The intellectual capital of the European Union

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de Baak
Management Centrum VNO-NCW

The intellectual capital of the European Union

Measuring the Lisbon agenda
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dr. D.G. Andriessen
drs. C.D. Stam mba

Centre for Research in Intellectual Capital
INHOLLAND University of professional education
de Baak - Management Centre VNO-NCW

Contact:
PO-box 261
1110 AG Diemen
The Netherlands
+31 (0)20-4951873
daan.andriessen@inholland.nl
c.stam@debaak.nl

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1. Limitations

Before drawing any conclusion about the intellectual capital (IC) of the EU, we would like to indicate the limitations of our research. First, the limitation of the methodology of multi-dimensional value measurement as described in Appendix 2. Second limitation was the limited availability of data. Our aim was to monitor the progress of the Lisbon Agenda of March 2000. The data available, however, on average does not go further than 2001. This means that it is impossible to identify effects of Lisbon policy measures. Therefore this report must be seen as a base measurement for monitoring the Lisbon Agenda. We will repeat our research in two years time to measure the progress Europe has made.

2. Lisbon Agenda

On 23-24 March 2000, the European Council formulated a new strategic goal for the EU in order to strengthen its knowledge-based economy. The main goal was *"to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion."*

In order to reach this goal, the European Council defined a set of supportive goals and measures. This so called 'Lisbon Agenda' is an indication of the kind of intellectual capital the EU wishes to create in order to reach its strategic goal.
At the Lisbon meeting in March 2000, the European Council invited the Commission "to draw up an annual synthesis report on progress on the basis of structural indicators" (European Parliament, 2000). These 14 structural indicators[1] are presented and published every spring meeting of the European Council and are the basis of measuring progress of the Lisbon Agenda. Another example of measuring progress based on these structural indicators is of course the recent publication "Facing the Challenge" by the High Level Group chaired by Wim Kok (High Level Group, 2004).
This report goes further and translates the Lisbon Agenda into 38 indicators from an intellectual capital perspective. This enables us to measure the value the intellectual capital of the EU ánd the progress of the Lisbon Agenda.

3. Value of intellectual capital

In general we can conclude that the Nordic countries (Sweden, Denmark and Finland) perform considerably better than the others. Figure 1 shows that the value of their intellectual capital assets is substantially higher than the value of a large group of followers (Belgium, The Netherlands, Luxemburg, Germany, France, Austria, United Kingdom and Ireland). Finally a group of laggards (Italy, Spain, Greece and Portugal) follows at considerable distance. This outcome is consistent with comparable research. For example, the top 3 of most competitive European countries in the ranking of the World Economic Forum in 2004 is Finland, Sweden and Denmark.
Noticeable is that these three groups are geographically divided. The leading group consists of northern European countries (>54˚ latitude), the group of followers consists of middle European countries (45˚-54˚ latitude). The laggards are all southern European countries (<45˚ latitude).
A possible cultural explanation for this could be that the Nordic countries throughout history have developed an attitude of looking at the future. In order to survive the long and severe winters they always had to plan their resources carefully.

Our main findings with regard to the value of the intellectual capital of the EU-15 can be summarized as follows:

1. *Investments in IC pay off*
   As expected there is a strong and significant correlation between human capital *investments* and human capital *assets* (0.470) and also between structural capital *investments* and structural capital *assets* (0.686).
   So, countries that have a high value of intellectual capital investments also have a high value of intellectual capital assets.
2. *Human capital and structural capital "go together"*
   Leading countries (SE, DK, FI) have considerably higher value of both human capital *and* structural capital.
   Laggards (ES, PT, EL, IT) have considerably lower value of human capital *and* structural capital. This supports the idea that human capital and structural capital are interdependent and mutual enhancing factors.

[1] *See: http://www.europa.eu.int/comm/eurostat/structuralindicators*

They “go together” in the creation of intellectual capital. This is what Edvinsson (2002) calls the multiplier effect. This is further supported by a strong and significant correlation (0.806) between human capital assets (HCA) and structural capital assets (SCA). However, we did not find a significant correlation between relational capital assets (RCA) and other types of intellectual capital.

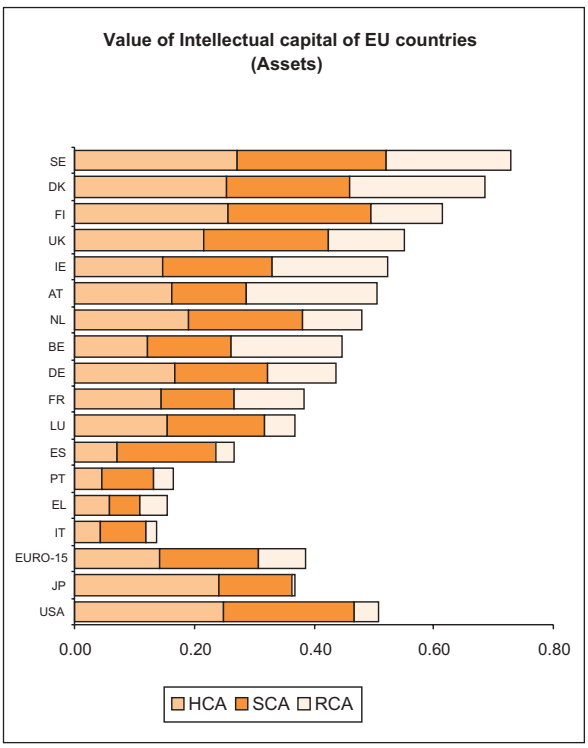

Figure 1: value IC of EU, 2001

3. *High value of IC is no guarantee for high productivity*
Measurement of the extent to which intangibles are made productive reveal that high values of intellectual capital assets are no guarantee for high intellectual productivity. However, low values of intellectual capital assets do seem to be a guarantee for low intellectual productivity. It seems that intellectual capital investments and assets are necessary, but not sufficient to make intellectual capital productive.

4. Growth over time (1999-2001)

Comparison of the value of intellectual capital over time (1999 and 2001) shows growth for almost all countries from all perspectives (investments, assets, effects). Our main findings are:

1. *Relative position of Germany will improve*
If it is true that there is a time lag between the investments in IC and the value of IC assets, the relative position of countries like Ireland, the UK and Finland will worsen. At the same time the relative position of Germany will improve.
2. *EU is catching up with the USA*
Noticeable is that the value of IC assets increased in all EU countries. This supports the idea that the knowledge economy is growing. At the other hand we see that the value of IC assets in the USA decreases, which means that the EU is catching up with the USA, although it is still far behind.
3. *EU is better in leveraging IC*
Europe as a whole became better in making its intangibles productive. Moreover, if we calculate the ratio between assets and effects, we see that the EU is better in leveraging intellectual capital than the USA. In the USA, one value unit of intellectual capital assets leads to 0.93 units of IC effects, while in Europe one unit of IC assets leads to 1.10 units of IC effects. This supports the idea that high values of IC assets are no guarantee for high intellectual productivity.

However, if we compare the EU as a whole with the USA and Japan we see that the value of its intellectual capital assets is considerably lower than the USA and slightly higher than Japan. This means that Europe, in 2001, still had a long way to go. In order to investigate the impact of the Lisbon Agenda this research will be repeated in the future.

5. Acknowledgement

The authors would like to thank Jera Keizer and Renze Kolster for their valuable help in collecting the necessary data.

II Introduction

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More and more we hear people say that we have entered a new economy, information economy, a network society, post-industrial society, knowledge-based society, etc. Whatever their names and differences, there is one major similarity between all these new kind of economies: The competitive advantage within these new economies has shifted from material and financial assets to intangible and non-financial assets; to intellectual capital (IC). The European Union is aware of this shift and is implementing an ambitious program to make the European economy the most dynamic and competitive knowledge-based economy of the world.

In this report we give an introduction to the concept of the intellectual capital of nations and apply it to the European Union. How do the countries of the European Union perform from an intellectual capital perspective? To answer this question we have developed an IC Monitor for 15 European countries that uses indicators to measure the value of intellectual capital. Thus we provide insight into the value of the intellectual capital of these countries in relationship to the goals set by the European Council on 23-24 March 2000 in Lisbon: The Lisbon Agenda.

1. The growing importance of intangibles

The past decades our production process has changed. Traditional factors of production, like natural resources, labor and capital have lost significance. At the same time the importance of intangible inputs, like information and knowledge, increased.

This shift in significance from tangible to intangible factors of production however, did not lead to changes in the traditional accounting and measurement systems. The result is that traditional financial accounting systems and macro-economic statistics have lost relevance. The decreasing relevance of traditional measurements can easily be illustrated by the unit price per lbs of some traditional industrial products compared with the unit price of some knowledge-based products (table 1).

More and more 'products' do not have any weight at all. "An ever increasing share of GDP resides in economic commodities that have little or no physical manifestations" (Youngman, 2003: p.7). The value of a Pentium Processor, or Viagra is not in the physical weight of the product itself (see table 1). It is not the material substance customers are paying for. The real value lies in the knowledge and skills of the people who made the products, and the marketing power of the companies to sell the products. These are all intangible assets.

With the introduction of the Fortune 500 largest companies in 2001, Thomas Stewart wrote *"In the pages of Fortune that follow are thousands upon thousands of statistics that reveal very little that's meaningful about corporations they purportedly describe"* (Stewart, 2001: p.184). The General Accepted Accounting Principles (GAAP) generally do an unacceptable job of accounting for the principal activities of Information Age companies. In today's economy indicators like revenues, profits and assets only tell a minor part of the story.

	Price (US$)	Weight (lbs*)	Unit $ price per lbs
Pentium	851	0.001984	42,893.00
Viagra	8	0.00068	11,766.00
Mercedes Benz E-class	78.445	4134	19.00
Hot rolled steel	370	2000	0.20

* 1 lbs = 0,454 kg

Table 1 Weightless wealth

Source: G.Colvin, Fortune

The real wealth of organizations has to be sought in the people, their knowledge and skills, internal processes and the company's reputation. That is why Fortune asked Baruch Lev, Professor of accounting at the Stern Business School at New York University, to make an alternative ranking of the smartest US companies by calculating their knowledge capital, in addition to the traditional ranking of the 500 largest companies.

While the top 10 of the traditional ranking is dominated by industrial companies, like General Motors, Ford, Daimler Chrysler, Toyota, Mitsubishi, BP and Shell, the alternative ranking by Lev provides a more balanced view of traditional and information age companies (see table 2).

These developments have not been limited to firm level only. We can see a growing discrepancy on an aggregate national level too. Like the Fortune 500 ranking, national accounts reveal only very little that is meaningful to get insight into the drivers of national wealth. More and more, statistical offices are faced with the problem of mapping and measuring the growth of today's economy. Indicative for this trend is the *OECD Science, Technology and Industry Scoreboard*, which brings together internationally comparable data in order to analyze trends in the knowledge-based economy (OECD, 2001). Moreover, the OECD-conference on Intangibles in June 1999 in The Hague (EZ, 1999) and the Lisbon Agenda of March 2000 (European Parliament, 2000), initiated several projects, aiming at developing indicators for the knowledge-based economy (e.g. Brusoni, et al., 2002, Eustace, 2003). How to get a better understanding of the new wealth of nations?

2. Measuring Intellectual Capital

Our main sources of competitive advantage have become intangible. What we need is a more reliable guide that provides better insight into the value of these intangible assets and their contribution to economic development and growth. However, contrary to the 500-year old double-entry bookkeeping system, communicating and reporting about intangibles, or intellectual capital, does not have a list of clear defined terms or models. Moreover, even the term intellectual capital counts for numerous definitions and interpretations. However, evaluating the state of the field, we recognize an emerging standard (Sveiby, 1998, Stam, 1999, Bontis, 2002, Andriessen, 2004), based on the groundbreaking work of people like Karl-Erik Sveiby (Sveiby, 1997), Leif Edvinsson (Edvinsson en Malone, 1997, Edvinsson, 2002), Thomas Stewart (Stewart, 1997, Stewart, 2002), and Göran Roos (Roos et. al., 1997).

Rank	Rank F500	Name	Knowledge Capital (mio US$)
1	8	General Electric	254,381
2	138	Pfizer	219,202
3	201	Microsoft	204,515
4	34	Philip Morris	188,538
5	1	Exxon Mobil	176,409
6	110	Intel	173,964
7	49	SBC Communications	155,402
8	19	Intl Business Machines	148,679
9	32	Verizon Communications	141,471
10	88	Merck	139,494

Table 2 Top 10 smartest companies

Source: Fortune, April 16, 2001

The roots of today's intellectual capital movement lies in the mid 1980s in the work of Karl-Erik Sveiby (Sullivan, 2000, Edvinsson, 2002). As stated above intellectual capital counts for numerous interpretations and definitions. However, after more than a decade of intangibles, we see that definitions are converging. Core-elements within these definitions are:

- Intellectual capital is an intangible organizational resource.
- Competitive advantage is based on intellectual capital
- Organizational value and value creation is the result of leverage of intellectual capital

Based on the above we would define intellectual capital as *all intangible resources that are available to an organization, that give a relative advantage, and which in combination are able to produce future benefits*.

In order to measure and manage intellectual capital, it is important to be more precise about the different components. One of the main merits of the intellectual capital movement is the development of a so-called taxonomy, a branch of various classes of intellectual capital and their relationships. Comparison of several intellectual capital models (table 3) shows us that many of them are based on a more or less same classification (Stam, 1999, Stam, 2001).

All three models are based on a taxonomy of three[2]. The logic of these models is that intellectual capital is the product of interaction of these three different classes of intangibles: human resources, organizational resources and relational resources (Roos, 2003).

- Human Resources: This first class represents anything related to the people within the organization, the employees, their tacit knowledge, skills, experience and attitude.
- Organizational Resources: This second class represents the 'tangible' intangibles. Everything of value that stays behind, after the employees have left the organization, like codified knowledge, procedures, processes, goodwill, patents, and culture.
- Relational Resources: This third class represents the relationship with customers, suppliers and other external stakeholders. The value of customer capital is mainly determined by the extent to which an organization is able to maintain confidence in its reputation.

Although the terminology that is used by different academics and practitioners differs, this taxonomy of three could be the main element of an emerging standard. More and more, this classification is used as a starting point for reporting and communicating about intellectual capital.

3. Intellectual Capital Monitor

Although the intellectual capital is unique and can never be compared objectively, we can improve comparability by using the same conceptual models. Moreover, we think that the above taxonomy of three has proven to be a sound basis for measuring and comparing intellectual capital on both firm and national level.

Therefore the starting point of our model is Bontis' proposed conceptualization (Bontis, 2002) of intellectual capital, in which he distinguishes between human capital, structural capital and relational capital. Based on this taxonomy of

	Intangible Assets Monitor	Skandia Navigator	Intellectual Capital Index
	(Sveiby)	(Edvinsson)	(Roos)
Human Resources	Individual's competences	Human Capital	Human Capital
Organizational Resources	Internal Structure	Process Capital	Infrastructure Capital
Relational Resources	External structure	Customer Capital	Relationship Capital

Table 3 Comparison of intellectual capital models

(Stam, 1999, Stam, 2001).

[2] *Sveiby was probably the first to use this family of three in The New Annual Report, 1988.*

three we developed the Intellectual Capital Monitor for the measurement of intangibles.

Within this monitor we have added a second layer of classification. Each of the three classes of intellectual capital is being monitored from three different perspectives in order to stress the importance and differences between past, present and future developments:

1. Assets (present) This perspective gives an indication of the present power of an organization. It provides an overview of the current main assets.
2. Investments (future) This perspective gives insight into the future power of an organization/nation. To maintain or strengthen its present power, organizations should invest in its potential continuously.
3. Effects (past) This perspective shows the extent to which the organization has made its intangibles productive during the past period[3].

The windows and perspectives are combined in a 3 by 3 matrix (see table 4). Implementation of this monitor means filling the fields with appropriate performance indicators. The power of this format appeared to be its simplicity, which makes it easy to implement, communicate and understand.

A well-defined Intellectual Capital Monitor consists of a combination of indicators from all three classes and all three perspectives.

4. Intellectual Capital of Nations

Intellectual Capital of Nations is a concept that applies the principles of intellectual capital measurement and management on a macro-economic level, in such a way that it helps to give direction to future economic developments.

An intellectual capital of nations report uses a system of variables (indicators) that helps to uncover and manage the invisible wealth and gives insight into the hidden value of a country or region of countries.

The concept of intellectual capital can be translated to macro-economic level very easily, because “the stories of our societies and of our nations are mirrors of ourselves and our organizations" (Edvinsson, 2002). The main difference of course is its level of application. Debra Amidon was among the first to recognize the possibilities of applying intellectual capital on a macro-economic level (Amidon, 2001). The most rigorous work in this field until now is done by Nick Bontis. In his work he defines IC of Nations as “the hidden values of individuals, enterprises, institutions, communities and regions that are the current and potential sources for wealth creation” (Bontis, 2004: p.4).

The main motivation for measuring the intellectual wealth of a nation is to get insight into the relative advantage of countries. This insight could help to develop policy in order to give direction to future economic developments. Examples of earlier IC of Nations reports are the IC report of the State of Israel (Pasher, 1999), National IC Index (Bontis, 2004), IC report of Croatia (2002), and several IC reports in The Netherlands (EZ, 2000; EZ, 2002) (Kennisland, 2003)[4].

Based on the international developments in this field and our own interpretation of intellectual capital, we define the IC of Nations as all intangible resources available to a country or region, that give relative advantage, and which in combination are able to produce future benefits.

	Human capital	Structural capital	Relational capital
Assets			
Investments			
Effects			

Table 4 Intellectual Capital Monitor

3 *Effects can be further divided into output, outcome and impact. See for example the Intellectual Capital Report 2003 of the Swedish Center for Molecular Medicine*

4 *For a more detailed comparison of the reports of Australia, Israel, New Zealand and The Netherlands see: Cees Schouten, De Kenniseconomie Gekend, Amsterdam, 2004*

For the measurement and communication of the IC of Nations, we can use the same model as on a firm level. However, to make it applicable on a national level, the meaning of the classes of intangibles are translated to an aggregate level.

- Human Capital. This first class represents anything related to people: knowledge, education and competencies of individuals in realizing national tasks and goals. Education is 'the basic building block of human capital' (Bontis, 2004: p.7).
- Structural Capital. The second class of intangibles on a macro-economic level represents the 'non-human storehouses of knowledge, which are embedded in its technological, information and communications systems as represented by its hardware, software, databases, laboratories and organizational structures' (Bontis, 2004: p.8).
- Relational Capital. This third class of intangibles assesses the intraorganizational relationships and linkages and the extent to which organizations are able to capitalize on cooperative and coordinating capabilities.

As we all know, measures in itself do not say much. It is the comparison of measures of one country against another, or of one period against another that give meaning to the figures. Although the intellectual capital is unique and can never be compared objectively, we can improve comparability by using the same conceptual models. We think the IC Monitor, based on the taxonomy of three has proven to be a sound basis for measuring intellectual capital on both firm and national level.

5. Indicators for intellectual capital in the EU

On 23-24 March 2000, the European Council held a special meeting to agree a new strategic goal for the EU in order to strengthen its knowledge-based economy. The goal was set *"to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion"* (European Parliament, 2000). To achieve this goal an overall strategy was formulated, aiming at:

- Preparing the transition to a competitive, dynamic and knowledge-based economy;
- Modernizing the European social model by investing in people and building an active welfare state;
- Sustaining the healthy economic outlook and favourable growth prospects by applying an appropriate macro-economic policy mix.

The Lisbon Agenda gives an indication of the kind of intellectual capital the EU wishes to create in order to become competitive and dynamic. In order to be able to translate this strategy into indicators, we should take a closer look at the underlying goals and measures.

1. *An information society for all*
   The first goal is to ensure that businesses and citizens have access to a world-class communications infrastructure (structural capital) and that they possess the skills to use it (human capital).
2. *Establishing a European Area of Research and Innovation*
   Second goal is to boost the amount of research taking place within the EU thereby creating explicit knowledge (structural capital) and implicit knowledge (human capital). At the European Council meeting in Barcelona in 2002 it was agreed that, in order to close the gap between the EU and its competitors, overall spending on R&D and innovation should be increased with the aim of approaching 3% of GDP by 2010. Two-thirds of this new investment should come from the private sector. In addition the EU wants to integrate the research activities between countries thereby creating EU relational capital.
3. *Creating a friendly environment for starting up and developing innovative businesses, especially Small and Medium-Sized Enterprises*
   This includes removing red tape, lowering the costs of doing business and improving the access to venture capital. This indicates the creation of structural capital.
4. *Economic reforms for a complete and fully operational internal market*
   The EU is working on the removal of barriers to trade, the liberalization in the areas of gas, electricity, postal

services and transport and the harmonization of regulations. Most of these measures concern increasing the structural capital of the EU as a whole. Therefore we did not select any country indicators, except for a score of each country on implementing EU directives.
The more harmonized the laws within the EU, the easier it becomes to do business.

5. *Efficient and integrated financial markets*
   The EU also aims for the integration of the financial markets. In addition the EU wants to increase the efficiency of the risk capital markets. This is a form of structural capital.
6. *Coordinating macro-economic policies: fiscal consolidation, quality and sustainability of public finances*
   The EU aims to coordinate macro-economic policies of its member states and to improve the quality and sustainability of public finances. The quality of public finances can be seen as a form of structural capital.
7. *Education and training for living and working in the knowledge society*
   The EU considers people to be its main asset. Therefore it aims at a substantial annual increase in per capita investment in human resources thereby lowering the number of 18 to 24 year olds with only lower-secondary level education. Also the EU wants to increase human capital through life-long learning.
8. *More and better jobs for Europe: developing an active employment policy*
   One of the EU's core aims is to reduce unemployment thereby increasing the level of productive human capital within the EU. The employment rate is an indicator of human capital assets. To increase this human capital EU governments invest in labor market policy measures.
9. *Modernizing social protection and promoting social inclusion*
   According to the EU, the European social model, with its developed systems of social protection, must underpin the transformation to the knowledge economy.
   According to the Council this is possible if the system is sustainable in the long-term, ensures that work pays, promotes social inclusion and gender equality, and provides quality health services. So according to the EU, its social system can be an important part of the structural capital of the EU.

Striking is that the Lisbon Agenda, from an intellectual capital perspective, focuses on structural capital in the first place, followed by human capital. Only goal number 2 aims at creating relational capital (intra-organizational relationships and linkages). This dominant focus on structural capital and human capital is probably inherent to the main goal and the overall strategy.

The next step of our research was that we translated the Lisbon Agenda into indicators. This resulted in 38 indicators for measuring the intellectual capital of EU countries.
Table 5 gives an overview of the indicators. The figures between brackets refer to the goals from which they are derived.

Although many more indicators could be thought of, the choice of indicators is of course largely dependent on availability of data for all countries.
Another striking point is that most indicators refer to the past (effects) or present (assets). Only few of the goals can be translated into indicators that say something about the future (investments). In terms of relational capital, no indicators could be found at all. This dominant focus on past and present reflects the traditional focus of statistical institutions.

	Human capital	Structural capital	Relational capital
Assets	• Proportion of active population using a computer for professional purposes that had computer training at the workplace (1) • Researchers per thousand total employment (2) • Proportion of total population having completed at least upper secondary education (7) • Proportion of the adult population aged 25 to 64 participating in education and training (7) • Proportion of active population using a computer for professional purposes that had computer training at the workplace (7) • Employment rate (7) • Employment in Knowledge intensive services and High tech & medium-high tech manufacturing (7) • Employment rate (8)	• Percentage of households who have Internet access at home (1) • Percentage of enterprises who have access to the Internet (1) • Number of patent applications to the European Patent Office (EPO) per million inhabitants (2) • Number of patents granted by the United States Patent and Trademark Office (USPTO) per million inhabitants (2) • Number of scientific publications per million inhabitants (2) • Enterprise environment indicator from World Economic Forum (3) • Entrepreneurial attitude (3) • Number of days needed to start a new business (3) • Venture Capital Investment as % of GDP (3) • Number of EU directives not notified (4) • Venture Capital Investment as % of GDP (5) • General government consolidated gross debt as a percentage of GDP (6)	• Percentage of international meetings hosted (2) • SMEs involved in innovation co-operation (2) • International outgoing telecom traffic (2) • Foreign students as percentage of all students (7)
Investments	• Total public expenditure on education as % of GDP (7) • Total public expenditure on labor market policy measures as a percentage of GDP (8)	• Expenditure for IT hardware, equipment, software and other services as a percentage of GDP (1) • Gross domestic expenditure on R&D as % of GDP (2)	
Effects	• GDP per hour worked (as % of US) (7)	• Percentage of businesses using the Internet for purchasing and selling (1) • Value added of high tech industry, relative to GDP (2) • Birth rate of enterprises (3) • Birth rate of enterprises (5) • The share of persons with an equivalised disposable income below the risk-of-poverty threshold (9) • Life expectancy at birth (9)	• Breadth of international scientific collaboration (2) • Percentage of patents with foreign co-inventors (2) • Export of royalty and license fees (2) • Export of services (2) • High tech export (2)

Table 5 Indicators for measuring the IC of the EU

III Value of intellectual capital in the EU

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This paragraph first analyses the intellectual capital of the EU-15 in 2001 from the perspectives of investments, assets and effects. Next we investigate the growth of intellectual capital between 1999 and 2001. Finally we investigate whether there is a correlation between the value of Intellectual capital and GDP.

1. Value of intellectual capital investments

This perspective gives insight into the future power of an organization/nation. To maintain or strengthen its present power, organizations/nations should invest in its intellectual capital continuously. Figure 2 shows the value of the investments in intellectual capital of the 15 EU countries on a scale from zero to one. We made a distinction between investments in human capital and investments in structural capital. We did not find any indicators for investments in relational capital.

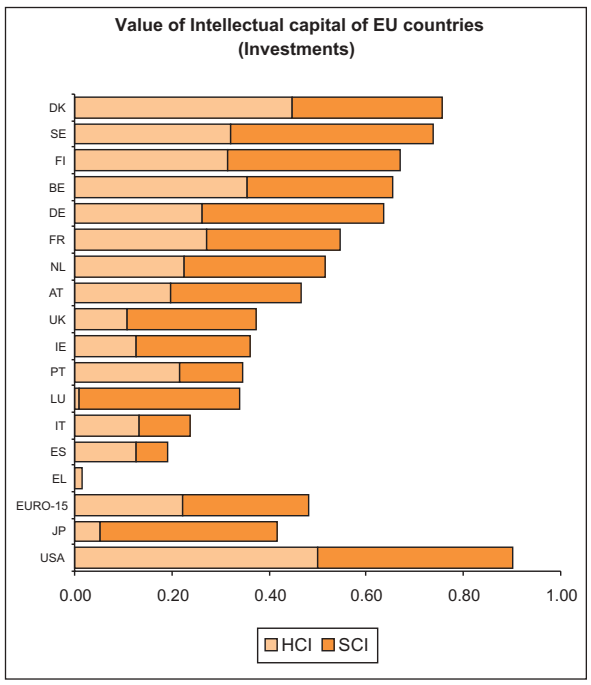

Figure 2 Investments in Intellectual Capital in 2001
(HCI=Human Capital Investments, SCI=Structural Capital Investments)

The Nordic countries Denmark, Sweden and Finland invest the most in intellectual capital, whereby the focus of Denmark is on human capital and that of Sweden and Finland on structural capital. Denmark scores high on both investments in education and investments in labour market policy. Sweden and Finland score high on investments in R&D, being the only countries in the EU that exceed the norm of 3% of GNP. There is a group of followers that includes Belgium, Germany, France, The Netherlands and Austria. Belgium is second in terms of investments in human capital but its investments in structural capital are much lower, resulting in a fourth place. Finally there is a group of laggards consisting of the UK, Ireland, Portugal, Luxembourg, Italy, Spain and Greece.

For comparison we have included Japan and the USA. However, it should be noted that in those values the indicator “Total public expenditure on labour market policy measures as a percentage of GDP” is not included. Japan scores high on investments in structural capital but low on investments in human capital. The USA have the highest values on both. The average value of investments of the EU-15 is slightly higher then Japan but substantially lower than the USA.

2. Value of intellectual capital assets

This perspective provides an overview of the current main assets from an intellectual capital perspective. It gives an indication of the present power of an organization/nation. Figure 3 visualizes the value of the intellectual capital of the EU. Again Sweden, Denmark and Finland have the highest values. Then there is a big group headed by the United Kingdom that includes Ireland, Austria, The Netherlands, Belgium, Germany, Luxembourg, and France. At the bottom we find the South European countries Spain, Portugal, Greece and Italy.

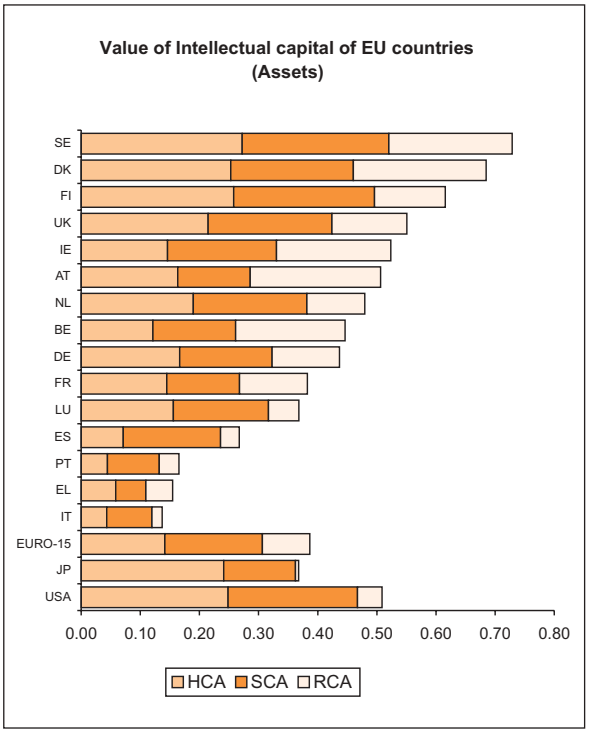

Figure 3 Intellectual capital assets in 2001 (HCA= Humans Capital Assets, SCA= Structural Capital Assets, RCA = Relational Capital Assets)

Noticeable is that the leading group (SE, DK, FI) has considerably higher value of human capital and structural capital *and* laggards (ES, PT, EL, IT) have considerably lower value of human capital and structural capital. This supports the idea that human capital and structural capital are interdependent and mutual enhancing factors. They "go together" in the creation of intellectual capital. This is what Edvinsson (2002) calls the multiplier effect. This is further supported by a strong and significant correlation between human capital and structural capital assets (0.806). However, we did not find a significant correlation between relational capital assets and other types of intellectual capital.

Human capital and structural capital "go together": Leading countries have considerably higher value of both human capital *and* structural capital.

We have included Japan and the USA for comparison. However, for those countries a number of indicators were missing (see appendix 1). For Japan three indicators were missing for human capital, six for structural capital and two for relational capital. For the USA three indicators were missing for human capital, three for structural capital and two for relational capital. Both countries score high on human capital assets, slightly below Sweden, Finland and Denmark. The USA score high on structural capital, behind Sweden and Finland. Japan scores low on structural capital, slightly below France. The average value of intellectual capital assets of the EU-15 is slightly higher then Japan and substantially lower than the USA. This is the same pattern as we saw with intellectual capital investments.

Both Japan and the USA score low on relational capital. From this one might be tempted to conclude that small countries have higher values for their relational capital because they need other countries more then big countries do. We did however not find a significant correlation between population and the value of relational capital assets.

Investments in intellectual capital pay off: there is a strong and significant correlation between *investments* and *assets*.

Important question is of course whether investments in intellectual capital contribute to increase in the value of intellectual capital assets. As expected there is a strong and significant correlation between in human capital *investments* and human capital *assets* (0.470). In addition there is a strong correlation between structural capital *investments* and structural capital *assets* (0.686). So, countries that have a high value of intellectual capital investments also have a high value of intellectual capital assets.

3. Value of intellectual capital effects

This perspective shows the extent to which the organization/ nation has made its intangibles productive during the past period. Figure 4 shows the value of the effects of human,

structural and relational capital. Related to the Lisbon agenda we find that Germany has the highest score, followed by Luxembourg. Germany has a high score on labour productivity as well as on value added of knowledge intensive services, relative to GDP. Luxembourg has the highest score on labour productivity. Germany also scores very high on the use of Internet and absence of poverty. The high scores of Germany and Luxembourg reflect the strong emphasis of the Lisbon Agenda on improving social cohesion. The social items on the Lisbon Agenda are often overlooked but are an integral part of it. This is reflected in the choice of our indicators, including indicators like absence of poverty and life expectancy.

Germany and Luxembourg are followed by the UK, The Netherlands and Denmark. Denmark scores very high on structural capital effects, especially the use of Internet, the birth rate of enterprises, and absence of poverty, but low on relational capital effects. A third group consists of Sweden, France, Ireland, Finland, Belgium and Austria. At the bottom we find the same group of countries as we found above: Italy, Spain, Greece and Portugal.

Comparison with Japan and the USA is difficult as the value of their structural capital effects is only based on one indicator (life expectancy). However, the USA have the third highest score on human capital effects and the highest score on relational capital effects. Japan scores low on human and relational capital effects, performing slightly better then Spain (human capital effects) and The Netherlands (relational capital effects) respectively. Because Japan has the highest score on life expectancy and because this is the only Japanese structural capital effect indicator Japan ends in third place.

High value of IC is no guarantee for high productivity: However, low values of intellectual capital assets do seem to be a guarantee for low intellectual productivity.

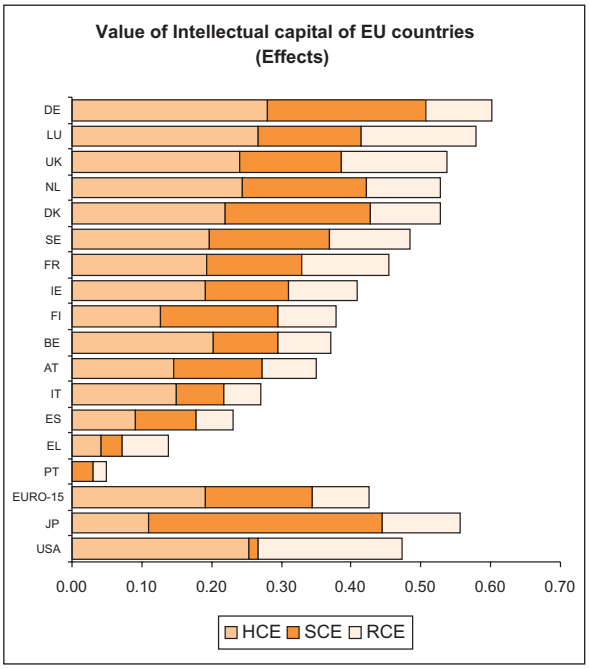

Figure 4 Intellectual capital effects in 2001 (HCE=Human Capital Effects, SCE=Structural Capital Effects, RCE=Relational Capital Effects)

Striking is that the ranking of the countries significantly differs from the previous two rankings (investments and assets). In this ranking Sweden, Denmark and Finland fall to a respective 5th, 6th and 9th place. High values of intellectual capital investments and assets are no guarantee for high intellectual productivity. However, low values of intellectual capital assets do seem to be a guarantee for low intellectual productivity. It seems that intellectual capital investments and assets are necessary, but not sufficient to make intellectual capital productive. One possible explanation is that there is a time lag between investments, the creation of assets and the productivity of those assets.

IV Growth in Intellectual Capital (1999-2001)

IV Growth in Intellectual Capital (1999-2001)

The average year of the 38 indicators was 2001. To see what the development was in intellectual capital we searched for data from earlier years. We aimed for data from 1995, however because of unavailability of data we did not succeed for all indicators. As a result the average year for the earlier indicators turned out to be 1999 (see appendix 1).
To calculate the value of the intellectual capital for 1999 we used the same value scale as constructed for 2001. This means that the minimum and maximum values from 2001 were used for 1999. This allowed us to measure the development in value between 1999 and 2001.

1. Growth in Investments

Figure 5 shows the development in the value of intellectual capital investments between 1999 and 2001. Most countries have increased the value of their intellectual capital investments, except for Ireland, Finland, the UK, Greece and the USA. Ireland and Finland have cut back significantly on expenditure on education, while Ireland has also lowered expenditure on labour market policy measures. In the UK, Greece and the USA there has been a lowering of investments in ICT between 2000 and 2003. For Germany (0.16), Italy (0.13), Spain and France (0.12) the growth in the value of investments has been the highest. Europe as a whole has increased the value of its intellectual capital investments with 0.09 between 1999 and 2001.

Based on the current investments in IC, we expect that **the relative position of Germany will improve**.

If it is true (as suggested above) that there is a time lag between the investments in IC and the value of IC assets, these figures could indicate that the relative position of countries like Ireland, the UK and Finland will worsen. At the same time the relative position of Germany will improve.

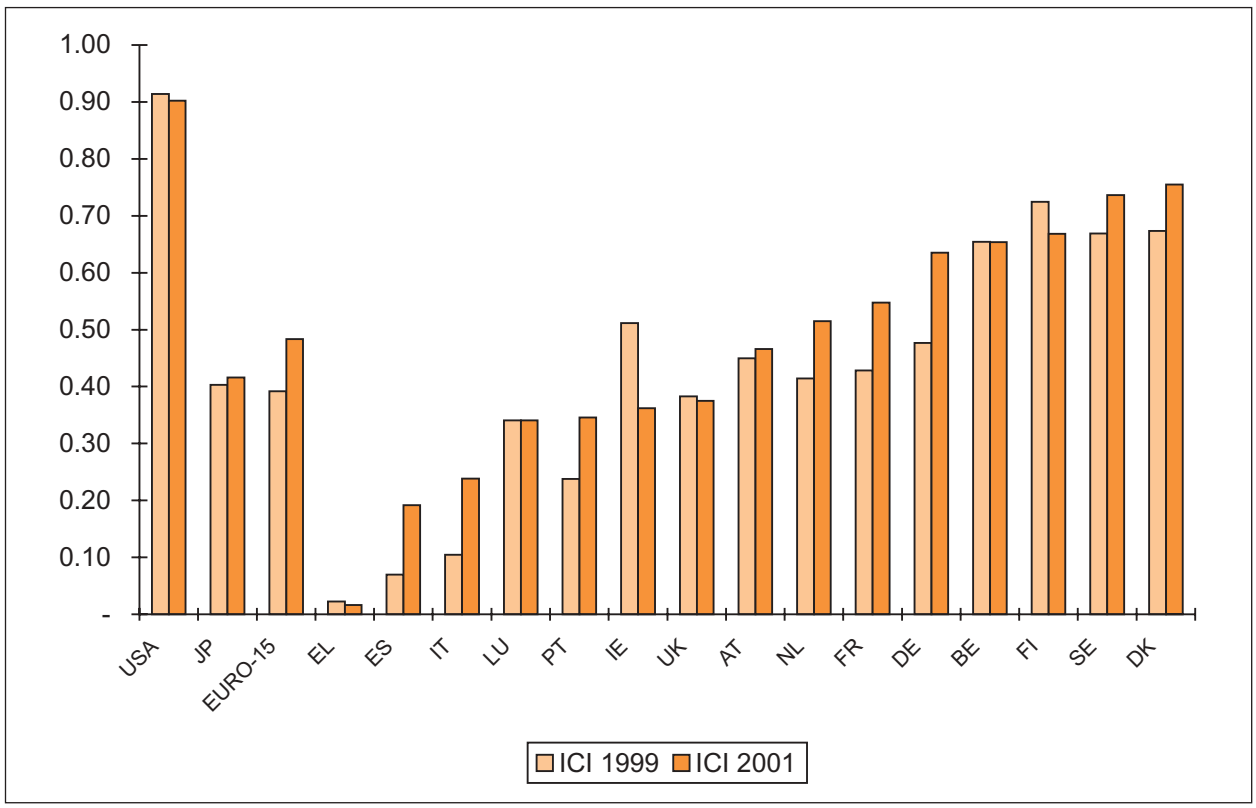

Figure 5 Growth in the value of intellectual capital investments between 1999 and 2001 (ICI=Intellectual Capital Investments)

2. Growth in Assets

Figure 6 shows the development in value of intellectual capital assets. All countries have increased the value of their intellectual capital assets except for the USA. In the USA the employment indicators, the number of scientific publications and the number of patents has decreased, which explains a decrease in value of –0.005. Sweden has managed to achieve the highest growth in value (0.11). This is largely due to an increase in human and relational capital assets. Human capital assets have increased as a result of progress in lifelong learning, number of researchers and employment. Relational capital assets have increased as a result of a rise in the number of foreign students and international outgoing telecom traffic. Second highest growth in value has been achieved by Finland and Ireland. Finland has almost doubled its number of researchers between 1995 and 2001. Its employment rate has increased by 6.1% between 1995 and 2003 and the number of foreign students has increased by 38% between 1998 and 2002. In Ireland employment has risen with 10% and the international outgoing telecom traffic has risen with 240% between 1995 and 1999, probably as a result of the growth in number of international call centres. Europe as a whole has increased the value of its intellectual capital assets with 0.05 between 1999 and 2001.

The European Union is catching up with the USA: although it is still far behind.

Noticeable in this figure is that the value of IC assets increased in all EU countries. This supports the idea that the knowledge economy is growing. At the other hand we see that the value of IC assets in the USA decreases, which

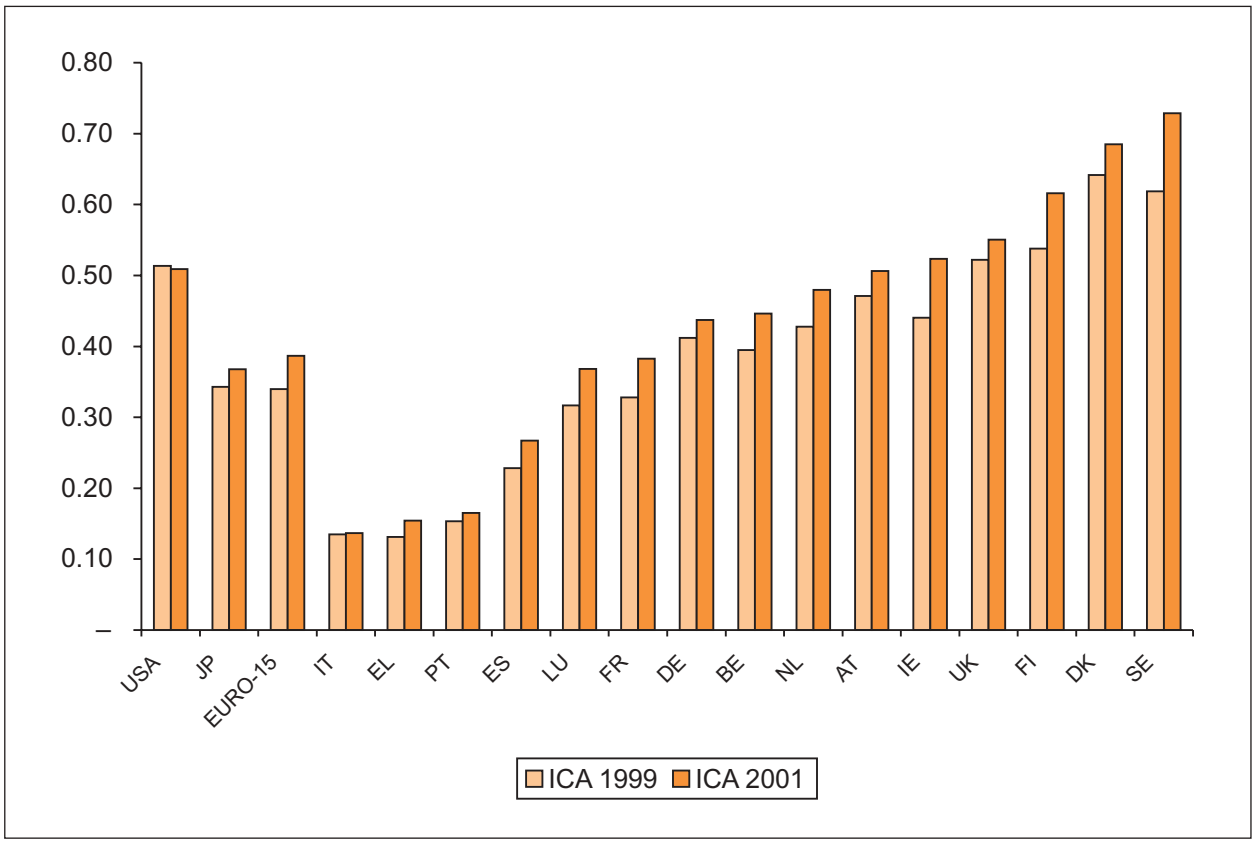

Figure 6 Growth in the value of intellectual capital assets between 1999 and 2001 (ICA=Intellectual Capital Assets)

means that the EU is catching up with the USA, although it is still far behind.

3. Growth in Effects

Figure 7 shows the development in the value of intellectual capital effects. The biggest progress in value has been achieved by Denmark (0.10) mainly because of a substantial growth in relational capital effects: the export of services in Denmark rose from 16% of all exports in 1995 to 27% in 2002, and there was a substantial growth in the number of countries it collaborated with writing scientific publications. Denmark is followed by France (0.08) and Belgium (0.07). Portugal is the only country where the value of intellectual capital effects has decreased, due to a relative decrease in labour productivity, compared with the USA. The growth of Japan is biased because the structural capital effect indicator for Japan only includes life expectancy, whose value has risen by 67%. In addition the value of the relational capital indicator 'royalty and license fees' has grown with 113%. Europe as a whole has increased the value of its intellectual capital effects with 0.06 between 1999 and 2001.

The European Union is better in leveraging IC: This supports the idea that high values of IC assets are no guarantee for high productivity.

As a whole, the EU became better in making its intangibles productive. Moreover, if we calculate the ratio between assets and effects, we see that the EU is better in leveraging intellectual capital. In the USA, one value unit of intellectual capital assets leads to 0.93 units of IC effects, while in Europe one unit of IC assets leads to 1.10 units of IC effects. This supports the idea that high values of IC assets are no guarantee for high intellectual productivity.

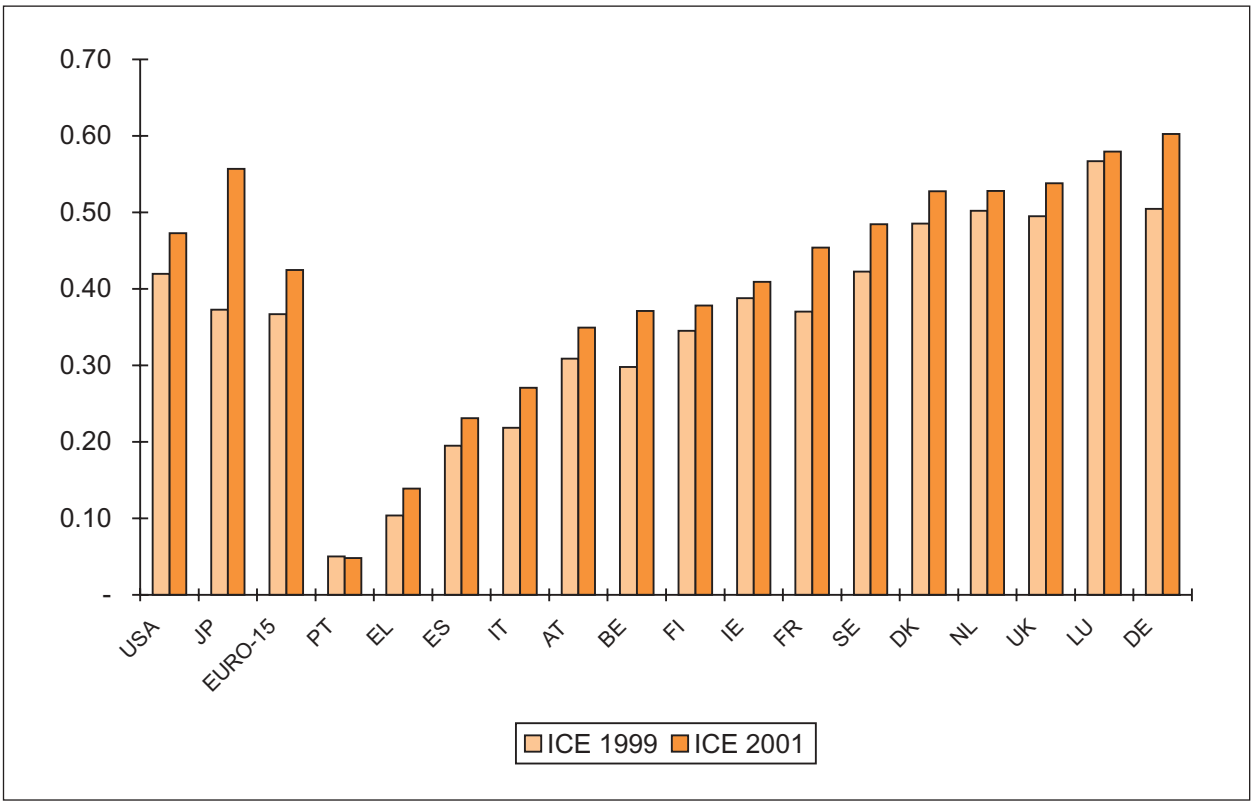

Figure 7 Growth in the value of intellectual capital effects between 1999 and 2001

4. Intellectual capital and GDP

One could think there is a relationship between intellectual capital investments and wealth. However, we only found a significant statistical correlation between GDP per capita and investments in structural capital (0.531), not with investments in human intellectual capital. This means that richer countries do not invest relatively (per capita) more in human capital then poorer countries, although they will invest more in absolute terms (see figure 8).

We also did not find a statistical correlation between GDP and intellectual capital assets (see figure 9). We did find significant correlations between human capital & relational capital effects and GDP per capita. This indicates that the effects we are measuring are not only the result of intellectual capital, but also the effect of financial wealth. This may explain why Germany and Luxembourg score high on effects but much lower on assets.

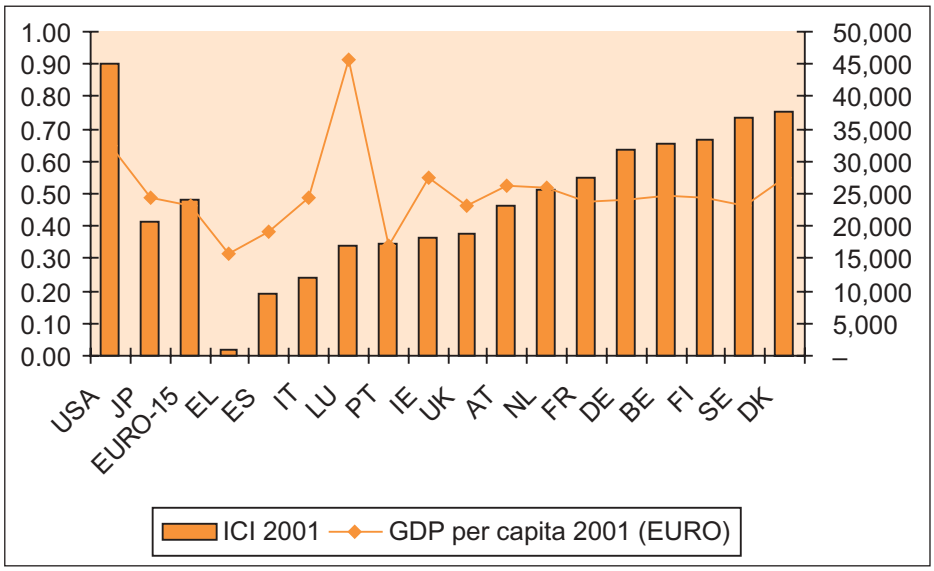

Figure 8: Relationship between wealth and investments in IC (ICI=Intellectual Capital Investments)

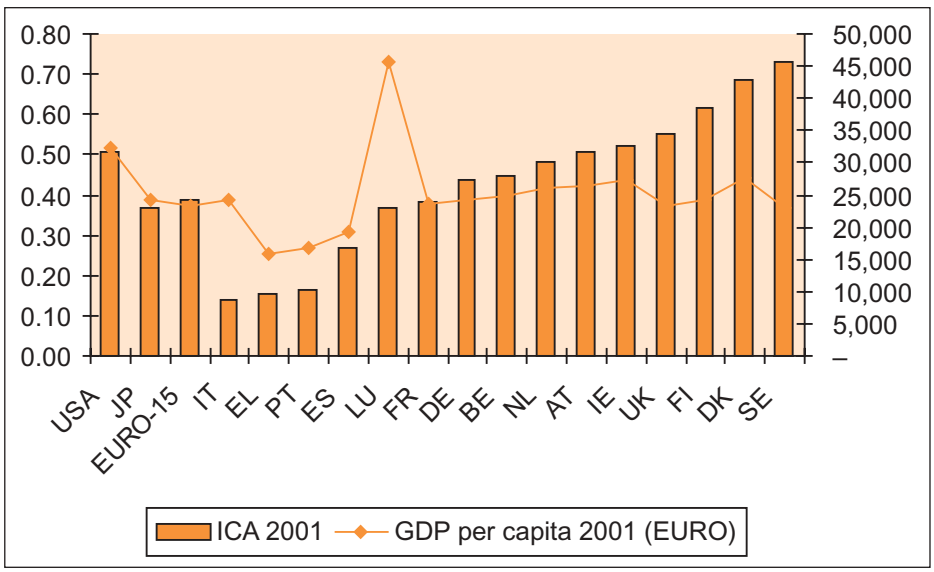

Figure 9: Relationship between Intellectual Capital Assets and Wealth

V References

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VI Appendices

Appendix 1: Overview of indicators

Indicator	Source	Year 1	Year 2	Missing countries
HCA_1: Proportion of total population having completed at least upper secondary education	EUROSTAT, OECD	2000	2002	–
HCA_2: Proportion of active population using a computer for professional purposes that had computer training	European Commission	2001	2002	JP, USA
HCA_3: Proportion of the adult population aged 25 to 64 participating in education and training	EUROSTAT	2001	2003	JP, USA
HCA_4: Researchers per thousand total employment	OECD	1995	2001	LU
HCA_5: Employment rate	EUROSTAT	1995	2003	–
HCA_6: Employment in Knowledge intensive services and High tech & medium-high tech manufacturing	EUROSTAT	2002	2002	JP, USA
HCI_1: Total expenditure on education as % of GDP	OECD	1995	2001	–
HCI_2: Total public expenditure on labor market policy measures as % of GDP	EUROSTAT	1999	2002	JP, USA
HCE_1: GDP per hour worked (as % of US)	OECD	1999	2002	EURO-15 ('99)
HCE_2: Value added of knowledge intensive services, relative to GDP	EUROSTAT	2000	2000	EL, JP, USA
SCA_1: Percentage of households who have Internet access at home	EUROSTAT	2001	2003	JP
SCA_2: Percentage of enterprises who have access to Internet	EUROSTAT	2001	2003	USA
SCA_3: Number of patent applications to the European Patent Office (EPO) per million inhabitants	EUROSTAT	2000	2002	–
SCA_4: Number of patent applications to the United States Patent and Trademark Office (USPTO) per million inhabitants	EUROSTAT	1999	2001	–
SCA_5: Number of scientific publications per million inhabitants	National Science Foundation	1995	1999	–
SCA_6: Enterprise environment indicator from World Economic Forum	World Economic Forum	2004	2004	JP
SCA_7: Entrepreneurial attitude 1	Flash Eurobarometer	2001	2001	JP
SCA_8: Entrepreneurial attitude 2	Flash Eurobarometer	2001	2001	JP
SCA_9: Number of days needed to start a new business	Worldbank	2001	2001	LU, EURO-15
SCA_10: Venture Capital Investment as % of GDP	European commission	2002	2002	LU
SCA_11: Number of EU directives not notified	European commission	2004	2004	JP, USA
SCA_12: General government consolidated gross debt as a percentage of GDP	EUROSTAT, Statistics Sweden	2003	2003	–
SCI_1: Gross domestic expenditure on R&D as % of GDP	EUROSTAT	1999	2001	–

Indicator	Source	Year 1	Year 2	Missing countries
SCI_2: Expenditure for IT hardware, equipment, software and other services as a percentage of GDP	EUROSTAT	2000	2003	–
SCE_1: Percentage of businesses using the Internet for purchasing and selling	EUROSTAT	2001	2001	BE, FR, IE, USA, JP
SCE_2: Birth rate of enterprises	EUROSTAT	1998	2000	AT, DE, EL, EURO-15, FR, IE, USA, JP
SCE_3: The share of persons with an equivalised disposable income below the risk-of-poverty threshold	EUROSTAT	1995	2001	JP, USA
SCE_4: Value added of high tech industry, relative to GDP	EUROSTAT	1998	2000	JP, USA
SCE_5: Life expectancy at birth	OECD	1995	2001	–
RCA_1: Percentage of international meetings hosted	Union of International Associations	2003	2003	LU
RCA_2: SMEs involved in innovation co-operation	EUROSTAT	1996	1996	JP, USA
RCA_3: Foreign students as percentage of all students	OECD	1998	2002	BE, EL, EURO-15, LU, NL, PT
RCA_4: international outgoing telecom traffic	EUROSTAT	1995	1999	LU, JP, USA
RCE_1: Breadth of international scientific collaboration	National Science Foundation	1986	1999	EURO-15, LU
RCE_2: Percentage of patents with foreign co-inventors	OECD	1999	1999	–
RCE_3: Export of royalty and license fees	EUROSTAT	1995	2002	DK
RCE_4: Export of services	EUROSTAT	1995	2002	–
RCE_5: High tech export	EUROSTAT	2001	2001	–

Appendix 2: Methodology

It was our aim to value the intellectual capital of the European Union using the Intellectual Capital Monitor. Value can be defined as “the degree of usefulness or desirability of something. Especially in comparison with other things”(Andriessen, 2004, p. 11). What is useful or desirable is subjective. It depends on the person that is doing the valuation. Value, like beauty, is in the eye of the beholder. Valuation requires the availability of values (Rescher, 1969). A yardstick is needed to determine what is useful or desirable. Often this yardstick has many dimensions. If we judge the desirability of an apple we will be looking at things like taste, colour, scent and tenability. To come to an overall estimation of the value of that apple we need to combine the separate assessments into one valuation. This process is called multidimensional value measurement.

M’Pherson and Pike (2001a), as well as Pike and Roos (2000), have defined the functional requirements for proper multidimensional value measurement. Their method is based on axiology or value theory, which states that value is measurable if the preferences of the beholder are well defined. This is what Pike et al. (2002) call a hierarchy of value. Their method requires that this value hierarchy be made explicit for every stakeholder for whom we want to measure value. This includes a description of the stakeholder’s objectives. The method assumes that all stakeholders will have the same set of objectives, but that they will differ in the relative importance of each objective (Pike and Roos, 2000). For each stakeholder a set of weights has to be developed.

The next requirement is that these objectives be translated into attributes that can be measured. These attributes must be necessary and sufficient with respect to the objective. This implies:

- *Completeness*: they cover the full meaning of the objective as understood by the stakeholder
- *Distinctness*: each attribute must carry one meaning only
- *Independence*: changes in the satisfaction of an attribute must not influence any other attributes
- *Minimality*: the attributes should be minimal sets

Furthermore, each attribute should be observable and measurable.

The next set of requirements deals with the process of combining different measurements into one measure. This includes the problem of different units and scales. To solve this problem the authors normalize all measurements by subtracting the minimal value and dividing it by the total length of the scale. The result is a number between zero and one. Zero denotes the threshold of uselessness; one signifies that the maximum value is completely achieved. In practice, this requirement means that for every indicator, a target value or maximum value needs to be defined. This target value acts as a yardstick to interpret the measure.

The authors also define rules for combining various value streams. Here the authors state that when it comes to combining value, the additive rule (1 + 1 = 2) is an exception. Much more common is the so-called **G-rule**, the goal-oriented rule that indicates that achieving a certain goal requires a trade-off between different values. When we combine indicators into one indicator we need to use the correct combinatory rule. The correct combinatory rule follows from the value hierarchy.

We have tried to apply this approach of multidimensional value measurement to the intellectual capital of 15 European states. The beholder from whose view the valuation takes place is the European Council. The objectives with respect to the EU that we used as the basis for our valuation are the objectives of the Lisbon Agenda. We have translated these objectives into attributes and grouped them into human capital, structural capital and relational capital attributes and into assets, investments and effects. In total we have used 38 indicators.

Then we have tried to create a value hierarchy of the beholder based on the Lisbon Agenda and to identify minimum and target values. We have used these minimum and maximum values to normalize all indicators by subtracting the minimal value and dividing it by the total length of the scale. We have used the value hierarchy to find the appropriate combinatory rules. These were used to develop 9 separate indicators for human capital, structural capital and relational capital and assets, investments and effect, using the 3x3 matrix of the IC Monitor. As a next step the three asset indicators were combined into one intellectual capital assets indicator and the same was done with respect to investment and effects. The result was a set of 12 combined indicators as shown in table 6.

Multidimensional value measurement requires the use of a maximum and minimum for each indicator. The minimum value denotes the threshold of uselessness; the maximum signifies that the maximum value is completely achieved. Maximum and minimum values can be used to normalize each indicator using a value scale between zero and one. Unfortunately the European Council has not been very specific about the targets of the Lisbon Agenda. The only quantitative target that has been decided upon is the requirement to spend 3% of GNP on R&D. However, the overall goal is to become the *most competitive and dynamic knowledge-based economy in the world*. This led us to the assumption that the target or maximum value of each indicator (except R&D) should be the value of the country in the world that performs best with respect to that particular indicator. In practice we narrowed this down to the highest value of USA, Japan or one of the 15 EU countries. Finding the threshold of uselessness was more difficult. We decided that the minimum value for an indicator was equal to the value of the lowest value of the 15 EU countries.

The combinatory rules are based on the value hierarchy of the stakeholder. This hierarchy expresses the preferences of the stakeholder with respect to the relative importance of the various objectives and underlying indicators. However, the European Council did not state what its preferences were. This forced us to create our own hierarchy. For matters of transparency we choose to make every objective and indicator equally important and to apply the additive combinatory rule.

	Human capital	**Structural capital**	**Relational capital**	**Intellectual Capital**
Assets	HCA (Human Capital asset indicator)	SCA	RCA	ICA
Investments	HCI (Human Capital investments indicator)	SCI	RCI	ICI
Effects	HCE (Human Capital effects indicator)	SCE	RCE	ICE

Table 6: Combined intellectual capital indicators

Appendix 3: Abbreviations

AT	Austria
BE	Belgium
DE	Germany
DK	Denmark
EL	Greece
ES	Spain
FI	Finland
FR	France
IE	Ireland
IT	Italy
JP	Japan
LU	Luxembourg
NL	The Netherlands
PT	Portugal
SE	Sweden
UK	United Kingdom
USA	United States