# INNODRIVE

## Intangible Capital and Innovations: Drivers of Growth and Location in the EU

**Ongoing project**

## SUMMARY


### Objectives of the research

The importance of intellectual assets in generating innovation, and thus in promoting economic growth and competitiveness in the EU, is widely recognised. Evidence of this is the significance attached to R&D and innovation in the Lisbon process. Yet, given its tacit nature, our knowledge of the contribution of intangible capital (a significant component of intellectual assets) to economic performance is far from comprehensive. The aim of this research project is to improve our understanding by providing new data on intangible capital and new evidence on the contributions of intangible capital to economic growth.

This study seeks to improve measurement of the capital embodied in intellectual assets (e.g. human capital, R&D, patents, software and organisational structures) and to uncover the growth potential associated with intangible capital accumulation in manufacturing, service industries and the rest of the economy.

In past decades, manufacturing investment, improvements in educational attainment and R&D investment were the key drivers of economic growth. But these factors alone do not explain growth performance today. This project will enable us to quantify the increasing importance of intangible capital as one of the main factors underlying economic growth.

### Scientific approach/ methodology

An essential feature of INNODRIVE is the combination of analysis at the firm and national levels (micro and macro components, respectively).

At the micro level, INNODRIVE will improve insight into the contributions of intangibles to the growth of firms by i) exploiting recently established, linked employer–employee datasets in a selection of old and new member states; and ii) implementing a performance-based methodology to analyse how firms use knowledge and human capital to increase their productivity and how mobile workers react to these processes.

Initial analyses of linked employer–employee data for Finland, Norway, the UK, Germany, the Czech Republic and Slovenia have proved encouraging regarding the scope for cross-country comparable analysis in the micro part of the project. Defining 41

occupational categories (using ISCO occupational codes as a benchmark), we are constructing a coherent set of estimates of organisational, R&D and ICT capital at the firm level.

At the macro level, INNODRIVE will provide new estimates of intangible capital at the national level and an evaluation of the contribution of intangible capital to the growth process in old and new member states (and the US for the purposes of comparison).

In the first year of the INNODRIVE project, work on the macro component has

1. identified detailed criteria for the selection of intangible variables (using Corrado, Hulten and Sichel (2005)[1] as a starting point; see table 1);
2. outlined a general estimation strategy for INNODRIVE;
3. examined available data sources for intangible variables excluded from gross fixed capital formation and defined an estimation method; and
4. provided a first estimate of intangible assets for the EU-27.

**New knowledge and/or European added value**

New data on intangible assets and new estimates of the capacity of intangible capital to foster growth will be generated by the project. All data produced at the national level (from the macro part and aggregated figures from the micro part) will be made publicly available on the project's website at www.innodrive.org. We are collaborating with other knowledge capital projects underway in the ENEPRI network, with continuous data interchange among the projects (in particular between INNODRIVE and the COINVEST project).[2]

Data that will be made publicly available include cross-country comparable estimates of business sector expenditure (investment) on intangibles (for the EU area). Table 1 gives the breakdown of the intangibles we use.

The macro part of INNODRIVE uses the classification of intangibles proposed by Corrado, Hulten and Sichel (2005), who identify three main categories of intangible assets: economic competencies, innovative property and computerised information. Economic competencies include spending on strategic planning, worker training and the redesign or reconfiguration of existing products in existing markets, as well as investment to retain or gain market share and investment in brand names.

[1] See C. Corrado, C. Hulten and D. Sichel (2005), "Measuring Capital and Technology: An Expanded Framework", in C. Corrado, J. Haltiwanger and D. Sichel (eds), *Measuring Capital in the New Economy*, National Bureau of Economic Research, Studies in Income and Wealth, Vol. 65, Chicago: University Chicago Press, pp. 11-45.

*Table 1. Intangible capital in the knowledge economy*

| Intangible capital in INNODRIVE | |
|---|---|
| Macro | Micro |
| *Economic competencies* | |
| 1) Brand equity: | 1) Organisational capital: |
| - Advertising | -Management |
| - Market research | - Marketing |
| 2) Firm-specific resources: | - Skilled administration |
| - Firm-specific human capital (e.g. training) | |
| - Organisational structure (e.g. management) | |
| *Innovative property* | |
| 1) Scientific research & development | 1) Research & development |
| 2) Other research & development: | 2) Innovative environment |
| - R&D in social science and humanities | 3) Macro: Other research |
| - Mineral exploration | & development |
| - New motion picture films and other forms of entertainment | |
| - New architectural and engineering design | |
| - New product development in the financial industry | |
| *Digitalised information - ICT capital* | |
| 1) Software | 1) ICT personnel assets |
| 2) Database | 2) Macro: software, database |

*Source*: Corrado, Hulten and Sichel (2005) for the macro component.[3]

Innovative property refers to innovative activity that builds on a scientific base of knowledge as well as to innovation and new product/process R&D more broadly defined. Computerised information basically refers to computer software.

There are considerable synergies from conducting analysis at both the micro and macro level since these components can inform one another. Results from the firm-level evaluation in the micro component may be aggregated up to the national level to provide data to augment the macro approach. The national-level evaluation in the macro component may be used to supplement the firm-level evaluation, particularly where firm-level information on intellectual assets is not available (e.g. software, databases and other research & development).

## Initial findings

In the micro component of INNODRIVE, we find management to be best paid. On average, remuneration for R&D and ICT work is higher than for organisational work (our proxies for intangible

[2] ENEPRI (the European Network of Economic Policy Research Institutes) brings together 24 leading national economic policy research institutes from most of the EU-27 countries.

[3] Corrado, C., C. Hulten and D. Sichel (2005), "Measuring Capital and Technology: An Expanded Framework", in Measuring Capital in the New Economy, edited by C. Corrado, J. Haltiwanger and D. Sichel, National Bureau of Economic Research Studies in Income and Wealth, Vol.65, pp.11-45, The University of Chicago Press, Chicago and London.

capital). Looking at organisational work in more detail, we find that in most countries annual earnings are highest in management occupations, followed by marketing occupations.

On average, for the European countries considered, production workers account for around 30% of all workers. The manufacturing sector is largest in Germany and the Czech Republic, where the share of production workers exceeds 45% and 40% respectively. Using a broad definition of R&D workers, these account for a sizable share of employment of around 7% in the six countries we analyse. In Germany, the share of R&D workers is less than 5%, which is surprisingly low given the size of the German manufacturing sector. In recent years, in the countries analysed around 3% of employment has been in ICT occupations. The share of ICT workers is highest in Germany (at 8%), where a large proportion of the service sector is concentrated in ICT.

Workers engaged in management, marketing or skilled administration are all classified as organisational workers. Although further analysis is required to ensure comparability across countries, our research to date suggests that in all countries the share of employment in organisational occupations is close to 15%. Relative compensation in management, marketing, IT and R&D jobs is broadly comparable across countries. Management jobs are typically the best paid, followed by ICT or R&D jobs.

The share of management occupations is highest in Finland, the Czech Republic and the UK at around 7%. In contrast, in the UK and the Czech Republic, relatively few jobs are concentrated in marketing. In Germany, the share of managers is much lower, at approximately 3%. Interestingly, the share of marketing occupations is fairly high in Germany. The share of skilled administrative occupations is highest in the Czech Republic, reflecting the large proportion of workers with tertiary education there.

It is highly possible that some of the differences in occupational distributions are driven by differences in occupational classifications across countries. Nevertheless, this information provides us with a good first approximation of intangibles embedded in the worker, which captures one element of intangible capital.

Our measures of intangible capital at the firm level include organisational capital, ICT personnel assets and R&D assets. Organisational capital is valued by estimating the productivity differential between organisational workers and other workers. ICT personnel assets and R&D assets are evaluated using traditional methods that rely on expenditures. If the assets are valued based on expenditures and the same depreciation rate of 20% is applied, the Finnish and Norwegian data suggest that

the value of organisational capital is around 9-10% of sales. The value of ICT assets and R&D assets is around 2-3% and 5-6% of sales, respectively. The shares are considerably lower in the Czech Republic. We believe, however, that the depreciation rate in organisational investment is considerably higher than 20% per year. Preliminary analysis in Finland has been carried out relying on the evaluation of the relative productivity of organisational capital to other work and assuming full depreciation. The share of organisational capital is then on average around 7% of sales, although no precise aggregation to the business sector level has been done yet. Together, the value of these intangible assets then adds to around 15% of sales for Finnish firms. This figure is not dissimilar to the value of intangibles obtained in the macro approach. Note that the firm-level figures exclude software and database expenditures, but include investment in ICT personnel. Also, the firm-level figures exclude the value added of the market research sector and training expenditures.

Progress in the macro component of INNODRIVE has resulted in the construction of initial estimates of gross fixed capital formation in 'new' intangibles as a share of GDP for the EU-27 (excluding Luxembourg) and Norway for the years 1995, 2000 and 2005. New intangibles refer to intangible items not currently included in the national accounts measure of gross fixed capital formation. In the terminology of Corrado, Hulten and Sichel (2005) in Table 1, new intangibles include all the items listed under "economic competencies" and all those listed under "innovative property" with the exception of "mineral exploration" and "new motion picture films and other forms of entertainment".

Preliminary findings suggest that new intangible capital, measured as a share of GDP, has increased since 1995. Between 1995 and 2005, the increase averaged around 1 percentage point across countries. The Nordic countries, except Norway, were characterised by high levels of intangible capital investment. The UK, the Netherlands, Belgium and France also made significant investment in new intangible capital (measured as a share of GDP). Germany was representative of the average, with intangible capital investment of around 4% of GDP.

The development of intangible capital over time was more heterogeneous across countries between 2000 and 2005. For most countries, there was a slowdown in the rate of increase in the share of intangible investment of GDP (Ireland, Romania and the Czech Republic stand out); in some countries, the share of intangible investment in GDP dropped (particularly in Belgium and the Netherlands).

**Key messages for policy-makers, businesses, trade unions and civil society actors**

### Taking intangibles seriously

An improved understanding of the role of intangibles will have important implications for firm-level decision-making and economic growth, which will have knock-on effects on savings, wealth and the income share in the economy. As such, an important objective of this project is to organise an international conference on the topic of policies designed to foster intangible capital accumulation.

Over the decades, the role of intellectual assets might be described as below:

- 1950s and 1960s – a period of massive investment in manufacturing;
- 1970s – the decade of education, during which human capital was a key driver of economic growth;
- 1980s – the second stage of globalisation, characterised by the use of ICT assets, task specialisation and inter-industry trade;
- 1990s – the expansion of higher education; investment in R&D was perceived to be the engine of economic growth; and
- 2000s and 2010s – intangible capital is viewed as the main impetus of economic growth; the significance of a skilled workforce for economic growth lies in its ability to create value added in the form of intangibles.

### Key messages

The key messages emerging from the analysis undertaken in the first year of the INNODRIVE project are the following:

1. Investment in intangibles appears to have weakened between 2000 and 2005, which may not bode well for European competitiveness. Further investigation aims at revealing the causes of this weakness.
2. Intangibles cover a broad range of production inputs, some of which may be better classified as intermediate consumption rather than investment. Thus, one should be careful in drawing conclusions solely based on aggregate expenditure measures of intangibles.
3. The market valuation of firms is strongly correlated with measures of intangible capital. For firms with high market value we find that up to 30% of market value is explained by intangible capital. This confirms earlier findings that R&D investment may have long-lasting effects on productivity and market value. Organisational capital and ICT assets raise firms' growth potential in the shorter term.

4. Intangible capital is particularly important in the service sector, where the relative productivity of organisational capital is highest. Our results indicate that the relationship between expenditure on organisational capital and the utilisation of organisational capital is complex, which poses a challenge for innovation policy.
5. INNODRIVE uses a detailed classification of intangibles to evaluate the importance of intangible capital in generating economic growth. This classification is likely to be particularly helpful in formulating innovation policy.

| | PROJECT IDENTITY |
|---|---|
| **Coordinator** | University of Vaasa (UNIVAASA) |
| **Consortium** | University of Vaasa (UNIVAASA), Finland, coordinator<br><br>Centre for European Policy Studies (CEPS), Belgium<br><br>Deutsches Institut für Wirtschafsforschung (DIW, German Institute for Economic Research), Germany<br><br>Statististisk sentralbyrå (STATNO, Statistics Norway), Norway<br><br>National Institute of Economic and Social Research (NIESR), UK<br><br>Inštitut za ekonomska raziskovanja (IER, Institute for Economic Research), Slovenia<br><br>Elinkeinoelämän tutkimuslaitos (ETLA, Research Institute of the Finnish Economy), Finland<br><br>Národohospodárský Ústav AV ČR (Center for Economic Research and Graduate Education of Charles University), Czech Republic<br><br>Libera Università Internazionale degli Studi Sociali Guido Carli (LUISS), Italy |
| **Duration** | The project started in March 2008 and will end in February 2011. |
| **Funding Scheme** | SSH-2007-1.1.2 Intangible investments and innovation in Europe |
| **Budget** | €1,496,523 |
| **Website** | www.innodrive.org |
| **Further reading** | |
| **Related websites** | |
| **For more information** | hannu.piekkola@uwasa.fi or mikko.lintamo@uwasa.fi |