PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE
ESCUELA DE INGENIERIA

SIZE, STRUCTURE AND GROWTH OF THE INFORMATION ECONOMY IN CHILE

DIEGO JOSÉ AVILÉS ARIAS

Thesis submitted to the Office of Research and Graduate Studies in partial fulfillment of the requirements for the Degree of Master of Science in Engineering

Advisor:
MARCOS SEPÚLVEDA F.

Santiago de Chile, July, 2007

PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE
ESCUELA DE INGENIERIA

SIZE, STRUCTURE AND GROWTH OF THE INFORMATION ECONOMY IN CHILE

DIEGO JOSÉ AVILÉS ARIAS

Members of the Committee:

MARCOS SEPÚLVEDA F.

JENS HARDINGS P.

SERGIO GODOY ETCHEVERRY

(REPRESENTANTE DE POSTGRADO)

Thesis submitted to the Office of Research and Graduate Studies in partial fulfillment of the requirements for the Degree of Master of Science in Engineering

Santiago de Chile, July, 2007

To Jose and Tita. Thanks.

ACKNOWLEDGMENTS

This paper was written by Diego Avilés, student of MSc in Engineering, Universidad Católica de Chile, as part of the BIT-Chile project (Fondecyt N° 1050769). The main supervisor was Dr Marcos Sepulveda, co-researcher of BIT-Chile and Director of CETIUC. Additional supervision was provided by Dr Sergio Godoy, director of BIT-Chile, and George Lever and Aldo Myrick, from the Santiago Chamber of Commerce (CCS). The author acknowledges CCS economist Pilar Cruz, Dr Hosun Rhim from the University of Korea Business School, Dr Uday Apte, and Dr Uday Karmarkar for their invaluable help with this work.

MAIN INDEX

Page

TABLE INDEX

FIGURE INDEX

Page

RESUMEN

El uso de la información en las organizaciones y la economía ha marcado un cambio en la sociedad en su conjunto. La economía ha experimentado un progresivo tránsito desde un modelo de producción industrial hacia otro basado en la creación, procesamiento y aplicación del conocimiento. Hoy vivimos en una sociedad de la información.

Variadas investigaciones se han desarrollado para establecer medidas acerca del desarrollo y el uso de la información en la sociedad. Aunque existe una cantidad considerable de estudios en el área de la "sociedad de la información", los esfuerzos por cuantificar el impacto de este desarrollo en la economía han sido escasos.

Esta tesis tiene el objetivo de cuantificar el impacto de la "economía de la información", término que agrupa a todas las actividades que implican transformación y comunicación de información.

Para lograr el objetivo antes planteado, se aplica la misma metodología que Apte & Nath (2000) aplicaron en EE.UU. al caso Chileno. Con esto se busca medir el impacto de la "economía de la información" en el producto interno bruto (PIB) de esta economía emergente, verificándose que su influencia existe, pero es menos significativa que en EE.UU. Esta metodología también se ha aplicado al caso de Corea del Sur, por lo que se analiza comparativamente el impacto de la "economía de la información" en estos tres países.

Los resultados de esta investigación indican que la economía de la información está creciendo a un ritmo similar que la economía en su conjunto. La economía de la información representaba un 51.21% del total del PIB en 1996, proporción que creció al 51.73% en el 2003. Se concluye que la economía de la información no constituye un sector

de explosivo crecimiento dentro del contexto de la economía chilena en el intervalo 1996-2003.

ABSTRACT

The use of information in the organizations and the economy has marked a change in the society as a whole. The economy has experienced a progressive transit from a model of industrial production towards other based on the creation, processing and application of knowledge. Today we live in an information society.

Although a considerable amount of studies about the development of the information society exist, the efforts to quantify the macroeconomic impact of this development in Chile have been little.

This paper presents the results of a research aimed at measuring the size and structure of the Chilean information economy in 1996 and 2003, as well as the growth experienced by the information services sector in this emerging country. This work is based on Porat's research framework, who quantified the size of the US information economy in 1967. This study also compares the information economy in Chile with other countries where the same methodology has been applied recently: Korea and US.

Our findings indicate that the information economy is growing at a rate similar to the observed in the aggregate economy. The results show that the share of the information economy in the total GNP grew from 51.21% in 1996 to 51.73% in 2003. Thus, information economy does not constitute a sector of explosive growth within the context of the Chilean aggregate economy between 1996 and 2003.

Keywords: Information economy; primary information sector; secondary information sector; input-output analysis; information services.

I INTRODUCTION

The use of information in the organizations and the economy has marked a change in the society as a whole. The economy has experienced a progressive transit from a model of industrial production towards other based on the creation, processing and application of knowledge (Centro de estudios de tecnologías de información [CETIUC], 2006) [1]

In the late 1990s, many business leaders, investors, journalists and politicians became firmly convinced about the fact that the world economy is undergoing a fundamental structural change driven by both globalization and the revolution in information and communication technology (ICT) (Pohjola, 2001). According to an opinion poll conducted in March 2000, 57% of Americans believed that the US has entered 'a new kind of an economy' that is 'significantly different from the industrial economy' (Business Week, 2000).

Several researches, following different approaches, have been developed to establish measures about the development and use of information in the society. According to the "Information Society Index", a world-wide study to measure the development of the society of the information, Chile ranks 29 out of 53 countries, but it is still the highest ranked in Latin America (IDC, 2004). The "Information Society Index" is based on IT spending, Internet usage, telecommunications (e.g., broadband penetration), and other factors such as the use of information in education and the government.

A study about the development of the information society in Latin America is presented by CELA/IESE Business School and Everis (2007). This study also indicates that Chile leads this index of information society development in the region. It emphasizes some statistics, such as the number of computers per capita, reaching 197 per each thousand inhabitants,

and cell phones penetration: 767 persons in a thousand own a device. In relation to its population, Chile has the greatest number of computers, servers and Internet users, as well as the largest expenditure on information technologies, of the five countries considered in this study: Argentina, Brazil, Chile, Colombia and Mexico.

Although a considerable amount of studies about the information society exist, the efforts to quantify the economic impact of this development in Chile have been little. One of the efforts to quantify the economic impact of the information technologies and communications is the "Satellite Account of Information Technologies and Communications in Chile" (CSTIC). A satellite account measures the size of an economic activity, in this case, the information technologies and communications industry.

The goal of our research is not the same as the ITC satellite account mentioned study, which is focused in the supply of goods and services associated to information technologies and communications (ITC). Our research is aimed at quantifying the impact of the "information economy", that is an ampler term, because it groups not only to the ITC sector, but all the activities and products that involve transformation and communication of information.

The first goal of our study is to quantify the size of the information economy in Chile, i.e., the information economy impact in the total economic activity of the country, working with public macroeconomic statistics.

The second goal is to be able to compare the results with other international studies that have followed the same methodology, in order to identify similarities and differences between the developments of the information economy in different countries.

We used the methodology developed by M.U. Porat, who quantified the US information economy in 1967 [5]. The same methodology was used by Apte & Nath to assess the US information economy size, structure and growth in 1997 and 2002 [6]. Porat measures the size and the structure of the information economy using the national income accounting framework. This approach is based on public information, so it is relatively simple to replicate at an international level. However, it has its limitations, because in most countries, public data is published with less disaggregation, and many of the information activities which can only be identified at a high level of disaggregation are not explicitly included in Porat's method.

This methodology uses "value added" as the measure of industry's contribution to GNP. Porat's method is based on measuring GNP by income, not by product sales (Income approach). Although the total for each of these measures will be the same for the entire economy, the total for individual industries can vary substantially. Porat justifies the use of "value added" on the following reasons. "First, it allows the researcher to measure the cost of the secondary information sector services directly. Second, value added is a more accurate measure of wealth and income originating in the economy since it is insensitive to the cost of goods sold. An item with costly intermediate purchases will "sell" more to final demand since its output price will be correspondingly higher. Two goods with identical wealth generating attributes could have very different demand sales, depending on the use of the item" (Porat, 1977, vol. 1, pp.47)

The rest of this work is organized as follows. The second section presents the main concepts and definitions. The sources of data and the computational methodology are described in section three. The fourth section presents the size and the structure of the

Chilean information economy in 1996 and 2003. It also includes a comparison of these measures with the US and Korea.

II CONCEPTS AND DEFINITIONS

In order to measure the information economy, Porat divides the economy in two different, but inseparable, domains. The first one is conceived as the transformation of matter and energy from a form to another one, while the second one is the transformation of information from a pattern to another one. The second dominion is conceived as the information economy. The notion of information economy is based on the concepts of "information" and "information activity". Porat defines information as "data that have been organized and communicated", whereas his operational definition of activity of the information is "all the workers, machineries, goods and services that are used in processing, manipulating and transmitting information".

Within the information economy, Porat makes a new division in two sectors: "primary information sector" and "secondary information sector" (PRIS and SIS respectively hereafter). The PRIS is defined as one that includes all the industries that produce goods and services which intrinsically convey information or are directly used in producing, processing or distributing information for an established market. It includes the following broad business categories: (1) production of knowledge and invention: private research and development and private information services; (2) distribution of information and communication: education, public information services, telecommunications; (3) risk management: insuring, financial industry and others; (4) search and coordination: brokerage industries, advertising, among others; (5) information processing and transmission services: computer based information processing, telecommunications infrastructure, etc.; (6) information goods: calculators, semiconductors, computers and other devices; (7) selected government activities: education, postal service and

management of the public health; (8) support facilities: buildings, office furniture, etc.; (9) wholesale trade and retail of information goods and services. Each of these ample categories are compound of an important number of industries.

On the other hand, the SIS is defined as "all the information services produced for internal consumption by the government and non-information companies". It comprises most of the public bureaucracy and all of the private bureaucracy. It includes "the costs of organizing companies, of maintaining and of regulating markets, to develop and to transmit prices, to manage the behavior of the company, and to create and to enforce rules".

The public bureaucracy comprises all the informational functions of the country and local governments. Those portions of public bureaucracy which have direct analogs in the primary information sector are entered in the primary sector for accounting purposes. For example, an important portion of the public bureaucracy is the public education, which is included in the primary sector.

The private bureaucracy is the portion of every non-information company that is involved in information tasks purely. This portion of the company produces information services similar to those in the PRIS, such as data processing. Conceptually, these are the informational costs of providing a non-information good. In any case, these information services are not sold in the market and for that reason they are included in the SIS.

III DATA SOURCES AND COMPUTATIONAL METHODOLOGY

The main sources of data for the development of this study are the Input-Output (I O) tables for 1996 and 2003. I O tables are compiled and developed by the Central bank of Chile. I O table for year 2003 is the most up-to-date table currently available.

Another important sources of information are the publications "National Accounts of Chile: Compilation of Reference 2003" and "I O table of Chilean Economy 1996", which include the methodology used by the Central bank to construct I O tables.

Other important sources of data include (1) "National Employment Survey" for years 1996 and 2003, published by the National Institute of Statistics of Chile (INE), (2) "Yearbook of average remunerations and costs 1993–2001", published by INE and (3) "Yearbook of average remunerations and costs 2003", published by INE.

Initial efforts were made to consider in the study the years 1977 and 1986. Later, they were discarded because some of the data was compiled using a very different methodology and public data about employment and remunerations was not available for those years.

III.a Measuring primary information sector

In order to measure PRIS, Porat identified 25 major 2-digit I O industries and aggregated them into four broad categories: construction, manufacturing, service and government sectors.

Chilean I O tables published by the Central bank for years 1996 and 2003 are disaggregated up to a level of 73 industries. A Technical Appendix of this work presents the 73 industries, which constitute our base to make calculations. The classification of industries used in Chilean I O table is not strictly similar to the one used by Porat or to the one used by Apte and Nath for 1992 and 1997. The classification of industries in the US I

O tables has undergone variations. Nevertheless, it is possible to establish relations between industry classifications in the U.S and Chile, and so, make the studies comparable. In order to establish the portion of the value added corresponding to PRIS of each one of the 73 industries, two criteria are used. The first one is to allocate the complete valued added of an industry to the PRIS. This happens when the description of the industry corresponds to an industry that Porat identifies as belonging to the PRIS completely. More often, only a part of an industry's value added is identified as being information based. This implies that the second criterion used is to account in the PRIS only a part of the value added of an industry.

In order to calculate the portion to be added to the PRIS, the following method is used:

For industries that have a direct economic relation with an industry of the US classification, the same proportion of the value added to the PRIS in the US is used in the Chilean study.

For industries that are not directly related in an economic way to any industry of the US classification, an estimation of the portion corresponding to PRIS has been made. In order to do this, source data analysis, literature and related works have been very helpful to obtain adequate approximations. Some information has been researched with industry-specific experts working in Santiago's Chamber of Commerce. More detailed information about estimations can be found in the technical appendix to this work.

III.b Measuring secondary information sector

To measure the non-marketed information services within non-information industries, Porat uses a rather restrictive definition of value added. The definition includes:

1. Employee compensation of information workers

2. Part of proprietors' income and corporate profits earned for performing informational tasks
3. Capital consumption allowances on information machines

In order to measure (1) employee compensation of information workers, the following method is used:

From the national employment survey datamart from INE, the relationship between occupational group and economic activity is taken. Each economic activity involves a determined number of I O classification industries, i.e., an economic activity is a group of related I O industries. The labor force by economic activity is prorated according to the industry value added contribution to its economic activity group.

The following occupational groups are considered as information workers:

- Professionals, technicians and people in compatible occupations.
- Managers, administrators and civil employees of directive category.
- Office employees and people in compatible occupations.
- Salesmen and people in compatible occupations.

Apte & Nath use a more detailed description for occupations related to information. The occupation classification used in the Chilean study is rougher, due to the lack of detailed occupation statistics.

The average remunerations for information workers by economic activity is taken from the "Yearbook of average remunerations and costs", published by INE.

The employee compensation to information workers value added is obtained by multiplying the industries' information labor force by its corresponding occupation remuneration.

In order to measure part of proprietors' income and corporate profits earned for performing informational tasks, the following method is used. Data on proprietors' income and depreciation allowances by economic activity for 1996 are obtained from I O tables published by the Central bank of Chile. The percentage shares of the secondary information sector in total proprietors' income, and percentage shares of the SIS in total depreciation allowances by economic activity, are applied as reported in table 9.2 of volume 1 of Porat (1977) study, to 1996 Chilean valued added figures.

However, it is needed to point out that this procedure does not take into account the possibility that over the years the informational activities of the proprietors or relative use of information capital goods may have increased. However, by using the above-mentioned procedure, a very conservative estimate of proprietors' income for informational activities and for depreciation of information capital goods is accounted. In any case, these two items represent only a very small part of the total SIS, and therefore this method presumably has a negligible impact on the overall accuracy of the SIS estimation.

For 2003, however, a slightly different approach is used. The 2003 I O Table reports three components of gross value added for each I O industry: "Compensation of Employees", "Other Net Indirect Taxes", and "Gross Capital Gains". The component 'Gross Capital Gains" mainly includes proprietors' income and depreciation allowances. Then, the total 1996 share of proprietors' income and depreciation allowances accounted for SIS is applied to 2003 "Gross Capital Gains" in order to obtain the corresponding SIS value added for 2003.

It is important to recognize that while calculating the value added contributions of different I O industries to the SIS, suitable adjustments have been made for those industries which

have already been entirely or partially allocated to the PRIS. Otherwise, it would lead to double counting parts of the value added of PRIS industries. To prevent double counting, the shares of the I O industries included in PRIS are used to purge out the pure contributions of the industries to the SIS.

In addition to study the contributions of different industries in the information economy value added, it is also interesting and important to estimate and analyze the growth rates experienced by these industries. For this purpose, 1996 value added measures were converted to 2003 constant Chilean pesos by using GNP implicit deflators by industries with 2003 as the base year. Then, both year measures were compared, all stated at 2003 values, in order to estimate the average annual growth rates for different industries.

By carrying out the above described computational methodology, an estimation of the size and structure of the Chilean information economy in 1996 and 2003 is made. The results are presented and discussed in the next section.

IV SIZE, STRUCTURE AND GROWTH OF THE CHILEAN INFORMATION ECONOMY

IV.a Overall performance of the Chilean Economy

In order to assess the growth performance of the information economy, the overall performance of the Chilean economy between 1996 and 2003 is considered.

As can be seen from Table 1, Chilean GNP was growing at an average annual growth rate of 3.23% between 1996 and 2003. The table shows that "Transport and communications" was the fastest growing industry, with a 9.19% average annual growth rate, followed by "Financial intermediation and business" (5.74%), "Mining" (5.33%), "Home ownership" (4.42%) and "Wholesale and retail trade, restaurants and hotels" (3.36%). All others industries were growing slower than the aggregate economy between 1996 and 2003. Particularly, "Manufacturing Industry" and "Construction" have the smallest growth rates. This shows a relative shrinkage of these sectors within the economy. Table 2 shows industries shares in GNP, in order to understand the structure of the Chilean economy.

(Values in millions of 2003 Chilean pesos)

	Industry	1996	2003	Average annual growth rate
1	Agriculture and Forestry	1.504.916	1.842.431	2,93%
2	Fishing	521.416	627.436	2,68%
3	Mining	3.005.304	4.321.571	5,33%
4	Manufacturing industry	8.099.408	8.398.990	0,52%
5	Electric, gas and sanitary services	1.198.625	1.461.211	2,87%
6	Construction	3.698.995	3.531.382	-0,66%
7	Wholesale and retail trade, restaurants and hotels	3.928.681	4.950.883	3,36%
8	Transportation and communications	2.545.726	4.711.435	9,19%
9	Financial intermediation and business services	5.177.396	7.650.975	5,74%
10	Home ownership	2.199.590	2.977.723	4,42%
11	Social and personal services	5.130.407	5.911.639	2,05%
12	Public Administration	1.901.937	2.214.717	2,20%
	Total	38.912.400	48.600.393	3,23%

Table 1. Growth of total GDP and Value Added by broad sectors

	Industry	Industry share in GNP 1996	Industry share in GNP 2003
1	Agriculture and Forestry	3,87%	3,79%
2	Fishing	1,34%	1,29%
3	Mining	7,72%	8,89%
4	Manufacturing industry	20,81%	17,28%
5	Electric, gas and sanitary services	3,08%	3,01%
6	Construction	9,51%	7,27%
7	Wholesale and retail trade, restaurants and hotels	10,10%	10,19%
8	Transportation and communications	6,54%	9,69%
9	Financial intermediation and business services	13,31%	15,74%
10	Home ownership	5,65%	6,13%
11	Social and personal services	13,18%	12,16%
12	Public Administration	4,89%	4,56%

Table 2. Industries shares in GNP

IV.b Size and structure of Chilean information economy

Table 3 presents the value added contributions of primary and secondary information sectors to GNP. In 2003, 51.73% of the GNP was generated in the information sector: 30.48% of GNP was generated in the PRIS sector and 21.25% was contributed in the SIS

sector. In 1996, the information sector accounted for 51.21% of the Chilean GNP: PRIS and SIS contributions to GNP were 28.41% and 22.80% respectively.

The information sector share has experienced a moderate growth of 0.52% of the GNP from 1996 to 2003 (from 51.21% to 51.73%). This is mainly due to the primary information sector share, which grew 1.5% of total GNP (from 28.41% to 30.48%). On the other hand, the secondary information sector share has experienced a decrease of 1.00% between these years (from 22.80% to 21.25%).

In 2003 Chilean pesos, Primary information sector grew from $11,055,740 in 1996 to $14,812,909 in 2003. Secondary Information sector grew from $8,872,216 in 1996 to $10,327,403 in 2003. Thus, Information Economy sector grew from $19,927,957 in 1996 to $23,460,082 in 2003. Total GNP grew from $38,912,400 in 1996 to $48,600,393.

(Values in millions of 2003 Chilean pesos)

Sector	1996	2003
PRIS	11.055.740 (28,41%)	14.812.909 (30,48%)
SIS	8.872.216 (22,80%)	10.327.403 (21,25%)
Information VA	19.927.957 (51,21%)	25.140.312 (51,73%)
Non-information VA	18.984.443 (48,79%)	23.460.082 (48,27%)
GNP	38.912.400 (100,00%)	48.600.393 (100,00%)

Note: Numbers in parentheses represent percentage shares in total GNP.

Table 3. Value Added of Primary and Secondary information sectors

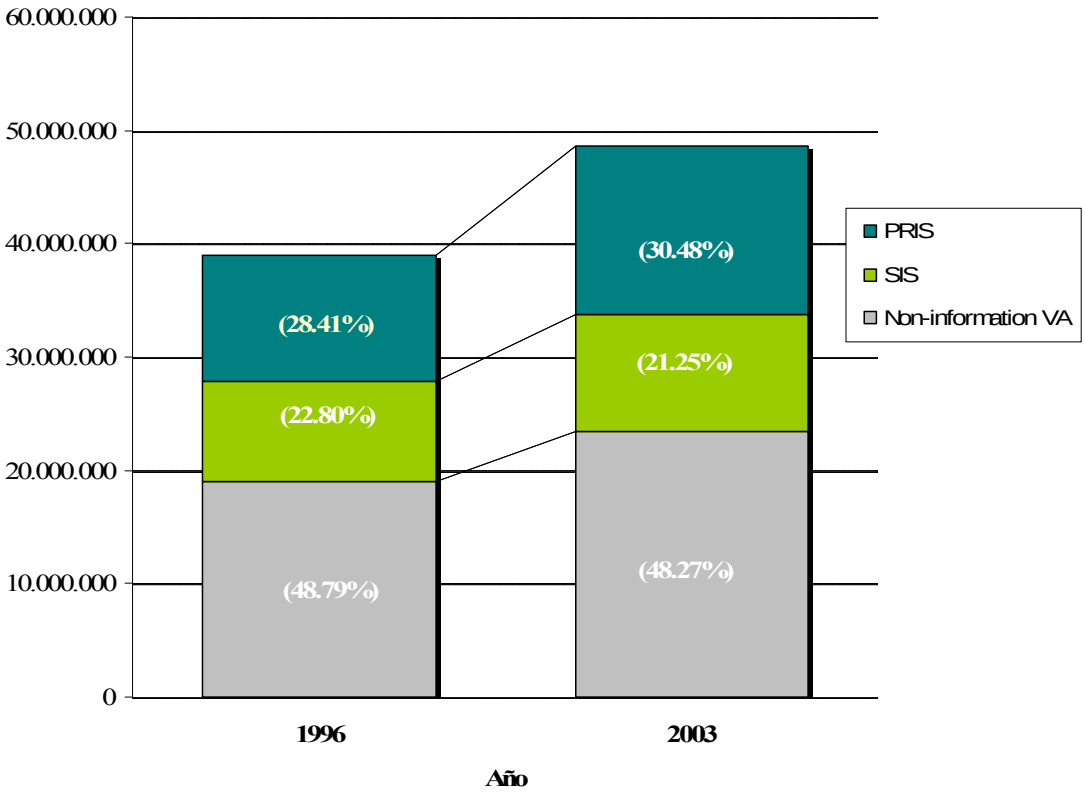

Figure 1. PRIS, SIS and Non-Information shares in GNP and Value Added in millions of Chilean pesos

Value added contributions of major economic activities to the PRIS, SIS and to the total information economy are shown in Table 3 and Table 4. Consider first the broad categories of "agriculture, forestry and fishing", "mining", "construction", "manufacturing", "services" and "government", following Apte & Nath's approach for U.S. information economy.

Industry	PRIS 1996	SIS 1996	Information 1996	PRIS 2003	SIS 2003	Total Information 2003
Agriculture, Forestry and Fishing	0	62,232	62,232	0	80,012	80,012
Agriculture and Forestry	0	21,444	21,444	0	27,196	27,196
Fishing	0	331,360	331,360	0	438,714	438,714
Mining	599,812	1,684,253	2,284,065	479,813	1,562,695	2,042,508
Mining	0	237,992	237,992	0	239,985	239,985
Construction	665,819	836,902	1,502,721	635,649	653,508	1,289,157
Construction	745,973	2,390,007	3,135,980	970,480	2,698,625	3,669,105
Manufacturing	441,725	627,729	1,069,455	1,170,554	1,415,370	2,585,924
Manufacturing industry	4,686,954	255,669	4,942,623	6,891,838	330,843	7,222,681
Services	0	0	0	0	0	0
Financial intermediation and business services	3,630,167	1,203,092	4,833,258	4,332,368	1,370,997	5,703,365
Social and personal services	285,291	1,518,087	1,803,378	332,208	1,847,259	2,179,467
Transportation and communications	11,055,740	9,168,768	20,224,508	14,812,909	10,665,204	25,478,113
Electric, gas and sanitary services	0	62,232	62,232	0	80,012	80,012
Home ownership	0	21,444	21,444	0	27,196	27,196
Wholesale and retail trade, restaurants and hotels	0	331,360	331,360	0	438,714	438,714
Government	599,812	1,684,253	2,284,065	479,813	1,562,695	2,042,508
Public Administration	0	237,992	237,992	0	239,985	239,985
Total	665,819	836,902	1,502,721	635,649	653,508	1,289,157

Table 4. Shares of different industries in PRIS and SIS value added (values in percentages)

"Services" is the sector with the largest share in both primary and secondary information sectors. The share accounted by "Services" industry increased in both PRIS and SIS between the years 1996 and 2003. The share of "Services" in PRIS was 85.97% and it rose to 90.23% in 2003. The share of "Services" in the SIS increased similarly, from 52.27% in 1996 to 57.65% in 2003.

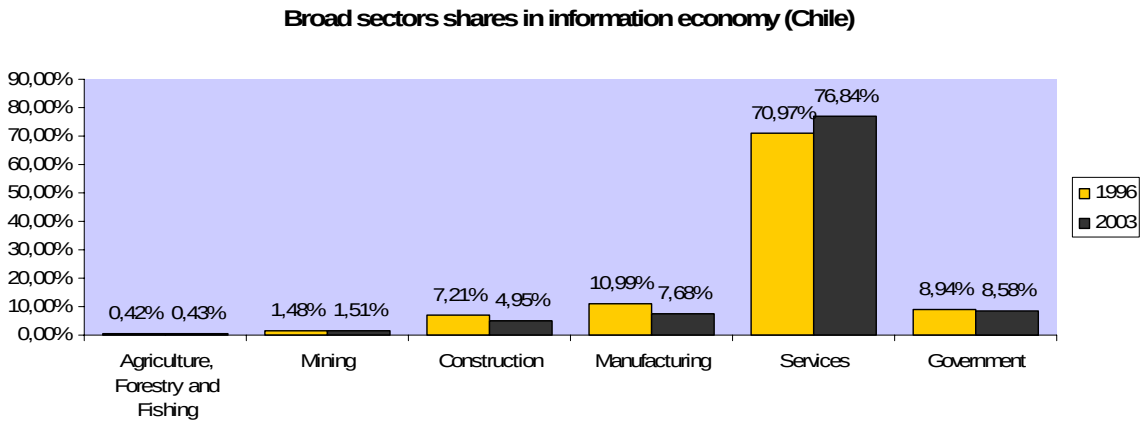

Figure 2. Broad sectors shares in Chilean information economy

The share of service industries was 70.97% of the total value added generated in the information economy in 1996, reaching 76.84% in 2003. This shows that information economy is based mainly on information services in Chile. This can be explained by a relative slow paced adoption of information related services in other economical activities other than services in Chile.

The emergence of new information services, and the outsourcing of many traditional "in-house" information services in non-information firms, may also have contributed to the faster growth of "Services" share in the information economy.

Detailed information about use and access of ITC and related services by Chilean enterprises can be found in various studies, including ENTI and BIT survey [16][17].

However, further research is needed to gain a more complete understanding of the newly emerging information usage services in Chile.

At a more detailed level within "Services", the results show that "Financial intermediation and business services" made the largest contribution in 1996 and 2003 (42.39% and 46.53% respectively) to PRIS. This was followed by the contribution of 'Social and personal services', which includes mainly health and education services (32.84% in 1996 and 29.25% in 2003). In third place, "Wholesale & retail trade, hotels and restaurants" accounted for 6.75% of PRIS in 1996. In 2003, "Transport and communications" took the third place by contributing 7.90% of PRIS, which grew from 4.00% share in 1996. Within "Transport and Communications", the only industry that contributes to PRIS is "Communications". With the maintained growth of services like the mobile telephony and broadband, "Communications" contribution to PRIS in 2003 is almost the double of the one in 1996.

In 1996, "Wholesale & retail trade, hotels and restaurants" was the largest contributor (26.73%) to the SIS, followed by "Manufacturing Industry" (17.92%) and "Public Administration" (13.42%). In 2003, "Wholesale & retail trade, hotels and restaurants" retained first position (26.00%), but followed by "Public administration" (17.68%) and "Manufacturing industry" (14.06%).

For the whole information economy (PRIS and SIS), the three main contributors have retained their place from 1996 to 2003, as shown in Figure 2. The largest contributor is "Financial intermediation and business services" (24.79% and 28.72% in 1996 and 2003 respectively), followed by "Personal and social services" (24.19% and 22.66% in 1996 and 2003 respectively) and "Wholesale & retail trade, hotels and restaurants" (15.28% and

14.18% in 1996 and 2003 respectively). The sector that had the greatest share growth is "Transport and communications", which grew from a 5.19% share in 1996 to a 10.02% share in 2003.

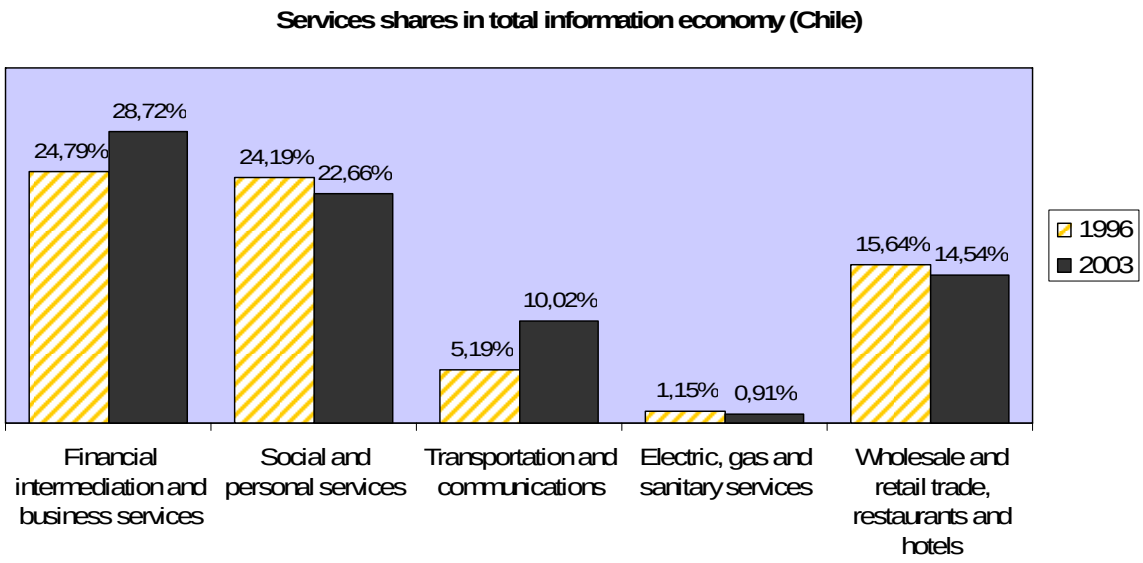

Figure 3. Services shares in Chilean information economy

IV.c Growth of the Chilean information economy

Table 4 shows that the Chilean information economy, in constant 2003 dollars, grew at an average annual growth rate of 3.37% between 1996 and 2003.

	Industry	Average annual growth rate (Total)	Average annual growth rate (Information)
8	Transportation and communications	9,19%	13,54%
9	Financial intermediation and business services	5,74%	5,57%
3	Mining	5,33%	3,68%
1	Agriculture and Forestry	2,93%	3,66%
2	Fishing	2,68%	3,45%
12	Public Administration	2,20%	2,78%
11	Social and personal services	2,05%	2,42%
7	Wholesale and retail trade, restaurants and hotels	3,36%	2,30%
10	Home ownership	4,42%	0,00%
5	Electric, gas and sanitary services	2,87%	-0,05%
4	Manufacturing industry	0,52%	-1,78%
6	Construction	-0,66%	-2,02%
	Total	3,23%	3,37%

Table 5. Growth of the Chilean Information Economy

"Transport and communications" shows the greatest annual growth rate (13.54%). "Transport and Communications" was growing faster than the average for information economy and the average annual growth rate for the whole industry.

The information sector in "Finance intermediation and business services" was growing at 5.74% annually between 1996 and 2003, showing a faster growth than the average for information economy. As mentioned before, this industry is the main contributor to the information economy, so its growing rate is very important to the main results.

Industries of intensive use of natural resources like "Mining" ,"Agriculture and Forestry" and "Fishing" show growth rates that are slightly greater than the average growth rate for the information economy.

The information sectors in “Agriculture and Forestry” and “Fishing” have been growing faster than their respective aggregate industry. This means that information services in these industries have been growing faster than its non-information sector.

On the other hand, information activities in manufacturing and construction industries experienced a decline during the period between 1996 and 2003. First, there could have been substantial outsourcing of information activities in the manufacturing industries to foreign vendors. As a second complementary explanation, the construction and manufacturing sectors are getting smaller to 2003, and information activities are the first to reduce, with a faster decreasing rate than the sector as a whole.

V COMPARISON BETWEEN CHILEAN, US AND KOREAN INFORMATION ECONOMY

Table 6 and 7 present the results for US and Korea information economy respectively.

	1967	1992	1997
Primary	200,025	2,055,950	2,940,121
	(25.15%)	(32.98%)	(35.23%)
Secondary	168073.00	1427119	2317419
	(21.13%)	(22.89%)	(27.77%)
Information	368,098	3,483,069	5,257,540
	(46.28%)	(55.87%)	(63.00%)
Non Information	427,290	2,750,836	3,088,106
	(53.72%)	(44.13%)	(37.00%)
Total GNP	795,388	6,233,905	8,345,646
	(100.00%)	(100.00%)	(100.00%)

Note: Numbers in parentheses represent percentage shares in total GNP

Table 6. Value added contribution of PRIS and SIS to the US GNP in 1967, 1992 and 1997 (Values in millions of 2004 dollars)

	1990	1995	2000
Primary	123,660,003	198,175,280	276,535,854
	(40.36%)	(45.03%)	(46.12%)
Secondary	35,437,394	50,645,531	77,521,997
	(11.57%)	(11.51%)	(12.93%)
Information	159,097,397	248,820,811	354,057,851
	(51.93%)	(56.54%)	(59.04%)
Non Information	147,289,941	191,229,460	245,587,282
	(48.07%)	(43.46%)	(40.96%)
Total GNP	306,387,338	440,050,271	599,645,133
	(100.00%)	(100.00%)	(100.00%)

Note: Numbers in parentheses represent percentage shares in total GNP

Table 7. Value added contribution of Primary and Secondary Information Sector to Korean GNP (Values in 2005 Korean Wons)

The primary sector grows in Chile, like in Korea and the US. Nevertheless, these two countries present greater rates of growth of the share of PRIS in total GNP. In Chile, the PRIS was growing slightly faster than the aggregate economy. Una comparación gráfica de la participación del PRIS en las economías de estos tres países se muestra en la figura T.

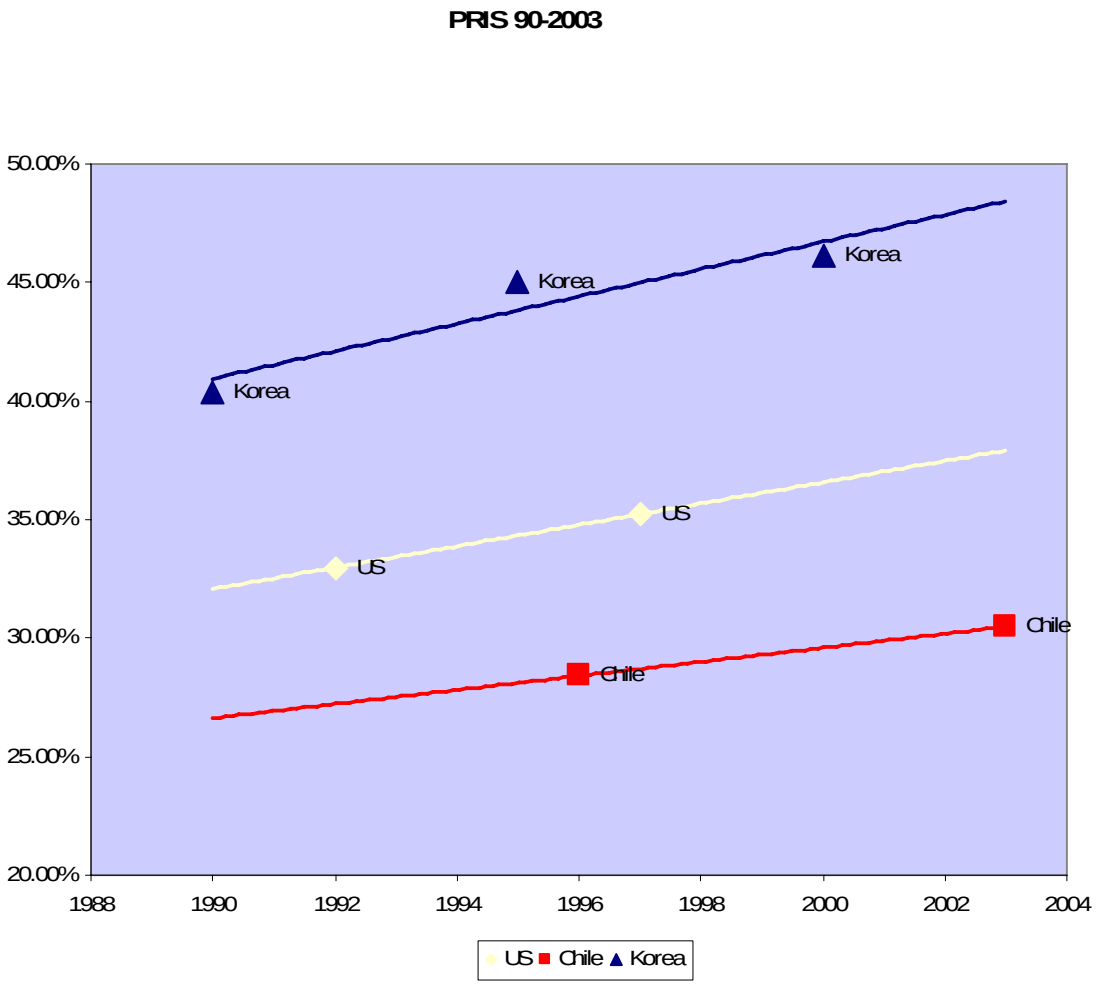

Figure 4. Primary information sector 1990-2003 in Chile, US and Korea

Compared to the US, in Chile the secondary information sector represents a smaller part of the total value added, as shown in Figure 5. Between 1996 and 2003, the secondary sector reduced its participation in Chile, while in the US grew. On the other hand, in Korea the SIS represents a smaller contribution to the total than in Chile, but it has grown in the interval between 1995 and 2000.

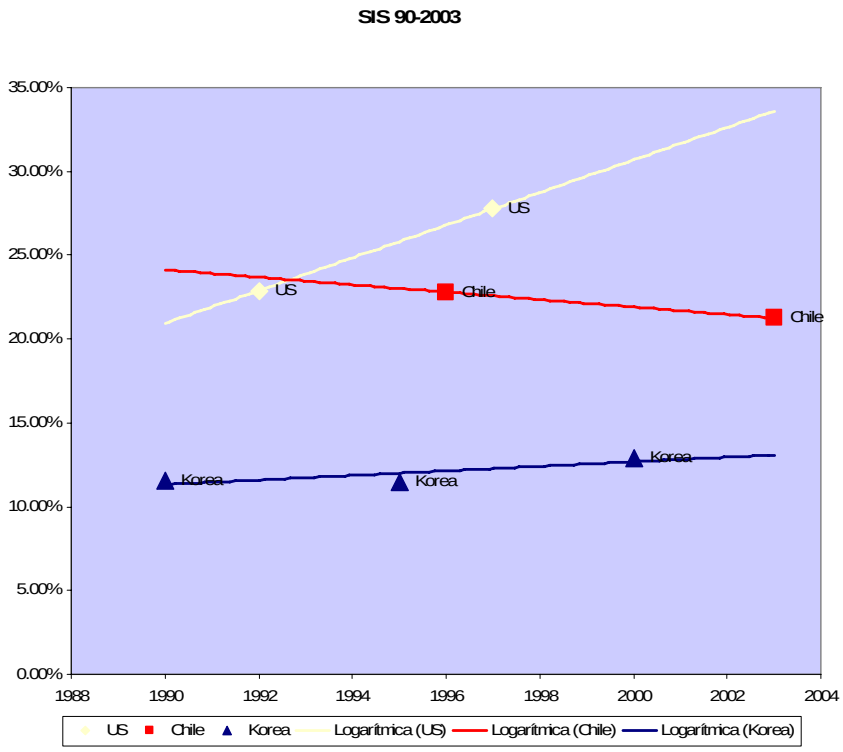

Figure 5. Secondary information sector 1990-2003 in Chile, US and Korea

In Chile, Korea and US, information economy represents more than half of the GNP. In Korea and US, the information sector share of the total value added is bigger than in Chile, and was growing faster than aggregate economy. In Chile, the information sector also had a very slight growth, much more moderate, as shown in Figure 6.

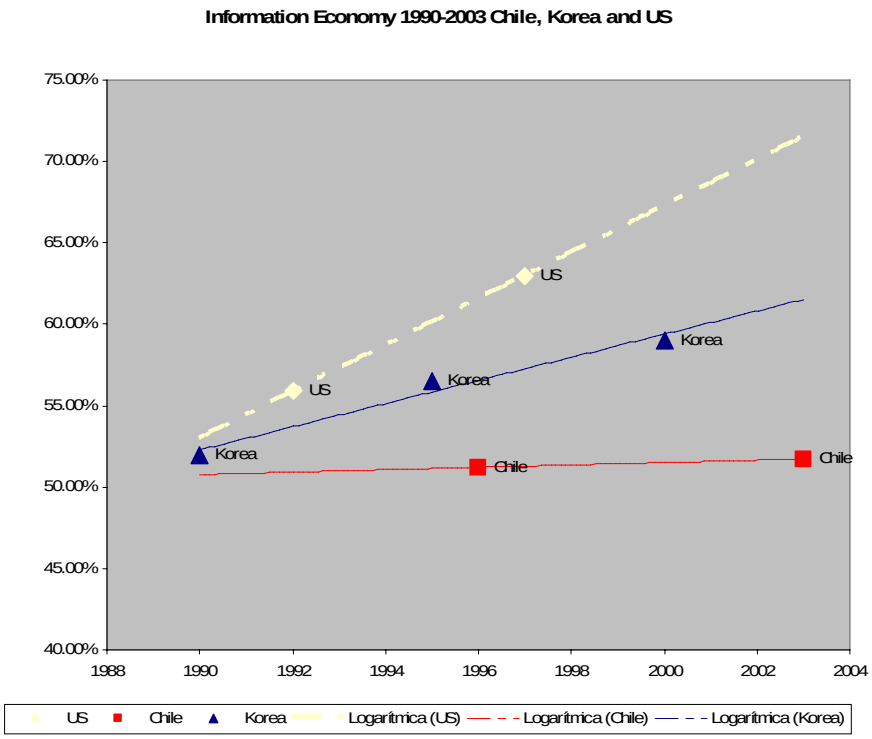

Figure 6. Information economy 1990-2003 in Chile, US and Korea

VI CONCLUSIONS

VI.a About Chilean Results

From the analysis, several important conclusions about the size, structure and growth of the Chilean Information Economy can be outlined.

First, more than half of total Value Added in 1996 and 2003 was generated by information related activities. An economy becomes an information economy when information-related work begins to exceed work related to the other sectors. The results show that Chile is an information based economy.

Second, the Information sector share in total Valued Added showed a moderate growth of 0.50%. This implies that it has grown in a similar way to the aggregate economy.

Third, the primary information sector has been growing faster than secondary sector during the time between 1996 and 2003. This could be originated by the development of new information services to the market and by the growth of the outsourcing of many information services in non-information firms.

Fourth, within the information economy, the shares of the service industries increased. "Transport and communications" registered the highest growth during the period, followed by "Financial intermediation and Information Services" and industries with intensive use of natural resources like "Mining", "Agriculture and Forestry" and "Fishing".

Traditionally, Chile's competitive advantage has been the exports of products with intensive use of natural resources, competing mainly trough low costs. Recent studies indicate that economies with intensive use of natural resources tend to grow less in the long term than those that develop technologically, unless they innovate to fortify their advantages around these resources or build new ones. (Tokman & Zahler, 2004). Important

challenges to Chile's economy are to incorporate innovation and technological development in sectors where there are competitive advantages, the application of knowledge (which could be originated abroad) in a productive way and the search of new competitive advantages. These topics are closely related to the growth of the information economy. The moderate growth of the information economy between 1996 and 2003 is a sign that Chile is innovating modestly. Chile is not incorporating innovation and technological development in a way that would allow the growth of productivity in the long term.

VI.b About international comparison

As in the US and Korea, information economy in Chile accounts for more than half of the total GNP. However, the information contribution to the GNP (51.73%) is only comparable to the information contribution at the beginning of the 90th in US and Korea.

PRIS follows a growing pattern similar to the US and Korea, but a slower growing rate. On the contrary, SIS is decreasing its relevance in the total GNP, while in Korea is slowly growing and in the US is growing significantly.

It is important to mention that comparisons between countries are needed to be taken carefully. National income, unemployment, inflation, investment, and international trade might be affected by economic short-run fluctuations in very different ways in each country.

A second study with data of future years is important, because it would allow confirming guidelines on the development of the information economy presented in this investigation.

BIBLIOGRAPHY

Agarwal, S., Erramilli, M.K., Dev, C.S. (2003), "Market orientation and performance in service firms: role of innovation", *The Journal of Services Marketing*, 17(1), 68-82.

Americans see the New Economy all around them. (2000, 19 May). *Business Week*. Retrieved July 29, 2007, from http://www.businessweek.com/bwdaily/dnflash/may2000/nf00519b.htm

Apte, Uday M. and Hiranya K. Nath. (2004). Size, Structure and Growth of the US Information Technology. Business and Information Technology. Anderson School of Business. UCLA

Banco Central de Chile. (2006). Cuentas Nacionales de Chile Compilación de Referencia 2003. Banco Central de Chile. Santiago, Chile

Banco Central de Chile. (2001). Cuentas Nacionales de Chile Compilación de Referencia 1996. Banco Central de Chile. Santiago, Chile

CELA-IESE Business School & Everis. (2007). Indicador de la Sociedad de la Información (ISI) Situación de las Tecnologías de la Información en Argentina, Brasil, Chile, Colombia y México edición 2007 4.° trimestre 2006. Retrieved June 19, 2007, from http://www.iese.edu/es/files/5_30149.pdf

Centro de estudios de tecnologías de información. (2006). Estudio nacional sobre tecnologías de información 2006. Santiago, Chile: Centro de estudios de tecnologías de información

Gunnar Eliasson. The nature of economic change and management in a new knowledge based information economy. *Information Economics and Policy*, 17(4), 428-56

Huub Meijers. Diffusion of the Internet and low inflation in the information economy. *Information Economics and Policy*, 18(1), 1-23.

International Data Corporation(IDC). (2004). *The Information Society Index (ISI).* Retrieved June 19, 2007, from http://www.idc.com/groups/isi/main.html

Instituto Nacional de Estadísticas. (1996). Encuesta nacional de empleo 1996. Instituto Nacional de Estadísticas. Santiago, Chile

Instituto Nacional de Estadísticas. (2004). Encuesta nacional de empleo 2003. Instituto Nacional de Estadísticas. Santiago, Chile

Instituto Nacional de Estadísticas. (2002). Anuario de costos y remuneraciones medias 1993 – 2001. Instituto Nacional de Estadísticas. Santiago, Chile

Instituto Nacional de Estadísticas. (2004). Anuario de costos y remuneraciones medias 2003. Instituto Nacional de Estadísticas. Santiago, Chile

Karmarkar, U.S. (2004). Will you survive the Services Revolution?. *Harvard Business Review*. 82(6), 100-8.

Kraemer, K.L., Dedrick, J., 2001. Information technology and productivity: results and policy implications of cross-country studies. In: Pohjola, M. (Ed.), Information Technology, Productivity, and Economic Growth. Oxford University Press, Oxford, pp. 257–279.

Kwan Wai Ko. Internet externalities and location of foreign direct investment: A comparison between developed and developing countries, *Information Economics and Policy*, 19(1), 1-23.

Lisa Correa. The economic impact of telecommunications diffusion on UK productivity growth. *Information Economics and Policy*, 18(4), 385-404.

Min Choi, Hosun Rhim, Kwangtae Park. (2006). New business models in information economy: GDP and case studies in Korea. Slrc working paper series 2006-1, Korea University Business School

Ministerio de Economía, Instituto Nacional de Estadísticas, Subsecretaría de Telecomunicaciones, Ministerio de Educación, Corporación de Fomento de la Producción y EMG Consultores. (2006). Cuenta satélite de tecnologías de información y comunicación en Chile. Santiago, Chile: EMG Consultores.

Pohjola, M. (2002). The New Economy: facts, impacts and policies. *Information Economics and Policy,* 14(2), 133-44.

Porat, M.U. and Rubin, M.R. (1977). The Information Economy (9 volumes), *Office of Telecommunications Special Publication 77-12*. US Department of Commerce, Washington D.C.

Qingxuan Meng and Mingzhi Li, New Economy and ICT development in China, *Information Economics and Policy*, Volume 14, Issue 2, June 2002, Pages 275-295.

Tokman M. & Zahler A. (2004). Innovación para un crecimiento sostenido: Siete lecciones para Chile. *En Foco.* Retrieved July 29, 2007, from http://www.expansiva.cl./media/en_foco/documentos/12102005132043.pdf