LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
Department of Industrial Engineering and Management
Information and Knowledge Management

INFORMATION AND COMMUNICATION SOCIETY'S IMPACT ON GLOBAL PAPER CONSUMPTION

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ASBSTRACT	
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The aim of this thesis is to find out how the information and communication society affects paper consumption globally. The idea is to find indicators that indicate the development of information and communication society to be able to compare developed and transitional markets. A solution for the research problem is sought by studying literature and examining statistics, and comparing them to suggested theories of information and communication society's development. This research aims to evaluate and depict the long term changes in the business environment concerning paper consumption from the information and communication society's point of view.

TIIVISTELMÄ	
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Tämän tutkielman tavoitteena on selvittää informaatio- ja kommunikaatioyhteiskunnan vaikutusta paperin kulutukseen maailmanlaajuisesti. Tarkoituksena on löytää informaatio- ja kommunikaatioyhteiskuntaa kuvaavia mittareita, joiden avulla voidaan vertailla kehittyneitä ja kehittyviä markkina-alueita keskenään. Tutkimusongelmaan haetaan ratkaisua tutkimalla sekä kirjallisuutta että tilastoja, ja vertaamalla niitä esitettyihin teorioihin informaatio- ja kommunikaatioyhteiskunnan kehityksestä. Tutkielman avulla pyritään arvioimaan ja kuvaamaan toimintaympäristön muutoksia paperin kulutuksen suhteen pitkällä aikavälillä informaatio- ja kommunikaatio-yhteiskunnan näkökulmasta.

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Heidi Herttuainen

Lappeenranta, December 2006

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

3G:	Third-generation mobile technology used in high-speed and high-bandwidth data transfer
BRIC:	Brazil, Russia, India, China
DOI:	Digital Opportunity Index
EU-15:	The 15 longest-standing members of the European Union (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom)
GNI:	Gross National Income
GDP:	Gross Domestic Product
IC-society:	Information and Communication Society
ICT:	Information and Communication Technology
IDC:	International Data Corporation
ITU:	International Telecommunication Union
iTV:	Interactive Television
KCL:	Keskuslaboratorio-Centrallaboratorium
R&D:	Research and Development
RFID:	Radio Frequency Identification
RISI:	Resource Information Systems Inc.
SCOT:	Social Construction of Technology
SEK&Grey:	Finland's largest advertising agency. Founded by Suhonen, Erkelenz and Knuus. Part of the Salomaa Group and the Grey Global Group
TBRC:	Technology Business Research Center

1 INTRODUCTION

The convergence of information, telecommunications and micro-electronics sectors, and changes in paper consumption alike have affected the competitiveness of the paper and board industry. New ways of communication (Internet, cellular phones, interactive television etc.) challenge paper as a communication medium all over the world. What will the paper industry do if paper products do not sell in the future? Is it game over then? These questions are worth asking, but how should they be answered?

1.1 Background

In this section a background is given for the development of the information and communication society (IC-society) and how certain trends in development can affect the paper industry. These 10 global trends are listed in Table 1. However, few of these trends (trends four and nine) do not directly affect the paper industry, and therefore their relation to the paper industry is not discussed further.

Table 1. Global Mega Trends (Himanen, 2004, pp.6-7)

1.	Increasing international tax competition
2.	The new global division of labor
3.	Population ageing
4.	Increasing pressures on the welfare society
5.	The second phase of the information society: from technological to social development
6.	The rise of cultural industries
7.	The rise of bio-industries
8.	Regional concentration
9.	A deepening global divide
10.	The spread of a “culture of emergency”

Firstly, international tax competition increases due to competition for investments and a skilled labor force, which secondly causes routine production to shift into more

productive and profitable countries, such as Brazil, Russia, India and China (BRIC-countries) (Himanen, 2004, pp.6-7). For example, paper production is already moving towards areas of growth and logistic efficiencies, such as India and China (Kytölä, Hurmelinna-Laukkanen, 2006, p.2). Thirdly, in developed IC-societies "population ageing causes labor force to decline by 2010" (Himanen, 2004, pp.6-7). The average age of the paper industry's workforce in the developed countries is mid-forties (M-Real, 2006). Strikes and mill closures as well as co-operation procedures leading to layoffs and denouncements cast a shadow of uncertainty over the industry. This negative image does not attract young professionals, which will most likely cause the average age of the labor force to rise. It will be one of the biggest challenges for the paper industry to attract young talents in the future (Haarla, 2002, p.104). The first three mega trends lead to increasing pressures on the welfare society (Himanen, 2004, pp.6-7), which is the fourth trend. In most countries the tax burden has shifted to its inhabitants to pay for welfare services, which widens the gap between the wealthy and the poor.

The first phase of IC-society emphasizes technology development. Although technological development continues, the second phase emphasizes social matters and changing the way to operate, which is the fifth trend. (Himanen, 2004, pp.6-7) In the first phase paper companies have focused more on achieving economies of scale to deal with high energy and raw material costs, as well as dealing with competitors from overseas. This has lead to the building of new production plants which are bigger, more productive, more efficient and more dynamic than the old ones. Furthermore, because paper companies do not perform a lot of research and development (R&D) themselves, they are surrounded by a complex network of cooperation partners (universities and institutes, material suppliers, machine manufacturers, and vendors) that provide them with advanced technologies and research in order to stay competitive. However, most of the developed innovations can be imitated by others and therefore the profit margins dry up. The second phase for the paper companies, to change the way they operate to differentiate themselves from the competitors, is still to come.

With the sixth trend, the information economy expands, especially towards culture sectors (television, movies, games, literature etc.), which are affected by the

convergence of technology (Himanen, 2004, pp.6-7). This trend is not necessarily a threat to the paper industry. Instead it can be seen as an emerging opportunity to innovate and develop new uses for paper and fiber based products, such as electronic paper or Radio Frequency Identification tags (RFID-tags), and to be a part of the culture sector on some level.

Seventhly, bio-industries begin to rise. Genetic engineering in e.g. medicine, bio- and welfare technology becomes a key technology as well as ICT. (Himanen, 2004, pp.6-7) Biology and bio-technology are employed actively in pulp and paper sector to find new solutions to raw-material problems (e.g. exploiting new raw-materials like eucalyptus), and to improve the efficiency of pulping. Medicine and environmental technologies are valuable in reducing health and environment strains caused by production processes (e.g. hazardous chemicals) and products. (Autio et al., 1997, p.6)

Eighthly, the urbanization rate exceeds 50 percent for the first time in history, as being on the leading edge in innovations calls for larger communities (Himanen, 2004, pp.6-7). Urbanization is related to increased living standards, improved literacy and growth in consumption. Urbanization accelerates the penetration of ICT, which leads to growth in paper demand. However, later on paper consumption slows down. Thus, the future market potential for the paper industry lies in countries where urbanization and computerization is at an early stage, such as China and India. The ninth trend, however, is the flipside of urbanization. Inequality and alienation continues inside and between areas of different development stage because of distortions in world trade and knowledge (Himanen, 2004).

Lastly, the accelerating pace of development increases volatility and creates a “culture of emergency” in working life. The deepening social gap creates tension and instability. The challenge of sustainable development (human and environmental) becomes relevant. (Himanen, 2004, pp.6-7) Although the volume of produced paper has increased, the profitability of the paper industry has been disappointing due to poor price development, high labor costs in the USA and North Europe, decreasing market power and lack of competitive innovations (Kytölä, Hurmelinna-Laukkanen, 2006). At

the same time pressure on the paper industry for sustainable environmental development comes from environmentalists and researchers whose "mission is to protect natural forests, reduce waste, and generally minimize the environmental impacts of the forest industry" (Hetemäki, 2005a, p.89). Hetemäki (2005a, p.89) points out that "electronic versions of newspapers, magazines, and books could place a smaller burden on the environment than the printed versions".

These ten mega trends concentrate more on societal development and they do not directly affect the consumption of paper products. More distinct changes, that seem to affect paper consumption at some level, are taking place in the media environment. The question is where are all these changes leading us? For example, newspaper circulation and readership have been declining for some time (Severin, Tankard, 2001, p.3). The "old" newspapers have had new competition from television and Internet. The number of television channels is increasing from a few network owned-and-operated channels to cable-systems of 50 channels and more magazines have started publishing articles on the World Wide Web. (Severin, Tankard, 2001, p.3). Together with online-newspapers and bloggers they provide consumers with real time information and entertainment. Revenues from advertising are lost by newspapers as advertisers move in accordance with the consumer. Therefore it has become relevant to ask, from the paper industry's view, whether people will change their habits completely from reading a physical newspaper to reading it on-line? Would they prefer electronic paper as a substitute for newspaper in the future?

Perhaps the new media takes place beside old media or maybe new technology causes old technologies to take on new roles (Severin, Tankard, 2001, p.3). When thinking back in time, television was supposed to displace radio and the movies, TV news were to displace newspapers, cd-roms were to displace books etc., but they did not. The old forms of media took on new roles beside new media and adapted to changes, because it was an opportunity to get more revenue and more customers. Whatever the future holds for the media now, the impacts of information and communication technology (ICT) on the paper industry and markets is more than obvious. The business environment has changed.

1.2 Objectives

The main objective of this study is to find out if the development of the information and communication society explains the changes in paper consumption. This objective is reached by studying what an information and communication society is, what direct changes it causes in the paper industry and how it affects the end-use of paper products. The idea is to find indicators to compare and contrast developed and transitional markets. A solution for these research questions is sought by analyzing both literature and statistics, and comparing them to theories about the information and communication society's development.

1.3 Limitations

Although this thesis discusses the changes paper industry encounters, the industry itself is not a central subject of research. Instead this thesis focuses more on paper product end-use, especially graphic papers. Production of paper products (including pulp and raw-materials) and niche products (cardboard, paperboard and tissue papers), are left outside the research's scope. Production of paper products is not seen as a central function of the IC-society and niche products, such as tissue paper, are not a general means of communication. Thus, niche products will most likely not be substituted in the IC-society.

There are 194 countries (Taiwan included) in the world, from which 25 countries were chosen for this study. The 25 countries (Argentina, Brazil, Canada, China, EU-15-members, India, Japan, Mexico, Russia, Singapore, and United States) account for 58 percent of the world population in 2005 (International Monetary Fund). They also represent countries that have been the focus of the paper industry, but are also IC-societies at some level. This study classifies countries as being either an industrial society, transitional IC-society, developed IC-society or advanced IC-Society. The countries that are being ignored by this classification are developing countries that have

not achieved a significant degree of industrialization relative to their population and have a low standard of living, and therefore they will not be studied further.

1.4 Structure

The subjects of the study are categorized into seven chapters, illustrated in Figure 1 and as hereafter: The first chapter explores the background of the subject, motives, objectives, limitations, literature and the structure of the research. The second chapter introduces the theoretical framework of the concepts of data, information, knowledge and communication. The chapter also further contemplates the history of the concept of the information society. The third chapter concerns theories of the diffusion of innovations. The fourth chapter covers the analytical point of views of information society. This chapter also comprises different indexes, the Information Society Index (ISI), ICT opportunity Index (ICTOI) and the Digital Opportunity Index (DOI), that portray the information society. The indexes are used to measure the information and communication society's developmental stage in chapter five. The fifth chapter portrays the evolutionary stages and paper consumption of the chosen developed and transitional market areas. The sixth chapter discusses the current issues in today's paper consumption and the meaning of the information society's evolution for forest industry. This chapter also concludes the findings and gives recommendations as the output of the study.

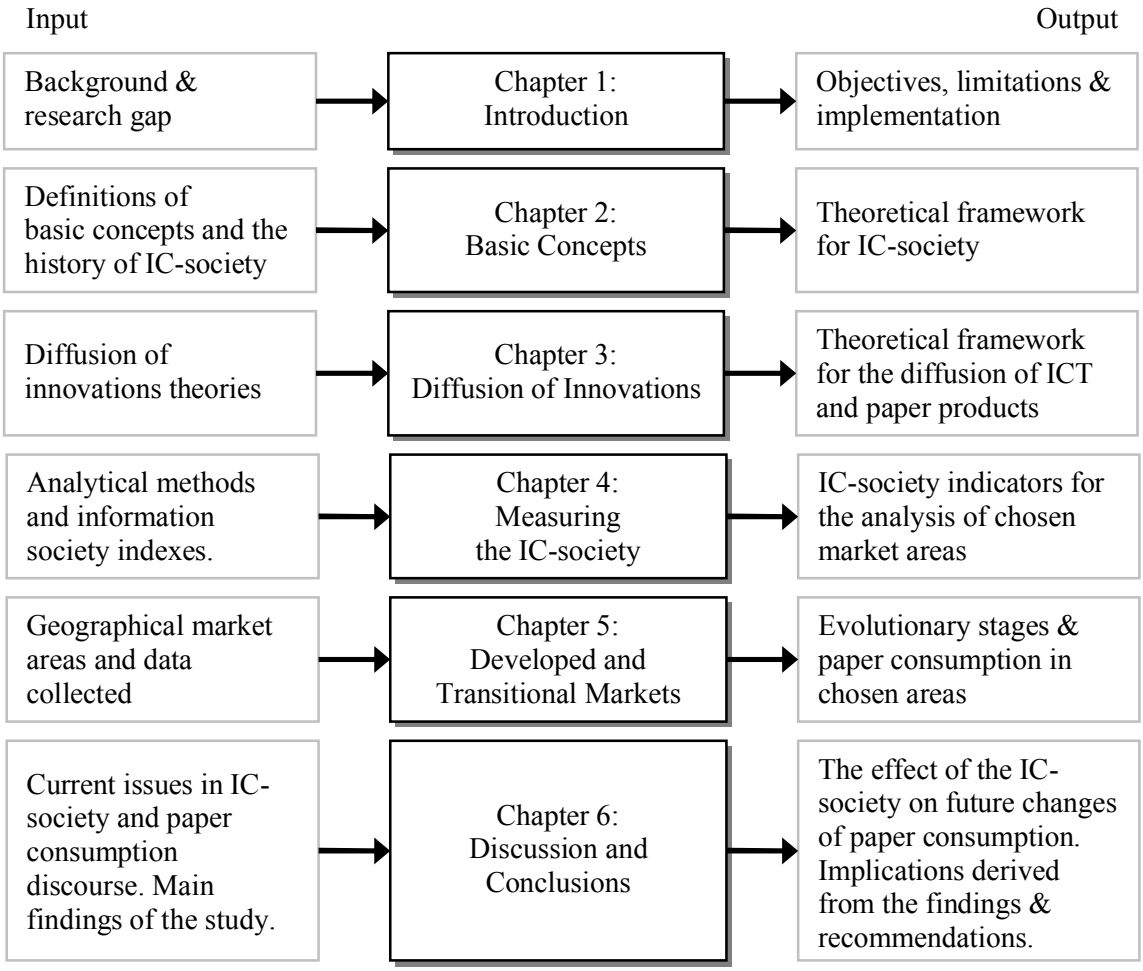

Figure 1. The Outline of the Thesis

2 BASIC CONCEPTS

In everyday use, the definitions of data, information and knowledge become obscure and they are used as synonyms for one another. Still, slight differences exist in the meaning of these words. This chapter is going to briefly define the words data, information and knowledge, examine communication theory and further clarify the differences between an IC-society and a knowledge-based society, and in the end give an overview of the history and future development of the concept of an IC-society.

2.1 Data, Information and Knowledge

Data consist of signals, symbols, characters or strings of characters that are for instance coded and stored on a computer hard drive. Therefore, it has no particular meaning. Information on the other hand is a quality of a message. It does not have to be true or false, because it is always about something, e.g. the sound of a leaf falling, the size of a paper, the amount of paper reels in a warehouse, or the occurrence of a printer paper jam. Basically data becomes information when it is interpreted by a receiver or it is given a meaning.

What is knowledge? According to Nonaka and Takeuchi (1995, p.58), knowledge is information that is connected with personal beliefs and commitment, and it is dependent on the person's stance, intention or perspective. Alternatively, the classic definition of knowledge (Greek *episteme*), originating from Plato's Theaetetus, states that knowledge is a justified and true belief. Nonaka and Takeuchi also adopt Plato's definition of knowledge, but stress that they highlight the nature of knowledge as "justified belief". They consider knowledge as a "dynamic human process of justifying personal belief toward the truth" (Nonaka, Takeuchi, 1995, p.58). This is where information and knowledge differ from one another.

2.2 Communication Theory

The basis for the concept of the information and communication society cannot be structured alone by defining the concepts of data, information and knowledge. Interaction and communication are a part of every society; however, with the emergence of new information and communication technologies (ICTs) the ways of communication have changed by becoming global. Former ways of communication through face-to-face conversations, letters, newspapers, magazines, television and radio have had new rivals, e.g. Internet and mobile communication. Therefore, communication is a crucial part of the IC-society.

Modern Communication Theory is based on mathematical theorems of communication developed in the late 1940's by a mathematician and engineer Claude E. Shannon. The mathematical theory of communication was originally used for describing electronic signal transmission or radio-telephone communication and for quantitative measurement of information flows. The theory studies communication processes from a technical viewpoint, where the communication system is the basic entity.

Shannon proposed a linear model of transmission, where all communication consists of seven elements: a source, an encoder, a message, a channel, a decoder, a receiver and a noise source; which are illustrated in Figure 2. The source selects symbols or a message *(information)* to be transmitted through an encoder. The encoder converts the message into signals *(data)* for the channel of communication. The decoder translates the encoded message to an understandable form *(information)* for the receiver. During the transmission a source of noise can distort the message so that there might not be correspondence between the messages sent and received. Noise is anything that is added to the signal that was not intended by the source, and an error of the communication process. (Severin, Tankard, 2001, pp.49-53; Solana-Ortega, 2002, pp.461-462)

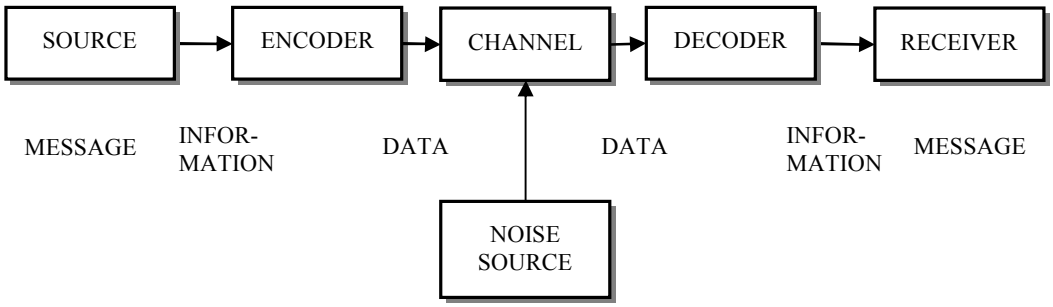

Figure 2. General Model of Communication

The Modern Communication Theory was further elaborated by Warren Weaver, who gave the theory a more popular, non-mathematical form. In fact, Warren extended Shannon's technical view into a broad theoretical model of human communication. According to Weaver the theory was general enough to be applied to spoken and written language, music notes and music itself, pictures, body movements and facial expressions, and many other communication signals. (Severin, Tankard, 2001, p.51)

As stated in the earlier, communication is a crucial part of the IC-society. The Modern Communication Theory explains information sharing in a simplistic way. It is important to understand the theory, because of its fundamental characteristics. Applications of this theory include the invention of the compact disc, the development of Internet, cellular phones, interactive television etc. All of these innovations concern communication technologies in the IC-society.

2.3 Why an IC-Society Instead of a Knowledge-based Society?

The separation of knowledge and information is a common subject in information society discourse. According to Aro (2001, p.150) the discourse repeats what is peculiar to the critique on technological determinism. In technological determinism, it is believed that social and cultural progress is driven by technological innovation. In other words, individuals (ICT users) are conceptualized as passive receivers of technology, which is seen as the objective force of determining human behavior (Gripenberg, 2005, p.19).

On the contrary, the theory of social construction of technology (SCOT) states that human action is not determined by technology, but instead human action affects the development of technology. (Wikipedia, 2006c) In the constructivist approach, "individuals are often given an active role as co-constructors of technology" and "technology should serve to release individuals' potential and increase their quality of life". This view also assumes that societal change is unpredictable, because "change is the result of a complex web of actions and interactions between people". (Gripenberg, 2005, p.19). The critique on technological determinism focuses on differentiating technological systems from the human and social systems. (Aro, 2001, p.150) Knowledge is something that is created through an iterative process and therefore the free flow of information should create more knowledge.

When considering that knowledge is something humans possess, technological determinism has a stronger standing point in information society discourse, if the society's development is measured in numbers of computers, cellular phones, cable-televisions and so forth. Furthermore, Järvinen (March 1998) points out that Internet itself has proven groundless the assumption, that totally free flow of information would increase knowledge and understanding about world issues. What has happened is that resources of information are unlimited because the threshold of publishing is rather low. Searching and analyzing information and measuring the source's trustworthiness are entirely left to the receiver. Keeping in mind that information does not have to be true or false, this also causes the philosophical paradox of the knowledge-based society.

For all these reasons, knowledge is something especially significant for human beings, who can define whether something is true, justified and believed, whereas information or data is something that concerns machines. Therefore, a piece of paper, a computer hard drive or Internet can never contain knowledge, only information or data. This differentiation is used particularly in suggestions that in a knowledge-based society the focus is on developing a social world exactly for the people, and not about a world materialized by technological development (Aro, 2001, p.150). Moreover, it is the reason that today's societies cannot be called more than information and communication societies.

2.4 History of the IC-Society Concept

The purpose of this section is to present a historical overview of the concept of the information and communication society based on different theorists. Information society theorists can be roughly divided into two groups. The first group consists of those who believe it is relevant to discuss about an information society because it differs greatly from a previous society (e.g. Daniel Bell, Yoneji Masuda and Manuel Castells). The second group consists of those who place an emphasis on informatization of the society, but do not acknowledge a major turning point from a previous society (e.g. neo-Marxist Herbert Schiller). (Webster, 2002, p.5) This thesis states that there has been a major turning point from an industrial society to an information and communication society. Therefore the focus will be on the first group of information society theorists.

In the 1970's Daniel Bell stated that the next society would firstly involve the change from an industrial society producing commodities to a post-industrial service society. Secondly, the society would also concentrate on theoretical information to produce technological innovations. Thirdly, new "intellectual technology" would emerge to serve decision making. (Bell, 1979, p.163) Bell saw information as "data processing in the broadest sense". According to Bell (Bell, 1979, p.168), the storage, retrieval and processing of data is the essential resource for all economic and social exchanges in the post-industrial society. These include: processing of records such as payrolls and government benefits (e.g. social security); processing for scheduling such as airline reservations, production scheduling and inventory analysis; and data bases such as characteristics of populations as shown by census data, market research, opinion surveys, election data and so on (Bell, 1979, p.168). In this new society, information becomes the main commodity in the marketplace.

Daniel Bell's concept of post-industrial society was extended by Yoneji Masuda who viewed it as an information society (Japanese *jōhōkashakai*). According to Masuda information society is a society, which grows and develops more and more around information. (Heinonen, 1995, p.67) The information society will be the highest developmental state of an affluent society, where intellectual creativity is more highly

valued than the consumption of commodities in the industrial society (Masuda, 1981, pp.480-481). Concrete changes in future cities would be e.g. cable television; computer controlled vehicle systems; and automated supermarkets. Automated supermarket would not have service personnel; they would operate with magnetic keycards and be integrated with a regional health control system. (Masuda, 1981) Some of these changes have already taken place in the society and others, e.g. automated supermarkets using RFID-tags, are at an experimental stage e.g. in Germany (Metro Group, 2006).

Although Masuda's visions were seen as an optimistic utopia of the future at that time, it has become clear that some of his visions were not as far fetched as believed. Looking back in history shows that technological innovation and fundamental technologies are the forces, which drive societal and economical development. Fundamental technologies extend through the society and help new methods of production to emerge. Historical examples are hunting and agricultural technologies and industrial production technologies, which were adequate enough to force societal change in the whole society. Today's fundamental technologies are particularly information and communication technologies. (Heinonen, 1995, p.67) What is so fundamental about ICT is that firstly it operates as a non-materialistic production technology (see Figure 3). Secondly it triggers a process to change an individual's values and behavior from consumption to achievement needs. Thirdly it makes the infrastructure of the information society to be based on computers and networks. Fourthly the leading industry becomes the information industry in all its forms. Lastly the political system becomes based on citizen activity, synergy and democracy instead of individualism; and the social structure consists of multi-centre and voluntary civil communities instead of industrial society's centralized power and hierarchical classes. (Heinonen, 1995, p.68)

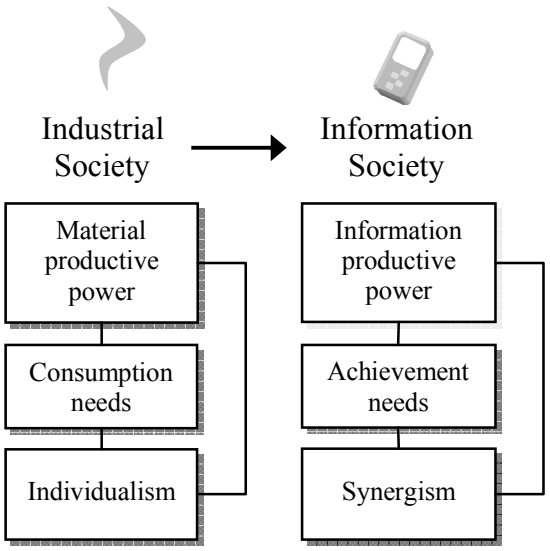

Figure 3. The Development from Industrial Society to Information Society (Masuda, 1981)

Similar thoughts were shared by Manuel Castells. Castells (2000, pp.29-31) views the information society as a network society, that is driven by a pervasive technological change throughout the society. What characterizes this revolution is that former information and knowledge are being more actively used to generate new information and knowledge. Castells (2000, pp.70-72; Kolehmainen, 2001, p.36) describes the societal effects of technological changes by five fundamental characteristics of a network society. First, information is its raw material or a product, because with information it is possible to produce new information. Secondly, new technology is pervasive by nature, because information is an integral part of all human activity. Technological changes shape all processes of people's individual and collective existence. Thirdly, networking caused by new information technology increases the complexity of interaction and unpredictability of development. In reference to Robert Metcalfe's mathematical formula of how the value of network increases with the number of nodes in the net, Castells states that when networks diffuse exponentially, the perceived benefits and the penalty of being an outsider of the network grow exponentially too. The fourth fundamental characteristic of the new technology paradigm is flexibility. Castells refers at this point to the flexibility of organizational processes, but flexibility can be seen on a societal level as possibility for constant change. Flexibility can be a liberating force, but vice versa it can be repressive

tendency, as it offers many options for the powers that be. Lastly, the fifth characteristic of the new technology revolution is the convergence of specific technologies, such as micro-electronics, telecommunications, optoelectronics and computers, into a highly integrated information system. (Castells, 2000, pp.70-72; Kolehmainen, 2001, p.36)

Many of the information society theories focus on information as becoming the main commodity in the market place (e.g. Bell, Masuda and Castells). They also recognize the convergence of different communications technologies (e.g. Castells), but do not stress the role of communications enough as an essential part of societal development in the information society. The concept of the communication society emphasizes the interaction between individuals, whether it is one or two-way communication. In the communication society the focus is on interpersonal communication as a way of transferring information through different means of communication. The convergence of telecommunications, information technology and media began in the early 1990s. Today they have intertwined so closely together that it is difficult to separate one from another. In practice the convergence of technologies means that for example one gadget can be used for many purposes such as making phone calls, watching television, listening to the radio, surfing Internet and taking photos.

Extending Masuda's ideas about the information society, and combining them with Bell's and Castell's theories gives an applicable alternative for the development of the IC-society (see Figure 4). This alternative is based on observations on the development of the current western society. The transition from an industrial society to a developed IC-society is accelerated by ICT innovations and growing networks. The leading industry is the information industry in all its forms. Individuals' values and behavior change from consumption to achievement needs, and later to experience needs. The political system will change from individualism to synergism and later on to egalitarianism. Strict hierarchical classes will diminish and power will become uniformly distributed.

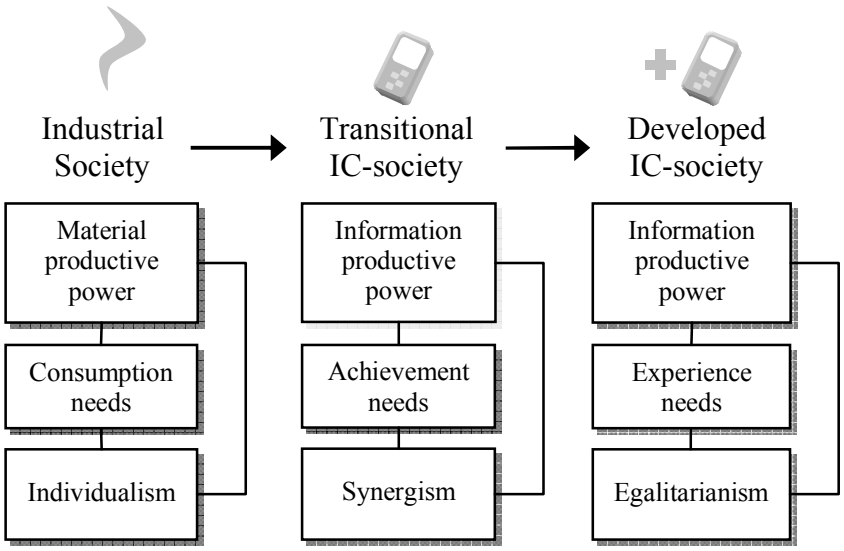

Figure 4. The Development from Industrial Society to IC-Society (Extended from Masuda, 1981)

3 DIFFUSION OF INNOVATIONS

Diffusion of an innovation is "a process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1995, p.10). This chapter studies theories, which help explain the diffusion of innovations in general but also the diffusion of information and communication technologies in the world. To study the diffusion of innovations, a fundamental theory constructed by Everett M. Rogers is used. The theory itself is epic and therefore only certain parts of it are studied. These parts are the definition of innovation, characteristics of an innovation and adopter categories. As a supplement to Rogers's theory, the factors affecting the diffusion of ICT and paper industry's innovations are covered in the last section.

3.1 Rate of Adoption

Innovation can have a number of different views about its meaning. However, it should be noted that every view focuses on the concept of newness. For instance, Rogers (1995, p.10) sees that innovation is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" or in other words "if the idea seems new to the individual, it is an innovation". Other theorists, e.g. Innes, focus on differentiating innovations from inventions. Inventing means creating a new idea, product, process or a concept and innovating means taking the invention and adapting it to fit a new situation or evolving earlier into something new (Innes, Green & Thomson, 2005, p.24).

Innovations can be further categorized into groups according to their order of magnitude. The Centre for Innovation Studies (2003) classifies innovations as incremental and radical innovations, and general purpose technologies. Incremental innovations are small (perhaps 1-2% a year) improvements that are continuous and cause relatively little disruption. Radical innovations represent new technologies that displace existing technologies totally, or cause extensive changes in business practices by being disruptive. General purpose technologies are huge innovations that cause far-

reaching changes in the world. They also have the potential to be used in a wide range of products and processes as complements for other technologies. (Innes et al., 2005, p.24; The Centre for Innovation Studies THECIS, 2003) Every innovation also has certain characteristics, such as relative advantage, compatibility, complexity, trialability and observability, which explain their different rate of adoption. (Rogers, 1995, p.15)

Relative advantage is the degree of perceived superiority of the idea compared to other ideas. Usually the amount of relative advantage is measured by economic profitability, low initial costs, resource savings and how fast the benefits are attained. For example, a new product may have a technological advantage or advances that result in reduced production costs leading to a lower selling price (and therefore accelerated diffusion of the innovation) or it can produce economic profitability and resource savings in costs, time and effort (Rogers, 1995, pp.212-213, 216; Sundqvist, 2003, p.16).

Compatibility is the degree of perceived consistency with existing values, experiences and needs. Compatibility helps the individual to give meaning to the new idea so that it seems familiar. On the other hand, incompatibility with cultural values, previous ideas and needs causes negativity towards the innovation, and can slow down or even block the adoption of the innovation. It can also be reflected onto future innovations as rejections. (Mohr, Sengupta & Slater, 2005, p.174; Rogers, 1995, pp.228)

Complexity is the degree of perceived difficulty in understanding and using the innovation (Rogers, 1995, p.242). The more learning the implementation of the innovation requires, the slower it will disperse in the community (Lintilä, Savolainen & Vuorensyrjä, 2001, p.45) and if it requires retraining, the risk of rejection is higher because of high switching costs (Pae, Huyn, 2002). Especially the early and the late majority users (see description below) of high technology products want to be able to transfer their skills developed earlier with a similar product. If it is not possible, they may decide not to learn how to use the new product and reject it. (Alba, Hutchinson, 1987)

The last characteristics, trialability and observability, usually go hand in hand and therefore are hard to tell apart. *Trialability* is the degree of possibility to experiment with the innovation on a limited basis (Rogers, 1995, p.243). The importance of trialability increases with the size of the investment, but also with the frequency of use and degree of visibility of the innovation (Sundqvist, 2003, p.17).The diffusion of the innovation is more rapid, if the innovation can be tried out without any greater risk and the experience is positive during the trial (Lintilä et al., 2001, p.45). *Observability* is the degree of visibility of the innovation's results by members of a social system (Rogers, 1995, p.244). In other words, the more obvious the benefits of the innovation are for e.g. friends, colleagues, celebrities and so on, the faster it will disperse in the community (Lintilä et al., 2001, p.45; Sundqvist, 2003, p.17).

3.2 Adopter Categories

Diffusion of innovation theory states, that the distribution of adopters over time is expected to form a bell-shaped curve, and the cumulative or total number of adopters as a function of time is expected to be an S-shaped curve. The number of adopters increases slowly at first due to uncertainty about the innovation, which results as a relatively flat curve. If the innovation is a success and a critical mass of adopters is reached, the speed of adoption increases rapidly resulting in a steep curve. When the market for the innovation is saturated, the curve flattens out again. (Rai, Ravichandran & Samaddar, 1998, pp.99-100)

The mean (x) and the standard deviation (sd) are used to divide normal adopter distribution (the bell-shaped curve) into five ideal adopter categories *(innovators, early adopters, early majority, late majority and laggards)* with standardized percentages of respondents in each category, which are shown in Figure 5. (Rogers, 1995, pp.262-293)

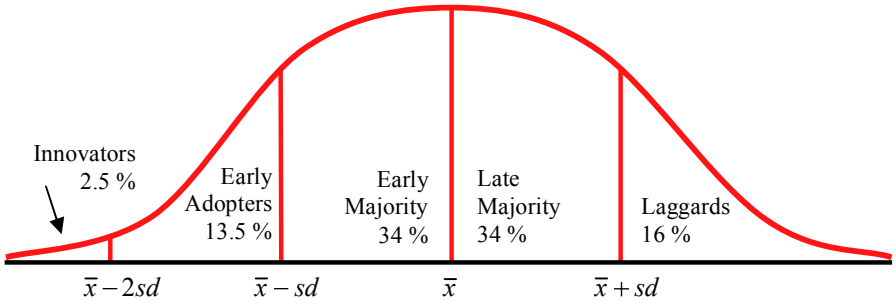

Figure 5. Categorization of Innovation Adopters (Rogers, 1995, p.262)

The first category from left to right forms the group of *innovators*, which is two standard deviations away from the mean, and 2.5 percent of the adopters. (Rogers, 1995, p.262) The second category is *early adopters*, which is the area between the mean minus one standard deviation and the mean minus two standard deviations, and 13.5 percent of the adopters. (Rogers, 1995, p.262) When innovations are introduced for the first time, most people often feel uncertain of their value. The technology can show poorer performance than anticipated and during this period problems facing the technology are improved. The reason why only individuals in the first and second category, innovators and early adopters, are interested is their willingness to take more chances than other groups. (Hetemäki, Nyrud & Boston, 2005, p.27) The individuals in the third category are called *the early majority*. The early majority is the area between the mean time of adoption and the mean minus one standard deviation. This area consists of 34 percent of the individuals. (Rogers, 1995, p.262) At this point the innovators and early adopters have gained insight and shared their experiences with others. The early adopters start to get excited about the benefits and adopt the innovation. (Hetemäki et al., 2005, p.27) The fourth category, *the late majority*, is the next 34 percent of individuals to adopt the innovation. The area of late majority is between the mean and one standard deviation to the right of the mean. (Rogers, 1995, p.262) The late majority adopts the innovation when it becomes more commonplace, leaving the last 16 percent of individuals, the *laggards* that probably never will adopt for personal, financial or philosophical reasons. (Hetemäki et al., 2005, p.27; Rogers, 1995, p.262).

3.3 Diffusion of ICT Innovations

In general the characteristics of a market have the strongest effect on the final penetration time and rate. The penetration time is longer in countries, where the adoption of the technology has happened early, the standard of living is high, and citizens are cosmopolitan and wealthy. (Frank et al., 2003, p.75) In contrast in laggard countries, market potential is strongly related to wealth and therefore it is smaller than in early adopter countries. The penetration time is noticeably shorter in laggard countries because once a mass of adopters is achieved the diffusion of ICT is usually exponential (see for example cellular phone penetration in Russia in section 5.2 Figure 11). The faster growth rates in late adopter and laggard countries means a catching-up process. This is because if the first-adopted country has the slowest growth, it is going to be reached by other countries at some point (Frank, 2003, p.2).

The factors affecting the adoption of ICT around the world are: socio-cultural, technological, economic and geopolitical factors (Castells et al., 2004, p.35). As mentioned earlier, the degree of compatibility of ICT with values, experiences and needs affects its diffusion in the social system (Rogers, 1995, p. 228). Trialability and observability of ICT are closely related to social systems e.g. observing friends and colleagues and trying out their gadgets. Complexity is caused by socio-cultural elements such as literacy and ICT skills that are requisites to the use of ICT. Thus, language causes barriers in non-English speaking countries in ICT usage, when most of its content originates from English-speaking countries.

Complexity and relative advantage are related to technological factors. A classic example of complexity is the QWERTY-typewriter keyboard. The QWERTY-keyboard was developed in the late 1860's as an incremental improvement to stop type bars from jamming into one another. Despite of superior alternatives, such as the Dvorak-keyboard, the QWERTY-keyboard has persisted as a standard. (Rosen, 1994) Another more modern example of complexity is when cellular phone manufacturers use different user interfaces and logic within their phones. When consumers change from one manufacturer's cellular phone to another manufacturer's phone, they may encounter

problems with usability. Relative advantage can be obtained by technological improvements in efficiency (e.g. speed, reliability, and accuracy), ease of use, costs, capacity, security, or access to information and so on. However, it should be noted that new products or services usually require large investments towards the development of an adequate infrastructure (e.g. Internet bandwidth, mobile network coverage), and relative advantage is small without it.

Economic factors e.g. pricing in proportion to income level and availability also influence the diffusion of rate of ICT. Initially a country's GDP affects its ability to adopt ICT. As stated earlier, countries that have high levels of GDP per capita also have a high penetration of ICT. High pricing slows down the diffusion of ICT, e.g. computers and Internet subscriptions are relatively costly for most people. Additionally, in some cases developing countries may be enthusiastic to adopt the technology, but tend to be limited by an inadequate infrastructure. For instance, developing countries may lack a decent fixed telephone line infrastructure, and therefore the people living in these countries are more willing to adopt mobile phones (Castells et al., 2004, p.35), which may slow down the diffusion of other ICTs and vice versa.

Geographically small and densely populated countries (e.g. Japan) are usually able to speed up the adoption of ICT because it is easier to set up the infrastructure. In wide areas (e.g. United States) establishing such systems requires more effort, financing and collaboration. (Castells et al., 2004, p.35) In addition, in some countries the involvement of government affects the rate of diffusion (Castells et al., 2004, p.37) more than in homogeneous and small markets. On the one hand, many countries have already set up agendas for improving their infrastructure. On the other hand, government regulation slows down the diffusion of ICT. For example, some developing countries (e.g. African countries) treat ICT products as luxury items and impose import taxes, making the products more expensive and unobtainable for most consumers (UNCTAD, 2000, p.98). Some authoritarian governments (e.g. China and Singapore) are concerned about the free flow of information and therefore restrict access to certain information sources. Generally the liberation of markets from close supervision advances and speeds up the

growth of infrastructure. Therefore, capitalism seems to be a fast lane into an IC-society.

3.4 Diffusion of Electronic Media - a Threat to Paper?

At the same time the diffusion of ICT, especially electronic media, is a threat to paper when end-customer behavior changes. On-line services pose a serious competition to traditional newspapers. Traditional daily, weekly and regional formats become available via Internet and the number of free and commuter papers grow. As classified advertising transfers to Internet, it erodes newsprint's important revenue sources. (Haarla, 2002, p.125) At the same time magazine publishers develop e-commerce services to compensate lost advertising revenues due to Internet, and special interest magazines emerge to satisfy individual needs. Catalogues and directories can already be found on-line. The search and retrieval capabilities of electronic media are more than a printed catalogue or directory can offer. Therefore, the volume of printed directories will drop through 2020. For similar reasons, academic books and reference material will transfer to electronic media. (Haarla, 2002, p.126) Other books will still be printed on paper as long as they do not have a substitute (electronic paper or a handheld device), that has a relative advantage over print. Stationary and transactional print is declining as e-mail and electronic forms become common. Security issues and reliability of systems are the biggest barriers to overcome before printed media is replaced.

4 MEASURING THE IC-SOCIETY

The development of the IC-society is driven by a vast number of factors. Some factors are easy to explain in numbers and others in words. This chapter focuses on the analytical points of view of the IC-society. After covering different points of view different indexes that are used to portray the IC-society are presented. Lastly the methodology of the study is explained to further demonstrate the reasons why certain indexes were chosen.

4.1 Choosing the right perspective

The development of the information society can be measured in many ways. Choosing the right perspective can be difficult, when every branch of science offers a different point of view. Frank Webster (2002, p.6) summarizes and criticizes five different analytical points of view of the information society: technological, economical, occupational, spatial and cultural.

4.1.1 Technological point of view - Convergence of Industries

The technological way of defining the information society is the most common among theorists. The basic idea is that breakthroughs in information processing, storage and transmission have led to information technology being applied almost in every corner of society. Computers are put into e.g. typewriters, cars, toys, televisions, watches and factory machines, because it has become economical and feasible to do so. (Mannermaa, 1998, pp.77-78; Webster, 2002, p.7) In addition, the convergence of computing and telecommunications has enabled new and faster ways to transfer information. The proclamation of today is that information is available to everyone, everywhere and anytime. In the technical point of view, it is evident that the trend of convergence is fundamental for the development of the information and communication society.

Webster (2002, p.8) finds the technological point of view sensible, but criticizes the ways that the technological development of the information society can be measured. For instance, how much information technology is needed in order to identify an information society, or when does a society cease to be an industrial society? How should and can the diffusion of technology be measured, by the uptake of ICT? What then is a relevant technology? What if technology evolves or new substitutive technologies emerge? How would one measure the qualitative changes? (Webster, 2002, p.8)

4.1.2 Economical point of view - Value of Information

The economical way of defining the information society focuses on the economic value of information. Webster (2002, p.11) emphasizes the contribution of an Austrian-American economist Fritz Machlup to assess the size and growth of the information industries in statistical terms. The different industry groups distinguished by Machlup were:

- Education (e.g. schools, libraries, colleges)
- Communication media (e.g. radio, television, advertising)
- Information machines (e.g. computer equipment, musical instruments)
- Information services (e.g. law, insurance, medicine)
- Other information activities (e.g. R&D, non-profit activities).
  (Webster, 2002, p.11)

The five industry groups were broken into fifty sub-branches and by examining the industry groups it was possible to evaluate their economic value and contribution to gross national income (GNI). Mainly the growth of these groups' proportion of GNI could implicate the emergence of the information economy. (Mannermaa, 1998, p.80; Webster, 2002, p.11)

Another, even more widely known theorist is Marc Porat, who divided the economy into three different sectors: the primary information sector, the secondary information

sector and the non-informational sector. Porat found that Machlup's theory had a weakness, mainly because it did not take into account the possibility of information activities being in-house elements of other industries. Therefore, Porat's primary information sector included all the industries which make their information available in established markets or where an economic value could be easily ascribed. The secondary information sector included important information activities. By combining the primary and the secondary sectors, Porat was able to separate out the non-informational elements of the economy. (Webster, 2002, pp.11-12)

Webster (2002, pp.12-13) criticizes Machlup's and Porat's economical point of view, as he did the technological point of view. Webster questions whether it is correct to separate a company's research and development (R&D) totally from its manufacturing for statistical purposes, when the activities are likely blurred. For example, a company's R&D department can enhance manufacturing processes and at the same time develop new products for the consumer market. Secondly, it is difficult to pinpoint what economically assessed characteristics are most important for the emergence of an IC-society. One cannot easily distinguish between state research institutions, multinational finance firms, software designers, copywriters of SEK&Grey advertising agency, and corporate brainstorming sessions. Thirdly, when a society can be referred as IC-society? Is it when 50 % of GNI comes from informational activities? It is difficult to point out when a society has moved from being an industrial society to being an IC-society by examining Machlup's or Porat's quantitative measures alone, as they have not been thoroughly defined. Again, how would one measure the qualitative differences? (Webster, 2002, pp.12-13)

4.1.3 Occupational point of view - Predominance of White-Collar

The occupational view is also popular among information society theorists. Central to this thinking is that the information society is achieved when the predominance of occupations is found in the information sector (Mannermaa, 1998, p.83). In practice this means that the amount of white-collar workers, e.g. lawyers, teachers and entertainers; exceeds the amount of blue-collar workers, e.g. coalminers, factory workers and

builders. Considering the fact that professions which required physical strength, are replaced by machines or professions of mind; it seems reasonable to say that we live in or at least are moving towards an information and communication society. For instance, physical strength is no longer needed to the same extent in a paper mill as earlier. Nowadays, computer-based high-tech operating systems administer paper machines automatically in many cases. However, work in a paper mill is not fully automated; maintenance work is still mostly physical.

The problem with measuring the information society from the occupational view lies in the division of occupations into certain categories. Porat divided occupations into 3 groups according to the handling of information (see Table 2). The first group consisted of producers of information, the second group of distributors of information and the third of those who support the two prior groups. Although Porat's division seems simplistic, it cannot be applied to professions that can belong to several groups. For example, one librarian could spend her day only moving books between shelves and therefore she would belong to the third group, while the other librarian could be advising academics on the best source of information for research and therefore belongs to the first group. Qualitative differences between and within professions challenge Porat's division of information occupations, because it is questionable whether there is such an occupation that does not involve information. (Mannermaa, 1998, p.83) Besides, what occupations can be classified as strategically important for the information society?

Table 2. Porat's division of information occupations (Mannermaa, 1998, p.83; Webster, 2002, p.16)

	Producers (1st group)	**Distributors (2nd)**	**Supporters (3rd)**
Nature of work	Producing and selling information	Collecting, distributing, searching and processing information	Using information technology and supporting the first and the second group
Occupations	Scientists, engineers, opticians, teachers, librarians, composers and paperback writers	Managers, secretaries, office workers, lawyers, stockbrokers, typists and journalists of quality newspapers	Computer operators and telephone fitters

4.1.4 Spatial point of view - Conversion of Time and Space

The spatial point of view has similar characteristics to the technological point of view. The spatial conception of information society emphasizes information networks that connect locations between towns, schools, homes and the entire world, and transform the comprehension of time and space. (Mannermaa, 1998, p.84; Webster, 2002, pp.18-19) Companies are able to develop global strategies for production, storage and distribution of goods and services, operate continuously and respond immediately. Global companies are able to get real-time information about their production plants and processes wherever they may be, and corporate executives in faraway places can arrange videoconferences to have meetings on short notice, which saves their time and money and so forth. For example, paper companies can integrate their systems with their customers and suppliers systems, to improve their profitability, efficiency and quality of service.

Webster (2002, p.20) questions whether a greater volume of information flows or the presence of networks would explain the emergence of a new society. One can also argue that information networks have been around for a long time. Furthermore, what constitutes a network and how can you distinguish different levels of networking? Is it a telephone network, broadcasting network, information network or something else?

4.1.5 Cultural point of view - Technology in Culture Creation

The cultural point of view focuses on how different information sources (e.g. radio, television, telephones, Internet, lifestyle magazines, books, newspapers) and the increased amount of information in social circulation change culture. (Webster, 2002, pp.21-23) For example, some technologies become a part of culture or create a new one. Cellular phones have changed the way people communicate. Computers and Internet have created new subcultures like hackers and brought into a new generation’s cultural knowledge timeworn subcultures like punk.

In addition, the information load that people face today changes the way they view the world. Signs come from so many directions, and are so fast to change and contradictory that their power to signify is diminished. As a result, nothing seems genuine enough and people choose what goes with their current interest. Webster (2002, p.23) notes that the cultural view has been the least measured of the five conceptions, probably due to the absence of proper criteria. (Webster, 2002, p.23)

This thesis agrees with the different point of views presented in this chapter. Firstly, the convergence of ICT affects our culture when information becomes ubiquitous. Secondly, it is clear that industries and occupations are becoming information biased, and that information industries are central to IC-societies' development. Thirdly, networks are fundamental part of the society and their rapid growth represents the present time. Lastly, different information sources and increased amount of information do change culture. Therefore one should not choose one point of view and overlook the others. However, the indexes (ISI, ICTOI and DOI) that measure the development of the IC-society are designed from the technological point of view. They measure technological development by infrastructure, uptake and skills. What is important to notice is that they do not distinguish when a society becomes an IC-society. The line between different societies is therefore subjective.

4.2 Information Society Index

The International Data Corporation and World Times have defined an Information Society Index (ISI) to measure how nations are able to compete in the global information economy. It consists of 23 variables, which are categorized under four groups: computer, Internet, information and social infrastructure. The 23 variables are summarized in Table 3. The ISI tracks 55 countries that account for 96 % of total GDP and 98-99 % of information technology expenditures, each year. (Welch, 1999; 2000) In 2006 the amount of variables in the ISI has decreased into 15 variables. Although the amount of countries measured does not concern this thesis, because all 25 chosen countries are included in the ISI, after 2006 the amount of countries has decreased to 52

and in 2007 the amount will increase to 70 countries. It should also be noted that this thesis focuses on the ISI made before 2006. Thus, these changes do not affect how the IC-society is measured over a longer period (1998-2004) based on existing data.

Table 3. The Variables of the ISI (Welch, 1999; 2000)

Information Society Index	
Computer Infrastructure • PCs installed per capita • Home PCs shipped per household • Government or commercial PCs shipped per professional workforce • Education PCs shipped per students & faculty • Networked PCs % • Software per hardware spending	**Information Infrastructure** • Telephone lines per household • Telephone faults per lines • Cost of local telephone call • Television ownership per capita • Radio ownership per capita • Fax ownership per capita • Cellular phones per capita • Cable subscribers
Internet Infrastructure • Amount of e-commerce • Number of Internet home users • Number of Internet business users • Number of Internet education users	**Social Infrastructure** • Secondary-school enrollment • Tertiary-school enrollment • Newspaper readership • Civil liberties & Press freedom

The ISI rates countries into five metaphoric categories of skaters, striders, sprinters, strollers (see Appendix 1) and starters. Skaters are countries that are in a strong position to take advantage of the information revolution because of their advanced computer, Internet, information and social infrastructures. Striders are countries that are moving intentionally towards the information age, with much of the needed infrastructures already in place. Sprinters are countries that are moving towards the information age, but are not able because of economic, social and political pressures. Stroller countries are also moving ahead, but do it inconsistently due to limited financial resources in relation to their vast populations. Starters are countries that are unranked, because they lack the basic infrastructures needed to exploit the advantages of the information age. (Welch, 1999) Starter countries consist of the remaining 139 countries of the world, which is approximately 24 % of the world's population, 4 % of global GDP and less than 1 % of global information technology expenditures (International Monetary Fund;

International Telecommunication Union, August 2006). The gap between the ISI countries and the starters depicts the digital divide of the rich and the poor countries. The 25 chosen countries do not include starters.

4.3 ICT Opportunity Index

The ICT Opportunity Index (ICTOI) measures ICT development and the digital divide in 139 countries during 1995-2003 (Sciadas, 2005, p.3) in order to understand, which countries are making progress, at what speed and with what technologies. The index measures country's Infodensity and Info-use. These measures are then aggregated to define the country's Infostate ranking (see Table 4) (Sciadas, 2005, p.3). The relative differences between countries Infostates depict the existing digital divide.

Table 4. The Empirical Model of Digital Divide (Sciadas, 2005, pp.3-6)

Infostate	
Infodensity	**Info-use**
Networks • Main telephone lines per 100 inhabitants • Waiting lines per mainlines • Digital lines per mainlines • Cell phones per 100 inhabitants • Cable TV subscriptions per 100 households • Internet hosts per 1,000 inhabitants • Secure servers per Internet hosts • International bandwidth (Kilobytes per inhabitant)	**Uptake** • TV equipped households per 100 households • Residential phone lines per 100 households • PCs per 100 inhabitants • Internet users per 100 inhabitants
Skills • Adult literacy rates • Gross enrolment ratios ○ Primary, secondary and tertiary education	**Intensity of use** • Broadband users per Internet users • International outgoing telephone traffic minutes per capita • International incoming telephone traffic minutes per capita

Infodensity refers to ICT capital and labor. ICT capital comprises material goods such as machinery, equipment and networks, e.g. cables, keyboards, routers and switches. The ICT labor stock is, in fact, a set of skills that is used by people from all occupational classes. The labor stock includes those within the labor force age as well as students and seniors who obtain skills through schooling or some other formal or informal training. They consume ICT goods and services but are not part of their production. When a large number of individuals are involved as both employees and consumers, skills related to consumption and skills related to productive capacity overlap substantially. (Sciadas, 2005, p.7) Consumption of ICT during working and spare time is hard to differentiate within certain occupations. ICT skills are part of the overall continuum of people's skills, starting from basic literacy. Hence, ICT skills cannot be viewed as separate.

Info-use refers to the uptake and consumption of ICT, and their intensity of use in households, businesses and governments. ICT consumption involves the use of capital and skills; many ICT goods are necessary for consuming ICT services. Such uptake forms a part of households' consumptive capacity, which determines future and current consumption flows. As new ICT penetrates the market, substitutions in the form of opportunity costs or displacement take place. Examples of opportunity costs can be e.g. purchasing a cellular phone instead something else and displacing earlier ICT can be e.g. substituting a dial-up connection with a broadband connection. The proportion of ICTs consumption is regarded as reflective of consumer choices, which is closely related to intensity of use. (Sciadas, 2005, p.7)

4.4 Digital Opportunity Index

The Digital Opportunity Index (DOI) measures ICT development and the digital divide in 180 countries during 2004-2005. The index measures the possibility of a country's citizens to benefit from access to information by using three categories: opportunity, infrastructure and utilization, which are illustrated in Figure 6. Firstly, opportunity measures the level of basic access and affordability (Percentage of population covered

by mobile cellular telephony, Internet and mobile access prices as a percentage of per capita income). For example, certain levels are needed in mobile coverage for a country to become an IC-society. Secondly, infrastructure measures different networks (households with fixed lines, mobile cellular and mobile Internet subscribers per 100 inhabitants, and households with Internet access at home) and devices (households with a computer and mobile Internet). A certain infrastructure is need for ICT penetration. Lastly, utilization evaluates the usage of ICT (proportion of Internet users, fixed and mobile broadband subscribers). (International Telecommunication Union, 2006, p.21)

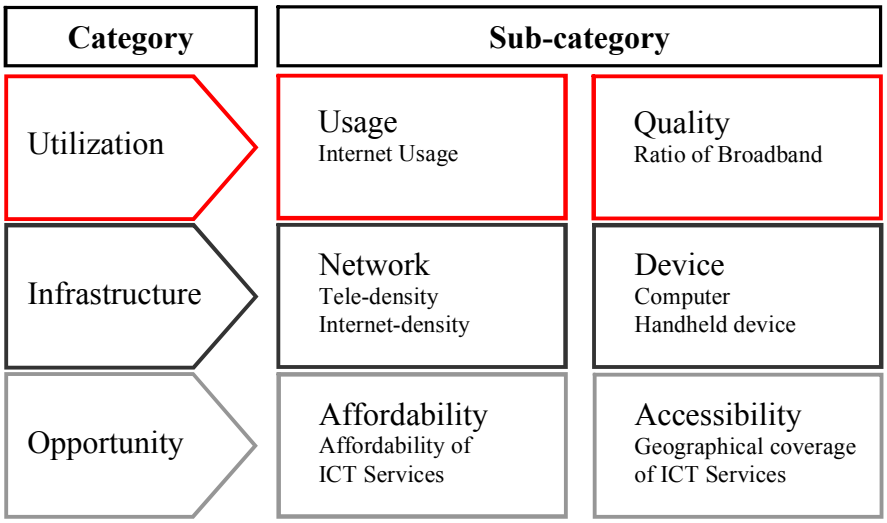

Figure 6. Digital Opportunity Index Categories (International Telecommunication Union, 2006, p.22)

4.5 Methodology of this study

The growing amount of computers and Internet users enables printed media to be more easily replaced by electronic media, such as reading a newspaper as an online newspaper. In fact reading a printed newspaper may be given up totally, because of new media and digital alternatives (e.g. video games, surfing on Internet, different multimedia equipment). (Hetemäki, 2005b) However, it should be taken into consideration that although computers, Internet, cellular phones and television are central technologies for receiving and distributing information in today's society, not everyone has the opportunity to access them. This digital divide can exist between

countries (e.g. civil rights, press freedom, wealth), demographical factors (e.g. gender, age and social groups), and education (e.g. literacy, language and ICT skills).

This thesis focuses on finding a methodology for measuring the IC-society's developmental stage within a set of countries through a series of elementary indicators. These indicators are commonly used in measuring the information society, but they are also salient in describing communication paths in a society. The ISI is used in this study to pinpoint how far from each other transitional and developed IC-societies are in each year. The ISI also shows graphically how different country categories differ in infrastructures (see Appendix 1). The ICTOI is used to measure ICT development and the digital divide during 1995-2003. The DOI is used to measure the IC-society's developmental state in 2004. It could also be used to measure the IC-society during 2001-2005, but because of a lack of data, it is left for further research. Each country's societal development is analyzed based on these indexes for the chosen countries during 1995-2005. After analyzing each country's developmental stage the underlying reasons for each rating is further analyzed according to technological and economical factors.

4.5.1 Technological Factors in Measuring

Peter Monk (1987, p.165) defines information technology innovation as "a form of technological change that is shaped by the characteristics of information and information processing". The latest technological changes that the world has faced are general purpose innovations e.g. telephones, radio, television, computers, and Internet.

Television and radio broadcasting are a form of one-way communication. Radio will always be a one-way communication medium, but through technological development (digital television and advanced services) television could become a two-way communication medium. For instance, television can act as means to access Internet. As a communication medium it is neglected by the ICTOI and DOI, because not every country publishes data on the number of broadcast sets per household. The ISI used in this study did measure television ownership per capita and radio ownership per capita. However as mentioned before in section 4.2, the variables of the ISI have decreased to

15 variables in 2006, and focus more on computer, telecom and Internet infrastructure in the future. In light of this, television should be part of these indexes in the future, as new communication ways via television emerge (e.g. interactive television also known as iTV) or as television transfers to Internet (Internet-TV) or to cellular phones (Mobile-TV).

Computers are vital for an IC-society. They are everywhere. Since the first digital computers were developed in the 1940's for military use (e.g. Electronic Numerical Integrator And Calculator, ENIAC, was used to build the hydrogen bomb**)**, the modern computer has become exponentially faster, more powerful, more compact and more affordable for the common consumer. Personal computers are general purpose tools to access Internet, type documents, send e-mail and play games for example. Personal computers are what people think of first, but they are not the only computers that exist. Small and simple devices called embedded computers are the most common computer used today. Embedded computers are used to control other devices e.g. industrial robots, factory controllers, traffic lights, cellular phones, digital cameras, televisions, toys and so forth. (Wikipedia, 2006a) However, the number of embedded computers used is too vast to compile statistics and seldom do they act as a means of communication. Thus, only personal computers are studied in large as characteristics of the IC-society.

Mobile communications is general purpose technology that is prevalent and personal. It is not necessary for everyone to have a cellular phone subscription or moreover mobile Internet access, but in a developed IC-society it is desirable because the society is more or less build around mobile communication. Mobile telephony began to take of in the mid-1990s and by the year 2000 mobile phones had become mainstream technology in most countries. Although mobile phones do not act as a direct substitute for fixed phone lines, their aggressive diffusion caused the diffusion of mainlines to slow down in most parts of the world. By the end of 2005, there were few countries which had more fixed telephone lines than cellular phone subscribers. In these countries fixed telephone lines together with computers may be used primarily as a means to access Internet instead of making a phone call.

Internet is a worldwide, public network of interconnected computer networks (such as domestic, academic, business and government networks). Together the networks carry information and services such as e-mail, chat, file transfer as well as web pages and documents of the World Wide Web. (Wikipedia, 2006b) Internet was opened to the public in the early 1990s, and since its inauguration it has grown exponentially. Mostly Internet is accessed via computer, but other ways such as using a cellular phone or another handheld device exist. Mobile Internet, however, is relatively new and therefore its rate of utilization is low in every country. Mobile Internet is used by some as a complement to computer access to Internet (e.g. 3G networks).

The growth of Internet can be measured either by the number of hosts or users connected to the network. Hosts are computers that have their own Internet Protocol address, are permanently connected to Internet and provide gateways to the rest of the network for Internet users. There has been a lot of discourse about which way is more suitable for measuring the size of Internet or its diffusion. However, the number of hosts does not represent the use of Internet, it only represents the infrastructure. When it comes to communication the number of Internet users is more practical in explaining end-user behavior and the diffusion of Internet. The number of Internet users per 100 individuals is used in this thesis, instead of the number of hosts per 100 individuals.

4.5.2 Economic Factors in Measuring

Ever since newspaper has been produced the economic and population growth have increased newspaper consumption (Hetemäki, 2005b). In the long run economic growth also fosters the transition to an information and communication society, where computers, Internet, broadband connections and so forth are available to more and more people. The wealthier the country is, the better chances people have for acquiring and using electric communication technology (Hetemäki, 2005b). Therefore it is relevant to measure a country's economic activity with gross domestic product (GDP). The GDP is the total value of commodities (goods, services) produced less the value of any commodities used to produce them during a year. The annual growth rate of GDP allows comparisons over time and between different sized economies irrespective of

price changes. (Eurostat, 2006) However, the growth of the economy and population may not explain paper consumption changes in IC-societies.

4.5.3 Graphic papers and their apparent consumption

After defining the IC-society developmental stage within a set of countries, the developmental stage is compared to paper product consumption to measure correlation between the two factors. Different communication papers are categorized as newsprint and printing and writing papers. Printing and writing papers can be further classified according to their end-use as office papers (photocopying, printing, envelopes, and stationery), high quality magazine papers and catalogues, and other print products (books, inserts, flyers, lower print quality magazines and catalogues). (Hetemäki et al., 2005, pp.8-9) However, data for any particular end-use and consumption is not directly available. Instead, data for paper consumption is available only for certain grades.

The apparent consumption of graphic paper is measured in metric tons of newspaper, coated and uncoated printing and writing paper as well as groundwood and freesheet paper. Groundwood paper is produced from pulp with a mechanical process that breaks wood into fiber (Lane Press, 2005) together with heat and (more often with) pressure. Freesheet paper is produced from pulp with a chemical process that breaks apart fibers and dissolves impurities to create a woodfree paper (Lane Press, 2005). Basically the wood is cooked to remove lignin that binds wood fibers either by using sulfates (alkaline cooking liquor) or sulfites (acid cooking liquor) (UPM-Kymmene, 2005, pp.12-13). Groundwood and freesheet paper end-uses differ from one another (see Table 5). The data is acquired from the Resource Information Systems Inc. (RISI) database, although the data for the different paper grades is not complete for each country. Because the data for graphic papers cannot be broken down to paper grades, they are divided into two groups, newspaper and printing & writing papers, which are used in the analysis.

Table 5. Differences of Groundwood and Freesheet (UPM-Kymmene, 2005, p.17)

Advantages of Mechanical Pulping	Drawbacks	End Uses
Excellent fiber yield (over 90 % of wood is transformed into pulp) High opacity Good printing characteristics	Low strength Yellowing High energy consumption (with thermo mechanical pulping)	Newspapers Periodicals Books Paperbacks

Advantages of Chemical Pulping	Drawbacks	End Uses
Resistance to yellowing Energy self sufficiency Good strength (sulfate) Easier bleaching (sulfite)	Low fiber yield (60 % of the tree is transformed into pulp) More wastes to be purified	Printing, writing Envelopes Industrial papers Packaging Sanitary

5 DEVELOPED AND TRANSITIONAL MARKETS

Transitional countries entering the information age may be able to exploit new ICT more efficiently than developed countries already in the information age. According to Wong (2002, p.168) the latecomers may be able to learn from the experience of the developed countries without having to pay the cost of initial learning and experimentation (the 'fast follower advantage'), but also to jump ahead into exploiting the latest generation of technologies, without having too much asset-specific investments sunken into earlier generations of obsolete technologies (the 'leapfrog' advantage).

On the other hand, opportunities for growth and catching-up may bring up threats for latecomers. Technological learning may require a long cumulative process of human capital development. The rate of new technology diffusion cannot be accelerated in developing countries to reach the level of developed countries because of a human capital bottleneck. Also the efficient adoption of new ICT requires a business infrastructure in the form of physical capital (computers, networks etc.), but also social capital (well functioning finance and regulatory institutions, relatively efficient markets etc.). Latecomer countries may also lack financial recourses to invest in new technologies as aggressively as the developed countries in which the productivity and innovation benefits from new ICT are greater for the developed countries. (Wong, 2002, p.168)

At first the development stages of the chosen developed and transitional market areas are analyzed in order to find out whether the latecomers are able to have fast follower and leap-frog advantages. Thereafter paper consumption in these areas is analyzed. Lastly paper consumption is compared to the indicators of the IC-society to find out if they have a connection or not.

5.1 Index Rankings

The ISI rankings (shown in Figure 7) show the existing digital divide between developed IC-societies and transitional IC-societies. After 2002 the western countries, the USA and Canada, have been ranked as the top competing countries in the global information economy or as the skaters; and the European Union's 15 initial member states (EU-15), Singapore and Japan have been rated as striders while the transitional countries Argentina, Brazil, Mexico, Russia, China and India can be found in the bottom half of the ranking as sprinters and strollers. Although the sprinter and stroller countries are found in the bottom half, they (excluding Argentina) have been able to maintain or improve their status since 1998. This indicates that these sprinter and stroller countries have been able to improve their ability to access and absorb information and information technology.

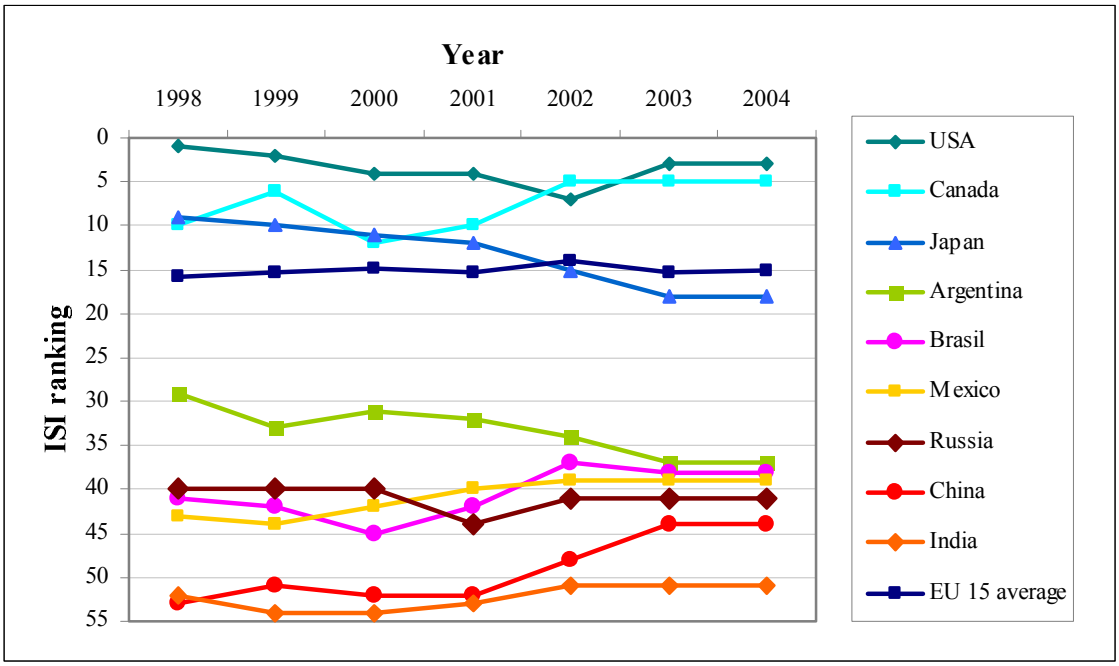

Figure 7. Information Society Index Rankings (IDC)

The digital divide illustrates the variations in accessing ICT across the world. In the ICTOI digital divide is counted as the relative difference between countries' Infostates. This dividedness can be seen in Figure 8. It is similar to the one that the ISI rankings showed. Again the top countries are North American countries, the EU-15, Singapore

and Japan; while the bottom half is taken by Argentina, Brazil, Mexico, Russia, China and India. Figure 8 also shows the development of developed and transitional IC-societies during 1995-2003. The evolution of transitional IC-societies has been slower than the evolution of developed IC-societies. In fact it has taken almost a decade for transitional IC-societies to reach the same Infostate level that current developed societies had in 1995.

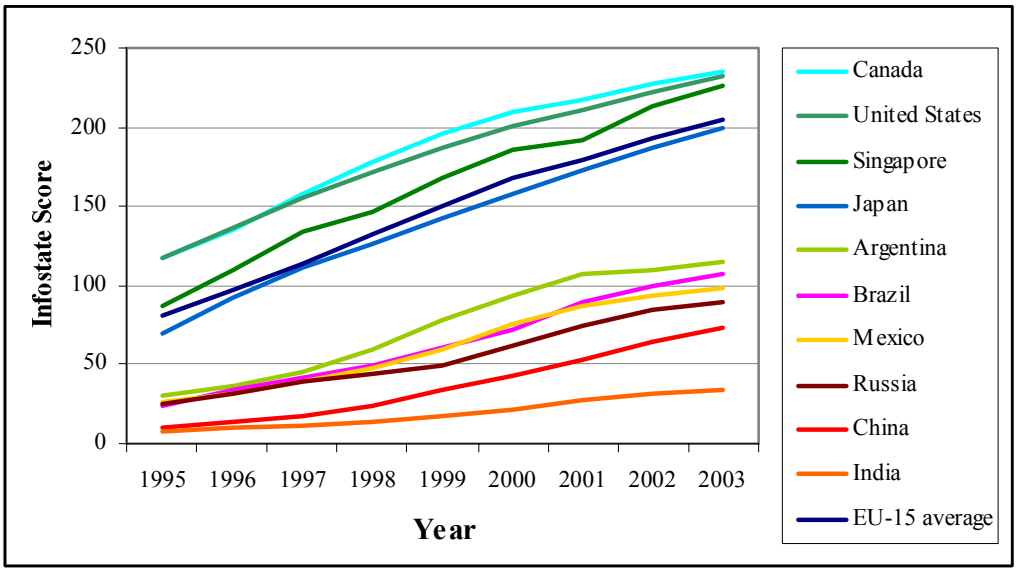

Figure 8. Evolution of Infostates by Country (Sciadas, 2005)

Similarly to the ICTOI, the DOI places the transitional countries below developed countries. The reason why transitional countries are beneath developed countries is firstly because of their infrastructure. Developed IC-societies scored over 0.50 in infrastructure (except in France, Portugal and Greece), while transitional IC-societies scored below 0.45. A score of 1.0 (or 100%) is the maximum a country can achieve (see Figure 9). For further details on country scores and data see Tables 12 and 13 in Appendix 4. However, the reason why societies score relatively low (by average 0.504) is because in developed countries some citizens are still reluctant towards ICT, and for transitional countries the acquisition costs of ICT are too high (International Telecommunication Union, 2005). A lack of computers in households and small amount of cellular phone subscribers are the main reasons why the infrastructure score is low, because these variables affect other variables. For example, without a computer (or as in

most areas without a cellular phone) it is not possible to have access to Internet or (mobile Internet).

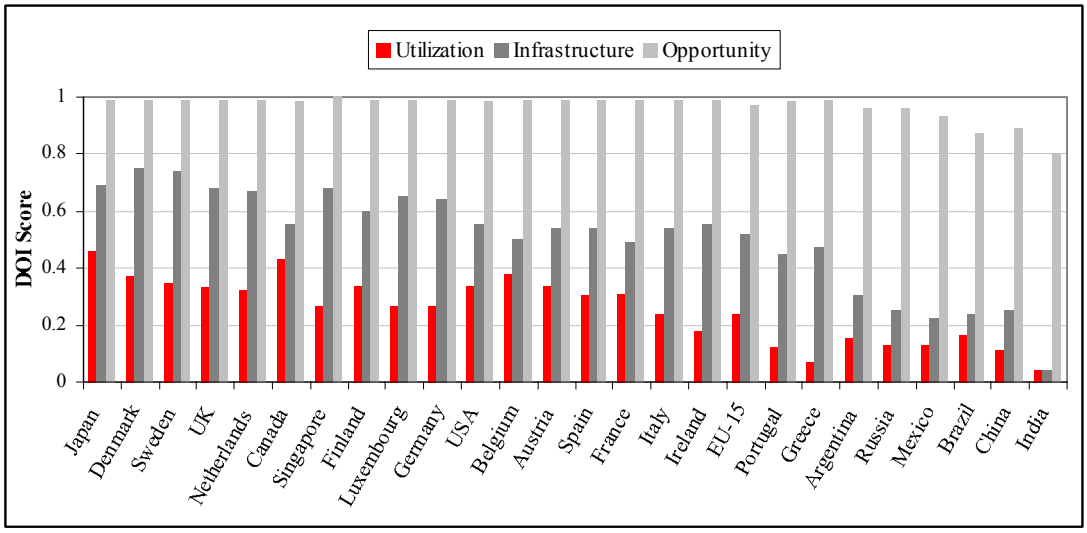

Figure 9. Digital Opportunity Index Results 2005 (International Telecommunication Union, 2006)

Utilization is the second reason for differences in DOI rankings. Utilization evaluates the usage of ICT and the proportion of Internet users (International Telecommunication Union, 2005). Most developed countries scored over 0.18 (excluding Ireland, Portugal and Greece), but still their utilization scores are low. Portugal and Greece scored lower in utilization than most of the transitional countries, mainly because of their low ratio of broadband Internet subscribers to total Internet subscribers. Communication is a central part of an advanced IC-society and "many socially desirable applications… are possible only with broadband access" (International Telecommunication Union, 2005, p.11).

The third reason is opportunity. Opportunity measures basic access and the affordability of networks (International Telecommunication Union, 2005). Certain levels in mobile and Internet coverage are needed for a country to become an IC-society. In developed countries mobile networks and Internet are wide spread and affordability is not a bottleneck. In transitional countries the case is totally different. For example, in India only 60 percent of the population is covered by mobile cellular networks. At the same time the lowest scoring developed country is Canada, with 95 percent of coverage. In addition, Internet access tariffs and mobile cellular tariffs are relatively higher per capita

income in transitional countries than in developed countries. Thus, access is more restricted in price and availability.

5.2 Factors Affecting the IC-Society's Developmental Stage

In the previous section the ISI, ICTOI and DOI showed similar results about the digital divide. This digital divide can be explained by technological, economic, cultural and institutional differences. However cultural and institutional differences are not represented by statistics, and they require thorough familiarization to be analyzed in the first place. Therefore only technological and economical differences are further analyzed in this thesis.

Figure 10 shows the diffusion of personal computers between 1995 and 2004. In transitional IC-societies the diffusion is generally slower than in developed IC-societies. In transitional IC-societies there were less than 11 computers per 100 individuals, while in developed IC-societies there were more than 47 computers per 100 individuals in 2004. Moreover, most computers per 100 individuals can be found in the United States, Canada and Sweden (more than 68 computers per 100 individuals in 2004). The smallest amount of computers per 100 individuals was in China and India (less than 5 computers per 100 individuals in 2004). Personal computers diffuse slowly in transitional IC-societies most likely due to pricing and poor infrastructure. However, in China and India the market size is big, and the total amount of computers exceeds many developed IC-societies.

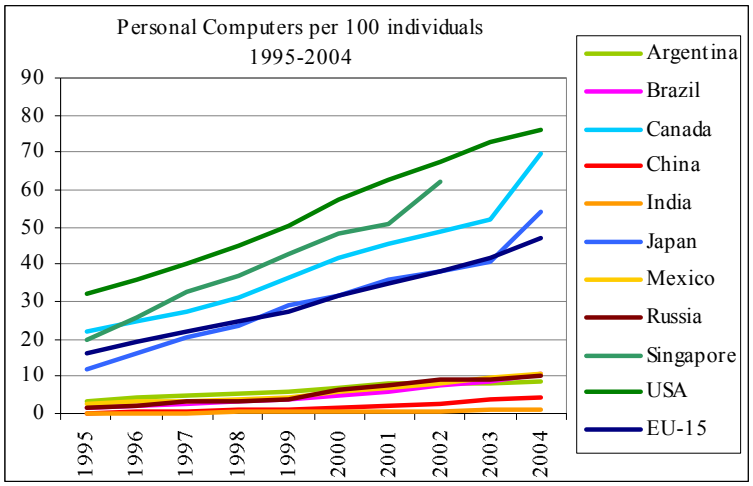

Figure 10. Diffusion of Personal Computers (International Telecommunication Union, August 2006)

Figure 11 presents the diffusion of cellular phone subscriptions between 1995 and 2005. Looking at the regional data it is clear that in various world regions mobile phones diffuse differently. In the western countries mobile phones began to penetrate the market in the mid-1990s approximately at 10 mobile phone subscriptions per 100 inhabitants, and after that the rate of diffusion was rapid. For example, in the EU-15-area the amount of cellular phone subscriptions increased from 7 to immense 101 subscriptions per 100 inhabitants between 1995 and 2005, which indirectly interpreted meant that either everyone in the society had a cell phone subscription or that some inhabitants had more than one. Mostly it means that the number of inhabitants is outnumbered by the number of cellular phone subscriptions.

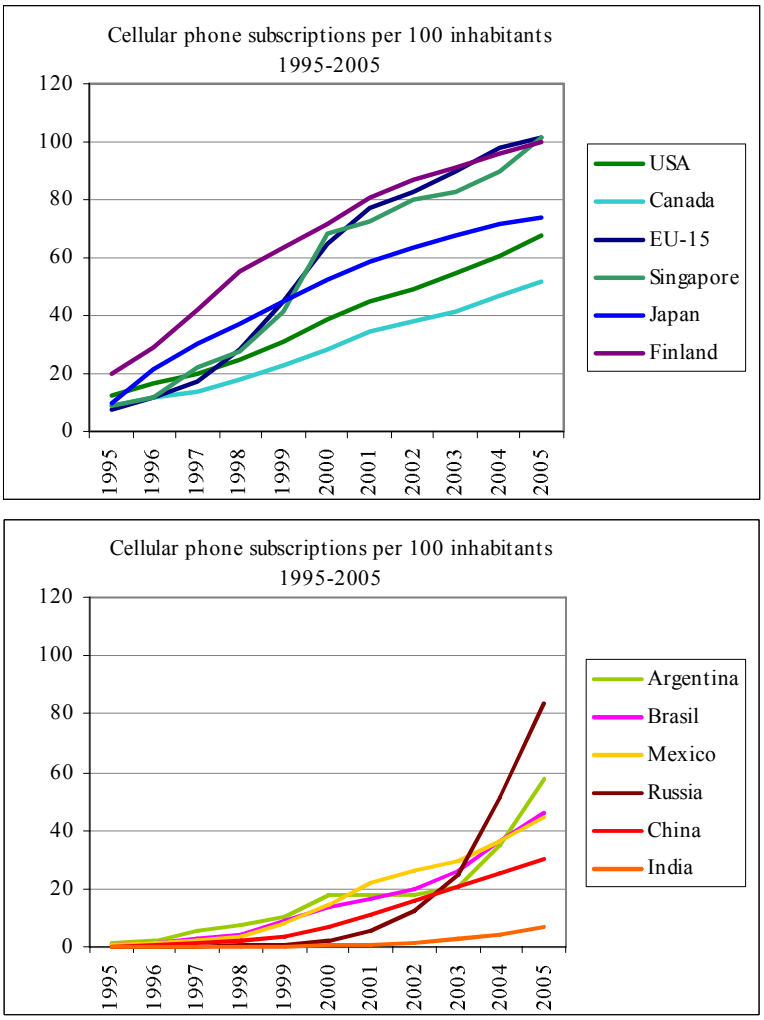

Figure 11. Diffusion of Cellular Phones in 1995-2005 (International Telecommunication Union, August 2006)

Transitional countries were noticeably behind the western countries in the 1990's, but after the year 2000 some of them started to narrow the gap. In 2000 the penetration of mobile phone subscriptions in transitional areas was less than 20 subscriptions per 100 inhabitants. Four years later, in 2004, in Latin American countries the penetration of mobile phone subscriptions had doubled to 40 subscriptions per 100 inhabitants, and Russia as a model student had passed Canada by a whisker and was going strong after Japan. At the same time China was getting a bit behind the Latin American countries, and India was struggling to keep up with the rest of the world.

Developed IC-societies have much more Internet users than transitional IC-societies (see Figure 12). In fact transitional IC-societies come almost a decade behind the

developed ones. In developed IC-societies there were more than 28 computers per 100 individuals in 2004, while in transitional countries there were less than 18 computers per 100 individuals. Most computers per 100 individuals could be found in Japan, Singapore, Denmark, Luxembourg, Netherlands, Finland, Canada and the United States in 2004. On the other hand, the smallest amount of computers per 100 individuals could be found in India and China with less than 9 computers per 100 individuals in 2004.

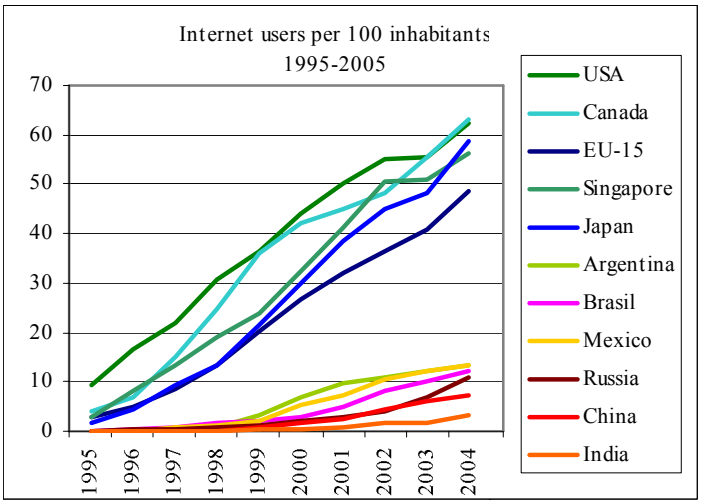

Figure 12. Diffusion of Internet by Users (International Telecommunication Union, August 2006)

Economic factors strongly influence the diffusion of ICT. In developed IC-societies gross domestic product per capita 2006 was estimated to be at 18,162 dollars or more, which is more than half of the GDP per capita of transitional IC-societies (International Monetary Fund). For further details see Table 9 in Appendix 3. The reason why the figures are smaller for transitional IC-societies is most likely due to their large population compared for example to Luxembourg. However, in general the growth rate of GDP per capita in transitional countries (e.g. BRIC-countries) is bigger than in developed IC-societies (see Figure 13). In fact the BRIC-countries are predicted to eclipse most of the current richest countries by the year 2050 (Wilson, Purushothaman, 2003).

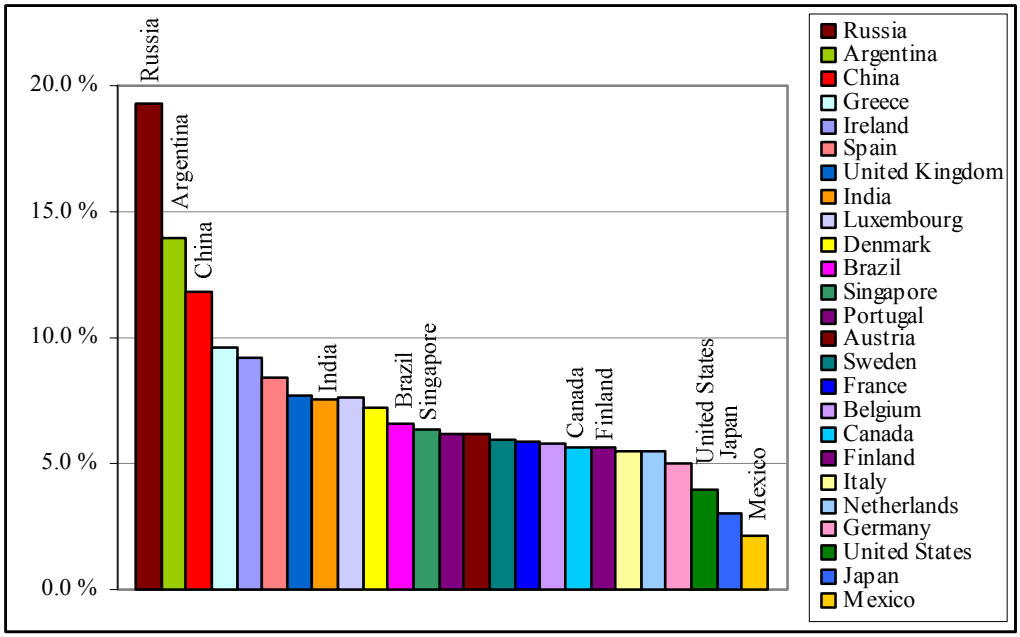

Figure 13. Gross Domestic Product Growth Rate (International Monetary Fund)

Gross domestic product seems to affect ICT diffusion. Personal Computers, cellular phones, Internet use and television, for example, all correlate strongly with GDP. For further details see Figures 22-25 in Appendix 2. This means that wealthier countries have better chances to adopt ICT. An uneven concentration to urban areas as well as culture and government policies could as easily explain low levels of market penetration of ICT. As said before, low levels of ICT penetration in some areas may be related to poor infrastructure and as well as to pricing.

5.3 Paper Consumption

In the previous section it was observed that GDP significantly correlates with the IC-society's development, but what was also noticed in section 3.3 was the importance of the right infrastructure, culture and government policies. Accordingly in this chapter the questions are: What affects paper consumption in different areas? Can GDP help explain the changes of paper consumption in the future? How the developmental state of the IC-society affect on paper consumption?

Figure 14 illustrates the apparent graphic paper consumption during the period 1980-2005. Until today the paper industry has feasted on a steady growth of demand and paper consumption, which will most likely continue to increase in the future. However, developed and transitional markets differ from one another. In some developed areas e.g. North America paper consumption has already started to decrease, when at the same time in transitional areas e.g. Asia the consumption has grown rapidly since the nineties.

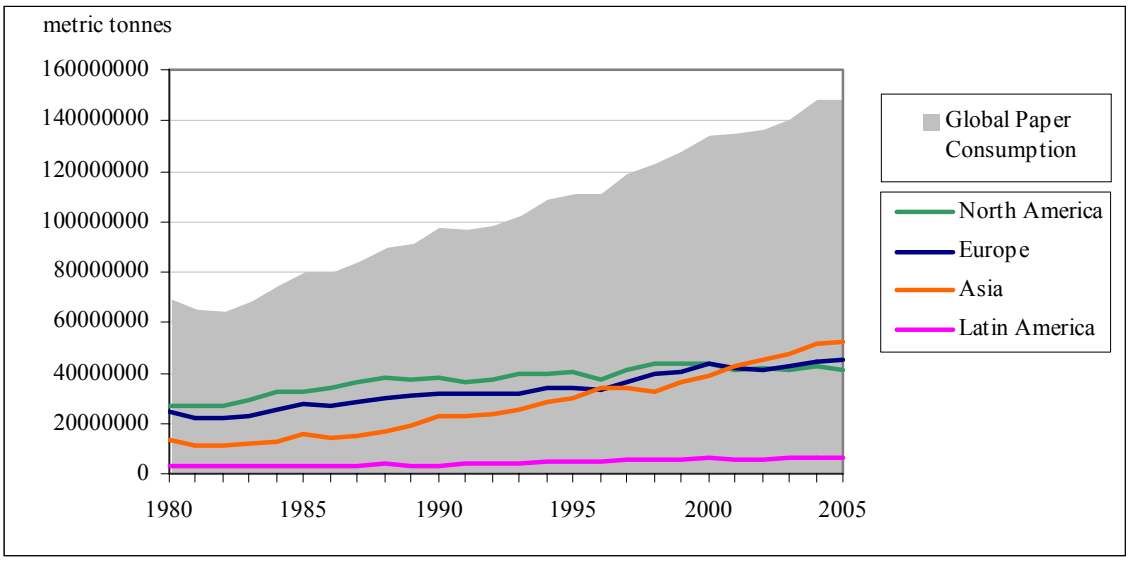

Figure 14. Graphic Paper Apparent Consumption in 1980-2005 (RISI, 2006)

Can GDP help explain the changes of paper consumption in the future? The growth of economy and population has increased paper consumption in the past. However they may not explain paper consumption changes in future IC-societies. Looking at world communication paper consumption in total and comparing it to the development in ICT during the period 1960-2000, it seems like the consumption of graphic papers has increased regardless of new ICTs emerging in the world. As stated earlier in this section, statistically paper consumption differs statistically between countries.

Countries that have a high GDP per capita, such as the United States, have a higher consumption of paper, than low GDP per capita countries, such as China. Growth in GDP per capita should increase paper consumption and vice versa. In developed IC-societies the growth is not as rapid as in transitional IC-societies. However in the United States paper consumption has decreased despite growth in GDP per capita, while in

China it has increased. Figure 15 shows no correlation between gross domestic product in billions of dollars and graphic paper apparent consumption in metric tons in 2005. Therefore the GDP does not explain changes in paper consumption in developed IC-societies.

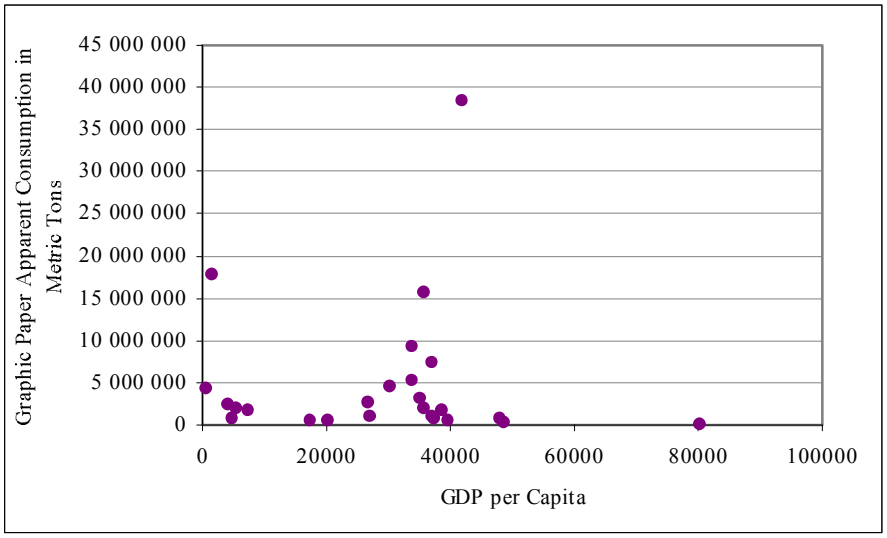

Figure 15. Graphic Papers apparent consumption vs. Gross Domestic Product (International Monetary Fund; RISI, 2006)

How do the developmental stages of the IC-society affect paper consumption? The following figures show how the Infostate scores of different IC-societies have increased relative to changes in graphic paper consumption during the period 1995-2003. The Infostate values have been counted as an average for developed and transitional IC-societies. Graphic papers include both newspaper and printing and writing papers.

The statistics show some interesting dissimilarities. In general, newspaper consumption has decreased in developed IC-societies after 1999, but in some European Union countries (e.g. Italy, Ireland, Luxembourg, and Spain), and in Japan newspaper consumption has grown at a slow rate (see Figure 16). In other European Union countries newspaper consumption has gone down or remains the same from year to year. In Canada, the United States and Singapore newspaper consumption has gone down considerably.

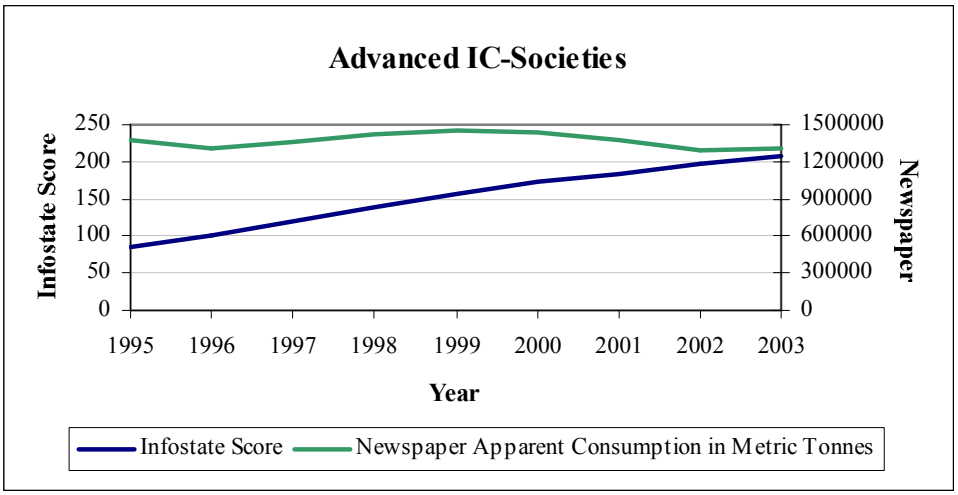

Figure 16. Newspapers Apparent Consumption in Developed IC-Societies (RISI, 2006; Sciadas, 2005)

Although, transitional IC-societies come many years behind developed IC-societies when it comes to paper consumption, in Asian countries (China and India) newspaper consumption is booming (see Figure 17). In fact, consumption has doubled in the last five years. In Russia, newspaper consumption is growing slightly. In Argentina, Brazil and Mexico newspaper consumption has decreased.

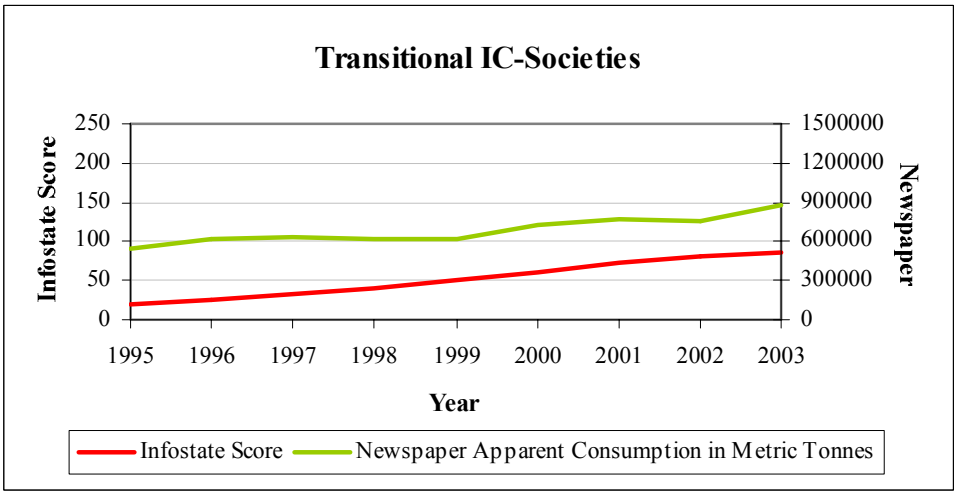

Figure 17. Newspapers Apparent Consumption in Transitional IC-Societies (RISI, 2006; Sciadas, 2005)

The consumption of printing and writing papers has decreased in developed IC-societies after 2000 (see Figure 18). However in most European Union countries (Austria, Belgium, Denmark, Germany, Italy, Luxembourg, Netherlands, Portugal, Spain, and United Kingdom) printing and writing paper consumption has grown slightly. In other

European Union countries (Finland, France, Greece, Ireland, and Sweden) and in Canada consumption has decreased. In the United States, Singapore and Japan, printing and writing paper consumption has grown noticeably.

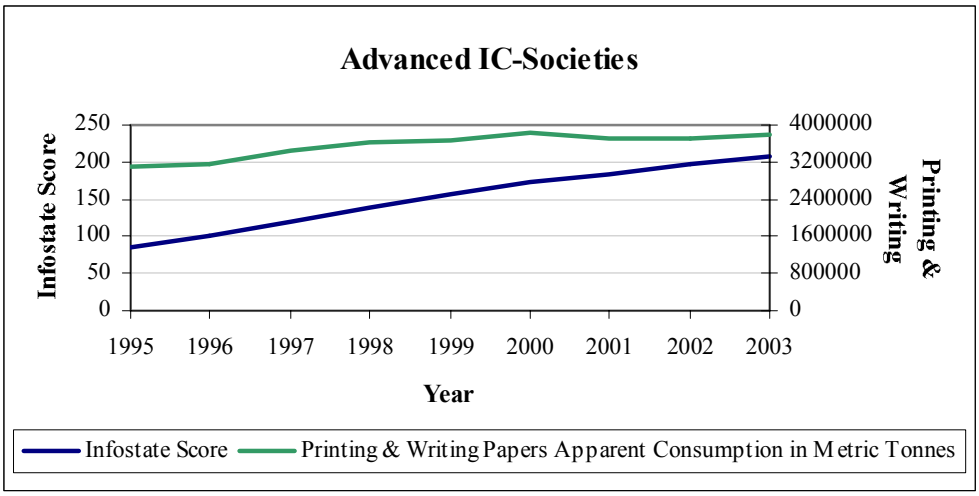

Figure 18. Printing and Writing Papers Apparent Consumption in Developed IC-Societies (RISI, 2006; Sciadas, 2005)

In transitional IC-societies printing and writing paper consumption has either stayed the same or grown significantly (see Figure 19). In Argentina consumption has stayed the same from year to year, and in the rest of the transitional IC-societies the consumption has grown. In China, India, Russia and Mexico the growth rate has been on average approximately 12 %, when in developed IC-societies (Canada, EU-15, Japan, Singapore, and United States) the growth rate has been on average approximately 6 %.

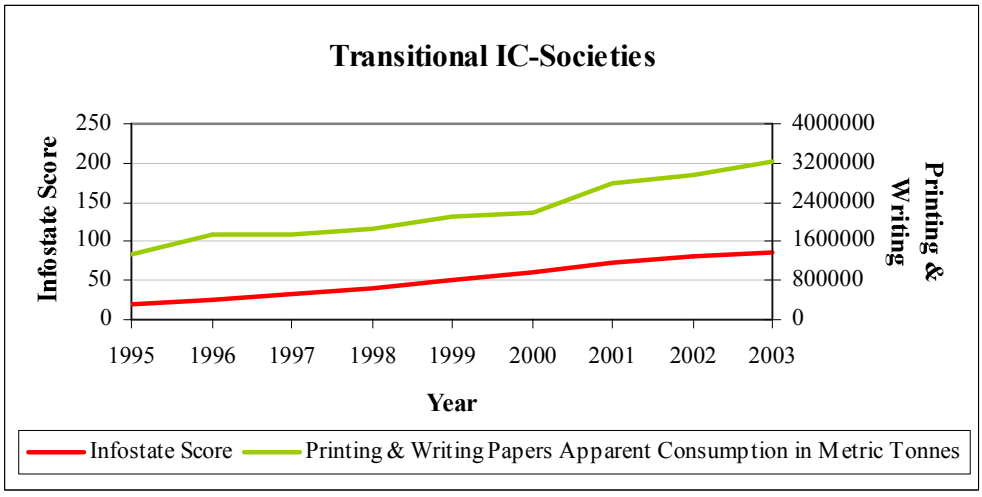

Figure 19. Printing and Writing Papers Apparent Consumption in Transitional IC-Societies (RISI, 2006; Sciadas, 2005)

6 DISCUSSION AND CONCLUSIONS

This chapter summarizes the work reported in this thesis and analyzes the key findings. In the beginning of this thesis a few provocative questions were asked. What will the paper industry do if paper products do not sell in the future and is it game over then? In line with these questions the main objective of this study was to find out if the development of thye information and communication society (IC-society) explains changes in paper consumption. This objective was reached by studying what an IC-society is in general, what kinds of changes depict this societal development and how these changes could affect the end-use of graphic papers.

An IC-society is the next step from an industrial society in societal development. In an IC-society the focus is on information being the main commodity in the market place, on the convergence of different communication industries (telecommunication, information and media), as well as on the role of information and communication technologies and their diffusion as the driving force of societal development. Diffusion theory helps to explain how innovations diffuse throughout society. The factors that affect the adoption rate are socio-cultural, technological, economic and geopolitical factors together with the characteristics of the innovation (relative advantage, compatibility, complexity, trialability and observability). Diffusion of ICT, especially electronic media, changes the behavior of end-customers of the paper industry. This diffusion can be analyzed from five different points of views: technological, economical, occupational, spatial and cultural. The technological point of view is the most commonly used and therefore it was also used in this study.

Answers to the aforementioned research questions can be sought by examining the development of the IC-society through certain indicators and comparing them with the developments of the paper industry. However, the data available for measuring the IC-society is limited in certain areas. General data for population and GDP are easy to collect, but when it comes to collecting data on ICT infrastructure, access and usage it is challenging to find scientifically reliable data sources on the latest technologies. For

instance the number of satellite or digital television subscribers is not gathered by most of the countries.

In this case it was best to use different existing indexes. For instance, transitional and developed IC-societies were compared and contrasted by using a set of indicators and indexes (ISI, ICTOI and DOI). Analyzing existing indexes helped to assess the meaning of the evolution of the IC-society for the paper industry. Findings indicated that the transitional IC-societies are almost a decade behind developed IC-societies in infrastructure development, but they are catching up. GDP per 100 individuals correlates strongly with ICT diffusion. This means that wealthier countries have better chances of adopting ICT. However, in transitional IC-societies the growth rate of GDP is currently much higher than in developed IC-societies. In fact, the transitional IC-societies were able to exploit new ICT more efficiently in some cases than developed countries already in the information age, thus having 'fast follower' and 'leapfrog' advantages.

Until now, the paper industry has enjoyed a steady growth in demand and the consumption of paper will probably continue to do so in the near future. However, some differences were found between developed and transitional markets. In some developed markets paper consumption, especially newspaper, is already decreasing, while in transitional areas the consumption has grown rapidly since the nineties. Examining indexes (ISI, ICTOI and DOI) that depict current developments in IC-societies together with paper consumption reveals how the ICT sector affects the paper industry. In general, paper consumption decreases over time, because traditional print media focuses more on electronic media when classified advertising transfers to Internet. Younger generations are also most likely used to dealing with new media, without using old printing and writing products. However the indexes (ISI, ICTOI and DOI) only show the development of the IC-society from the technical point of view, and not the economical, socio-cultural or geopolitical factors behind it.

The questions asked in the beginning were meant to shake up the paper industry's ingrained way of thinking. Based on the findings, the industry has to take action in

developed market areas to create new opportunities of growth. It is clear that raising productivity and efficiency by e.g. growing the width or speed of the wire, has not yielded the desired results. New growth in developed market areas should be sought by developing and launching new kinds of products (e.g. electrical paper or RFID-tags), that take into account changing end-customer needs. These changes are inevitable at some point in every IC-society, including countries at the transitional and industrial stage.

The indicative results of this research are consistent with the diffusion of innovations theory and earlier research done by e.g. Hetemäki and Haarla, who primarily focused on ICT or electronic media as a challenger to paper-based products. Firstly, ICT and especially the IC-society is a challenge for the paper industry. Secondly, the growth of the economy may not explain changes in paper consumption in developed market areas anymore. Lastly, economic growth fosters the transition to an information and communication society, where computers, Internet, broadband connections and so forth are available for more and more people.

The limitations of this study reveal promising areas for further research, such as exploiting the Digital Opportunity Index in the long run to measure the development of IC-society, as wells as studying cultural and institutional differences that affect the diffusion process of ICT in transitional and developed IC-societies. Instead of analyzing changes in paper consumption, an analysis on the changing end-use of paper products and the possibilities and threats they bring should be conducted to get a clearer view on which direction the paper industry needs to go to. Further research could include e.g. studying end-customer behavior and how new products and services are adopted. Firstly this would give information about how new products and services substitute paper products and secondly it might reveal products or services, that could be made or done more efficiently or economically by using paper. Overall, it would give the industry an opportunity to think through what their actual core competencies are and how to utilize them. For the paper industry the game is not over - it has just begun.

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APPENDICES

Appendix 1. Infrastructure Differences of Skater, Strider, Sprinter and Stroller Countries

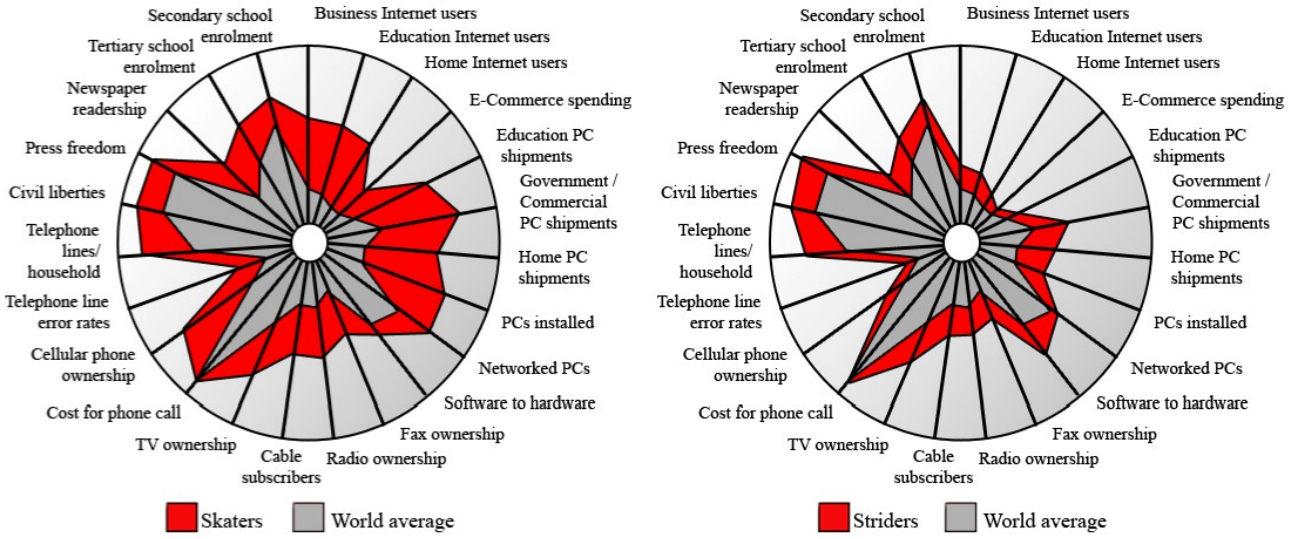

Figure 20. Skaters and striders stage of development (Welch, 1999)

Appendix 1. Infrastructure Differences of Skater, Strider, Sprinter and Stroller Countries (continued)

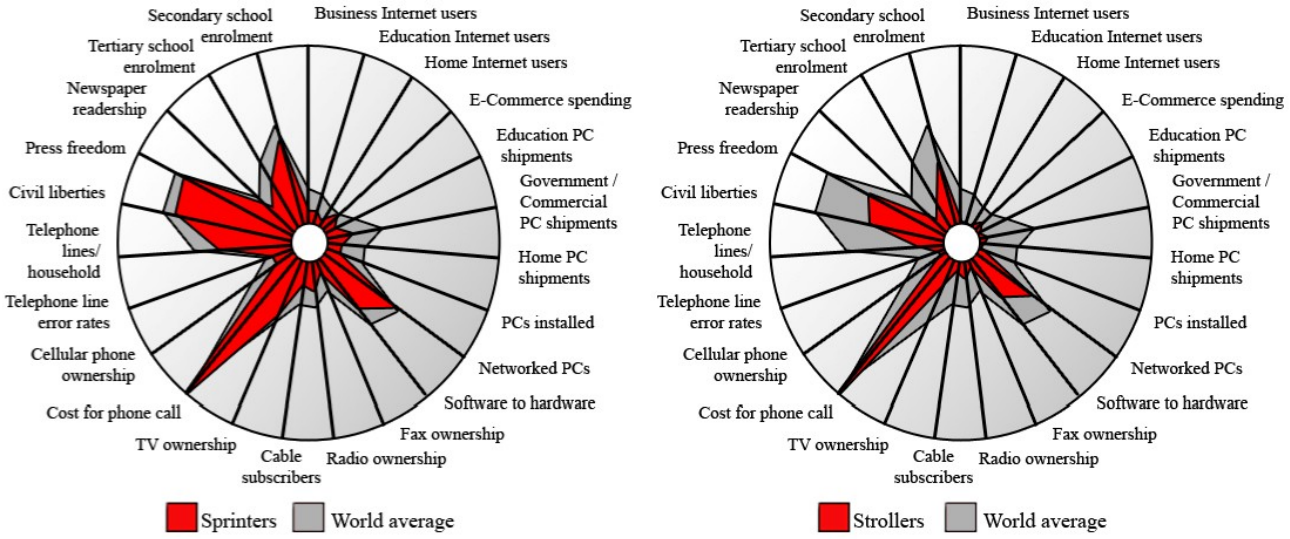

Figure 21. Sprinters and strollers stage of development (Welch, 1999)

Appendix 2. Diffusion of ICT vs. GDP per Capita

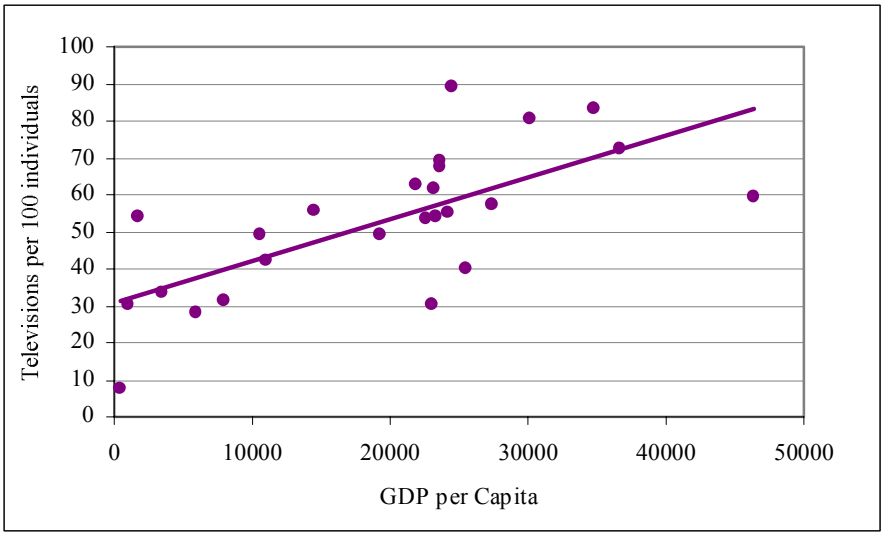

Figure 22. Television Penetration vs. GDP per Capita in 2000 (International Telecommunication Union, 2006)

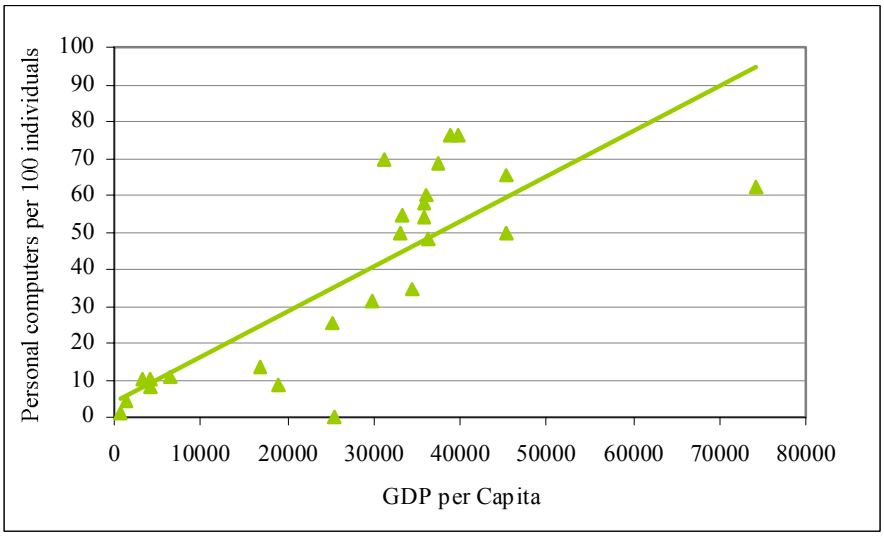

Figure 23. Personal Computer Penetration vs. GDP per Capita in 2002 (International Telecommunication Union, 2006)

Appendix 2. Diffusion of ICT vs. GDP per Capita (continued)

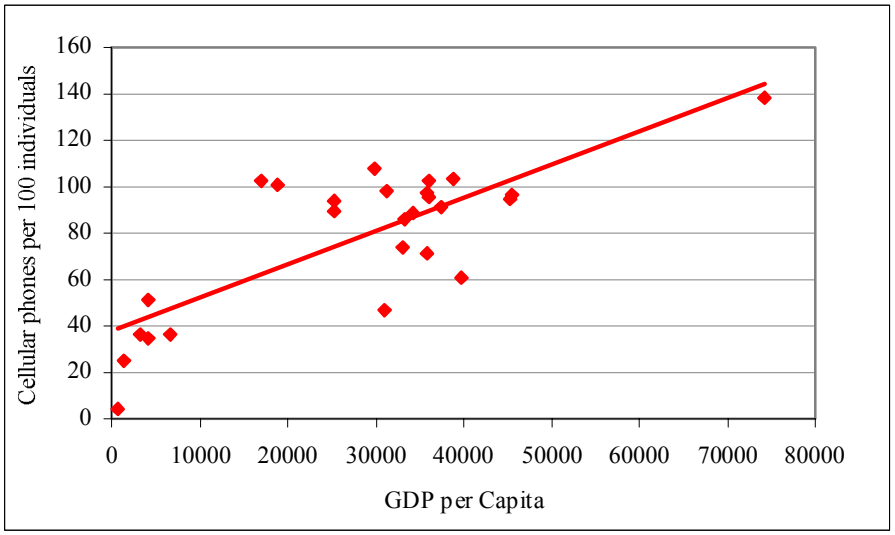

Figure 24. Cellular Phone Penetration vs. GDP per Capita in 2004 (International Telecommunication Union, 2006)

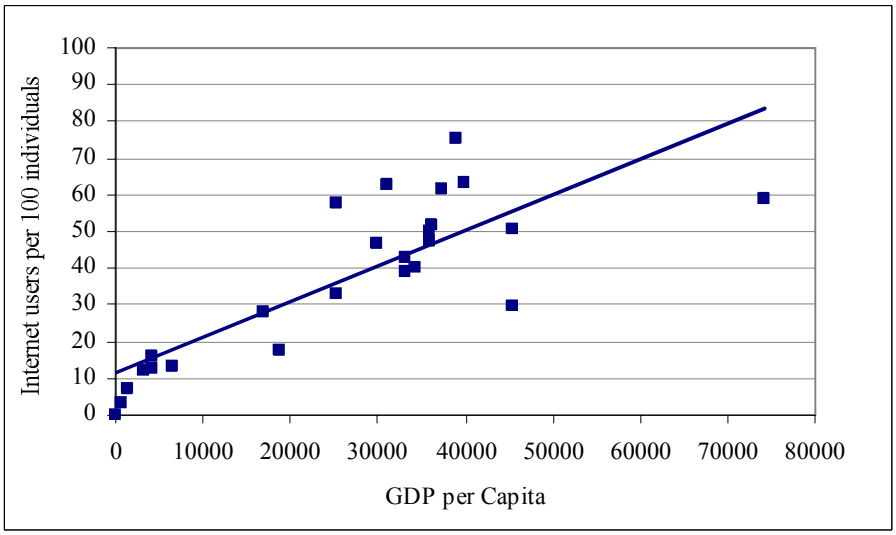

Figure 25. Internet Penetration vs. GDP per Capita in 2004 (International Telecommunication Union, 2006)

Appendix 3. General Data

Table 6. Population in Millions (International Monetary Fund)

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Argentina	34,03	34,39	34,76	35,13	35,50	35,88	36,26	36,65	37,04	37,43	37,83	38,23	38,64
Austria	7,95	7,96	7,97	7,98	7,99	8,01	8,04	8,08	8,12	8,18	8,23	8,24	8,25
Belgium	10,14	10,17	10,19	10,21	10,24	10,26	10,31	10,36	10,40	10,40	10,41	10,41	10,42
Brazil	158,88	161,32	163,78	166,25	168,75	171,28	173,82	176,39	178,99	181,59	184,18	186,77	189,34
Canada	29,26	29,57	29,87	30,13	30,37	30,65	30,97	31,32	31,63	31,93	32,23	32,53	32,82
China	1211,21	1223,89	1236,26	1247,61	1257,86	1267,43	1276,27	1284,53	1292,27	1299,88	1307,56	1314,10	1320,67
Denmark	5,22	5,25	5,28	5,30	5,31	5,33	5,35	5,37	5,38	5,40	5,41	5,43	5,44
Finland	5,11	5,13	5,14	5,15	5,17	5,18	5,19	5,20	5,21	5,22	5,23	5,24	5,24
France	59,42	59,62	59,83	60,05	60,34	60,71	61,12	61,53	61,93	62,32	62,70	63,03	63,36
Germany	81,66	81,90	82,05	82,03	82,09	82,26	82,44	82,54	82,52	82,50	82,46	82,52	82,57
Greece	10,66	10,74	10,81	10,88	10,93	10,98	11,02	11,05	11,08	11,10	11,10	11,10	11,10
India	905,50	923,50	941,50	959,50	978,25	1007,00	1028,50	1046,50	1063,75	1081,50	1094,25	1110,46	1128,41
Ireland	3,60	3,63	3,66	3,70	3,74	3,79	3,85	3,92	3,98	4,04	4,13	4,19	4,25
Italy	56,85	56,85	56,88	56,91	56,91	56,93	56,97	56,99	57,32	57,89	58,46	58,73	58,95
Japan	125,44	125,71	126,01	126,35	126,59	126,83	127,13	127,40	127,63	127,73	127,74	127,70	127,69
Luxembourg	0,41	0,42	0,42	0,43	0,43	0,44	0,44	0,45	0,45	0,45	0,46	0,46	0,46
Mexico	91,15	92,57	93,93	95,25	96,58	97,97	99,38	100,82	102,29	103,79	105,30	106,84	108,40
Netherlands	15,42	15,49	15,57	15,65	15,76	15,93	16,05	16,15	16,23	16,28	16,31	16,35	16,62
Portugal	9,92	9,93	9,96	9,98	10,00	10,22	10,29	10,37	10,45	10,51	10,52	10,53	10,54
Russia	148,30	148,00	147,80	147,50	146,90	146,30	145,20	145,00	144,20	143,50	142,70	142,16	141,63
Singapore	3,53	3,67	3,79	3,92	3,95	4,02	4,13	4,17	4,19	4,24	4,35	4,43	4,50
Spain	39,26	39,32	39,39	39,49	39,67	40,12	40,37	40,63	40,88	41,13	41,38	41,58	41,77
Sweden	8,84	8,85	8,86	8,86	8,87	8,88	8,91	8,93	8,97	9,00	9,04	9,08	9,12
UK	58,03	58,16	58,31	58,48	58,68	58,89	59,11	59,32	59,55	59,83	60,22	60,53	60,84
USA	266,46	269,58	272,82	276,02	279,20	282,31	285,25	288,13	291,00	293,82	296,56	299,27	302,23

Appendix 3. General Data (continued)

Table 7. Gross Domestic Product in Billions (US$) (International Monetary Fund)

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Argentina	258,03	272,15	292,86	298,95	283,52	284,20	268,70	97,73	127,64	151,96	181,55	219,65	253,05
Austria	239,80	236,47	209,00	214,15	213,39	194,41	193,35	208,57	255,84	293,19	305,34	320,24	340,58
Belgium	277,04	274,69	249,81	255,65	254,36	232,43	231,93	252,72	310,52	357,45	371,70	387,02	409,83
Brazil	703,96	775,28	808,05	788,02	536,69	601,55	510,38	460,61	505,54	603,78	795,67	966,83	1044,79
Canada	590,65	613,81	637,67	617,43	661,35	725,16	715,63	734,77	868,49	993,91	1132,44	1273,14	1357,07
China	727,95	856,01	952,65	1019,48	1083,28	1198,48	1324,81	1453,84	1640,97	1931,64	2234,13	2554,20	2871,02
Denmark	182,18	184,48	170,64	173,90	174,17	160,53	160,58	174,42	214,27	245,17	259,64	275,76	296,42
Finland	130,75	128,53	123,43	130,47	130,95	122,22	125,27	135,97	165,03	188,90	196,05	205,93	217,84
France	1571,90	1575,35	1427,08	1475,55	1456,78	1333,00	1341,43	1463,90	1805,03	2059,72	2126,72	2227,33	2370,84
Germany	2524,95	2439,35	2163,23	2187,48	2146,43	1905,80	1892,60	2024,06	2444,28	2744,22	2791,74	2890,09	3036,85
Greece	117,65	124,38	121,51	122,19	125,80	116,47	119,21	135,51	175,89	209,39	225,59	243,33	266,70
India	356,86	377,66	411,40	414,12	442,38	462,64	474,10	493,54	575,27	665,58	771,95	854,48	933,05
Ireland	67,24	74,25	81,51	88,49	96,83	96,61	104,57	122,72	157,12	183,47	200,77	219,31	242,78
Italy	1126,63	1259,95	1193,62	1218,67	1202,40	1100,56	1118,32	1223,24	1510,06	1726,79	1765,54	1841,04	1949,88
Japan	5274,48	4623,22	4239,02	3857,62	4363,11	4650,95	4090,19	3911,58	4237,07	4587,15	4567,44	4463,59	4599,36
Luxembourg	20,70	20,59	18,54	19,38	21,22	20,33	20,22	22,69	29,04	33,64	36,53	39,21	42,56
Mexico	286,18	332,34	400,87	421,03	480,59	580,79	621,86	648,63	638,75	683,49	768,44	811,28	840,71
Netherlands	415,19	411,97	377,39	394,00	399,06	371,73	401,00	439,36	539,34	609,04	629,91	662,81	710,58
Portugal	113,02	117,66	112,13	118,60	121,82	112,98	115,81	127,91	155,52	177,83	183,62	191,23	203,29
Russia	313,45	391,78	404,95	271,04	195,91	259,70	306,58	345,49	431,43	589,03	763,29	975,34	1158,92
Singapore	84,29	92,55	95,87	82,40	82,61	92,72	85,61	88,47	92,73	107,50	116,78	133,53	144,50
Spain	597,28	622,61	573,32	601,65	618,74	582,38	608,88	688,50	882,67	1041,04	1126,57	1216,74	1325,25
Sweden	251,03	272,85	249,69	250,03	253,88	242,79	221,88	244,31	304,85	350,66	358,81	380,75	405,26
UK	1136,10	1194,97	1328,49	1425,83	1467,03	1445,19	1435,63	1574,47	1814,64	2155,16	2229,47	2357,58	2552,66
USA	7397,65	7816,83	8304,33	8746,98	9268,43	9816,98	10127,95	10469,60	10960,75	11712,48	12455,83	13262,07	13928,46

Appendix 3. General Data (continued)

Table 8. Gross Domestic Product per Capita (US$) (International Monetary Fund)

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Argentina	7583,10	7913,73	8426,19	8510,76	7986,56	7921,39	7410,25	2666,90	3446,41	4059,68	4799,10	5745,13	6548,80
Austria	30166,22	29707,93	26226,88	26843,08	26696,38	24262,71	24036,03	25798,97	31510,70	35861,36	37117,06	38865,18	41265,53
Belgium	27313,62	27009,67	24510,66	25029,32	24841,93	22646,86	22495,70	24405,69	29869,25	34363,34	35712,39	37163,61	39331,44
Brazil	4430,91	4805,73	4933,73	4739,92	3180,30	3512,09	2936,25	2611,31	2824,45	3325,05	4319,94	5176,55	5518,21
Canada	20184,45	20757,38	21349,12	20495,23	21776,56	23658,83	23103,94	23458,43	27460,64	31125,74	35133,49	39134,97	41347,87
China	601,01	699,41	770,59	817,14	861,21	945,60	1038,03	1131,81	1269,83	1486,02	1708,63	1943,69	2173,91
Denmark	34926,98	35132,48	32349,17	32842,63	32776,11	30118,82	30021,17	32492,60	39797,37	45419,05	47984,30	50807,80	54474,42
Finland	25598,16	25080,53	24013,72	25315,97	25350,57	23611,88	24145,46	26146,92	31657,53	36192,37	37504,05	39332,31	41542,39
France	26454,58	26421,29	23852,01	24573,36	24144,44	21955,41	21947,37	23791,58	29145,11	33048,31	33917,67	35335,96	37416,55
Germany	30919,89	29785,90	26364,18	26667,20	26148,26	23167,94	22957,25	24523,07	29620,50	33262,88	33854,01	35021,65	36779,14
Greece	11038,91	11580,33	11237,67	11236,04	11511,86	10612,15	10822,56	12265,47	15882,15	18867,17	20326,65	21925,22	24030,41
India	394,10	408,95	436,97	431,60	452,22	459,43	460,96	471,61	540,80	615,43	705,46	769,49	826,87
Ireland	18670,77	20477,44	22245,33	23896,82	25878,73	25493,93	27180,65	31329,63	39487,87	45371,47	48604,26	52360,41	57163,07
Italy	19819,03	22164,10	20985,09	21414,56	21126,72	19332,01	19630,74	21462,65	26343,81	29829,71	30199,53	31350,16	33077,98
Japan	42049,12	36776,56	33640,13	30531,53	34467,26	36670,34	32173,09	30704,13	33198,60	35914,22	35756,53	34954,69	36021,22
Luxembourg	50515,36	49539,13	44037,74	45439,25	49053,28	46360,39	45789,99	50857,67	64542,36	74207,68	80288,16	85444,26	91926,63
Mexico	3139,88	3590,09	4267,92	4420,17	4975,88	5928,50	6257,56	6433,63	6244,40	6585,60	7297,55	7593,53	7755,69
Netherlands	26918,11	26588,90	24242,59	25169,12	25320,93	23341,52	24990,27	27206,57	33240,83	37418,65	38617,88	40552,28	42762,96
Portugal	11391,95	11843,83	11261,50	11884,31	12185,20	11051,37	11250,23	12339,42	14888,76	16922,33	17455,88	18161,50	19287,51
Russia	2113,63	2647,13	2739,83	1837,54	1333,61	1775,13	2111,45	2382,66	2991,88	4104,70	5348,90	6860,77	8183,02
Singapore	23907,88	25215,76	25269,60	21009,33	20909,36	23077,09	20723,24	21208,81	22155,82	25352,55	26836,16	30160,63	32082,02
Spain	15213,44	15835,19	14556,03	15234,66	15598,76	14515,26	15081,38	16947,91	21593,77	25312,48	27225,57	29266,06	31726,55
Sweden	28410,97	30831,03	28197,31	28220,35	28632,62	27338,76	24916,48	27346,76	33997,49	38949,70	39693,64	41944,54	44454,36
UK	19579,43	20544,82	22781,64	24383,63	24998,78	24542,20	24286,12	26541,08	30470,47	36019,02	37023,35	38947,02	41959,85
USA	27762,90	28996,24	30438,61	31689,37	33196,97	34774,09	35505,52	36335,84	37666,38	39863,36	42000,45	44314,78	46085,15

Appendix 3. General Data (continued)

Table 9. GDP per Capita Growth Rate 2006-2007 (International Monetary Fund)

Country	GDP per Capita			Population (Millions)		
	2006	2007	Growth	2006	2007	Growth
Argentina	5745	6549	14.0 %	38.23	38.64	0.41
Austria	38865	41266	6.2 %	8.24	8.25	0.01
Belgium	37164	39331	5.8 %	10.41	10.42	0.01
Brazil	5177	5518	6.6 %	186.77	189.34	2.57
Canada	39135	41348	5.7 %	32.53	32.82	0.29
China	1944	2174	11.8 %	1314.1	1320.67	6.57
Denmark	50808	54474	7.2 %	5.43	5.44	0.01
EU-15 (average)	23713	23620	-0.4 %	387.41	388.93	1.52
Finland	39332	41542	5.6 %	5.24	5.24	0.00
France	35336	37417	5.9 %	63.03	63.36	0.33
Germany	35022	36779	5.0 %	82.52	82.57	0.05
Greece	21925	24030	9.6 %	11.1	11.1	0.00
India	769	827	7.5 %	1110.46	1128.41	17.95
Ireland	52360	57163	9.2 %	4.19	4.25	0.06
Italy	31350	33078	5.5 %	58.73	58.95	0.22
Japan	34955	36021	3.0 %	127.7	127.69	-0.01
Luxembourg	85444	91927	7.6 %	0.46	0.46	0.00
Mexico	7594	7756	2.1 %	106.84	108.4	1.56
Netherlands	40552	42763	5.5 %	16.35	16.62	0.27
Portugal	18162	19288	6.2 %	10.53	10.54	0.01
Russia	6861	8183	19.3 %	142.16	141.63	-0.53
Singapore	30161	32082	6.4 %	4.43	4.5	0.07
Spain	29266	31727	8.4 %	41.58	41.77	0.19
Sweden	41945	44454	6.0 %	9.08	9.12	0.04
United Kingdom	38947	41960	7.7 %	60.53	60.84	0.31
United States	44315	46085	4.0 %	299.27	302.23	2.96

Appendix 4. Index Data

Table 10. Information Society Rankings (Innes et al., 2005)

Country	1998	1999	2000	2001	2002	2003	2004
Argentina	29	33	31	32	34	37	37
Austria	18	16	14	16	11	-	14
Belgium	15	15	17	19	13	-	16
Brazil	41	42	45	42	37	38	38
Canada	10	6	12	10	5	5	5
China	53	51	52	52	48	44	44
Denmark	6	5	5	5	1	1	1
Finland	3	1	3	8	4	7	7
France	19	21	21	20	20	19	19
Germany	16	13	13	15	14	15	15
Greece	27	29	26	25	28	30	30
India	52	54	54	53	51	51	51
Ireland	22	19	20	21	19	23	23
Italy	23	23	23	23	24	24	24
Japan	9	10	11	12	15	18	18
Luxembourg	-	-	-	-	-	-	-
Mexico	43	44	42	40	39	39	39
Netherlands	7	7	10	6	3	6	6
Portugal	25	26	25	26	22	25	25
Russia	40	40	40	44	41	41	41
Singapore	4	9	9	13	17	13	13
Spain	24	24	24	24	25	21	21
Sweden	2	3	1	1	2	2	2
United Kingdom	14	12	6	7	9	10	10
United States	1	1	2	4	4	7	3

Appendix 4. Index Data (continued)

Table 11. Infostates Scores (Sciadas, 2005)

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003
Argentina	30,2	36,5	45,1	59,1	78,0	93,9	107,7	110,3	115,0
Austria	84,0	107,0	122,0	142,7	163,5	182,2	185,2	197,4	210,6
Belgium	79,2	101,5	119,0	138,2	157,0	184,1	193,6	210,3	217,8
Brazil	24,0	34,4	41,3	49,5	60,0	72,2	90,2	99,4	107,3
Canada	116,9	134,7	157,5	177,9	196,2	210,2	217,0	227,2	235,0
China	9,5	13,4	17,7	24,1	34,7	43,4	52,8	64,4	73,5
Denmark	109,7	127,6	150,7	176,9	195,1	212,7	219,6	241,2	254,9
Finland	111,3	132,3	152,2	167,2	181,7	194,1	202,1	217,7	228,4
France	72,8	84,0	99,5	115,0	131,5	147,8	166,6	178,7	193,7
Germany	82,4	95,7	115,5	130,4	151,2	173,5	185,1	194,8	201,9
Greece	45,5	54,7	63,1	76,4	93,1	104,8	118,2	124,2	127,0
India	7,0	9,5	11,9	14,4	17,6	21,8	27,2	31,0	33,7
Ireland	71,0	87,4	105,2	125,2	140,5	164,4	175,0	187,8	197,7
Italy	54,9	65,6	80,9	96,6	118,0	133,2	144,2	156,6	169,2
Japan	69,5	92,6	110,5	126,3	142,8	158,3	173,1	187,3	198,9
Luxembourg	85,2	110,1	122,3	143,8	160,9	178,8	194,5	207,5	218,9
Mexico	26,0	31,3	38,8	48,1	59,7	75,7	87,2	93,2	98,5
Netherlands	101,0	116,4	132,4	155,8	185,9	204,9	211,4	228,0	242,5
Portugal	56,3	69,8	83,8	100,4	113,9	129,5	142,7	153,7	162,2
Russia	24,8	31,6	39,3	44,7	49,3	61,8	74,6	84,0	90,2
Singapore	87,3	109,3	133,4	146,6	167,6	185,7	191,5	213,1	225,7
Spain	49,4	68,4	82,3	94,3	107,7	126,2	143,1	157,5	168,0
Sweden	113,9	136,8	163,1	183,4	203,5	215,7	223,3	240,3	251,1
United Kingdom	87,2	103,4	118,0	137,8	159,5	173,9	183,3	204,7	214,9
United States	117,1	136,9	155,5	171,4	186,9	200,9	210,6	221,7	231,8

Appendix 4. Index Data (continued)

Table 12. Digital Opportunity Index Results 2005 (International Telecommunication Union, 2006)

Country	Utilization	Infrastructure	Opportunity	DOI Index	Ranking
Japan	0.46	0.69	0.99	0.71	2
Denmark	0.37	0.75	0.99	0.71	3
Sweden	0.35	0.74	0.99	0.69	6
United Kingdom	0.33	0.68	0.99	0.67	7
Netherlands	0.32	0.67	0.99	0.66	9
Canada	0.43	0.55	0.98	0.65	14
Singapore	0.27	0.68	1.00	0.65	16
Finland	0.34	0.60	0.99	0.64	17
Luxembourg	0.27	0.65	0.99	0.64	18
Germany	0.27	0.64	0.99	0.63	19
United States	0.34	0.55	0.98	0.62	21
Belgium	0.38	0.50	0.99	0.62	23
Austria	0.34	0.54	0.99	0.62	24
Spain	0.30	0.54	0.99	0.61	25
France	0.31	0.49	0.99	0.60	27
Italy	0.24	0.54	0.99	0.59	28
Ireland	0.18	0.55	0.99	0.58	31
EU-15 (average)	0.24	0.52	0.97	0.58	-
Portugal	0.12	0.45	0.98	0.52	41
Greece	0.07	0.47	0.99	0.51	42
Argentina	0.15	0.30	0.96	0.47	51
Russia	0.13	0.25	0.96	0.45	60
Mexico	0.13	0.22	0.93	0.43	66
Brazil	0.16	0.24	0.87	0.42	71
China	0.11	0.25	0.89	0.42	74
India	0.04	0.04	0.80	0.29	119

Appendix 4. Index Data (continued)

Table 13. Digital Opportunity Index Data 2004 (International Telecommunication Union, 2006)

Country	DOI2004	Opportunity			Infrastructure					Utilization		
		Percentage of population covered by mobile cellular telephony	Internet access tariffs as a percentage of per capita income	Mobile cellular tariffs as a percentage of per capita income	Proportion of households with a fixed line telephone	Mobile cellular subscribers per 100 inhabitants	Proportion of households with Internet access at home	(Mobile) Internet subscribers per 100 inhabitants	Proportion of households with a computer	Number of individuals that used Internet	Ratio of Broadband Internet subscribers to Internet subscribers	Ratio of Broadband mobile subscribers to mobile subscribers
Argentina	0,47	0,95	0,95	0,97	0,66	0,35	0,17	0,02	0,30	0,20	0,26	-
Austria	0,62	0,98	0,99	0,99	0,70	0,96	0,40	0,12	0,53	0,40	0,59	0,024610
Belgium	0,62	0,99	0,99	0,99	0,74	0,81	0,40	0,03	0,51	0,34	0,81	0,000155
Brazil	0,42	0,79	0,90	0,91	0,49	0,37	0,12	0,04	0,16	0,12	0,36	0,000023
Canada	0,65	0,95	1,00	0,99	0,96	0,45	0,60	0,03	0,69	0,55	0,73	-
China	0,42	0,80	0,91	0,97	0,68	0,26	0,09	0,01	0,20	0,07	0,27	-
Denmark	0,70	0,99	0,99	0,99	0,89	0,86	0,60	0,15	0,69	0,51	0,28	0,004937
Finland	0,64	0,99	0,99	1,00	0,91	0,96	0,69	0,41	0,79	0,56	0,54	0,024136
France	0,60	0,99	0,98	0,99	0,81	0,89	0,34	0,14	0,52	0,30	0,59	0,002591
Germany	0,63	0,99	0,99	1,00	0,60	0,86	0,51	0,44	0,57	0,53	0,50	0,000444
Greece	0,51	0,99	0,99	0,99	0,82	0,70	0,34	0,08	0,50	0,39	0,55	0,000589
India	0,29	0,99	0,99	0,99	0,90	1,00	0,57	0,26	0,65	0,53	0,42	0,043634
Ireland	0,58	0,99	0,99	0,99	0,88	0,99	0,17	0,03	0,29	0,15	0,07	0,000457
Italy	0,59	0,60	0,87	0,94	0,10	0,04	0,02	0,00	0,05	0,02	0,09	-
Japan	0,71	0,99	0,99	0,99	0,83	0,91	0,38	0,19	0,46	0,30	0,26	0,000270
Luxembourg	0,64	0,99	0,99	0,99	0,80	1,00	0,34	0,16	0,40	0,24	0,43	0,054140
Mexico	0,43	0,99	0,99	0,99	0,87	0,67	0,56	0,58	0,78	0,62	0,64	0,127481
Netherlands	0,66	0,98	0,99	1,00	0,94	1,00	0,59	0,06	0,67	0,48	0,34	-
Portugal	0,51	0,86	0,97	0,98	0,48	0,37	0,09	0,00	0,18	0,13	0,26	-
Russia	0,45	1,00	0,99	0,99	0,91	0,99	0,65	0,07	0,74	0,56	0,41	0,000310
Singapore	0,65	0,99	0,97	0,97	0,57	0,95	0,26	0,06	0,41	0,22	0,13	0,005020
Spain	0,61	0,95	0,96	0,98	0,60	0,51	0,05	0,00	0,11	0,12	0,27	-
Sweden	0,69	1,00	0,99	1,00	0,97	0,91	0,65	0,12	0,74	0,57	0,23	-
UK	0,67	0,99	0,99	0,99	0,94	1,00	0,79	0,11	0,84	0,59	0,42	0,032941
USA	0,62	0,95	1,00	1,00	0,89	0,61	0,57	0,04	0,64	0,57	0,46	0,000554

Appendix 5. Global Paper Consumption

*Table 14. Graphic Papers Apparent Consumption in Metric Tonnes (*average) (RISI, 2006)*

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Austria	712 000	743 000	797 000	914 000	981 000	1 009 000	1 123 000	1 020 000	1 040 000	985 000	901 000
Belgium	1 360 000	1 386 100	1 653 400	1 715 900	1 779 600	1 930 000	1 793 000	1 881 000	1 907 000	1 732 000	1 871 000
Canada	3 075 998	3 108 998	2 832 998	4 053 000	3 510 000	3 373 000	3 356 000	3 246 000	3 186 000	3 347 000	3 142 000
Denmark	627 000	356 700	655 200	664 000	658 000	706 750	642 000	620 000	677 000	735 000	688 000
Finland	701 000	690 000	675 000	822 000	851 000	829 000	950 000	831 000	827 000	798 000	758 000
France	4 558 000	4 365 000	4 962 000	5 120 000	5 358 000	5 607 000	5 254 200	5 318 500	5 280 000	5 555 400	5 311 800
Germany	8 015 200	7 334 700	7 867 000	8 529 000	8 745 000	9 449 000	9 007 000	8 227 000	8 544 000	9 157 000	9 150 000
Greece	427 700	438 600	516 000	445 000	541 000	481 000	460 000	438 000	385 100	400 000	407 000
Ireland	0	118 400	130 900	146 000	220 000	171 000	196 000	222 000	219 000	188 000	236 000
Italy	3 658 900	3 518 300	3 846 900	3 988 100	4 149 400	4 328 000	4 159 720	4 180 000	4 300 000	4 531 000	4 543 000
Japan	14 092 000	14 846 000	14 778 000	14 416 000	14 590 000	15 450 000	15 060 000	15 047 000	15 314 000	15 627 000	15 697 000
Luxembourg	25 500	22 740	30 800	29 330	105 998	67 000	74 000	83 000	87 000	105 000	109 000
Netherlands	1 312 000	1 345 000	1 396 000	1 408 000	1 551 000	1 771 000	1 804 000	1 614 000	1 720 000	1 702 000	1 652 000
Portugal	304 000	312 000	374 000	384 000	397 000	461 000	406 000	378 557	415 000	591 000	481 000
Singapore	344 000	347 000	340 000	335 000	345 000	351 000	278 000	301 000	398 720	423 510	410 400
Spain	1 971 798	1 974 500	2 104 400	2 908 000	2 514 000	2 623 300	2 230 600	2 358 600	2 563 694	2 380 000	2 701 000
Sweden	594 900	1 018 600	1 039 500	1 089 000	1 020 000	1 159 000	1 236 000	1 116 000	967 000	1 034 000	993 000
United Kingdom	5 871 000	5 851 600	6 374 000	6 655 000	6 939 000	7 155 000	7 268 000	7 094 474	7 182 851	7 411 943	7 268 000
United States	37 518 000	34 384 998	38 155 000	39 388 000	39 979 000	40 274 000	38 122 000	38 475 000	38 335 530	39 614 464	38 321 970
*Advanced IC-Societies**	*4 482 579*	*4 523 291*	*4 873 950*	*5 116 407*	*5 180 722*	*5 343 669*	*5 127 584*	*5 079 507*	*5 128 272*	*5 296 240*	*5 207 787*
Argentina	613 000	639 000	754 000	805 000	705 000	728 400	681 000	437 000	566 000	652 000	683 000
Brazil	1 929 000	1 906 000	2 100 000	2 114 000	2 112 000	2 398 000	2 192 000	2 227 000	2 147 000	2 335 000	2 281 000
China.	5 284 096	7 686 696	7 437 596	7 952 596	9 101 000	9 530 000	13 045 000	14 179 200	15 125 700	17 132 900	17 689 800
India	1 825 000	2 070 000	2 110 000	2 165 000	2 215 000	2 321 000	2 914 000	2 777 800	3 594 500	4 173 000	4 275 000
Mexico	917 000	1 016 000	1 243 000	1 194 000	1 359 000	1 252 000	1 402 000	1 435 000	1 701 000	1 540 000	1 612 000
Russia	749 000	711 000	718 000	717 999	922 000	1 229 000	1 225 000	1 292 000	1 619 027	1 820 000	1 979 000
*Transitional IC-Societies**	*1 886 183*	*2 338 116*	*2393766*	*2491433*	*2735667*	*2909733*	*3576500*	*3724667*	*4125538*	*4608817*	*4753300*

Appendix 5. Global Paper Consumption (continued)

*Table 15. Newspaper Apparent Consumption in Metric Tonnes (*average) (RISI, 2006)*

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Austria	168 000	169 000	198 000	242 000	287 000	297 000	304 000	245 000	244 000	242 000	243 000
Belgium	300 200	284 300	320 200	349 000	347 600	406 000	377 000	305 000	331 000	320 000	292 000
Canada	1 189 000	1 292 000	978 000	1 258 000	1 270 000	1 182 000	1 203 000	1 077 000	1 146 000	1 122 000	1 078 000
Denmark	261 500	0	263 400	268 000	264 000	266 750	239 000	246 000	246 000	242 000	238 000
Finland	344 000	307 000	298 000	321 000	307 000	301 000	305 000	269 000	241 000	208 000	289 000
France	794 000	755 000	797 000	805 000	881 000	909 000	891 400	917 400	903 000	923 200	882 800
Germany	2 312 600	2 097 700	2 263 000	2 434 000	2 565 000	2 678 000	2 493 000	2 181 000	2 419 000	2 461 000	2 489 000
Greece	130 400	135 700	128 700	101 000	140 000	127 000	132 000	120 000	100 000	115 000	120 000
Ireland	0	70 000	72 700	81 000	77 000	59 000	82 000	100 000	86 000	86 000	125 000
Italy	640 400	557 300	632 500	642 900	648 600	709 100	756 980	719 000	751 000	787 000	779 000
Japan	3 578 000	3 747 000	3 792 000	3 795 000	3 750 000	3 893 000	3 899 000	3 875 000	3 808 000	3 917 000	3 880 000
Luxembourg	7 400	6 900	8 000	9 000	10 000	9 000	12 000	18 000	10 000	16 000	18 000
Netherlands	490 000	499 000	457 000	474 000	624 000	708 000	766 000	700 000	601 000	542 000	535 000
Portugal	69 000	80 000	84 000	86 000	94 000	95 000	101 000	89 216	98 000	104 000	95 000
Singapore	143 000	157 000	157 000	155 000	158 000	165 000	116 000	132 000	135 770	137 030	133 380
Spain	495 000	477 000	490 000	566 000	633 000	666 300	632 600	525 800	563 194	623 000	754 000
Sweden	382 000	459 000	410 000	451 000	434 000	498 000	509 000	428 000	431 000	456 000	469 000
United Kingdom	2 213 800	2 221 200	2 350 000	2 500 000	2 572 000	2 620 000	2 662 000	2 499 138	2 534 444	2 566 158	2 552 000
United States	12 683 000	11 621 000	12 081 000	12 315 000	12 605 000	11 821 000	10 483 000	10 220 000	10 096 000	9 900 678	9 290 034
*Advanced IC-Societies**	*1 379 016*	*1 312 426*	*1 356 868*	*1 413 311*	*1 456 168*	*1 442 639*	*1 366 525*	*1 298 240*	*1 302 337*	*1 303 582*	*1 276 959*
Argentina	283 000	257 000	306 000	303 000	285 000	296 000	261 000	174 000	222 000	247 000	250 000
Brazil	701 000	641 000	723 000	658 000	600 000	640 000	522 000	495 000	443 000	482 000	500 000
China	813 100	1 254 000	1 180 800	1 186 800	1 244 000	1 659 000	1 865 000	2 043 200	2 408 100	3 102 600	3 310 200
India	745 000	900 000	880 000	880 000	720 000	791 000	1 005 000	920 000	1 164 000	1 452 000	1 437 000
Mexico	290 000	295 000	364 000	353 000	389 000	404 000	408 000	391 000	403 000	421 000	400 000
Russia	433 000	378 000	373 000	370 000	487 000	535 000	560 000	537 000	649 755	721 000	691 000
*Transitional IC-Societies**	*544 183*	*620 833*	*637 800*	*625 133*	*620 833*	*720 833*	*770 167*	*760 033*	*881 645*	*1 070 933*	*1 098 033*

Appendix 5. Global Paper Consumption (continued)

*Table 16. Printing & Writing Papers Apparent Consumption in Metric Tonnes (*average) (RISI, 2006)*

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Austria	544 000	574 000	599 000	672 000	694 000	712 000	819 000	775 000	796 000	743 000	658 000
Belgium	1 059 800	1 101 800	1 333 200	1 366 900	1 432 000	1 524 000	1 416 000	1 576 000	1 576 000	1 412 000	1 579 000
Canada	1 886 998	1 816 998	1 854 998	2 795 000	2 240 000	2 191 000	2 153 000	2 169 000	2 040 000	2 225 000	2 064 000
Denmark	365 500	356 700	391 800	396 000	394 000	440 000	403 000	374 000	431 000	493 000	450 000
Finland	357 000	383 000	377 000	501 000	544 000	528 000	645 000	562 000	586 000	590 000	469 000
France	3 764 000	3 610 000	4 165 000	4 315 000	4 477 000	4 698 000	4 362 800	4 401 100	4 377 000	4 632 200	4 429 000
Germany	5 702 600	5 237 000	5 604 000	6 095 000	6 180 000	6 771 000	6 514 000	6 046 000	6 125 000	6 696 000	6 661 000
Greece	297 300	302 900	387 300	344 000	401 000	354 000	328 000	318 000	285 100	285 000	287 000
Ireland	0	48 400	58 200	65 000	143 000	112 000	114 000	122 000	133 000	102 000	111 000
Italy	3 018 500	2 961 000	3 214 400	3 345 200	3 500 800	3 618 900	3 402 740	3 461 000	3 549 000	3 744 000	3 764 000
Japan	10 514 000	11 099 000	10 986 000	10 621 000	10 840 000	11 557 000	11 161 000	11 172 000	11 506 000	11 710 000	11 817 000
Luxembourg	18 100	15 840	22 800	20 330	95 998	58 000	62 000	65 000	77 000	89 000	91 000
Netherlands	822 000	846 000	939 000	934 000	927 000	1 063 000	1 038 000	914 000	1 119 000	1 160 000	1 117 000
Portugal	235 000	232 000	290 000	298 000	303 000	366 000	305 000	289 341	317 000	487 000	386 000
Singapore	201 000	190 000	183 000	180 000	187 000	186 000	162 000	169 000	262 950	286 480	277 020
Spain	1 476 798	1 497 500	1 614 400	2 342 000	1 881 000	1 957 000	1 597 900	1 832 800	2 000 500	1 757 000	1 947 000
Sweden	212 900	559 600	629 500	638 000	586 000	661 000	727 000	688 000	536 000	578 000	524 000
United Kingdom	3 657 200	3 630 400	4 024 000	4 155 000	4 367 000	4 535 000	4 606 000	4 595 336	4 648 407	4 845 785	4 716 000
United States	24 835 000	22 763 998	26 074 000	27 073 000	27 374 000	28 453 000	27 639 000	28 255 000	28 239 530	29 713 786	29 031 936
*Advanced IC-Societies**	*3 103 563*	*3 147 341*	*3 452 700*	*3 638 024*	*3 659 600*	*3 837 383*	*3 702 024*	*3 722 754*	*3 767 138*	*3 933 681*	*3 873 386*
Argentina	330 000	382 000	448 000	502 000	420 000	432 400	420 000	263 000	344 000	405 000	433 000
Brazil	1 228 000	1 265 000	1 377 000	1 456 000	1 512 000	1 758 000	1 670 000	1 732 000	1 704 000	1 853 000	1 781 000
China	4 470 996	6 432 696	6 256 796	6 765 796	7 857 000	7 871 000	11 180 000	12 136 000	12 717 600	14 030 300	14 379 600
India	1 080 000	1 170 000	1 230 000	1 285 000	1 495 000	1 530 000	1 909 000	1 857 800	2 430 500	2 721 000	2 838 000
Mexico	627 000	721 000	879 000	841 000	970 000	848 000	994 000	1 044 000	1 298 000	1 119 000	1 212 000
Russia	316 000	333 000	345 000	347 999	435 000	694 000	665 000	755 000	969 272	1 099 000	1 288 000
*Transitional IC-Societies**	*1 341 999*	*1 717 283*	*1 755 966*	*1 866 299*	*2 114 833*	*2 188 900*	*2 806 333*	*2 964 633*	*3 243 895*	*3 537 883*	*3 655 267*