4.1 Final publishable summary report

INNODRIVE

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

EU 7th framework programme project 2008-2011
www.innodrive.org, for more information
hannu.piekkola@uwasa.fi

Innodrive Consortium		Country
University of Vaasa - (*Coordinator*)	UNIVAASA	Finland
Centre for European Policy Studies	CEPS	Belgium
Deutsches Institut für Wirtschaftsforschung (German Institute for Economic Research)	DIW	Germany
Statististisk sentralbyrå (Statistics Norway)	STATNO	Norway
National Institute for Economic and Social Research	NIESR	United Kingdom
Inštitut za ekonomska raziskovanja (Institute for economic research)	IER	Slovenia
The Research Institute of The Finnish Economy	ETLA	Finland
The Center for Economic Research and Graduate Education of Charles University	EI	Czech Republic
Libera Università Internazionale degli Studi Sociali Guido Carli	LUISS	Italy

Executive Summary

The European political agenda – encapsulated in the Europe 2020 strategy – recognises the importance of investment in knowledge, innovation, education and ICT as drivers of 'smart growth'. The aim of this research project has been to improve our understanding by providing new data on intangibles and new estimates of the capacity of intangible capital to generate growth. We have done this at both the firm and national levels. At the micro level, the goal of the research was to improve our insight into the contributions of intangibles to the growth of firms, by exploiting the potential of recently established linked employer–employee datasets (LEEDs) and by also implementing a performance-based methodology to analyse how firms use knowledge and human capital to increase their productivity. At the national-economy level, we have expanded the traditional growth accounting framework by including, in capital formation, estimates of the investment in intangibles that have hitherto largely been counted as current expenditure in the conventional national accounts.

Our main findings are as follows. GDP in the EU27 area is 5.5% higher after including all intangible investment. In national approach intangible capital investment share of GDP was 6.7% of GDP in EU27 and Norway and only 1.1% is thus recorded in System of National Accounts. Organisational

competence cover nearly half of this being 3.1% of GDP. The latter half of 1990's was a period of increasing intangible share of GDP, while in 2000's the GDP shares have stayed mostly constant.

Own account intangible investment is in firm-level approach estimated in European firms to account between 7% (Finland, Czech Republic) and 11% (the UK, Norway) of business sector new value added. This figure is half of national measures in national approach with broader selection of intangibles but narrower definition of companies' own account intangible (Jona-Lasinio and Iommi 2011 and section 3). Intangible investment is increasingly likely to become more important as greater emphasis is placed on 'smart' growth (Europe 2020). Investment in intangible assets has been shown to be an important factor in performance of European and US companies increasing Tobin's q (e.g. Piekkola 2010, Lev and Radhakrishnan 2005) and intangible capital type work is tied up with total factor productivity of Finnish firms (Ilmakunnas and Piekkola, 2010). Macro level studies have the same outcomes (Corrado, Hulten, Sichel 2006; Marrano, Haskel 2006; Roth and Thum 2010; Belhocine 2009). Ignoring intangibles in national accounts implies an underestimation of GDP by 5.5% in EU27 area and labor productivity growth by 10 to 20 percent.[1]

Firm-level analysis also shows that own account organisational capital can be even higher share of intangible capital when performance-based methodology is applied. This highlights the importance of organisational capital as an important form of intangible capital thus even exceeding in importance R&D investment in many European countries. In fact in nearly all EU27 countries except Finland and Sweden the share of economic competence from new value added exceeded the respective R&D share. Countries are also specialized in different type of intangible capital so that the share of R&D investment is highest in Nordic countries. In six countries with firm-level data of intangibles the share of workers engaged in intangible capital type work was around 18% of all workers and again the type of work differs from one country to another. We have also analysed innovation work and gender wage gaps, see section 5. In innovation work the average gender wage gap is usually larger among innovation workers than among non-innovation workers (Finland and Czech Republic), but with exceptions (Norway).

Intangible capital is concentrated in metropolies although the regional concentration is lower in Germany with 10 top regions covering half of intangibles. Micro and macro analysis shows that intangible capital enhances growth and that organisational capital, in particular, creates important regional spillovers.

Our working paper and proceedings from final conference in Brussels are available in project web site www.innodrive.org. We have also published in our website intangible capital data in 1995-2005 in EU27 countries and Norway. National data cover intangibles reported in national accounts (entertainment, literary and artistic originals, database and software) and eight types of new intangible capital: architectural design, new financial products, own-account and purchased economic competence, firm-specific human capital (training), branding (advertising), market research and scientific research & development. Firm-level data in period in six countries 1995-2008 (years vary by country) cover three types of own account intangible capital: organisational capital, R&D capital and ICT capital.

[1] See www.innodrive.org. Intangible investments included in the official systems of national accounts, software, licences and property rights and mineral exploration represent only a small fraction of all intangible assets accumulated in a firm or a whole economy (Corrado, Hulten, Sichel 2006, 40).

A summary description of project context and objectives

It is widely recognised that knowledge and intellectual capital are major determinants of the generation of innovation and thus the enhancement of growth, employment and competitiveness of the European Union. The importance of R&D and innovation is also explicitly recognised in the 'Lisbon process'. Yet, our knowledge of the contribution of intangibles to economic performance is still incomplete. While firms undoubtedly are at the centre of innovation and productivity growth, their activities are hard to analyse empirically. Furthermore, at the macro level the national accounts data on capital formation focus primarily on fixed investment and have only recently attempted to measure investment in intangibles such as software, mineral exploration and artistic creations. The aim of this research project has been to improve our understanding by providing new data on intangibles and new estimates of the capacity of intangible capital to generate growth. This research has thus explored uncharted territories in EU socio-economic research.

A central theme of the smart growth strategy recognises the need to treat intangibles as investments, creating future value, rather than as intermediate costs. INNODRIVE produces new estimates of intangibles for EU27 countries and Norway following the approach of Corrado, Hulten & Sichel (2006) (hereinafter CHS). Besides computerised information (software and database), this new approach includes the following items, which are often excluded from both the bookkeeping systems of companies and the national system of accounts:

- innovative property – scientific and non-scientific R&D, with scientific R&D leading to a licence or a patent, mineral exploration, copyright and licence costs (spending for artistic originals) – and
- economic/firm competences (spending on reputation (advertising), firm specific training and organisational capital

In the CHS analysis, estimates of the purchased part of intangible investment are based on findings from a number of empirical surveys. For the own account component, they make broad assumptions, since expenditures on labour, intermediates and capital used to create intangible capital at the company level are difficult to determine.

INNODRIVE advances the CHS approach by developing new data on intangibles at the company level, which allow us to analyse different types of intangibles and their role in economic performance and growth. Using both expenditure- and performance-based estimates of intangible capital, company data provide information on the own account part of intangible investment. The expenditure-based approach estimates the combination of labour, intermediates and capital required to produce intangible assets, based on the simplifying assumption that intangible investment is proportional to the salary costs of ICT, R&D and organisational (management and marketing) personnel. The performance-based approach replaces management and marketing salary costs by the estimated productivity of the same type of work. Performance-based estimates are larger in comparison to the expenditure-based estimates, which helps to narrow the well-known gap observed between market values and book values of assets.

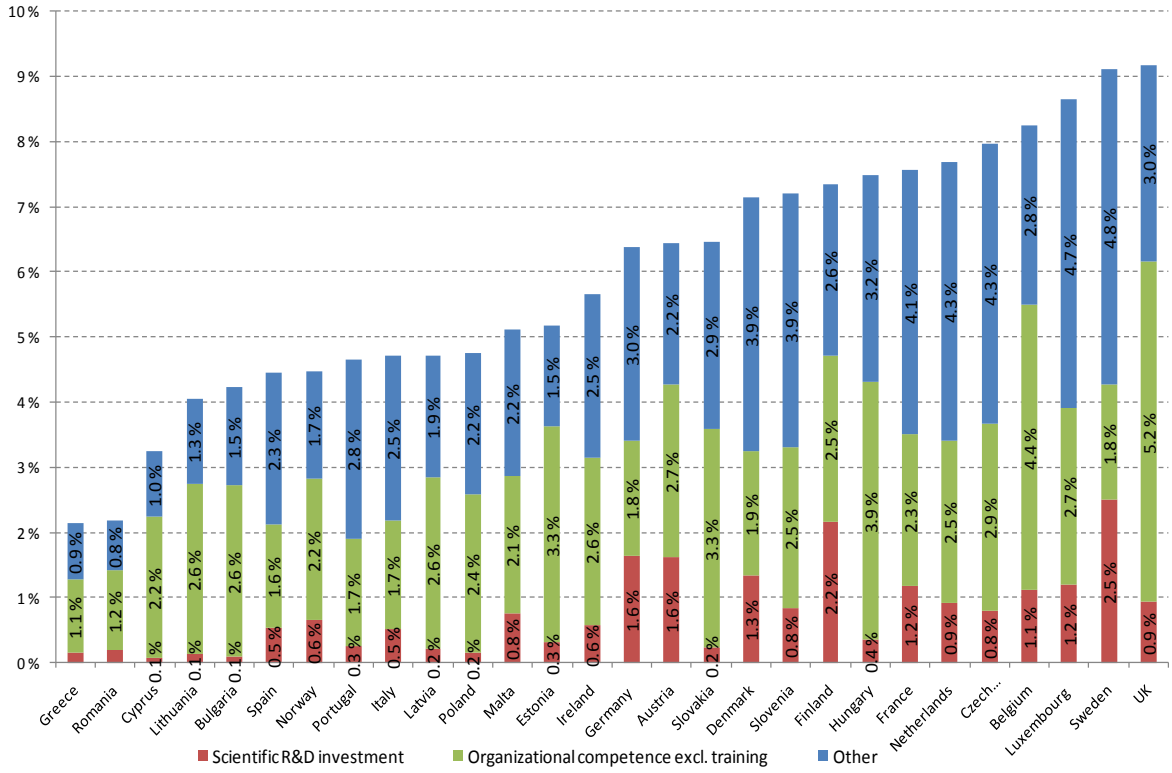
Main findings and foregrounds

Innovation is more than R&D: Other intangibles matter for creating value

Figure 1 presents investment in intangibles (R&D, organisational competence and other factors) as a share of conventional GDP in 2005 based on national accounts in Europe (in Luxembourg new

financial product share is set at five times the EU27 average). This can be seen as one indicator of innovation intensity, measuring the cost of innovation, which is considerably higher than R&D alone.

Figure 1. Intangibles as share of GPD (%) 2005: EU-27 countries (and Norway)



All countries with traditionally high rates of R&D (such as Sweden, Finland and Germany) rank above average in terms of their investment in intangibles (company-level data also suggest that R&D in Norway is underestimated). However, many countries that are not R&D-intensive rank highly using the broader measure of innovation intensity (the UK, Belgium the Czech Republic, the Netherlands and Hungary; organisational capital for Germany is underestimated here). This phenomenon points to a different type of innovation model; one that emphasizes organisational competence. In addition, Sweden, Luxembourg, the Czech Republic and France are intensive in other types of intangibles (which capture training, architectural design, new financial product and databases and software).

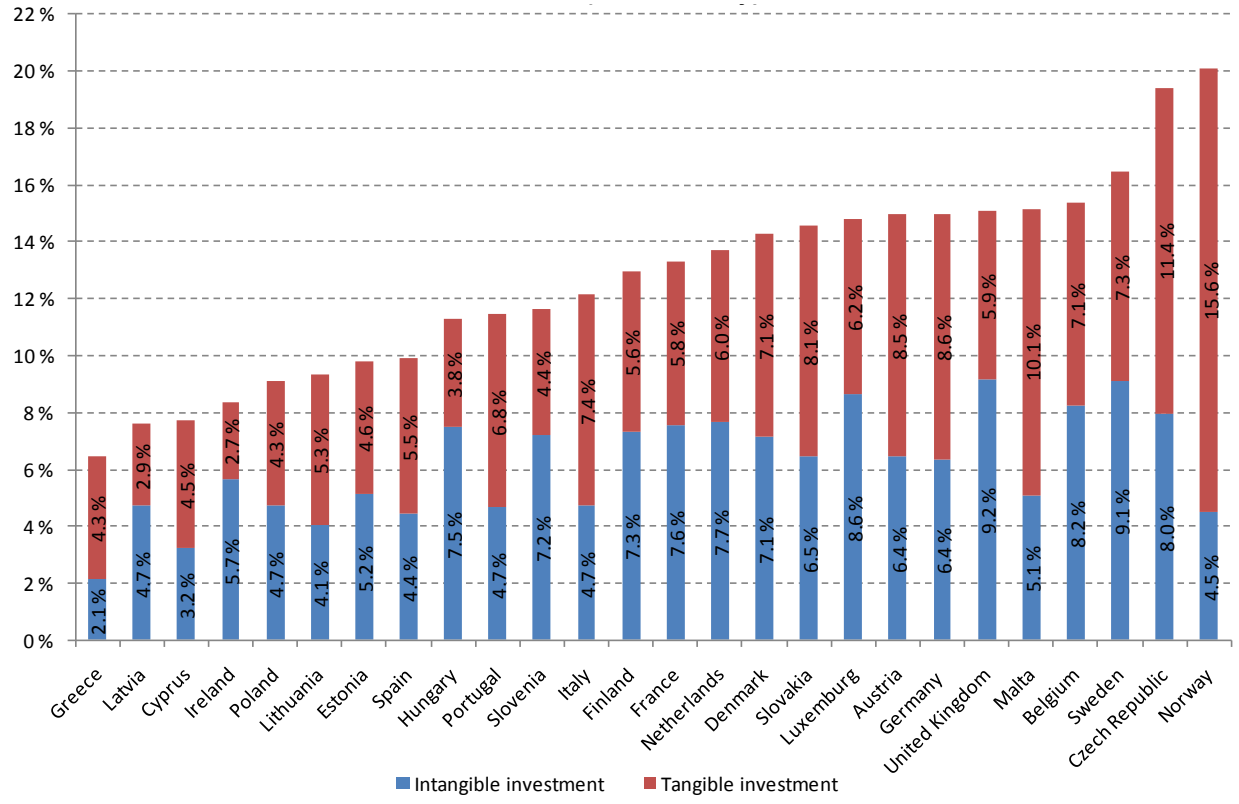
The share of new intangibles in GDP not currently included in the national accounts increased in European countries by around 1 percentage point during the ten-year period from 1995 to 2005. Compared with 1995, expenditure in 2005 on new intangible assets has increased in almost all countries, except Spain (where the share has remained unchanged), Greece, Estonia and Norway. Generally, Nordic countries demonstrated particularly high levels of intangible capital investment, with the UK, the Netherlands, Belgium and France also making significant investments together with Eastern Europe as a whole.

The development of intangible capital over time was 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, but not in Ireland and Malta. Overall, new intangible shares of GDP vary considerably across countries:

- ranging from 2% to 9% of GDP, but with the Eastern European economies being able to catch up with the skill-intensive countries;
- showing steady investment share of value added in 2000-05 in all the old EU member states (EU15) except Austria; and
- with economic competencies accounting for at least half of all intangibles, ranging from 45% to 75% of intangibles assets across all countries, advertising and organisational capital being typically at the core.

Total tangible and intangible investments are fairly evenly distributed throughout Europe. Norway, Czech Republic Sweden, Belgium and Malta rank as the top countries in the half of countries with business investment intensity between 13%-20% of GDP. Other countries have total private investment share of around 10% of GDP.

Figure 2. Tangible and Intangible Investment as share of GDP (%) 2005: EU-27 countries (and Norway)



Countries with relatively low intangible investment have high levels of tangible investment. The figure can be seen as an indication of the degree of transition towards the knowledge economy in 2005.

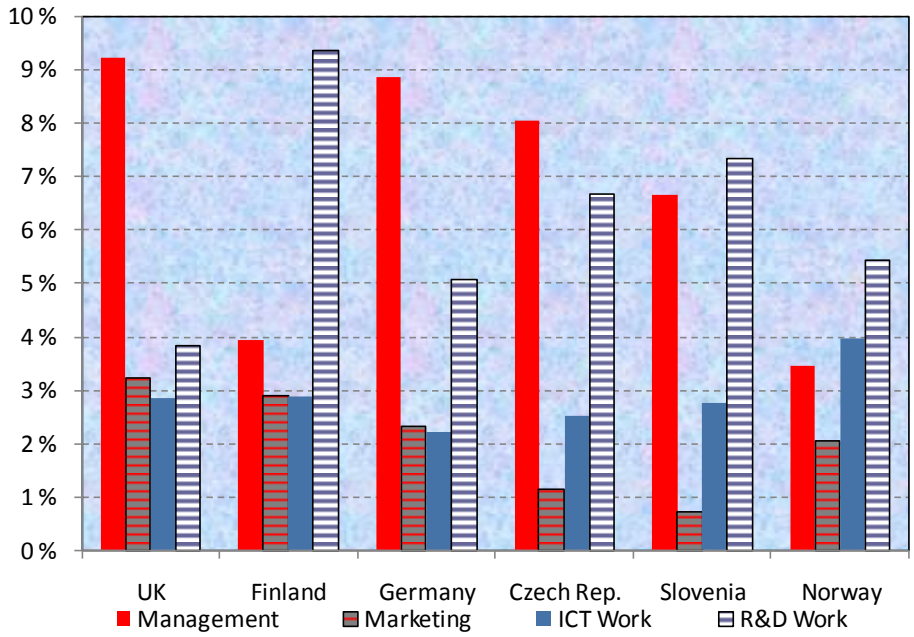
Average impact of capitalizing intangibles on GDP

The capitalization of intangibles implies an average increase of 5.5% of GDP for the EU27 over the period 1995-2005. The average increase for the EU15 GDP is slightly lower (5.4%), while for the new member states (NMS), it is one percentage point less (4.5%).

Structures of intangibles differ across countries

Aggregation of company-level data gives statistics on business sector intangibles that are comparable to data obtained at the country level. In the six countries with micro data, we find substantial variation in the shares of occupations engaged in producing intangible capital.

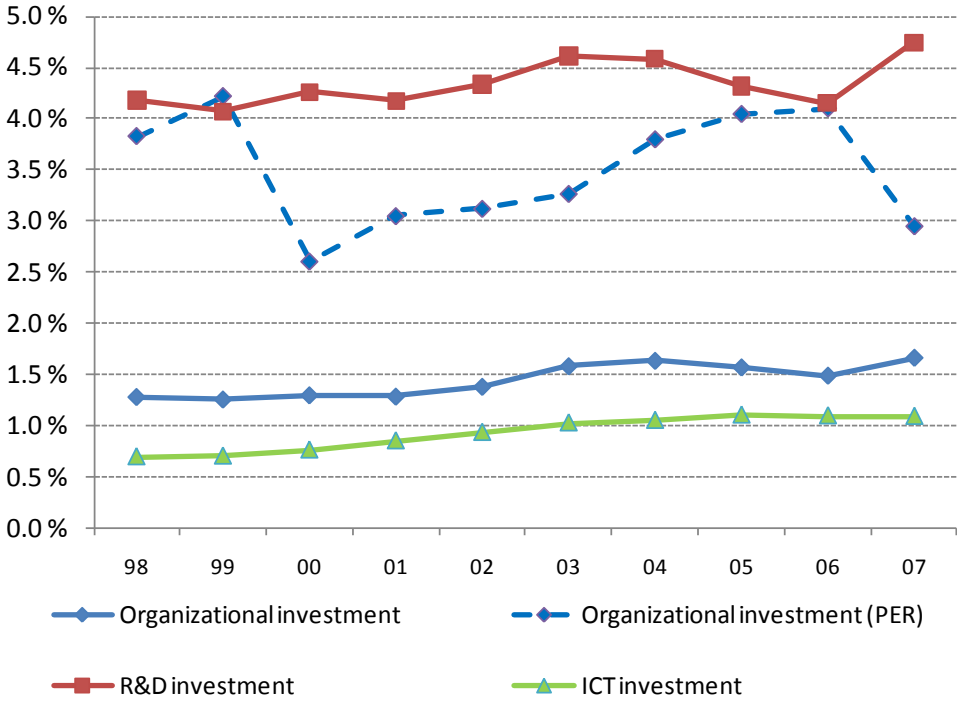
Figure 3. Share of management, marketing, ICT and R&D workers (% of all workers, 2003)



Including all intangible-type workers in the analysis gives more harmonised figures of workers engaged in intangible capital production than counting only the number of managers. The total share of intangible capita-type workers is typically around 18%. The share of organisation workers (the sum of the share of management and marketing workers) varies between 13% in the UK and 5.5% in Norway, while the respective R&D worker shares tend to be higher in countries with lower organisation worker shares (only 4% in the UK compared with 9% in Finland). Organisational workers are the largest group with the UK at the top at around a 12% share. The share of managers is around 9% in the UK, 4% in Finland, 8% in the Czech Republic, 9% in Germany, 3.5% in Norway and 6.5% in Slovenia.

Analysis of intangible capital at the company level shows that that Nordic countries are intensive in R&D capital and fairly poor in organisational capital (managerial and management). Large countries – the UK and Germany – are rather intensive in organisational capital and have relatively less R&D capital. The UK, on the one hand, and the two Nordic countries Finland and Sweden, on the other, can be taken as two extreme opposite examples of either organisational capital-driven or R&D-driven economies (Figure 1). The company-level data for Finland and the UK show the same structural differences in intangible capital. Finland and the UK are two examples of either organisational capital- or R&D-driven economies. Figures 4 and 5 show how the structure of intangible capital has evolved in Finland and the UK, based on firm-level data. New value-added figures are generated in the respective business sectors to include the investment in intangibles.

Figure 4. Development of investment in intangibles as a share of new value added: Finland



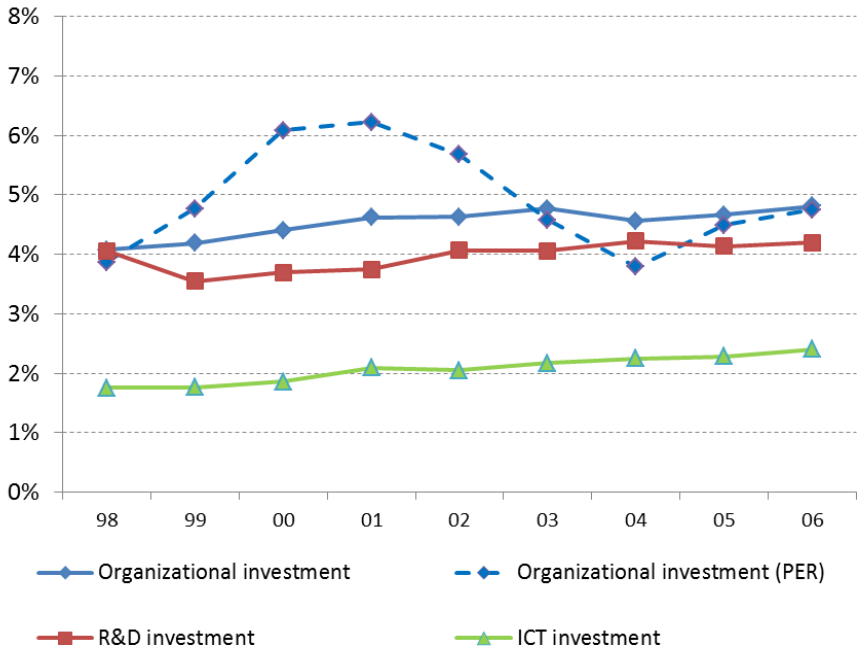
Note: Covers non-farm market sectors.

Sources: Employee data from Confederation of Finnish Industries; Asiakastieto's company information database.

The investment rate for all intangibles (R&D, ICT and organisational capital investment) is around 7% of value added in Finland and around 10% of value added in the UK. The UK also has considerable R&D activity when a more holistic definition of R&D-type work is used, covering engineering and architectural design work (in national estimates 0.9% of GDP in Figure 1). This wider definition accounts for a greater R&D effort in service industries.

The expenditure-based approach gives only part of the picture regarding the value of intangibles when they are owned by the firm and employees are not fully compensated for the value of intangible production. Indeed, the performance-based approach increases the relative importance of organisational investment. This is explained by the widely observed gap between productivity and wage costs of organisational workers. Using the performance-based approach, organisational investment is now more similar to R&D investment in Finland, which is also supported by its impact on the market value of Finnish listed firms.

Figure 5. Development of investment in intangibles as a share of new value added: the UK



Note: Covers non-farm market sectors excluding sectors CA, DF, E, F, J.

Sources: Annual Survey of Hours and Earnings, Labour Force Survey, Annual Business Inquiry.

In the UK, organisational investment exceeds R&D investment regardless of the estimation method used. Organisational investment (the largest component of organisational competence in the national estimates) has decreased over recent years in both countries when the productivity of organisational-type work is used to construct these estimates. This decline may call for new types of innovation policy measures. In national accounting, business sector investment in organisational capital (economic competence excluding training) are also highly important. They are on average 2.6% of GDP; while investment in (scientific) R&D is over three times lower (0.8%).

Accumulation of intangible capital promotes labour productivity and well-being

Growth accounting for a set of countries reveals interesting results. Labour productivity, a measure of living standards, depends strongly on the accumulation of intangible capital. With the inclusion of intangible capital, the 'unexplained' component of productivity growth, the Total Factor Productivity (TFP), becomes less important, while physical capital turns out to be strongly complementary to intangible capital:

- Over the period 1995-2000, the capitalisation of intangibles increased labour productivity in all countries considered, while in 2000-05, it had the opposite effect.
- The relative contribution of capital deepening and TFP to labour productivity growth changed considerably after the inclusion of all intangibles; the rate of capital deepening increased and the growth of TFP decreased. Capital deepening becomes the dominant source of labour productivity growth

In an analysis of regional effects in Germany, Finland and the UK, company-level productivity is also shown to be strongly related to firms' own intangible capital as well as regional intangible capital, suggesting positive localised spillovers. Productivity is highest in firms that also have considerable human capital. There is a need to be clear about the distinction between human capital and intangibles; intangibles enhance the profitability of economic activity while human capital is

owned by the employee and capitalised in wages. Organisational capital, i.e. the competence of management and marketing workers appears to be the most clearly related to productivity growth.

Policy consequences and impact

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Taking intangibles seriously

The significance of a skilled workforce for economic growth lies in its ability to create value added in the form of intangibles. The INNODRIVE project has documented the important role that intangibles play as a new source of growth; it is crucial therefore not only to measure them but also to improve their management and exploitation. This is why policy measures should aim to stimulate a better understanding of intangibles by including them in the GDP measure and encouraging their use by means of appropriate incentives.

Key messages

1. GDP in the EU27 area is 5.5% higher after including all intangible investment.
2. Intangibles are an important source of future growth across European countries. Intangibles explain a substantial part of the market value of the companies that is only partially captured in standard economic analysis.
3. Countries with less tangibles invest more in intangible capital showing an indication about the degree of transition towards knowledge economy.
4. The observed decrease in tangible capital over time is not fully offset by intangible capital investment.
5. Nordic countries are R&D-intensive and have relatively less organisational capital than the UK, Belgium and the Netherlands and in company level analysis in Germany.

6. Organisational capital investment is one of the key drivers of growth, accounting for close to three times more investment than in R&D at national level, but also due to the narrow definition of R&D activity.
7. Intangible capital is agglomerated in metropolitan areas in the private sector: the greater Helsinki area accounts for 48% of all intangibles in Finland; the London City-Region 41% of UK intangibles. In Germany intangible capital is more dispersed, with the top-ten regions accounting for 48.3% of the German total (Munich 7.5%, Stuttgart 7.2%, Frankfurt 6.4%, Düsseldorf 5.6%, Hamburg 5.2%, Berlin 4.7%, Cologne 3.9%, Duisburg/Essen 2.8%, Nürnberg 2.7% and Karlsruhe 2.3%).
8. Foreign direct investment is an important aspect of intangible growth in the EU8. Greenfield FDI brings with it more R&D and the companies are seen to have a higher share of organisational workers in Czech Republic.
9. Future research should focus on refining the range of production inputs, and the extent to which they should be classified as intermediate consumption or intangible investment. For example, one could incorporate the training provided by firms and address the issues of double-counting of R&D and ICT investments (database and software investments), which are often estimated in national accounting systems using employment compensation in relevant occupations.

Intangible capital in broader perspective describes the main innovation activities of private companies and are, almost by definition, the sources of future growth. Management activity engaged in productivity growth in longer term is though hard to judge. However, our performance-based estimates clearly show that the traditional expenditure-level estimates of organisational activity (mainly management and marketing) are lower bounds for the true value of organisational investments. The reason is that the productivity of these types of activities usually exceeds the respective wage expenditures. The combination of labour, intermediates and capital in production of intangible capital increases more value added than what is the cost of expenditures.

An important consequence of this is that intangible capital investment also improves markedly the profitability of the firms given the productivity-wage gap. It should be noted that intangible capital has also positive impact on hourly wage growth, but the improvement in efficiency allows a decrease in overall wage expenditures over the course of year. We have not analysed labour utilisation rates but it may well be that good performance induced by intangible investment also increases overall demand for employment.

Intangible investment is increasing in its share, although the growth in the shares have somewhat diminished in 2000s. An exception is the new member states that are catching up both in GDP levels and in the intangible capital shares of GD the rest of Europe. Overall, the level of intangible investment in Europe appears insufficient when compared with the US that is more prone to use all types of innovation activity more intensively.

We have also shown clearly that intangible investment in general and not only R&D investment drives productivity growth. Organisational and ICT work are close complements but may also work as substitutes in resource allocation for R&D work activity. Policies for promoting R&D activity alone may hence not be appropriate; as such policies may crowd out other intangible investments. EU 2020 program aims at smart, sustainable and inclusive growth with clear object that 3% of the EU's GDP should be invested in R&D. Since Europe has average R&D investment level below other developed countries including the US, this target is well founded, but should be in the future also cover wider set of intangible capital assets. Our findings support the importance of organisational

capital. Firm-level analysis is also able to show some numeric estimates of growth effect of organisational capital. In Finland and Germany the doubling of organisational investment, less than 2% of business value added, increases productivity growth by 0.2% in a three year period. Such growth effects are absent in R&D investment or even negative. Nordic countries and Germany intensive in R&D activity should have their focus on organisational investment. Many non-R&D intensive countries (the UK, Belgium, the Czech Republic, the Netherlands, and Hungary) also have innovation model that emphasizes organisational competence.

An important finding is the clear differences found in the level of R&D investment in national and firm-level calculations. Our project has shown that R&D investments are clear only part of total intangible activity. It is likely that overall intangible capital can be calculated more precisely representing better the innovation potential of any country than the mere any individual type of intangible investment such as R&D capital. It is also true that most of the R&D activity takes place in separate departments in manufacturing, while in services research and development is tight to marketing and organisational activities. Proper measurement of R&D activity has larger scope of activities that may better cover the service sector than what is currently the case. INNODRIVE also applied a broad definition of R&D occupations in firm-level approach leading to higher share of R&D workers in the UK in particular.

Our results emphasize intangible investment as tacit knowledge that is less bound to regional borders. We can say that regional policies can be targeted for subsidizing innovative activity also outside metropolitan area. Regional policies should also be targeted for providing *sufficient* level of educational skills as intangible and human capital are clear complements at firm-level. Most of the intangible capital spillovers also accrue for organisational capital, indeed all in the UK and Finland. Business is in their location decisions also interested in profitability rather than in productivity, where the tacit knowledge within the firm plays the most significant role.

Countries with less tangibles invest more in intangible capital showing an indication about the degree of transition towards knowledge economy. The PIGS countries have recently suffered from financing sovereign debt burden. The investment policy has relied more on tangible than on intangible investment, and therefore countries have suffered relatively more from the transition of production outside Europe especially in Asia. Intangible capital investment in the future is likely to give more solid growth. Intangible GDP shares were in 2005 4.5% in Italy, 4.1% in Spain and Portugal and 2.0% in Greece, all below the average EU27 and Norway share of 6.7%. At the same time, the diversity of intangible capital should be emphasized so that policies should not promote R&D investment alone. Our research has also not covered public intangible investment that should also have far reaching implications.

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