Chapter 6

Measuring Innovation: Intangible Capital Investment in the EU

Felix Roth

Abstract This contribution is drawn from the discussions of a forum that examined the strategies adopted by the European Commission and the member states for the intensification of innovative activities. It analyses business investment in intangible capital using a new internationally comparable dataset in the EU27 created within the FP7 project INNODRIVE. First, it finds that the EU's innovation agenda would be well advised to switch its benchmark criteria from a sole focus on R&D to a focus on overall investment in intangible capital, in particular, on investments in economic competencies. Second, it finds that today's national accounting framework seems to be ill-suited for identifying the ongoing transition of European economies towards knowledge economies. Without identifying the full range of intangibles as an investment in Gross Fixed Capital Formation, the overall levels of capital investment of European economies are too low.

Keywords Innovation · Intangible capital · R&D · EU · Manufacturing sector · Service sector

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The European Commission's 2020 strategy has put forward five EU targets for the year 2020: focusing on 1) employment, 2) research and innovation, 3) climate change and energy, 4) education, and 5) poverty reduction. The following contribution focuses on the target of research and innovation and is structured as follows. First, the EU-2020 target on Research and Development is briefly discussed and the most recent criticism of the sole measure of R&D to capture innovativeness is highlighted. Second, R&D investment in the EU-25¹ is compared to the wider investments in intangible capital using a new internationally comparable dataset on intangibles for the EU-27 created within the FP7 project INNODRIVE. Third, the comparison of investments in tangible and intangible capital in 11 selected European countries is discussed. This contribution concludes by putting forward policy conclusions.

1 Innovation and EU 2020: Is R&D the Sole Factor for Measuring Innovativeness?

In measuring innovation, most contemporary research identifies investments in Research and Development (R&D) as a percentage of GDP as one of the classical benchmarks. In this sense, many empirical papers on the relationship between innovation and productivity growth focus on a set of R&D indicators.² This focus on R&D is prominently emphasized in the European 2020 strategy³ for smart, sustainable, and inclusive growth, which proposes as one of its headline targets to foster innovation via a 3% benchmark for investment by the individual member states in R&D as a share of GDP. This target of investing 3% of GDP in R&D had already been formulated in the Lisbon strategy in 2000 and seems to be the only

¹The cases of Bulgaria and Romania were not analyzed, as the data from the INNODRIVE project does not include values for Gross Value Added at current basic prices.

²A. Bassanini, S. Scarpetta: Does human capital matter for growth in OECD countries? A pooled mean-group approach, in: *Economic Letters*, Vol. 74, No. 3, 2002, pp. 399–405; M. Khan, K. Luintel: Sources of Knowledge and Productivity: How Robust is the Relationship?, OECD Science, Technology and Industry Working Paper No. 2006/6; F.R. Lichtenberg: R&D Investment and International Productivity Differences, 1993, In H. Siebert (Ed.), *Economic growth in the world economy*, J. C. B. Mohr, pp. 89–110.; D. Coe, E. Helpman: *International R&D Spillovers*, *European Economic Review*, 39, 859–887, 1995; W.G. Park: *International R&D Spillovers and OECD Economic Growth*, in: *Economic Inquiry*, Vol. 33, No. 4, 1995, pp. 571–591; D. Guellec, B. van Pottelsberghe: R&D and productivity growth: panel data analysis of 16 OECD countries, in: *OECD Economic Studies* No. 33, 2001/II; D. Coe, E. Helpman, A.W. Hoffmaister: *International R&D Spillovers and Institutions*, NBER Working Paper 14,069, 2008.

³European Commission: *Europe 2020 – A European strategy for smart, sustainable and inclusive growth*, 2010.

benchmark criterion to have been carried over from the original Lisbon strategy.⁴ However, initial criticism of exclusively applying the 3% benchmark can already be heard.⁵ This criticism is strongly based on the fact that R&D investment does not seem to be a valid indicator of a country's innovativeness. It is rightly claimed that R&D measures are of the utmost concern for those countries with a strong manufacturing sector, e.g. Germany, but can more easily be neglected in those countries with a strong services sector, e.g. the UK.⁶ This is one of the reasons why the most recent research financed within the FP7 research program of the European Commission has developed an internationally comparable dataset to measure innovation by including a wider range of innovational dimensions, identifying these dimensions as knowledge or intangible capital.⁷ Early research results suggest that an innovation indicator focusing solely on R&D might not take all dimensions of innovation into proper consideration and thus might overlook important information on how to strengthen Europe's competitiveness.⁸

This view of treating innovation as general knowledge capital has been prominently developed by Corrado, Hulten, and Sichel,⁹ who have grouped the various items that constitute a firm's knowledge into three basic categories: 1) computerized information, 2) innovative property, and 3) economic competencies. Their approach is currently under consideration by national statistical agencies¹⁰ and think tanks such as the OECD¹¹ and several research projects financed under the European Commission's 7th Framework Program, as indicated above.¹²

⁴It should be noted that the Europe 2020 strategy does indicate that it is necessary to develop an indicator that would reflect "R&D and innovation intensity" (p. 9); thus the European Commission seems to be aware of the weakness of putting forward spending on R&D as the sole indicator to measure innovativeness.

⁵S. Tilford, P. Whyte, *The Lisbon Scorecard X The road to 2020*, Centre for European Reform, London 2010.

⁶S. Tilford, P. Whyte, *ibid.*, p. 23; OECD: *The OECD Innovation strategy – Getting a head start on tomorrow*, OECD, Paris 2010.

⁷C. Jona-Lasinio, M. Iommi, F. Roth: Report on data gathering and estimations for the INNODRIVE project – Macro approach (Deliverable No. 15, WP9), 2009; F. Roth, A.E. Thum: Does intangible capital affect economic growth?, CEPS Working Document 335, 2010, <http://www.ceps.eu/book/does-intangible-capital-affect-economic-growth>.

⁸F. Roth, A.E. Thum: Does intangible capital affect economic growth?, *op. cit.*

⁹C. Corrado, C. Hulten, D. Sichel: *Measuring Capital and Technology: An expanded framework*, in C. Corrado, J. Haltiwanger, D. Sichel (eds.): *Measuring Capital in the New Economy*, National Bureau of Economic Research, Studies in Income and Wealth, Vol. 65, Chicago 2005, University Chicago Press, pp. 11–45; C. Corrado, C. Hulten, D. Sichel: *Intangible Capital and Economic Growth*, *Review of Income and Wealth*, 55, 661–685, 2009.

¹⁰J. Kestenbaum: New approaches to measuring innovation, in: S. Tilford, P. Whyte, *op. cit.*, p. 26.

¹¹OECD, *op. cit.*

¹²Two projects measuring a wider set of innovation indicators have been financed under the 7th Framework Program of the European Commission: COINVEST and INNODRIVE. Whereas the COINVEST project has focused on a more detailed measurement for six European countries, the INNODRIVE project has developed an intangible capital dataset for the EU-27.

In particular economic competencies—which include the three dimensions of brand names, workforce training (or firm-specific human capital), and organizational design (or organizational capital) of a firm—seem to be essential prerequisites for innovative processes in the manufacturing and service sectors. In the manufacturing sector, these investments should be regarded as crucial complementary investments alongside classical R&D investment. In the services sector, investments in economic competencies seem to play a key role in enhancing labor productivity.¹³

2 How Does R&D Investment by Businesses Compare to Investment in Intangibles in the EU?

Using newly developed internationally comparable data on intangible capital, Fig. 6.1 shows the overall investment in intangible capital by businesses¹⁴ when including scientific R&D and the three dimensions of economic competencies:

Fig. 6.1 Investment in intangible capital by businesses in the EU25 compared to R&D

Source: INNODRIVE Project (F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit).

¹³Currently the two FP7 projects INDICSER and SERVICEGAP try to identify, among other things, the role of intangible capital on labor productivity within the service sector.

¹⁴As the Europe 2020 strategy identifies in particular business investment in R&D as significantly lower compared to levels in the US and Japan, it seems crucial to focus on businesses' investments of intangible capital. Concrete reasons why the included intangible indicators should be classified as investment in Gross Fixed Capital Formation are given in C. Jona-Lasinio, M. Iommi, F. Roth, op. cit. and F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit.

1) brand names (advertising and market research investment), 2) firm-specific human capital, and 3) organizational capital investment.¹⁵

Interestingly, closer analysis of intangible capital investment indicates that the 3% benchmark for total R&D spending is quite low in comparison to intangible capital investments of up to 9% by businesses in Sweden. In addition, the innovation ranking has changed significantly. When focusing solely on business R&D spending, Sweden is followed by Finland, Germany, and France (see R&D share in Fig. 6.1). Furthermore, the UK is positioned at the lower end of the distribution. However, when focusing on a wider range of innovation indicators, Sweden is followed by Belgium and the United Kingdom, both of which have investment rates of approximately 8%. These two countries are then followed by the Netherlands and France. Germany and Austria are positioned in the middle of the distribution, while the two Mediterranean countries Greece and Spain are positioned at the bottom of the distribution. With an investment rate of more than 4%, Italy performs similarly compared to the analysis with a focus solely on R&D. It is the poorest performer among the four big European economies. This finding in combination with Italy's poor achievement when it comes to human capital indicates that the country seems to be ill-equipped for future economic competition.¹⁶ It also underlines once more the deep structural imbalances existing within the Eurozone, with Mediterranean countries lagging behind in terms of innovativeness. Figure 6.2 once more clarifies the significant differences between R&D investments and investment in economic competencies within an EU-15 country sample.

Investment in R&D seems to be positively (although weakly) related to investments in economic competencies. In Sweden and Finland, high investment in R&D

¹⁵ As opposed to the original CHS framework, the author has not included software and entertainment, mineral exploration and literary or artistic originals, as those indicators have already been included in the asset boundary of national accounts (see here F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit.). Furthermore, the following intangible index will not include the indicator "development in the financial service industry," as the inclusion of this indicator creates a clear outlier in the EU-15 in the case of Luxembourg, distracting from the overall importance of the findings for policymaking. Furthermore, taking the financial crisis into consideration, the author feels that the indicator should be handled quite cautiously when measuring intangible capital in future approaches. Focusing on economic competencies in addition to R&D already highlights the inadequacy of an innovation indicator focusing solely on R&D. However, the indicator "development in the financial service industry" will be included in intangible capital measure later in this paper. In 2005, it represented around one-tenth of intangible capital in the EU-25 on average.

¹⁶ D. Gros, F. Roth, The Post-2010 Lisbon Process—The Key Role of Education in Employment and Competitiveness, in: Bundesministerium für Wirtschaft und Arbeit: Die Zukunft der Wirtschaftspolitik der EU—Beiträge zum Diskussionsprozess "Lissabon Post 2010," Vienna 2008, Bundesministerium für Wirtschaft und Arbeit, pp. 179–195; F. Roth, A.E. Thum: The Key Role of Education in the Europe 2020 strategy, CEPS Working Document 338, Centre for European Policy Studies. 2010.

Fig. 6.2 Relationship between investment in R&D and economic competencies

Source: INNODRIVE Project (F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit).

by businesses is associated with moderate investment in the economic competencies of their firms. The same is true for the three economies Denmark, Austria and Germany, as well as for Luxembourg, Ireland, Portugal, and Italy, in which the investments in business R&D are also closely matched to their investments in economic competencies. However, the scatterplot also identifies four interesting cases in which R&D investment seems to be not so closely linked to investment in economic competencies. These countries are the Netherlands, Belgium, the United Kingdom, and Greece. Whereas Greek investment in economic competencies seems to be relatively small compared to its investment in R&D, investments by the Netherlands, the UK, and Belgium are particularly higher than their R&D investment. This finding implies that especially for the UK, the Netherlands, and Belgium, an innovation indicator focusing solely on R&D investment poorly measures these countries' competitiveness if focusing on their innovative potential. In the UK this is due to the fact that its economic structure is more heavily dependent on the services sector as opposed to the manufacturing sector, which tends to be more important in other European member states.

3 Comparison between Tangible and Intangible Capital Investment in the EU

Efforts have been made to stop the steady decline of investment in traditional tangible capital in most advanced economies. However, the efforts to increase investment in tangible capital do not seem to have taken into account the fact that the most advanced economies have simply undergone a structural transformation towards becoming knowledge societies. But since the traditional national accounting framework has not taken these processes into consideration, the accounts were (and still are) not able to identify the actual investments made by businesses in recent decades. Figure 6.3 compares the levels of investment in traditional tangible capital with the new investments made in ICT and intangible capital for an EU11 country sample¹⁷ for the time period 1995–2005. Whereas traditional tangible capital investments have remained at a 16% level, the investments in ICT and intangible capital

Fig. 6.3 Comparison of business investment in traditional tangible capital and new ICT and intangible capital in an EU11 country sample

Sources: INNODRIVE Project (F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit) and EUKLEMS database (EUKLEMS: EU KLEMS Growth and Productivity Accounts, March 2008 Release, <http://www.euklems.net/>).

¹⁷ The following 11 countries in the EUKLEMS dataset (EUKLEMS: EUKLEMS Growth and Productivity Accounts, March 2008 Release, <http://www.euklems.net/>) are included in the aggregated EU-11 trend: Austria, Czech Republic, Germany, Denmark, Finland, Italy, the Netherlands, Portugal, Slovenia, Sweden, and the United Kingdom. ICT includes computing equipment and communications equipment. New intangibles include scientific R&D, economic competencies, software and—as Luxembourg is not included in the country sample—“new development in the financial service industry.” The share of investment in “new development in the financial service industry” in 2005 was, as stated above, on average one-tenth of total investment in intangible capital in the EU25 countries.

have risen continuously and in 2005 reached a higher investment ratio than traditional tangible capital investment. Furthermore, if one accounts for both investments, the overall capital investments in the 11 EU member states were as high as approximately 32% in 2005 and have steadily risen (due to ICT investment) from 1995 to 2001 and beyond. Due to the burst of the dot-com bubble, the investment rate in 2005 remained at the same level as in 2001.

Figure 6.3 shows aggregated trends of 11 European countries. But to what extent do the trends differ in the individual EU member states? Figure 6.4 shows the three trends for the United Kingdom. Most interestingly, new investments in ICT and intangibles were already higher than investments in traditional capital investment in 1996, and were equal in 1997 for the last time. From 1997 onward, there has been a steady increase in investment in ICT and intangibles coupled with a steady decrease in traditional tangible capital. Whereas business investment in traditional capital, e.g., machinery, equipment, buildings, etc., reached a level as low as 10% in 2004, investments in new ICT and intangibles doubled that amount. Focusing on the total capital investment shows a steady increase in capital investment in the UK (with a minimal decline from 2002 to 2003 due to the burst of the dot-com bubble), reaching a level of approximately 32% in 2005.

We now turn to Europe's largest economy. Figure 6.5 shows the comparison of business investments in traditional capital investment and new ICT and intangible capital investment in Germany. As in the UK, investments in ICT and intangible capital are diametrically related to each other. Whereas investment in traditional capital has decreased slowly but steadily, investments in ICT and intangibles have gradually grown. In 2001, investments in ICT and intangible capital were already higher than in traditional capital. Furthermore, Germany's overall capital investment

Fig. 6.4 Comparison of business investment in traditional tangible capital and new ICT and intangible capital in the UK

Source: INNODRIVE Project (F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit) and EUKLEMS database (EUKLEMS: EU KLEMS Growth and Productivity Accounts, March 2008 Release, <http://www.euklems.net/>).

Fig. 6.5 Comparison of business investment in traditional tangible capital and new ICT and intangible capital in Germany

Sources: INNODRIVE Project (F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit) and EUKLEMS database (EUKLEMS: EU KLEMS Growth and Productivity Accounts, March 2008 Release, <http://www.euklems.net/>).

in 2005 was near the 26% benchmark and increased steadily over the time period 1995–1999 and again from 2002 to 2005 after the bursting of the dot-com bubble.

4 Conclusion

This contribution has analyzed business investment using a new internationally comparable dataset comparing the rate of business investment in intangible capital in the EU27. Two main policy conclusions can be drawn.

First, the European 2020 agenda should switch its benchmark criteria from a sole focus on R&D to a focus on overall investment in intangible capital, in particular, on investments in economic competencies. The R&D indicator seems to be particularly inappropriate for European economies with stronger services sectors, e.g. the United Kingdom, and to overestimate the innovation potential for those countries that rely heavily on manufacturing, e.g. Germany. Thus, including a wider range of intangible capital variables in measuring innovative potential would give a more accurate picture to European policymakers.

Second, today's national accounting framework seems to be ill-suited to correctly identify the ongoing transition of European economies to becoming knowledge economies. Failing to identify intangibles as an investment in Gross Fixed Capital Formation has the effect of strongly mismeasuring the levels of capital investment by European economies. Any policy conclusion based purely on an analysis of “brick

and mortar” investment without accounting for intangible capital variables seems to be highly problematic. The frequently heard lament of falling capital investment levels in the European Union seems to be unsubstantiated once ICT and intangible investments are taken into account. The apparent decline in traditional fixed capital formation is in fact in most European economies more than fully compensated for by an increase of ICT and intangible capital formation. European policymakers should therefore find new ways of promoting investment in intangible capital and stop subsidizing traditional forms of tangible capital, e.g., via the European structural funds.

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