by age, sex and broad region; Proportion of teachers using a computer or the Internet, by age, sex and broad region.
	Business and government use of	Proportion of businesses and farms with computers, web sites, Internet access, by business/farm size; Proportion of businesses with Internet access, by broad industry group; Barriers to Internet use

	ICT	by businesses; Number of non-household (includes business and government) ISP subscribers; Government expenditure on ICT, as a proportion of total expenditure, by government type; Business expenditure on ICT.
	Prevalence of electronic commerce	Proportion of businesses purchasing or selling via the Internet, by broad industry group; Proportion of business income attributable to selling goods or services over the Internet, by business size; Business perceptions of the impact of Internet selling on the business; Business perceptions of the benefits of Internet purchasing to the business; Proportion of individuals using the Internet to purchase goods and services, by value of purchases; Barriers to Internet purchasing by individuals; Number of secure web servers (those encrypted for the security of on-line transactions) per capita.
	ICT skill base	ICT workers as a changing proportion of the labour force; Lack of skills as a constraint to business and individual use of computers and the Internet.
	Strength of the ICT industry	ICT sector revenue by broad industry group; ICT sector proportion of total business value added; ICT sector proportion of total business employment; R&D performed by the ICT sector as a proportion of total business R&D; R&D expenditure on ICT, by sector; ICT patents, proportion of total resident patent applications; Capital expenditure by the ICT sector as a proportion of total business capital expenditure; Production of ICT goods and services by broad commodity group; Trade in ICT goods and services by broad commodity group.
Context	Macro-economic factors	GDP; Exchange rates; Interest rates; Inflation.
	Social and cultural factors	Age structure of the population; Income levels and distribution of the population; Participation in community activities.
	Product, financial and labour markets	GDP Market Sector; Australian Stock Exchange(ASX) All ordinaries index; Labour market participation by age and sex; Industrial action, working days lost.
	Openness	Foreign direct investment flows as a proportion of GDP; Trade openness: imports plus exports as a proportion of GDP.
	Legal and regulatory frameworks	No indicators are proposed.
	Political institutions and transparency	No indicators are proposed.
Economic and social impacts	Economic and structural change	GDP per capita; Labour productivity; Multifactor productivity; Correlation between ICT use and financial performance at firm level; Contribution of technology- and knowledge-intensive industries to Gross Value added (GVA); Contribution of high technology imports and exports to total trade; Contribution of trade in business services to total trade; Exports of education and training services;

	Social change	Relative earnings of employees by level of educational attainment; Relative earnings of the self-employed by level of educational attainment; Unemployment rates and duration of unemployment by highest level of educational attainment; Changes in patterns of work: teleworking trends among Australian workers

Appendix 5.5: Readiness for the networked world

Group	Indicator
Network access	Information infrastructure, internet availability, internet affordability, network speed and quality, hardware and software, service and support.
Networked learning	Schools' access to information and communication technologies, enhancing education with ICTs, developing the ICT workforce.
Networked society	People and organizations online, locally relevant content, information and communication technologies in everyday life, information and communication technologies in the workplace.
Networked economy	ICT employment opportunities, business-to-consumer electronic commerce, business-to-business electronic commerce, e-government.
Network policy	Telecommunications Regulation, ICT Trade policy

Group	Indicator	Characteristics
Network access	Information infrastructure	Telephone penetration, teledensity, mobile wireless penetration, cable penetration.
	Internet availability	No of ISPs, public internet access, bandwidth.
	Internet affordability	Internet access cost, price for leased business lines.
	Network speed and quality	Dropped connections, sound quality of telephone calls, internet access speed.

	Hardware and software	Availability of hardware/software, price of hardware/software.
	Service and support	Mainline installation, time needed for providing technical support, availability of technical experts.
Networked learning	Schools' access to ICTs	Number of computers by education level, LAN availability at schools, internet connection at schools.
	Enhancing education with ICTs	Use of computers by teachers, ICT learning.
	Developing the ICT workforce	Training in ICT, availability of online training courses.
Networked society	People and organizations online	Internet usage by age and sex, number of registered local domains, advertising in traditional media for online companies.
	Locally relevant content	Availability of local websites, local languages in websites, availability of web-related training.
	ICTs in everyday life	Use of ICTs, availability of public phones, e-commerce.
	ICTs in the workplace	Deployment of ICTs in internal processes, e-mail accounts by employees, internet usage for business.
Networked economy	ICT employment opportunities	Significance of ICT in employment, ICTs role in business strategy.
	Business-to-consumer electronic commerce	Local businesses with website, availability of online retail, turnover of online sales.
	Business-to-business electronic commerce	Availability of online B2B transactions, online ordering and delivery.
	e-government	Websites with information, interactive websites, e-procurement.
Network policy	Telecommunications Regulation	Liberalization of telecommunication sector, promotion of universal access, open telecommunications market, competition of mobile wireless providers,
	ICT Trade policy	ICT tariffs, foreign investment in ICT, e-commerce.

Appendix 5.6: Global diffusion of the internet

Dimension	Levels
Pervasiveness	0: Nonexistent; 1: Embryonic; 2: Nascent; 3: Established; 4: Common
Geographic dispersion	0: Nonexistent; 1: Single location; 2: Moderately dispersed; 3: Highly dispersed; 4: Nationwide
Sectoral absorption	0: Nonexistent; 1: Rare; 2: Moderate; 3: Common; 4: Widely used
Connectivity infrastructure	0: Nonexistent; 1: Thin; 2: Expanded; 3: Broad; 4: Extensive
Organizational infrastructure	0: None; 1: Single; 2: Controlled; 3: Competitive; 4: Robust
Sophistication of use	0: None; 1: Minimal; 2: Conventional; 3: Transforming; 4: Innovating

Appendix 5.7: Infostate Index

Infostate	Sub-components	Indicators
Infodenity	Networks	Main telephone line per 100 inhabitants, waiting line/ mainlines, digital lines/ mainlines, cell phone per 100 inhabitants, cable TV subscription per 100 households, internet hosts per 1.000 inhabitants, secure servers/ internet hosts, international bandwidth (Kbs per inhabitant).
	Skills	Adult literacy rates, gross enrolment ratio – primary education, gross enrolment ratio – secondary education, gross enrolment ratio – tertiary education.
Info-use	Uptake	TV equipped households per 100 households, residential phone lines per 100 households, PCs per 100 inhabitants, internet users per 100 inhabitants
	Intensity	Broadband users/ internet users, international outgoing telephone traffic minutes per capita, international incoming telephone traffic minute per capita.

Appendix 5.8: Digital Access Index

Category	Variable	Indicator
Infrastructure	Fixed Telephone subscribers	Fixed telephone subscribers per 100 inhabitants
	Mobile cellular subscribers	Mobile cellular subscribers per 100 inhabitants
Affordability	20 hours per month of internet access	Internet access as percentage of Gross National Income (GNI) per capita
Knowledge	Literacy	Adult literacy
	School enrolment	Combined primary, secondary and tertiary school enrolment level
Quality	International internet bandwidth (Mbis/s)	International internet bandwidth per capita
	Broadband subscribers	Broadband subscribers per 100 inhabitants
Usage	Internet users	Internet users per 100 inhabitants

Appendix 5.9: ICT-Opportunity Index (ICT-OI)

Infostate	Sub-components	Indicators
Infodensity	Networks	Main telephone line per 100 inhabitants, mobile cellular subscribers per 100 inhabitants, international internet bandwidth (Kbps per inhabitant).
	Skills	Adult literacy rates, gross enrolment ratio – primary education, gross enrolment ratio – secondary education, gross enrolment ratio – tertiary education.
Info-use	Uptake	Internet users per 100 inhabitants, proportion of households with a TV, computers per 100 inhabitants
	Intensity	Total broadband internet subscribers per 100 inhabitants, international outgoing telephone traffic minutes per capita

Appendix 5.10: Digital Opportunity Index (DOI)

Category	Indicator
Opportunity	Percentage of population covered by mobile cellular telephone, internet access tariffs as a percentage of per capita income, mobile cellular tariffs as a percentage of per capita income.
Infrastructure	Proportion of households with a fixed line telephone, proportion of households with a computer, proportion of households with internet access at home, mobile cellular subscribers per 100 inhabitants, mobile internet subscribers per 100 inhabitants.
Utilization	Proportion of individuals that used the internet, ratio of fixed broadband subscribers to total internet subscribers, ratio of mobile broadband subscribers to total mobile subscribers.

Appendix 5.11: ICT Development Index (IDI)

Sub-Index	Indicator
ICT access	Fixed-telephone subscriptions per 100 inhabitants, mobile-cellular telephone subscriptions per 100 inhabitants, international internet bandwidth per internet user, percentage of households with a computer, percentage of household with internet access
ICT use	Percentage of individuals using the internet, fixed (wired)-broadband subscriptions per 100 inhabitants, active mobile-broadband subscriptions per 100 inhabitants
ICT skills	Adult literacy rate, secondary gross enrolment ratio, tertiary gross enrolment ratio.

Appendix 5.12: Network Readiness Index

Sub-index	Pillar	Indicator
Environment	Political and regulatory environment	Effectiveness of law-making bodies, laws relating to ICTs, judicial independence, efficiency of legal system in setting disputes, efficiency of legal system in challenging regulations, intellectual property protection, software piracy rate, number of procedures to enforce a contract, number of days to enforce a contract.
	Business and innovation environment	Availability of latest technologies, venture capital availability, total tax rate, number of days to start a business, number of procedures to start a business, intensity of local competition, tertiary education gross enrolment rate, quality of management schools, government procurement of advanced technology products.
Readiness	Infrastructure and digital content	Electricity production, mobile network coverage, international internet bandwidth, secure internet servers per million population, accessibility of digital content.

	Affordability	Mobile cellular tariffs, fixed broadband internet tariffs, internet and telephony sectors competition index.
	Skills	Quality of educational system, quality of math and science education, secondary education gross enrolment rate, adult literacy rate.
Usage	Individual usage	Mobile phone subscriptions per 100 population, percentage of individuals using the internet, percentage of household with computer, households with internet access, fixed broadband internet subscriptions per 100 population, mobile broadband internet subscriptions per 100 population, use of virtual social networks.
	Business usage	Firm-level technology absorption, capacity for innovation, PCT patent applications per million population, business-to-business internet use, business-to-consumer internet use, extent of staff training.
	Government usage	Importance of ICT to government vision of the future, government online service index, government success in ICT promotion.
Impact	Economic impacts	Impact of ICTs on new services and products, ICT patent applications per million population, impact of ICT on new organizational models, employment in knowledge-intensive activities.
	Social impacts	Impact of ICT on access to basic services, internet access in schools, ICT use and government efficiency, e-participation index.

Appendix 5.13: ICT Diffusion Index

Dimension	Indicator
Connectivity	Internet hosts per capita, PCs per capita, telephone mainlines per capita, mobile subscribers per capita
Access	Number of internet users, literacy, cost of a local call, GDP per capita.

Appendix 5.14: Technology Achievement Index

Dimension	Indicator
Creation of technology	Patents granted per capita, receipts of royalty and license fees from abroad per capita.
Diffusion of recent innovations	Internet hosts per capita, high and medium technology exports as a share of all exports.
Diffusion of old innovations	Logarithm of telephones per capita (mainline and cellular combined), logarithm of electricity consumption per capita.
Human skills	Mean years of schooling, gross enrolment ration at tertiary level in science, mathematics and engineering.

Appendix 5.15: Knowledge Economy Index

Pillar	Indicator
Economic and institutional regime	Tariff and non-tariff barriers, regulatory quality, rule of law.
Education and skill of population	Adult literacy rate, gross secondary enrolment rate, gross tertiary enrolment rate.
Information infrastructure	Telephones per 1.000 people, computers per 1.000 people, internet users per 1.000 people.
Innovation system	Royalty payments and receipts, technical journal articles per million people, patents granted to national by the U.S. Patent and Trademark Office per million people.

Appendix 5.16: Digital Economy Index

Category	Criteria
Connectivity and technology infrastructure	Broadband penetration, broadband quality, broadband affordability, mobile phone penetration, mobile quality, internet user penetration, international internet bandwidth, internet security.
Business environment	Overall political environment, macroeconomic environment, market opportunities, policy towards private enterprise, foreign investment policy, foreign trade and exchange regimes, tax regime, financing, the labour market
Social and cultural environment	Educational level (measured by school life expectancy, gross enrolment in education and enrolment in tertiary education), internet literacy, degree of entrepreneurship, technical skills of workforce, degree of innovation (measured by the generation of patents and trademarks as well as R&D spending).
Legal environment	Effectiveness of traditional legal framework, laws covering the internet, level of censorship, ease of registering a new business, electronic ID.

Government policy and vision	Government spend on ICT as a proportion of GDP, digital development strategy, e-government strategy, online procurement, availability of online public services for citizens, availability of online public services for businesses, e-participation.
Consumer and business adoption	Consumer spending on ICT per head, level of e-business development, use of internet by consumers, use of online public services by citizens, use of online services by businesses.

Appendix 5.17: Digital Economy and Society Index

Dimension	Sub-Dimension	Indicator
Connectivity	Fixed Broadband	Fixed Broadband Coverage, Fixed Broadband Take-up
	Mobile Broadband	Mobile Broadband Take-up, Spectrum
	Speed	NGA Coverage, Subscriptions to Fast Broadband
	Affordability	Fixed Broadband Price
Human Capital	Basic Skills and Usage	Internet Users, Basic Digital Skills
	Advanced Skills and Development	ICT Specialists, STEM Graduates

Use of Internet	Content	News, Music Videos and Games, Video on Demand
	Communication	Video Calls, Social Networks
	Transactions	Banking, Shopping
Integration of Digital Technology	Business Digitization	Electronic Information Sharing, RFID, Social Media, eInvoices, Cloud
	eCommerce	SMEs Selling Online, eCommerce Turnover, Selling Online Cross-border
Digital Public Services	eGovernment	eGovernment Users, Pre-filled Forms, Online Service Completion, Open Data

Appendix 5.18: Other

SN	Name	Description
1	Harvard University model	Looks at how ICT are used in a society
2	APEC's method	Government policies for e-commerce
3	Bridges.org	e-readiness indicators
4	McConnell international	Comparative data for 42 countries. Reports measures five areas: connectivity, e-leadership, information security, human capital, e-business climate
5	Internet economy indicators (Center for Research on Electronic Commerce at the Graduate School of Business, the University of Texas at Austin, and sponsored by Cisco Systems)	Seek to provide a foundation for conceptualizing and measuring the various components of the Internet Economy. The Internet Economy Indicators divide the Internet Economy into four distinct but related layers: Internet infrastructure, Internet applications, Internet intermediaries and Internet-based transactions.
6	Index of the Massachusetts Innovation Economy	Measures progress of three key components of the Massachusetts Innovation Economy: Results, Innovation process, Resources.
7	City of Seattle	Measuring the community's level of access to the Information Economy. The indicator categories are: Access, Community Building, Civil Participation, Human Relationships to Technology and Partnerships and Resource Mobilization.
8	Computer Systems Policy Project's (CSPP) "Readiness for the networked world"	Examines 19 different categories of indicators, ranking each by levels of advancement in Stages One through Four. The categories fall within five groups: Network Access (Information Infrastructure, Internet Availability, Internet Affordability, Network Speed and Quality, Hardware and Software, Service and Support), Networked Learning, Networked Society, Networked Economy and Network Policy.
9	Allen E–commerce Preparedness (ECP) Index	Based on key factors illustrating enduring structural differences between the preparedness of the States and Territories to adopt e-commerce. has been thus developed to identify and assess the structural regional differences in the impact of greater use of e-commerce.

Appendix 6: Rankings

Digital Access Index, 2002	
Rank	Country
1	Sweden
2	Denmark
3	Iceland
4	Korea (Rep.)
5	Norway
6	Netherlands
7	Hong Kong, China
8	Finland
9	Taiwan, China
10	Canada
11	United States
12	United Kingdom
13	Switzerland
14	Singapore
15	Japan
16	Luxembourg
17	Austria
18	Germany
19	Australia
20	Belgium
21	New Zealand
22	Italy
23	France
24	Slovenia
25	Israel
26	Ireland
27	Cyprus
28	Estonia
29	Spain
30	Malta

Infostate Index, 2001	
Rank	Country
1	Sweden
2	Denmark
3	Canada
4	Netherlands
5	United States
6	Switzerland
7	Norway
8	Belgium
9	Hongkong
10	Finland
11	Luxembourg
12	Iceland
13	Singapore
14	Germany
15	United Kingdom
16	Australia
17	New Zealand
18	Austria
19	Korea (Rep.)
20	Japan
21	Ireland
22	France
23	Israel
24	Portugal
25	Slovenia
26	Italy
27	Spain
28	Malta
29	Estonia
30	Czech Republic
31	Cyprus

ICT Opportunity Index, 2005	
Rank	Country
1	Sweden
2	Luxembourg
3	HongKong, China
4	Netherlands
5	Denmark
6	Switzerland
7	Singapore
8	United Kingdom
9	Iceland
10	Norway
11	Canada
12	Belgium
13	United States
14	Australia
15	Austria
16	Germany
17	Taiwan, China
18	Israel
19	Finland
20	Ireland
21	Macao, China
22	Korea (Rep.)
23	France
24	Estonia
25	Barbados
26	New Zealand
27	Japan
28	Italy
29	Spain
30	Slovenia
31	Antigua & Barbuda
32	Aruba
33	Cyprus
35	Malta

Digital Opportunity Index, 2006	
Rank	Country
1	Korea (Rep.)
2	Japan
3	Denmark
4	Iceland
5	Singapore
6	Netherlands
7	Taiwan, China
8	Hong Kong, China
9	Sweden
10	United Kingdom
11	Finland
12	Norway
13	Luxembourg
14	Israel
15	Macao, China
16	Switzerland
17	Canada
18	Austria
19	Germany
20	United States
21	Spain
22	Australia
23	Belgium
24	Estonia
25	New Zealand
26	France
27	Barbados
28	Italy
29	Bahamas
30	Slovenia
31	Ireland
32	Portugal
33	Lithuania
34	Malta
35	Bahrain
36	Hungary
37	United Arab Emirates
38	Qatar
39	Cyprus

ICT Development Index, 2011

Rank	Country	Rank	Country
1	Korea (Rep.)	40	Bahrain
2	Sweden	41	Hungary
3	Denmark	42	Croatia
4	Iceland	43	Antigua & Barbuda
5	Finland	44	Cyprus
6	Netherlands		
7	Luxembourg		
8	Japan		
9	United Kingdom		
10	Switzerland		
11	Hong Kong, China		
12	Singapore		
13	Norway		
14	Macao, China		
15	United States		
16	Germany		
17	New Zealand		
18	France		
19	Austria		
20	Ireland		
21	Australia		
22	Canada		
23	Belgium		
24	Estonia		
25	Slovenia		
26	Malta		
27	Israel		
28	Spain		
29	Italy		
30	Qatar		
31	Poland		
32	Czech Republic		
33	Greece		
34	Barbados		
35	Lithuania		
36	Latvia		
37	Portugal		
38	Russian Federation		
39	Slovak Republic		

Network Readiness Index, 2012

Rank	Country
1	Finland
2	Singapore
3	Sweden
4	Netherlands
5	Norway
6	Switzerland
7	United Kingdom
8	Denmark
9	United States
10	Taiwan, China
11	Korea, Rep.
12	Canada
13	Germany
14	Hong Kong SAR
15	Israel
16	Luxembourg
17	Iceland
18	Australia
19	Austria
20	New Zealand
21	Japan
22	Estonia
23	Qatar
24	Belgium
25	United Arab Emirates
26	France
27	Ireland
28	Malta
29	Bahrain
30	Malaysia
31	Saudi Arabia
32	Lithuania
33	Portugal
34	Chile
35	Cyprus
37	Slovenia
50	Italy
38	Spain

ICT Diffusion Index, 2004

Rank	Country
1	Luxembourg
2	United States
3	Iceland
4	Sweden
5	Denmark
6	Netherlands
7	Switzerland
8	Bermuda
9	Australia
10	United Kingdom
11	Finland
12	Hong Kong
13	Canada
14	Norway
15	New Zealand
16	Singapore
17	Israel
18	Germany
19	Korea (Rep. of)
20	Estonia
21	Austria
22	Japan
23	Ireland
24	Italy
25	France
26	San Marino
27	Malta
28	Belgium
29	Slovenia
30	Czech Republic
31	Spain
32	Cyprus

Technology Achievement Index, 2009	
Rank	Country
1	Korea, Rep. of
2	Finland
3	Sweden
4	Singapore
5	Japan
6	Netherlands
7	Luxembourg
8	United States
9	United Kingdom
10	Canada
11	Norway
12	New Zealand
13	Ireland
14	Australia
15	Germany
16	France
17	Iceland
18	Estonia
19	Slovenia
20	Greece
21	Belgium
22	Spain
23	Malaysia
24	Austria
25	Italy
26	Israel
27	Hungary
28	Malta
29	Barbados
30	Hong Kong, China (SAR)
31	Portugal
32	Czech Republic
33	Latvia
34	Belarus
35	Cyprus
	Denmark
	Switzerland

Knowledge Economy Index, 2009	
Rank	Country
1	Sweden
2	Finland
3	Denmark
4	Netherlands
5	Norway
6	New Zealand
7	Canada
8	Germany
9	Australia
10	Switzerland
11	Ireland
12	United States
13	Taiwan, China
14	United Kingdom
15	Belgium
16	Iceland
17	Austria
18	Hong Kong, China
19	Estonia
20	Luxembourg
21	Spain
22	Japan
23	Singapore
24	France
25	Israel
26	Czech Republic
27	Hungary
28	Slovenia
29	Korea, Rep.
30	Italy
31	Malta
32	Lithuania
33	Slovak Republic
34	Portugal
35	Cyprus

Countries ranked higher than Cyprus in all indicators	
1	Sweden
2	Denmark (Not included in TAI)
3	Iceland
4	Korea (Rep.)
5	Norway
6	Netherlands
7	Hong Kong, China
8	Finland
9	Canada
10	United States
11	United Kingdom
12	Switzerland (Not included in TAI)
13	Singapore
14	Japan
15	Luxembourg
16	Austria
17	Germany
18	Australia
19	Belgium
20	New Zealand
21	France
22	Israel
23	Ireland

Countries ranked higher than Cyprus in all indicators except in one	
1	Italy
2	Estonia
3	Slovenia

Countries ranked higher than Cyprus in all indicators except in two	
1	Spain
2	Malta

Appendix 7: ICT Development Index

2007	
Rank	Country
1	Sweden
2	Korea (Rep.)
3	Denmark
4	Iceland
5	Netherlands
6	Luxembourg
7	Japan
8	Switzerland
9	Norway
10	Hong Kong, China
11	Finland
12	United Kingdom
13	Germany
14	Australia
15	Singapore
16	New Zealand
17	United States
18	Canada
19	Austria
20	Ireland
21	Belgium
22	France
23	Israel
24	Italy
25	Estonia
26	Spain
27	Slovenia
28	Macao, China
29	Malta
30	Portugal
31	Greece
32	Lithuania
33	United Arab Emirates
34	Hungary
35	Bahrain
36	Poland
37	Croatia
38	Latvia
39	Czech Republic
40	Cyprus

2008	
Rank	Country
1	Sweden
2	Luxembourg
3	Korea (Rep.)
4	Denmark
5	Netherlands
6	Iceland
7	Switzerland
8	Japan
9	Norway
10	United Kingdom
11	Hong Kong, China
12	Finland
13	Germany
14	Singapore
15	Australia
16	New Zealand
17	Austria
18	France
19	United States
20	Ireland
21	Canada
22	Estonia
23	Belgium
24	Macao, China
25	Spain
26	Slovenia
27	Israel
28	Italy
29	United Arab Emirates
30	Greece
31	Malta
32	Portugal
33	Bahrain
34	Hungary
35	Lithuania
36	Croatia
37	Czech Republic
38	Slovak Republic
39	Cyprus

2010	
Rank	Country
1	Korea (Rep.)
2	Sweden
3	Denmark
4	Iceland
5	Finland
6	Luxembourg
7	Netherlands
8	Japan
9	Switzerland
10	Singapore
11	Norway
12	Hong Kong, China
13	Macao, China
14	United Kingdom
15	Germany
16	United States
17	France
18	New Zealand
19	Ireland
20	Canada
21	Australia
22	Austria
23	Belgium
24	Slovenia
25	Israel
26	Estonia
27	Spain
28	Malta
29	Italy
30	Poland
31	Qatar
32	Barbados
33	Czech Republic
34	Lithuania
35	Greece
36	Portugal
37	Latvia
38	Cyprus

2011	
Rank	Country
1	Korea (Rep.)
2	Sweden
3	Denmark
4	Iceland
5	Finland
6	Netherlands
7	Luxembourg
8	Japan
9	United Kingdom
10	Switzerland
11	Hong Kong, China
12	Singapore
13	Norway
14	Macao, China
15	United States
16	Germany
17	New Zealand
18	France
19	Austria
20	Ireland
21	Australia
22	Canada
23	Belgium
24	Estonia
25	Slovenia
26	Malta
27	Israel
28	Spain
29	Italy
30	Qatar
31	Poland
32	Czech Republic
33	Greece
34	Barbados
35	Lithuania
36	Latvia
37	Portugal
38	Russian Federation
39	Slovak Republic
40	Bahrain

Rank	Country
41	Hungary
42	Croatia
43	Antigua & Barbuda
44	Cyprus

Appendix 8: E-government measures and actions

Measure 6 - Network and information security

- Action 6.1 Design and build the government Next Generation Network (NGN).
- Action 6.2 Further develop the academic and research network.

Measure 7 - Paperless Government and eGovernment Services

- Action 7.1 Install the Web-enabled version of the Office Automation System (eOAS) in all Government Departments.
- Action 7.2 Revise the Information Systems Strategy (ISS).
- Action 7.3 Develop the Government Secure Gateway.
- Action 7.4 Develop the Central Government Data Warehouse.
- Action 7.5 Set up a Help Desk System.
- Action 7.6 Develop the Human Resource Management System.
- Action 7.7 Expand the Point of Single Contact (PSC).
- Action 7.8 Set in full operation the e-filing system for online registration of companies.
- Action 7.9 Online payments to Government (epayments).
- Action 7.10 Give incentives to citizens to use the available egovernment services.
- Action 7.11 Define the basic public services that cannot be offered online and remove any existing obstacles eg amendment of legislations in order to enable the online provision of these services.
- Action 7.12 Develop more public eServices based on the citizens and businesses needs.
- Action 7.13 The public eServices should ensure social inclusion including vulnerable groups.
- Action 7.14 Develop cross-borders, interoperable egovernment services based on the European Interoperability Framework.
- Action 7.15 Provide access to citizens to their personal data.
- Action 7.16 Publish Information of the Public Sector (PSI).
- Action 7.17 Develop tools to promote eDemocracy.
- Action 7.18 Consolidate the several datacenters of the government into 3-4 major datacenters (Data Consolidation).
- Action 7.19 Set up and operate a call center for citizens and businesses to inform them about the services offered by the government.
- Action 7.20 Establish more Citizen Service Centers (CSCs) all over the island.
- Action 7.21 Review and amend the procedures of the public sector to achieve effective egovernment.
- Action 7.22 Establish an Advisory Committee to advice the Minister of Finance on egovernment issues.

Measure 8 - Electronic Local Authorities

- Action 8.1 Establish a centralized information management system that will be used to serve all municipalities.
- Action 8.2 Set up and operate a call center for citizens to inform them about the services offered by the Municipalities.
- Action 8.3 Install in public places a number of computers with fast internet access taking into account the vulnerable groups.
- Action 8.4 Give incentives to businesses and citizens to use the available online services.
- Action 8.5 Use social networks to increase the participation and involvement of citizens.

Measure 9 - eHealth

- Action 9.1 Install and operate in all hospitals the Integrated Health Care Information System that covers the key elements of the hospital procedures in order to control both quality of service to patients and hospital cost, in all public hospitals. With the Integrated Health Care Information System the Ministry of Health will achieve the standardization of hospital procedures at all public hospitals (the public hospitals will work the same way).
- Action 9.2 Install and operate the drug management system in all hospitals.
- Action 9.3 Create regional health networks to exchange information between all health care providers.
- Action 9.4 Create an Internet portal to provide private physicians access to patients' electronic health records.
- Action 9.5 Design and implement an Ambient Assisted Living (AAL) program. Introduce an AAL program on a pilot basis by choosing a group of elder people that lives in a remote area. Depending on the results of the pilot project the AAL program will be expanded.
- Action 9.6 Use Telemedicine

Measure 10 - eID and esignatures

- Action 10.1 Every citizen will be issued an eID which will include personal identity data and passport (biometric) data. The eID will also be capable to store an advanced certificate for the creation of qualified signatures and other data.
- Action 10.2 Implementation of the legal framework for electronic signatures.
- Action 10.3 DITS to become Government Certification Service Provider (CSP).

Measure 11 - Use of ICT to promote cultural heritage

- Action 11.1 Prepare a comprehensive strategic plan for the promotion of cultural heritage with the use of ICT.
- Action 11.2 Digitize the major objects of the Cyprus museum.
- Action 11.3 Expand the digitization of the objects of the Cyprus museum and link them with the respective archeological sites.
- Action 11.4 Digitize exhibitions that will be organized during the Cyprus EU presidency.
- Action 11.5 Develop a 3D digital museum.

Measure 12 –Use of ICT to promote tourism

- Action 12.1 Prepare a strategic plan for the promotion of tourism with the use of ICT.
- Action 12.2 Set up and operate a call center (single number) for tourists and tourism partners.
- Action 12.3 Promote tourist attractions through social networks.
- Action 12.4 Create an online tourism observatory though which tourism partners and the general public will be informed on the latest developments through detailed statistics and focus reports.

Appendix 9: Selected Indicators for the Cyprus Model