9th IRIMA WORKSHOP
INDUSTRIAL RESEARCH AND INNOVATION MONITORING AND ANALYSIS

'Intangible investments for competitiveness: micro-macro evidences'

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SUMMARY REPORT

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Objective of the workshop

This workshop was part of the Industrial Research and Innovation Monitoring and Analysis II (IRIMA II) project,[3] under Work Package 4 which aims at validating and disseminating the project activities. The workshop discussed the state of the art of research in intangible assets for policy making from two possible approaches: the industrial and the territorial perspective. The key issues tackled by the academics and, policymakers focussed on the following questions:

1. What is the **general relevance of intangible assets in the economy** and their relation to tangibles?
2. What are the main national and financial **accounting challenges for intangible assets**?
3. Which **differences across sectors and countries** can be observed?
4. How does the anticipated shift to the **intangible-based economy challenge policymaking**?
5. What is the role of policy to support the **upgrade of EU industry towards the intangible-based economy**?

Marnix Surgeon (DG RTD A.4) opened the day outlining activities of their unit and the role of the present workshop. He underlined the shift from a policy focused on R&D towards incorporating the wider context in all aspects of innovation. Within this, other intangibles are increasingly driving competitive advantage, such as new types of service-related innovation have emerged. At the company level, the traditional R&D tasks are more closely interacting

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2 The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission

3 See: http://iri.jrc.ec.europa.eu/home / The activity is undertaken jointly by the Directorate General for Research and Innovation (DG RTD.A; see: http://ec.europa.eu/research/index.cfm?lg=en) and the DG Joint Research Centre, Directorate B Growth & Innovation (DG JRC-B; see: https://ec.europa.eu/jrc/en/science-area/innovation-and-growth).

with other intangible tasks, providing new challenges to policy-making. Alexander Tübke (JRC B.3) briefly presented the role of the Joint Research Centre (JRC) in collecting evidence for policy support. In this framework, the IRIMA project is a joint effort together with DG-RTD. While the main result of the IRIMA project are the EU Industrial R&D Investment Scoreboards, the project provides additional sound contributions on industrial dynamics from a company perspective, e.g. analysing the role of intangibles within the Scoreboard firms.

Key Note Speech: Intangible Investment and the Economy

The day was kicked-off with a keynote speech by Jonathan Haskel (Imperial College, UK) on intangible investment and the economy. He underlined that much of the research in intangibles is the **outcome of data collection** in projects that benefitted from national and international public funding, which are the basis to construct a wider picture.[4] Then he showed how capitalism is currently under **increased social scrutiny** in many aspects. For example, a perceived rise in income divergence and social inequality, decreasing regional cohesion and concentration of the benefits of economic activity. For this it is important to understand how **productivity has been concentrating** over the past decades in companies, cities and regions, and the **productivity gaps towards the less productive ones widened**. This also has implications in the labour market as highly productive workers are better paid and also found in highly productive companies, while the gap to the less productive ones is growing.

A longer-term review of investment data over the past 80 years has revealed that **intangible investment has constantly increased, while tangible investment somewhat stagnated and then fell in the past 15 years**. Since the financial crisis, **intangible investment growth, and especially that for non-R&D intangible investment, suffered more than tangible investment growth, and both growth rates are now very similar**. Nowadays, for every €1 of tangible investment there is around €1.10 of intangible. Important **variations among countries remain**, e.g. Spain having less than half the share of intangible investment of GDP compared to Sweden. Jonathan then presented different analyses showing that the **country variations can be explained by**:

- ⇨ **Market strictness**: higher strictness is more closely linked to economies with high tangible investment (e.g. Germany or Italy), whereas low strictness is more correlated to economies with high intangible investment (e.g. UK or US).
- ⇨ **Service trade restrictedness**: lower service trade restrictedness favours the share of intangible investment (e.g. UK or Sweden).
- ⇨ **Government R&D**: higher shares of government R&D lead to crowding-in effects of intangible investment.

Despite their role for the economy, intangibles are **very difficult to account for both in corporate and national accounts**. This not only leads to underestimation of intangible investment at the corporate level but, at the national level, GDP is undercounted and it becomes more difficult to detect business cycles. These measurement challenges are directly

[4] EU-funded projects included e.g. EU-KLEMS, innodrive, coinvest, or Spintan.

related to the **properties of intangibles**. They are **sunk** (=investment cannot be recovered), **scalable** (=fixed investment in software can be scaled), and a source of **spill overs** (=knowledge investment can be used by others) and **synergies** (=investment synergies with other intangible capital and human capital). The properties of intangible investment provide an explanation for their economic effects. As sunk costs, they are more prone to **financing difficulties**. Spill overs of intangible investment produce **less investment by other firms**, scalability makes **intangible-intensive companies getting relatively larger**, so the frontier gap gets bigger, and the **investment synergies produce potentially large wage gains for intangible capital owners**.

Regarding the productivity gap between the most and the least productive companies (=the frontier gap), with **tangible-intensive industries the frontier gap remains constant** as the leaders provide constant returns and productivity does not increase with expansion. With **intangible industries the frontier gap widens** as the leaders receive increasing returns via scalable assets and productivity increases with expansion.

The unusual economic characteristics of intangible investment make an **intangible-based economy fundamentally different from a tangible-based one**. Intangible investment has proven an **underappreciated cause of different phenomena:** from economic and social inequality to stagnating productivity.

Regarding policy implications, **knowledge and skills, leadership and management capabilities are the only key** for reaping the benefits of intangibles. For policy-makers, there is a **wide range of policy instruments** correlated with intangible investment. Beyond education fostering the knowledge and skill base, these include e.g. strictness of employment and service trade **legislations**, the **Intellectual Property** (IP) regime, **cities' policies** for attracting talent and collaboration, **intangible asset valuation** and **banking policies for financing intangibles**. **Regulation can have a double-sided** impact as both gains from integration via de-regulation and losses from over-regulation have become very large.

A lively discussion followed after the presentation. Whereas tangible and intangible investment often go together, tangible investment had suffered less than the intangible one in the financial crisis. This raised the question of the **resilience of an intangible-based economy** which is not well understood and should be further addressed.

Concerning the role of the economic structure in shaping the intangible economy, it was outlined that **manufacturing and services become more and more intertwined** via the intangible economy, so that the boundaries between the two may well disappear within the next 10 years.

This produces policy challenges in many areas, e.g. via the potential of intangibles for **shifting market powers**. As an example, whereas aircraft leasing allows those who operate a plane to reduce their capital exposure, it also blurs the boundaries between the tangible and intangible aspect of airplane transportation depending on the offer of operating and leasing services. This challenges competition policies towards the **market conditions around the product-service bundle as a whole**.

Regarding social cohesion, expansion of the intangible-based economy is expected to produce **new social trade-offs** in the new economic model. Public investment in intangibles may offer an **important trigger for avoiding social digital exclusion** and leveraging private

investment. Evidence suggests a crowding-in effect of government spending in intangibles, e.g. investment in broadband infrastructure and public digital access.
The intangible-based economy also raises important **challenges for the tax system** as intangibles are highly mobile towards the most tax-favourable regime. This **increases global tax competition** which might be addressed by global tax cooperation. It may also produce pressure on income-based tax models to **shift towards more consumption-based** ones.
Addressing the historical parallel with the shift from agriculture to manufacturing, it was observed that the shift towards the intangible-based economy shows in the statistical data in the US since about 25 years and is therefore relatively young compared to the industrialisation which took more than 100 years in most countries. From a policy-making point of view, however, the **shift to the intangible-based economy is more difficult to handle** due to the much higher mobility of intangibles compared to tangibles.

Session I: the industrial perspective

Sara Amoroso (JRC.B3) then presented the work on intangibles undertaken in the IRIMA project. The project centres on the R&D investment of the biggest companies worldwide. Because these companies are important stakeholders for innovation, the role of intangibles was analysed using additional variables from corporate accounting to understand and anticipate trends in productivity, innovation and globalization for these companies. Although the dataset is different than those from official statistics, the analyses **underlined the important role of intangibles** in:

- ⇨ Increasing **firm efficiency** in general and productivity gains in particular for high-tech companies (Kumbhakar et al. 2010)
- ⇨ The relevance of **marketing** in the success of innovations, which was found higher than R&D as such (Garcia-Torres, 2011)
- ⇨ The potential of **design** for increasing European firms' innovative performance, which might constitute a low-cost alternative to R&D especially for European SMEs (Ciriaci, 2011)
- ⇨ The relevance of **training** for European firms' innovative performance (Ciriaci, 2011)
- ⇨ Increasing the **propensity to innovate** (Montresor&Vezzani, 2014)
- ⇨ Increasing innovation and firm performance in European companies **via balancing external vs internal resources** rather than fixing a specific type or amount of intangible investment (Montresor&Vezzani, 2016)

Sara also showed a recent analysis focussing on the role of intangibles for the productivity of the largest R&D investors by providing an **analysis of the regional and sectorial differences** of productivity growth patterns between EU and US firms. It found that only firms in high tech sectors (such as ICT or health) enjoy fast productivity growth, a 10% increase in R&D capital stock (or in patents stock) leads to a 7.8% (2.9%) increase in MFP only in high- and medium/high-tech sectors, EU firms are less productive than US firms and have lost ground in some sector where they used to outperform US (such as health and

industrials), and R&D investment may be one of the contributing factors that sets apart the productivity of US firms from that of EU firms.

After this, Sandro Montresor (Kore University, Italy) showed the **methodology of raising intangibles data from companies by the Innobarometer surveys** and the empirical evidence for the measurement of innovation activity. A direct longitudinal comparison among the different Innobarometers is impossible due to changes in content between the 2013 and 2014 waves and changes in sampling and industry shares between the 2015 and 2016 waves. The different survey years however reveal **important observations on intangibles** by the surveyed companies:

- ⇨ Formal R&D and software development are less reported intangibles than training and organisation (Innobarometer 2013)
- ⇨ Substantial intangible investment intensity is found in large firms with more than 250 employees, mainly due to the services sector, but not for micro enterprises with less than 10 employees (Innobarometer 2013)
- ⇨ Innovation rather depends on the amount of the resources invested in technological intangibles which are built up internally (Innobarometer 2013)
- ⇨ The firm's innovativeness positively correlates with design investments, but with an increasingly more central role of design too (Innobarometer 2015)
- ⇨ Lacking financial resources correlates with higher intangible investments, mainly for innovators (Innobarometer 2015)
- ⇨ Costly and complex regulations and standards correlate with higher intangible investments, mainly for non-innovators (Innobarometer 2015)
- ⇨ Established incumbents do not threaten innovators' intangible investments, while they spur those by non-innovators (Innobarometer 2015)

For **policy measures directed at increasing intangible investment**, public procurement, support to internationalisation (export), and to networking (meeting/conferences) help higher intangible investments by both innovators and non-innovators.

For the **Innobarometer surveys** as such, their value lies in the important potential source of systematic (cross-country, cross-industry, and cross-size) evidence on determinants and impact of intangibles. However, the multi-purpose use should be taken into account and caveats in drawing policy implications need to be considered, given the different concepts and sample compositions. The importance of keeping future Innobarometers on intangibles was stressed.

Luca Marcolin (OECD, France) then presented the results of a project based on international statistics relating intangible investment and the international fragmentation of production. **Intangibles and internationalised production go hand in hand**. On the one hand, intangibles are key for value creation, allow for greater flexibility and quality of outputs, and provide ability to monitor production across borders. They are key asset for skilled labour and for switching from domestic production to an internationalised one. On the other hand, an internationalised production provides access to imported inputs of greater technological content and lower costs, allows reallocation of market shares and provides access to outsourcing some business functions.

The main results from the analysis reveal the **importance of non-R&D intangible investments**. Further, given the interplay between intangible investment and production fragmentation, the role of intangible investment for absorbing external knowledge, exploiting the returns of production fragmentation, and adaption and diffusion of technology is underlined. The global production chains offer an opportunity to stimulate or embed technological advancements.

For policies, this means that intangible investment **needs to be sustained and considered in relation to the international production fragmentation**. Additional evidence is necessary to distinguish between countries which are receivers of offshoring, to address the effect of the crisis, and tackle offshoring e.g. to China.

After that, Thomas Niebel (ZEW, Germany) presented an analysis on the **contribution of intangible assets to sectoral productivity growth in the EU**. This was a first attempt to quantify the impact of intangible assets for European countries at the sectoral level by comparing the econometrically determined output elasticity of intangibles with the results obtained from growth accounting. The results reveal a **higher contribution of intangibles to labour productivity trends in manufacturing than in services**, which is associated to relatively high R&D investment and low depreciation rates in this sector. However, the service sector is responsible for the high overall contribution of intangibles to labour productivity in the UK.

The discussion in this session focused outlined DG-GROW's Action Plan for design-based innovation,[5] and the fact that design-related projects may receive support in H2020 and its successors. Regarding the link between production fragmentation and intangibles, the role of many non-observable variables should be further exploited, including to address all stocks and flows. Due to persisting data constraints, **future firm-level surveys** such as Innobarometer could be the only way to tackle these issues.

Session II: the territorial perspective

Nicola Grassano (JRC.B3) then showed work of the JRC using **patent data to proxy the worldwide R&D distribution** by world top R&D investors. This is of high interest as R&D trends are difficult to monitor and anticipate, and R&D inflows are mostly missing in the current national statistical systems. The results of these estimations have proven the feasibility of this approach for world regions (EU, US, Japan and China), but additional work on estimating the cost of patents by technology is underway to improve the accuracy of the estimations. He also showed the results of a study based on FP7 data to proxy R&D collaborations by EU regions, which reveals that **more developed regions tend to collaborate among themselves and capture bigger FP7 projects**. This outlines the need to better align the policy goals of promoting excellence among leading regions, on the one hand, and integrating peripheral regions, on the other.

Jesús Peiró-Palomino (University Jaume I, Spain) then outlined the results of a project on the role of intangibles in European regional convergence. The results shed new light on intangibles as previous studies did not yet cover the period after the latest enlargements, nor

[5] See http://ec.europa.eu/growth/industry/innovation/policy/design_en

considered the new Member States as economies in transition nor accounted for the impact of the financial crisis. Given the "twin-peaks" GDP distribution of differentiated groups of regions, or convergence clubs, **intangibles seem to offer leverage for regional convergence and economic cohesion**. The study is based on different datasets on human, technological and social capital (plus life-long-learning) intangibles. Between the two periods 2000-07 and 2008-11, a **rather small degree of convergence** was found which made regions retain most of the original differences in wealth distribution. It was also discovered that the **intangibles** studied are at least to some degree **responsible for discrepancies of income between regions**. The effect of the intangibles was, however, relatively limited and highly heterogeneous:

- ⇨ The strongest effects of intangibles on convergence are found **for regions with middle and middle-high relative income**
- ⇨ **Technological capital** has the most remarkable effects among the intangibles studied

It was highlighted that the study is still in progress to include other factors of regional convergence as well as to address the impact of the financial crisis on future convergence more in detail.

After that, Gaétan de Rassenfosse (EPFL, Switzerland) produced an assessment of how well intangibles are accounted for. Currently, the **Corrado-Hulten-Sichel (CHS)** framework is the leading methodology for establishing official statistics on intangibles. It uses as main variables computerised information (computer software and databases), innovative property (knowledge acquired through scientific R&D and non-scientific inventive and creative activities) and economic competencies (value of brand names and other knowledge embedded in firm-specific human and structural resources). This heuristic framework is tested by **assessing the strength of the correlation between the investment series and "objective" measures of intangible assets**. More concretely, the study assesses the extent to which investment in architectural and engineering design is correlated with the count of registered design rights and if investment in brand equity is correlated with trademark counts. The results show a **very weak correlation between investment in design and design rights** compared to a **high correlation between brand equity investment and trademarks**. The corresponding elasticity shows that a 10% increase in brand equity investment is associated with a 1.8–3.9% increase in trademark applications.

Beñat Bilbao Osorio (DG-RTD.A4) then outlined the results of a Commission study on unlocking investment in intangible assets in Europe. While economic growth is resuming since the financial crisis, slow productivity dynamics hinder its robustness and point out to **changes in the innovation landscape driven by long-term socio-economic forces**. The increased complexity of the innovation process, increasingly converging technologies and sectors, the role for off-the-shelf technologies and the concentration of benefits in superstar firms lead to **higher concentration in industries and very rapid innovation pace change**. In a decade, only 3 companies remained in the top-10 by market capitalisation.[6] Both in non-

[6] The top-4 most capitalised companies in 2016 (position ten years earlier in brackets): 1-Apple (33) 2-Alphabet (22); 3- Microsoft (6); 4- Amazon (NA)

financial services and manufacturing sectors, a **divergence of highly productive frontier firms compared to laggards can be observed which increases over time**. While a vast and robust theoretical and empirical literature highlights the positive effects of R&D and other intangible assets on productivity growth, it is well known that stronger innovation diffusion requires investment in both tangible and intangible assets. From the policy perspective however, using **intangibles as a trigger for structural change remains challenging**. To this end, the study addresses drivers and barriers from discussing specific economic characteristics of intangibles: competition-related ones, risk and uncertainty, and synergies and complementarities. The results show that:

- ⇨ investment in intangible assets tend to be **underestimated**
- ⇨ investment in intangibles in industrialized countries tends to **shift towards more intangible/knowledge-based capital**
- ⇨ trends in investment in intangible assets have been **rather stable even during the financial crisis**
- ⇨ tangible and intangible assets appear to be **affected differently by some key drivers and barriers**

For policymakers, an **enlarged understanding** of knowledge creation and improved measurement is needed. Characteristics of intangibles are **increasingly relevant for competition policies**. Also the **regulatory framework** plays an important role and a **balance is needed between promoting flexible markets and effective IPR systems**. **Access to finance** is essential, and **direct public intervention** can stimulate investing in intangibles, but **careful policy design is needed to avoid crowding-out**.
The subsequent discussion highlighted that for tax policies the **reaction to long-term interest rate levels and debt-equity-financial conditions** needs to be taken into account. Regarding **existing financial instruments**, in many cases they would need to be adapted and improved to support intangible investment.

Round table discussion

The round table discussion started by reiterating that the existing evidence highlights intangibles appearing as ever more important components of our economic activity, with **key role for competitiveness, employment and regional development** and **longer-term confluence of the tangible and the intangible economy**. This poses many policy challenges and a **clear need for more and better data**, especially at the sectoral and regional levels, longitudinal over time, and between the different categories of intangibles. It was outlined that **companies are main actors** of the shifts towards an intangible economy, but even **the largest ones may fall victim to its rapid innovation dynamics** and the challenges for business processes and corporate organisation.

Measurement challenges remain in **bringing together perspectives** of financial accounting terms, economic analyses and national account flows. Future Commission Innobarometer surveys may provide a suitable platform once they are designed according to the objectives

for intangible assets measurement. Maybe this highlights the need for analysing the consistency between the different ways intangibles are captured and accounted for, and identifying the gaps could show a way forward. This could also include validation with **other measurements of desirable societal outcomes**, e.g. productivity may not be the most adequate measure for the society as a whole but rather employment created or the ecological footprint of economic activities.

Interestingly, intangibles put **knowledge and capacities at the centre**, in many of which Europe is top at: design, inventive capacity, marketing, and skills where Europe is doing quite well (maths, programming). However, the European paradox remains as Europe is not reaping the benefits from its theoretical capacity to create intangibles. **Education policy** seems to have huge potential to **teach skills relevant to intangibles**: not only programming, but design, creativity, and linking these aspects to innovation. Business models based on intangibles are superior in the US compared to the rest of the world as they systematically exploit complementarities between human capital, skills and intangibles, with sufficient support to start-ups. While not all of this can be transferred to Europe one to one, systematic intangible policy learning could take place based on the specific barriers.

It was proposed that more **radical changes in the policy design** need to take place, and they should go well beyond isolated measures towards the social perception of intangibles. While the scientific and policy analyses are very clear regarding the importance of intangibles, often national statistical offices budgets are cut just there.