Monitoring industrial research:

The 2012 EU Survey on R&D Investment Business Trends

Joint Research Centre
Research & Innovation

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IRMA activities aim to improve the understanding of industrial R&D and Innovation in the EU and to identify medium and long-term policy implications.
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Any comments can be sent by email to: JRC-IPTS-IRI@ec.europa.eu

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European Commission
Joint Research Centre
Institute for Prospective Technological Studies
Edificio Expo
C/ Inca Garcilaso 3
E-41092 Seville (Spain)
Tel.: +34 95 448 83 18, Fax: +34 95 448 83 00

IPTS e-mail: jrc-ipts-secretariat@ec.europa.eu

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Table of Contents

Key Findings

The present document contains the main findings of the seventh survey on R&D investment business trends based on 187 responses of mainly large companies from the 1000 EU-based companies in the 2011 EU Industrial R&D Investment Scoreboard. These 187 companies are responsible for R&D investment worth almost €56 billion, constituting around 40% of the total R&D investment of the 1000 EU Scoreboard companies. The main findings of the survey are as follows:

R&D investments and Innovativeness

Companies expect to maintain robust R&D investment increases (average 4% p.a.) over the next three years.
These expectations indicate a positive and stable trend for R&D investment growth as observed before the 2008 economic and financial crises. R&D investment growth expectations were higher than in the past for companies from software & computer services (11% p.a. over the next three years), general industrials (6.8%), automobiles & parts (6.0%), chemicals (5.5%), oil & gas producers (4.6%), aerospace & defence (4.1%), construction & materials (3.8%), technology hardware & equipment (3.5%), and fixed line telecommunications (2.6%). However, in the pharmaceuticals and biotechnology sector, the expectations for 2012-2014 (3% p.a.) were lower than the average rate observed over 2007-2010.

The responding companies report significant shares of sales coming from innovative products and services introduced in the past three years: from 33% to 10% in high and low R&D intensity sectors respectively.
The average share of sales coming from new innovative products and services was 18%. Some had much higher averages than their sector group: technology hardware & equipment and software & computer services (high R&D intensity) automobiles & parts, electronic & electrical equipment and fixed line telecommunications (medium R&D intensity) and industrial metals & mining (low R&D intensity). The different shares of sales coming from innovative products introduced in the past three years seem to reflect different sectoral innovation cycles.

Almost half of the respondents named themselves as the innovation leader in the sector.
Almost half of the 120 respondents named themselves as the innovation leader in the sector. Among those naming a different company, Genentech, Intel, Roche and Texas Instruments were most frequently named. For pharmaceuticals & biotechnology and technology hardware & equipment (high R&D intensity), aerospace & defence and fixed-line telecommunications (medium R&D intensity) and oil & gas producers (low R&D intensity), the majority chose one of the top five R&D investors as the innovation leader.

Drivers and Policies

R&D within the company is the most important component of innovation, followed by market research related activities for new product introduction.

As might be expected, R&D is critical for innovation for 95% of the top R&D investing companies. Market research and related activities for new product introduction was the second most relevant component, followed by training, acquisition (of new machinery & equipment), and R&D outsourced to public research organisations in the EU. Purchase or licensing of IPR and other knowledge was of relevance mainly for the high R&D intensity sectors.

Collaboration agreements were a more important way of knowledge sharing than licencing.
For companies in high R&D intensity sectors, this is followed by licencing in/out with other companies, and then collaboration agreements with higher educations institutions and other public research organisations. For companies in medium and low R&D intensity sectors, collaboration agreements with higher education institutions and other public research organisations are seen as more important than licensing. The generally higher relevance of collaboration agreements contrasts with the relatively lower relevance of more formal licencing, which could be a sign of the increasing role of open innovation.

For the impact of factors and policies on the company's innovation activities, national public support had the most positive effect.

Direct support (especially fiscal incentives and national and EU grants) were seen as the main positive factor for the company's innovation activities, closely followed by public-private partnerships (both at national and EU level). The indirect measures, like cooperation policies, loans and guarantees, and cooperation and human resource exchange policies, were seen as less positive for innovation than the direct ones. Availability of qualified personnel (scientists, engineers, designers and technology transfer experts) was also considered to promote innovation, whereas access to risk and venture capital played a minor role. Respondents from companies in France, Italy and Spain saw a much stronger positive impact of EU and national direct and indirect policy measures than the average on innovation activities.

The perception of product market regulation is different among sectors.

Product market regulation had a somewhat positive effect on the company's innovation activities in a number of sectors (mainly in software & computer services, aerospace & defence, automobiles & parts, general industrials, construction & materials, electricity and oil & gas producers), while it had a slightly negative effect in pharmaceuticals & biotechnology, health care equipment & services and banks.

Labour costs and conditions of Intellectual Property Rights (enforcement, time and costs) continue to be perceived as negative factors for company innovations.

Labour costs of researchers and different aspects related to Intellectual Property Rights (IPRs), namely conditions for putting them into force, the costs, and the time to obtain protection, were perceived as negative for company innovation. This underlines the importance of an efficient IPR regime for the support of company innovations. Respondents from companies located in Germany, The Netherlands and Finland saw a more negative impact of the IPR related aspects (conditions for putting them into force, costs and time to obtain protection) on innovation than those from other countries.

Collaboration and outsourcing

The majority of R&D collaboration agreements with other companies are with customers or suppliers (vertical agreements), while less than 10% are made with competitors.

The average number of R&D collaboration agreements with other companies varies by sector. The fixed line telecommunications sector (medium R&D intensity) stands out with over 800 R&D collaboration agreements with other companies, followed by technology hardware & equipment and pharmaceuticals & biotechnology (high R&D intensity) with more than 200 agreements. Regarding the location of the other companies involved in the R&D collaboration agreement, the high R&D intensity sectors are the most internationalised and have almost 40% of their partners outside the EU. The low R&D intensity sectors have nearly 80% of their R&D collaboration agreements with other companies in the same or another EU country.

More than one fifth of the respondents preferred Germany as the most attractive location for outsourcing R&D, mostly because of a very high share of statements from the home country, followed closely by the US.

The US is the non-EU country receiving most of the statements as the preferred location for R&D outsourcing, followed by India and China. Among the respondents, all from EU-based companies, almost a third considered the company's home country the most attractive, less than a third chose a different EU country, and the remaining ones chose a non-EU country. Thus, the choice of an EU country as preferred location for outsourcing R&D to other companies has a high degree of a preference for the company's home country.

The US is the most attractive source of Intellectual Property Rights, followed by Germany.

Regarding country attractiveness as a source of IPRs through licencing or acquisition of intangible assets, the US was preferred by almost half of the respondents. Germany was mentioned by over one fourth of the respondents, followed by Japan, the UK and France as stated by only 3-4% of the respondents.

Licencing Intellectual Property Rights

Among the types of Intellectual Property Rights (IPRs) licencing, licencing-in ranges before licencing-out.

The most frequently named licencing efforts are licencing-in activities. These instruments are stated by nearly half of the respondents. That is followed by licencing-out activities at second place. Free-usage of companies' IPRs for the public and the participation in cross-licensing activities are less-often mentioned.

Favourable tax treatment of licencing revenue would encourage more licencing activity.

Favourable tax treatments of licencing revenues are the most preferred instrument to increase companies licencing activities whereas model contracts are by far less important. However, sector differences remain. Companies in high R&D intensive sectors prefer favourable tax treatments more than companies in less R&D intensive sectors. On the contrary, model contracts and unitary patents and patent judiciary in the EU are more relevant for companies in low R&D intensity sectors than for companies in medium and high R&D intensity sectors.

High R&D intensive companies report the highest licencing-in expenditure and licencing-out revenues.

While companies in low and medium R&D intensive sectors report higher shares for licencing-in expenditures than licencing-out revenues, firms in high R&D intensity sectors report significant higher licencing-out revenues than licencing-in expenditure.

1 Introduction

Investment in research and innovation is at the heart of the Europe 2020 strategy,[1] which is aimed at a smarter, greener and more inclusive economy delivering high levels of employment, productivity and social cohesion. Private sector R&D investment plays a particularly important role in this strategy.

The overall purpose of this project is to monitor and analyse industrial R&D and innovation activities in order to support the implementation and monitoring of the European research and innovation agenda (the Innovation Union flagship[2], which includes a 3% EU headline target for R&D investment intensity[3]). The evidence gathered might also contribute to policy-making related to other relevant Europe 2020 flagship initiatives such as the "Industrial Policy[4]", the "Digital Agenda" and the "New Skills for New Jobs" flagships.

The survey is part of the Industrial Research and Innovation Monitoring and Analysis (IRIMA) initiative,[5] which supports policymakers in these initiatives and monitors progress towards the associated 3% headline target. The survey complements IRIMA's core activity, the *EU Industrial R&D Investment Scoreboard,*[6] which analyses private R&D based on the audited annual accounts of companies and shows ex-post trends. The present survey is an additional instrument addressing the Scoreboard companies which collects ex-ante expectations and qualitative statements.

Under the IRIMA predecessor activities, six previous surveys[7] have been undertaken to gather information from EU companies on the factors and issues influencing R&D investment by firms. The present survey focuses on the R&D investment expectations for 2012[8], the relationship between R&D and innovation and the role of different knowledge transfer activities, including also collaboration and licencing. R&D investment in the surveys refers to the total amount of R&D financed by the company, regardless of where or by whom it was performed. This excludes R&D financed by governments or other companies as well as the companies' share of any associated company or joint venture R&D investment. It includes research contracted out to other companies or public research organisations, e.g. Universities. The survey reports what each responding company states as its particular financial commitment to R&D. This is different from the official statistical concept, Business Expenditure on R&D (BERD), which provides a geographical perspective.[9]

The questionnaire was sent to the CEO or previous year's contact person of the 1000 European companies which appear in the *2011 EU Industrial R&D Investment Scoreboard*. These 187 responses were equivalent to a response rate of 18.7%.[10] The companies are responsible for a total global R&D investment of around €56 billion, which corresponds to 40% of the total R&D investment by the European Scoreboard companies.

[1] See: European Commission: Europe 2020: A strategy for smart, sustainable and inclusive growth: http://ec.europa.eu/eu2020/index_en.htm.

[2] The Innovation Union flagship aims at strengthening knowledge and innovation as drivers of future growth by re-focusing R&D and innovation policies for the main challenges society faces, such as climate change, energy and resource efficiency, health and demographic change.

[3] This target refers to the EU's overall (public and private) R&D investment approaching 3% of GDP (see: http://ec.europa.eu/research/era/areas/investing/investing_research_en.htm).

[4] The Industrial Policy for the Globalisation Era flagship aims at improving the business environment, notably for SMEs, and supporting the development of a strong and sustainable industrial foundation for global competition.

[5] See: http://iri.jrc.ec.europa.eu/. The activity is undertaken jointly by the Directorate General for Research (DG RTD C, see: http://ec.europa.eu/invest-in-research/) and the Joint Research Centre, Institute of Prospective Technological Studies (JRC-IPTS, see: http://ipts.jrc.ec.europa.eu/activities/research-and-innovation/iri.cfm).

[6] The Scoreboard is published annually and provides data and analysis on companies from the EU and abroad investing the largest sums in R&D (see: http://iri.jrc.ec.europa.eu/research/scoreboard.htm).

[7] See: http://iri.jrc.ec.europa.eu/research/survey.htm

[8] The title of the present report refers to 2012, the year for which expectations were collected, whereas our previous surveys were launched at different times of the year, and their titles referred to the Scoreboard reference year.

[9] BERD includes R&D financed by the company itself as well as R&D performed by a company but funded from other sources. Official BERD figures comprise R&D carried out by the companies physically located in a given country or region (including foreign-owned subsidiaries), regardless of the source of funding.

[10] See: Annex A: The Methodology of the 2012 Survey.

The responses by R&D intensity and sector group are shown in Table 1[11].

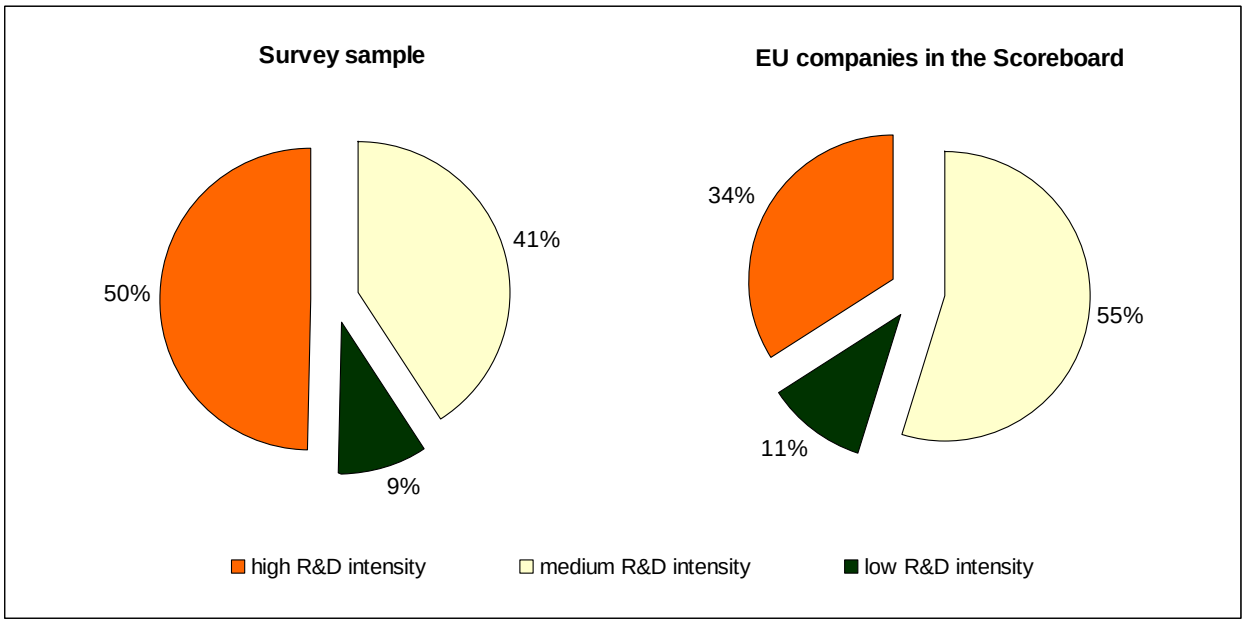
Table 1: Number of responses, by sector group

Sector group	ICB Sector	Number of responses	compared to Scoreboard
High R&D intensity	Pharmaceuticals & biotechnology, technology hardware & equipment, software & computer services, health care equipment & services, and leisure goods	54	58%
Medium R&D intensity	Industrial engineering, chemicals, aerospace & defence, electronic & electrical equipment, automobiles & parts, general industrials, fixed line telecommunications, food producers, alternative energy, household goods & home construction, oil equipment, services & distribution, other financials, personal goods, beverages, and tobacco	93	30%
Low R&D intensity	Industrial metals & mining, construction & materials, banks, electricity, oil & gas producers, gas, water & multiutilities, industrial transportation, forestry & paper, mining, and mobile telecommunications	40	35%
		187	**40%**

Source: European Commission JRC-IPTS (2012)

In terms of the numbers of responses, most came from companies in the medium R&D intensity sector group, whereas the high R&D intensity sectors constitute the majority of the R&D investment in the survey sample. In comparison to the R&D investment composition of the 2011 Scoreboard (Figure 1), the high R&D intensity sectors are more represented than the medium and low ones.

Figure 1: Distribution of R&D investment in the survey compared to the Scoreboard



Note: The figure refers to all 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

In comparison to our previous survey, the share in the sample of R&D from companies in the low R&D intensity sectors has decreased. The companies in the sample were on average very large, with an average turnover of €10 billion, 25,500 employees, and 1,500 employees in R&D. This is similar to our previous surveys. Among the respondents, there are 5 medium-sized companies in the high R&D intensity sectors. Consequently, this survey differs from the Community Innovation Survey (CIS), which uses a different sampling technique and also addresses small and medium-sized firms.[12]
The response rate of repeating participants has increased compared to the past year by one third[13].

[11] R&D intensity is the ratio between R&D investment and net sales. An individual company may invest a large overall amount in R&D but have a low R&D intensity if net sales are high (as is the case of many oil & gas producers, for example). For the groupings see: Annex A: The Methodology of the 2012 Survey.
[12] The CIS uses stratified sampling for at least 3 size classes (small, medium and large enterprises) across all EU Member States.
[13] Out of the 187 responding companies, 104 had participated in the previous two surveys (past year 88 out of 205), 63 in the previous three, 31 in the previous four, 22 in the previous five, 13 in the previous six and 7 in the previous seven surveys.

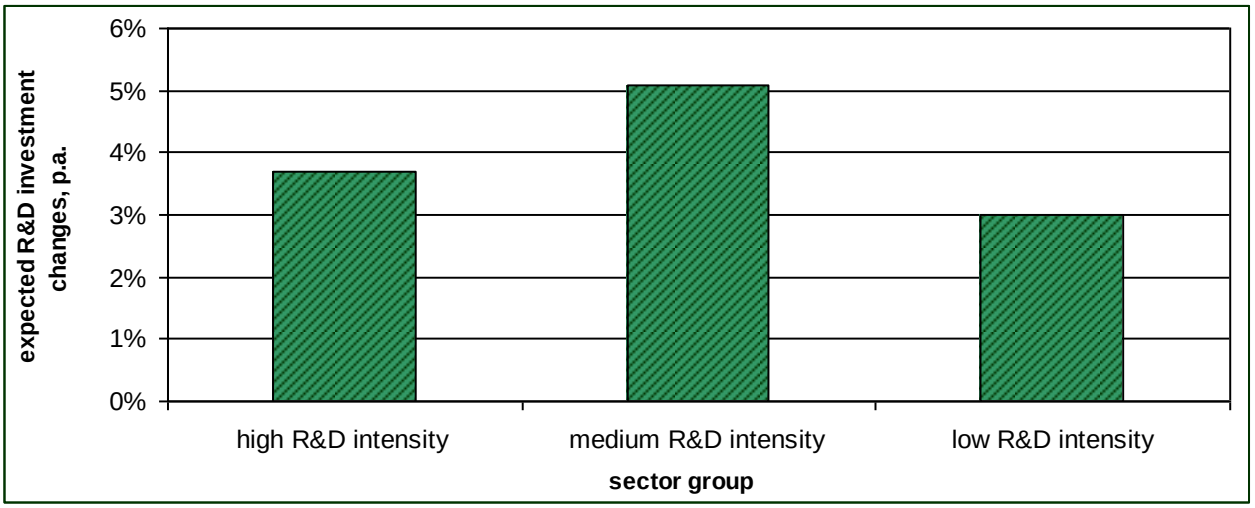
2 R&D Investments and Innovativeness

2.1 R&D Investment Expectations

The responding companies expect to increase their R&D investments by an average of 4.2% over the period of 2012-14.[14] This compares to the 5% increase expected in last year's survey and is twice the level of the 2009 Survey, which reflected the impact of the 2008 economic and financial crises. The data shown here suggest that company R&D investment follows a stable growth path for 2012 onwards. However, expectations have not yet reached the levels expected prior to the 2008 crisis (7% in the 2007 survey). The 4.2% expected growth rate is higher than the nominal EU GDP growth estimates at 1.7% for 2012 and 3.4% for 2013[15].

As shown in Figure 2 below, expectations are highest for the medium R&D intensity companies (5.1%), followed by the high (3.7%) and low (3.0%) R&D intensity ones. Compared to last year's survey, investment expectations have dropped especially in the high R&D intensity sectors by almost 3 percentage points (mainly due to lower expectations in technology hardware & equipment companies).

Figure 2: Expected changes in R&D investment in the next three years, per annum, in real terms

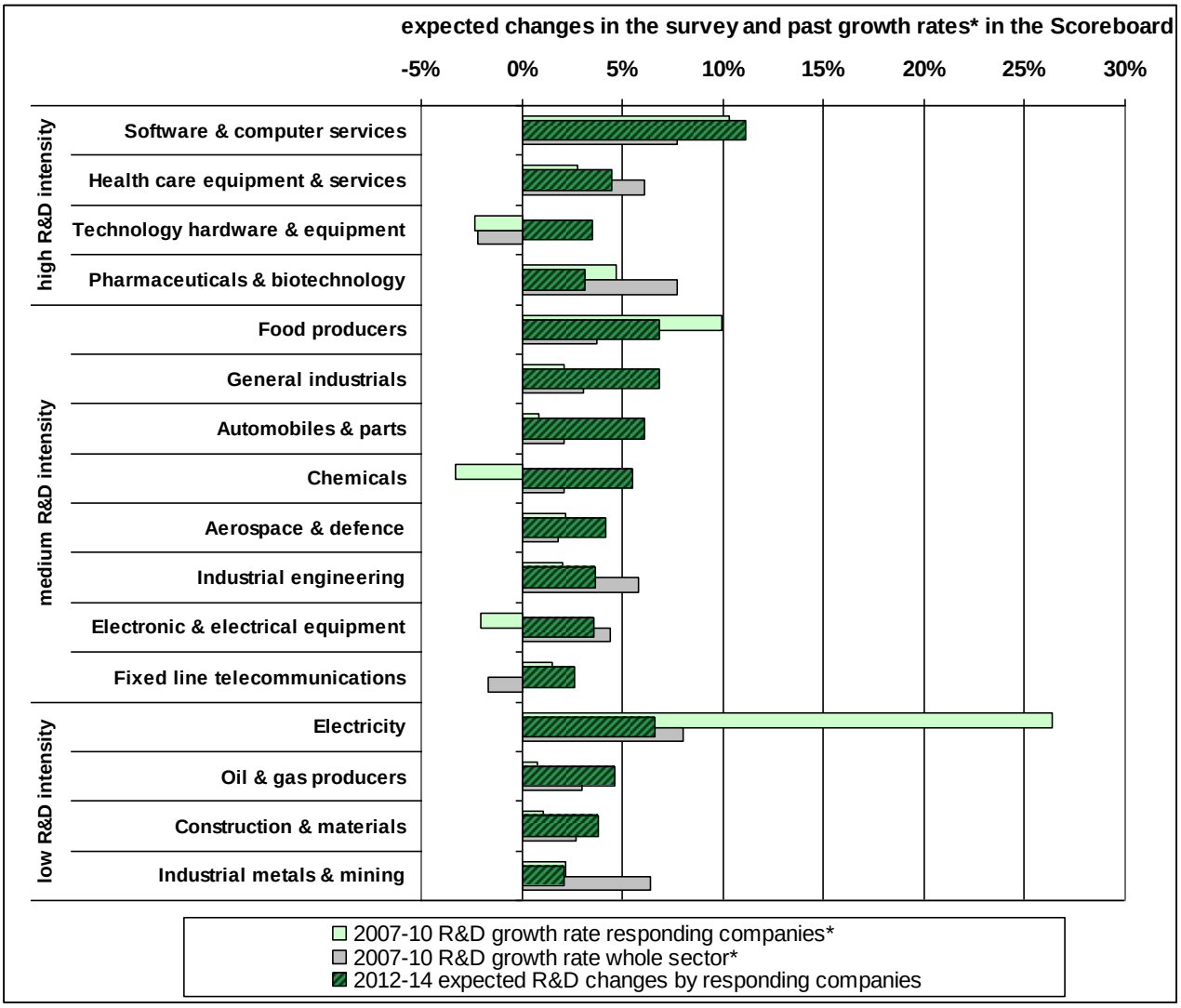


Note: The figure refers to 162 out of the 187 companies in the sample, weighted by R&D investment.
Source: European Commission JRC-IPTS (2012)

For sectors with at least five responses, Figure 3 below compares the respondents' 2012-14 expected R&D investment changes with the 2007-10 R&D investment growth rates observed before for these companies and the ones for the whole sector in the Scoreboard[16].

[14] The expectations are per annum over the next three years, weighted by R&D investment.
[15] for GDP in Euros at market prices per May 2012.
[16] The samples are different as the number of companies participating in the survey is only share of the number of companies in the Scoreboard (see Table 1 in Annex A).

Figure 3: Expected changes in R&D investment compared to the growth rates observed in the past



Note: * Previous three years averages as the companies' compound annual growth rates over the previous three years as observed in the Scoreboard (see Annex A: The Methodology of the 2012 Survey).
The figure refers to 135 out of the 187 companies in the sample, weighted by R&D investment. Only for sectors with at least five responses.

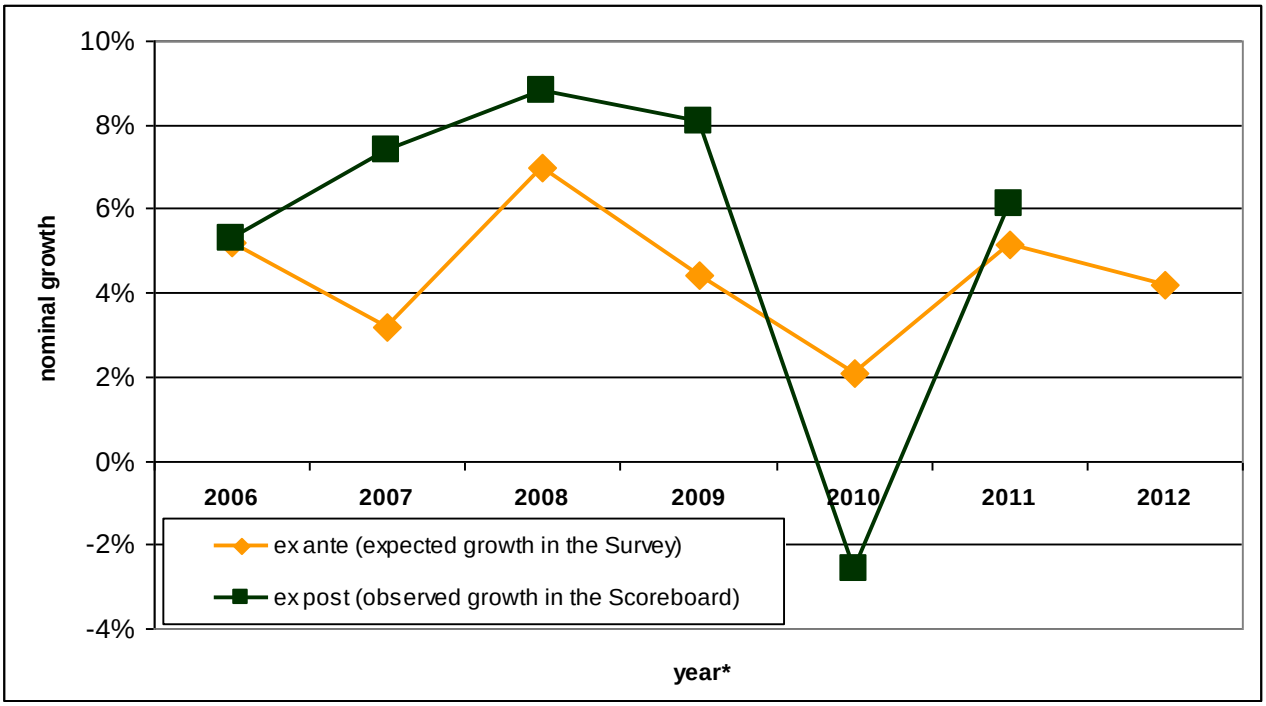
Source: European Commission JRC-IPTS (2012)

For some sectors, the expected R&D investment changes of the respondents are higher than the growth rates observed in the past (both for the responding companies and the whole sector): software & computer services (11% p.a. over the next three years), general industrials (6.8%), automobiles & parts (6.0%), chemicals (5.5%), oil & gas producers (4.6%), aerospace & defence (4.1%), construction & materials (3.8%), technology hardware & equipment (3.5%), and fixed line telecommunications (2.6%).For a few other sectors, the expected changes are lower than the past growth rates (both for the responding companies and the whole sector): electricity (4.6% p.a. over the next three years) and pharmaceuticals & biotechnology (3.2%).
A link between the R&D investment figures and past company performance in terms of operating profit or net sales was not found for these companies.
The outlook for the R&D investment for US companies in 2012 is similar to the expectations for EU companies reported above. A 3.4% growth[17] is expected for US companies for 2012, with a level a slightly lower level compared to the previous year due to reduced growth dynamics[18].

[17] See: "The Batelle 2012 Global R&D Funding Forecast", R&D Magazine December, 2011
[18] See: "The Industrial Research Institute's 2012 R&D Trends Forecast", Research-Technology Management, January-February 2012

The comparison of R&D investment growth expectations collected in our past surveys with the development of R&D investment is shown in Figure 4.

Figure 4: Expected (survey) vs. observed (Scoreboard) R&D growth



Note: * Survey annual growth expectations are for the next three years following the exercise, while the Scoreboards refer to the latest audited accounts. The figure refers to 162 out of the 187 companies in the 2012 survey sample, weighted by R&D investment.
Source: European Commission JRC-IPTS (2012)

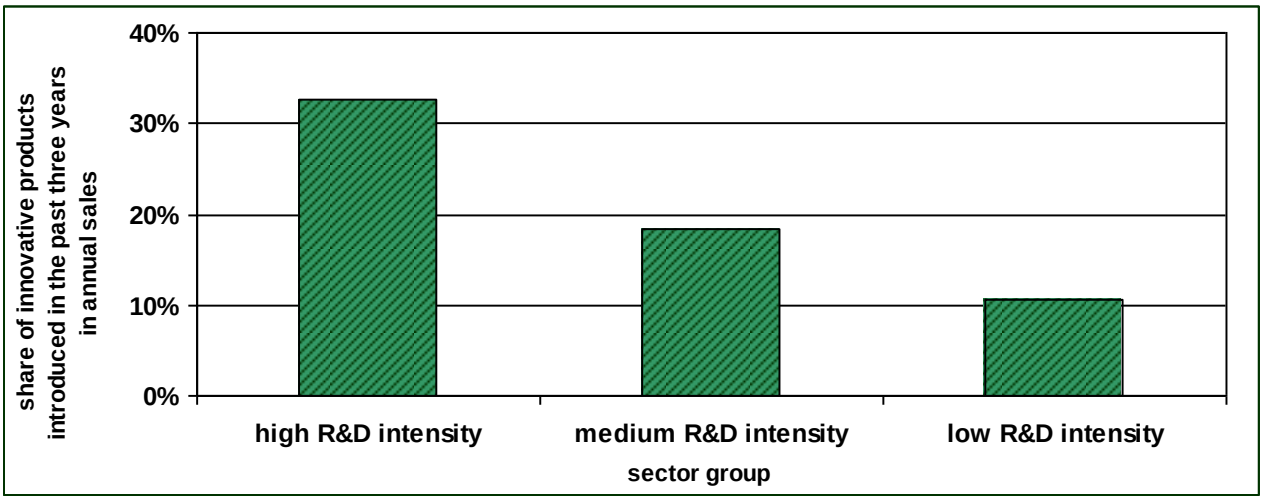
For most years, trend expectations from past surveys have been consistent with the actual trends observed in the Scoreboards, and the trends anticipated in the survey since 2007 have been statistically significant.[19] The upcoming 2012 Scoreboard is scheduled to be released in November 2012.[20]

2.2 Innovativeness

Given the linkage of R&D and innovation in the Europe 2020 strategy, the survey addresses four main topics: the importance of activities for innovation, factors and policies for innovation, and the role of knowledge sources for innovation.
Regarding the share of annual sales coming from innovative products and services introduced in the past three years,[21] the average was 18%. This share broadly correlates with the R&D intensity of the company as shown in Figure 5. The companies from the high R&D intensity sectors derive 33% of annual sales from these products, compared to 18% for the medium and 10% for the low R&D intensity companies. The figure for the high R&D intensity sectors is similar to that observed in the Community Innovation Survey[22]. For the medium and low R&D intensity sectors it is smaller probably because of the survey sample composition with a very high number of very large companies, whereas the Community Innovation Survey covers companies of all sizes.

[19] Using two-sample t-tests with unequal variances between the trends for each of the five data points, the trends were statistically significant at least at the 98.3% level.
[20] For the latest EU Industrial R&D Investment Scoreboard see: http://iri.jrc.ec.europa.eu/reports.htm.
[21] Innovation is defined as the introduction of new or significantly improved products, services or processes.
[22] The proportion of turnover from new products in CIS 3 was 28% (see: Eurostat, Community Innovation Survey 3 results).

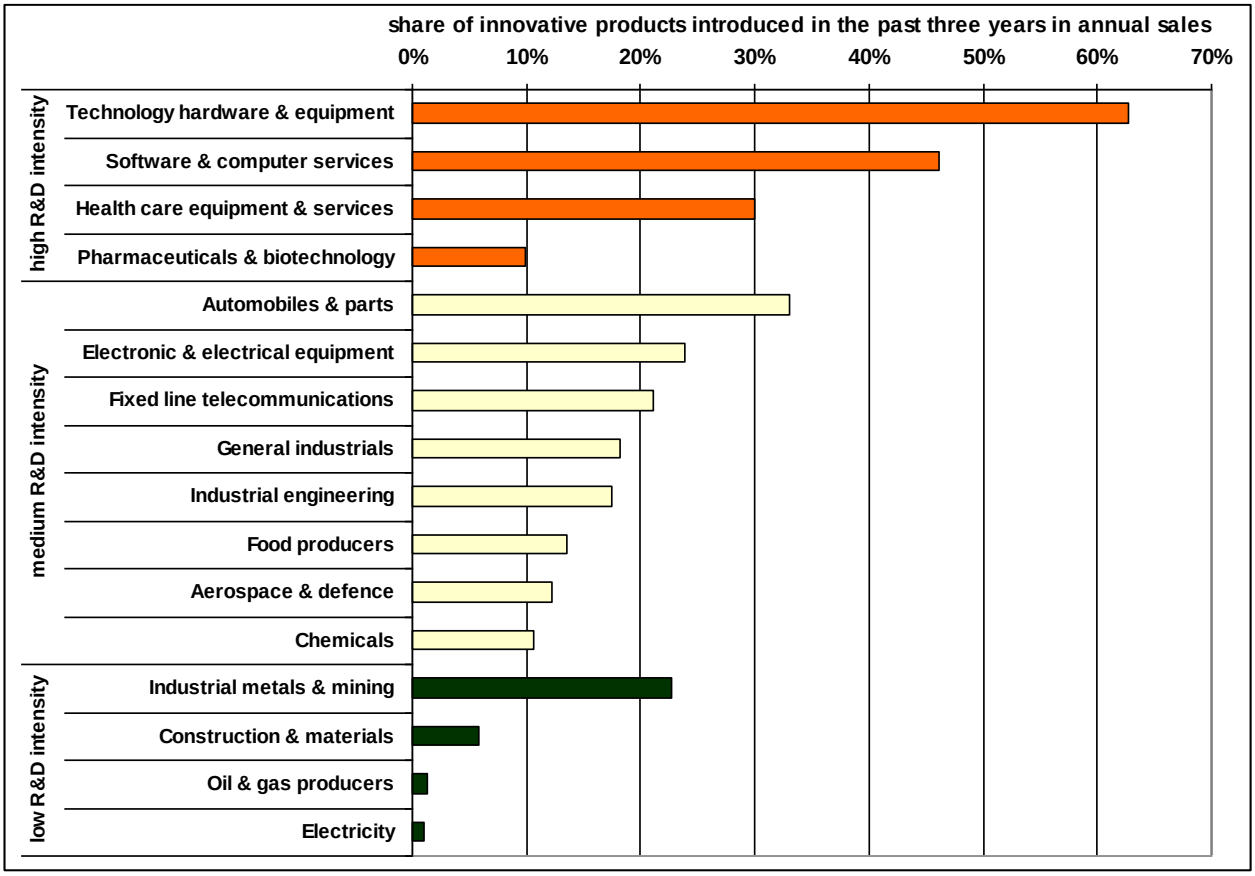
Figure 5: Share of annual sales from innovative products introduced in the past three years.



Note: The figure refers to 141 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

Figure 3 below shows differences in the share of net sales from innovative products introduced in the past three years by sector.

Figure 6: Share of innovative products introduced in the past three years in annual sales



Note: The figure refers to 135 out of the 187 companies in the sample, weighted by R&D investment. Only for sectors with at least five responses.
Source: European Commission JRC-IPTS (2012)

Technology hardware & equipment and software & computer services (high R&D intensity), automobiles & parts, electronic & electrical equipment and fixed line telecommunications (medium R&D intensity) and industrial metals & mining (low R&D intensity) had above average revenues from innovative products. The

differences between the sectors are not related to R&D investment amounts, R&D intensity or net sales but rather seem to reflect different sectoral innovation cycles.

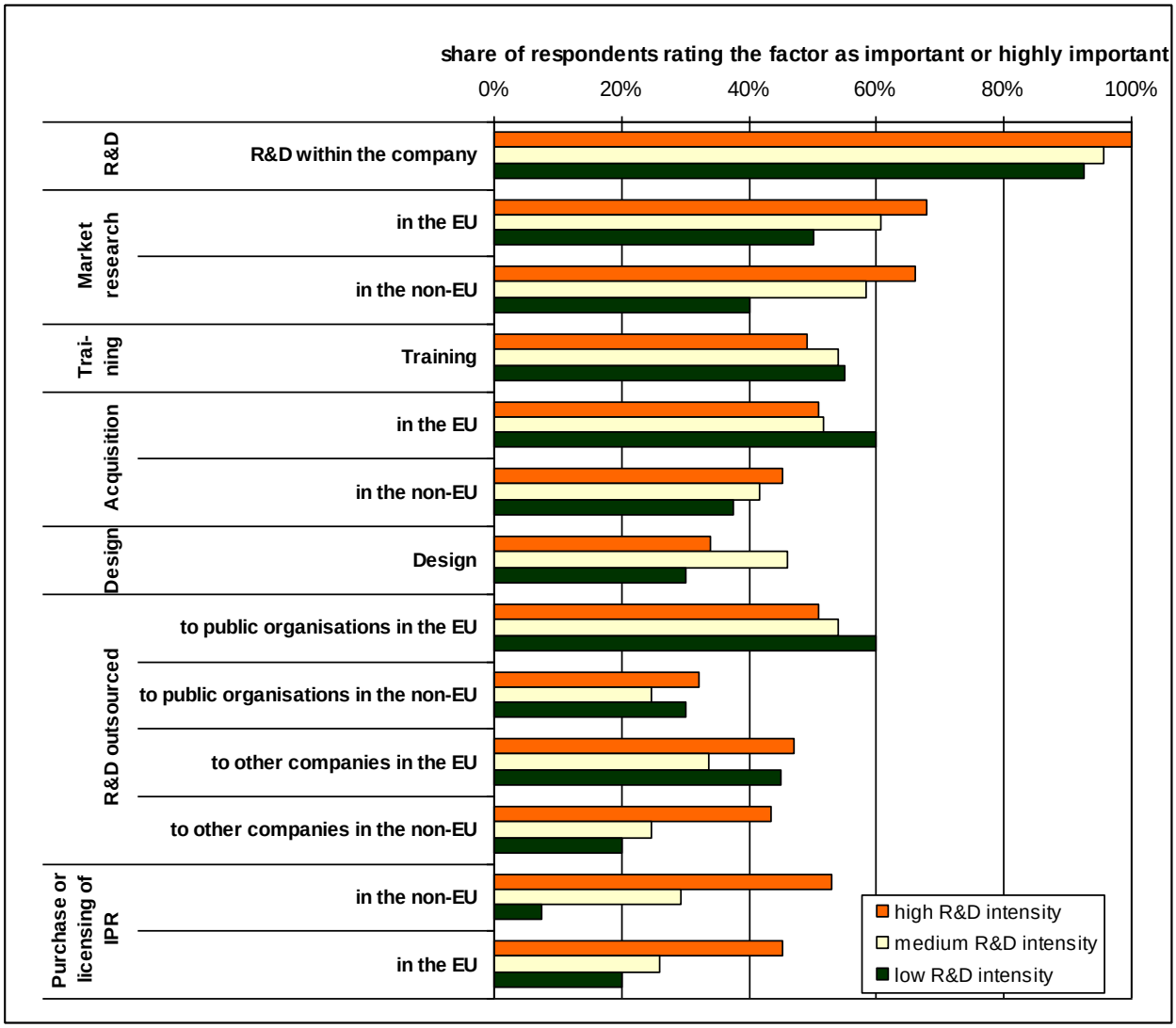
Respondents were requested to state the name of the innovation leader in their sector. Almost half of the 120 responses mentioned themselves as the innovation leader in their sector. Among those mentioning a different company, only Genentech, Intel, Roche and Texas Instruments received at least two statements each. The other 63 respondents chose different individual companies as the innovation leader in their sector. For pharmaceuticals & biotechnology and technology hardware & equipment (high R&D intensity), aerospace & defence and fixed-line telecommunications (medium R&D intensity) and oil & gas producers (low R&D intensity), the majority chose one of the top five R&D investors as innovation leader.

A few respondents added that there is no single innovation leader as this depends on the business segment in question (mainly companies from chemicals, electronic & electrical equipment, industrial engineering and software & computer services).

3 Drivers and Policies

The respondents were asked about the relevance of a number of activities for the company's innovations.[23] Not surprisingly, given the sample of companies surveyed and the positions of the respondents, R&D within the company is regarded as the most relevant factor for innovation, being considered relevant or highly relevant by more than 95% of the respondents (Figure 7). For all respondents from the high R&D intensity sectors, R&D was relevant or highly relevant for innovation.

Figure 7: Relative importance of activities for the company's innovations



Note: The activities are listed by average relevance of the major items in the survey.
The figure refers to 182 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

Most other factors have some relevance for innovation[24]. Market research, launch advertising, and related marketing activities for new product introduction[25] were rated before training to support innovative activities, acquisition of new or highly improved machinery, equipment and software, design (graphic, packaging, process, product, service or industrial), and outsourced R&D[26]. For these activities, the importance in the EU was higher than in non-EU countries. Purchase or licensing of IPR and other knowledge was of less

[23] Innovation is the introduction of new or significantly improved products, services or processes.
[24] "Some relevance" means that the factor is relevant or highly relevant for more than one-third but less than two-thirds of the respondents.
[25] Recent empirical evidence found a higher impact of marketing expenditures in innovation success (in terms of the elasticity of this effort to innovative sales) than the flow of investment in R&D (See: Garcia, A.: "The relevance of marketing in the success of innovations", IPTS Working Papers on Corporate R&D and Innovation, 2011, http://iri.jrc.es/papers.htm).
[26] Marketing and design expenditures are somewhat closer to the market with a more direct effect than R&D (with a medium-long term effect and uncertain outcome) or training (with uncertainty due to knowledge spillovers and labour turnover).

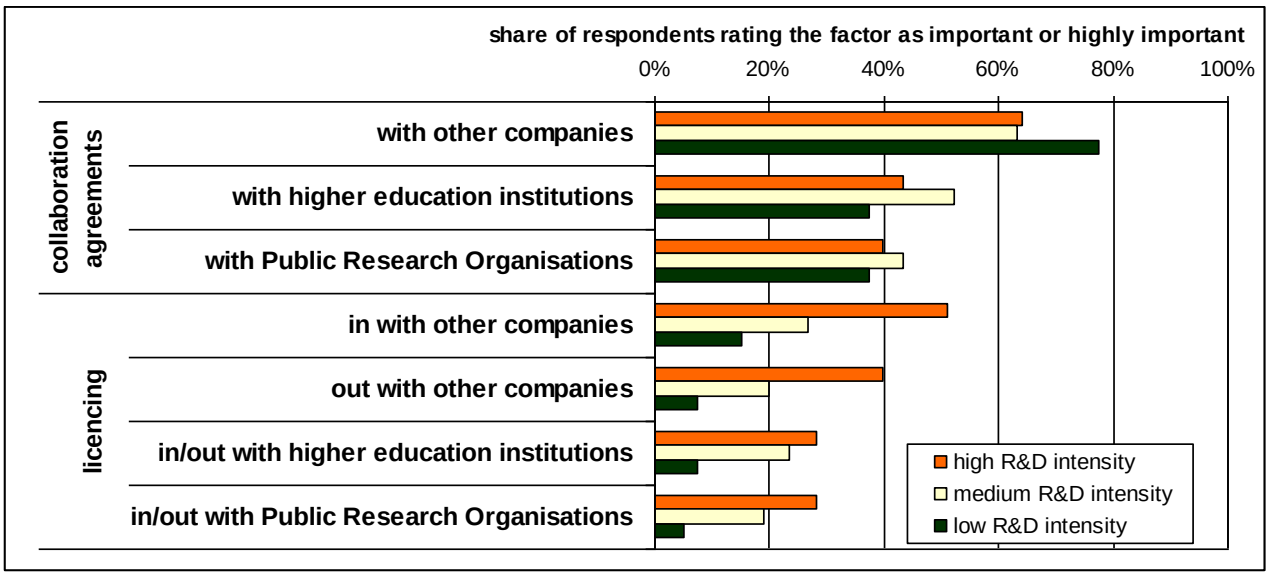
relevance on average[27]. Recent research on the importance of design and R&D investment for innovativeness shows a crucial role of design investment for innovation and its role to complement technological R&D[28].

There are differences between sector groups.[29] Purchase and licensing of IPR and other knowledge in general was relatively more relevant for the high R&D intensity sector (especially pharmaceuticals & biotechnology and technology hardware & equipment). For oil & gas producers (low R&D intensity), purchase or licencing of IPR in non-EU countries was more important than inside the EU. Design was more important for many medium R&D intensity companies. It is also interesting to note that market research, launch advertising, and related marketing activities for new product introduction was rated less relevant for low R&D intensity companies than acquisition of new or highly improved machinery, equipment and software or training to support innovative activities. The reason for this may be that many companies in these sectors are very large and capital intensive. In fact, recent research suggests that the degree of use of Knowledge-Intensive Business Services (KIBS) is highly sector-specific and tends to increase with the R&D intensity of the sector considered.[30]

Regarding the difference between activities in EU vs. non-EU countries, R&D outsourcing to other companies outside the EU is less relevant for medium and low R&D intensity companies than outsourcing inside the EU, while in the high R&D intensity ones outsourcing in- and outside the EU is equally relevant. Purchase or licencing of IPR in non-EU countries was much less relevant for many low R&D intensity companies than inside the EU.

The survey also included a question on the importance of different ways of knowledge sharing for the company's R&D and innovation activities, namely collaboration agreements and licencing. As shown in Figure 8, collaboration agreements were a more important way of knowledge sharing than licencing. Collaboration agreements with other companies, higher education institutions and Public Research Organisations were generally important sources of knowledge.[31] Knowledge sharing with other companies through collaboration agreements stood out as highly important[32] for many low R&D intensity sectors (construction & materials, electricity, industrial metals & mining and oil & gas producers).

Figure 8: Importance of knowledge sharing activities for the company's R&D and innovation activities.



Note: The sources of knowledge are listed in importance for the major items in the survey.
The figure refers to 183 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

Less important sources of knowledge[33] include licencing in/out of companies with the different parties. For companies in high R&D intensity sectors, collaboration agreements with other companies as an important way of knowledge sharing are followed by licencing in/out with other companies (especially pharmaceuticals

[27] "Less relevance" means that the factor is relevant or highly relevant for less than one-third of the respondents.
[28] See Ciriaci, D.: "Design and European firms' innovative performance: A less costly innovation activity for European SMEs?", IPTS Working Papers on Corporate R&D and Innovation, 8/ 2011 at: http://iri.jrc.es//papers/WP%2008-2011.pdf.
[29] Only differences of at least 10% between the two values were considered as an indication of a difference.
[30] See: Ciriaci, D. and Palma, D.: "To what extent are knowledge-intensive business services contributing to manufacturing? A subsystem analysis", IPTS Working Papers on Corporate R&D and Innovation, forthcoming in 2012 at: http://iri.jrc.es/papers.htm.
[31] "Important" means that the factor is important or highly important for more than one-third but less than two-thirds of the respondents.
[32] "High importance" means that the factor is important or highly important for more than two-thirds of the respondents.
[33] "Less importance" means that the factor is important or highly important for less than a third of the respondents.

& biotechnology, software & computer services and technology hardware & equipment), and then collaboration agreements with higher educations institutions and other public research organisations. For companies in medium and low R&D intensity sectors, collaboration agreements with higher education institutions and other public research organisations are seen as more important than licensing. The generally higher relevance of collaboration agreements contrasts with the relatively lower relevance of more formal licencing, which could be a sign of the increasing role of open innovation.

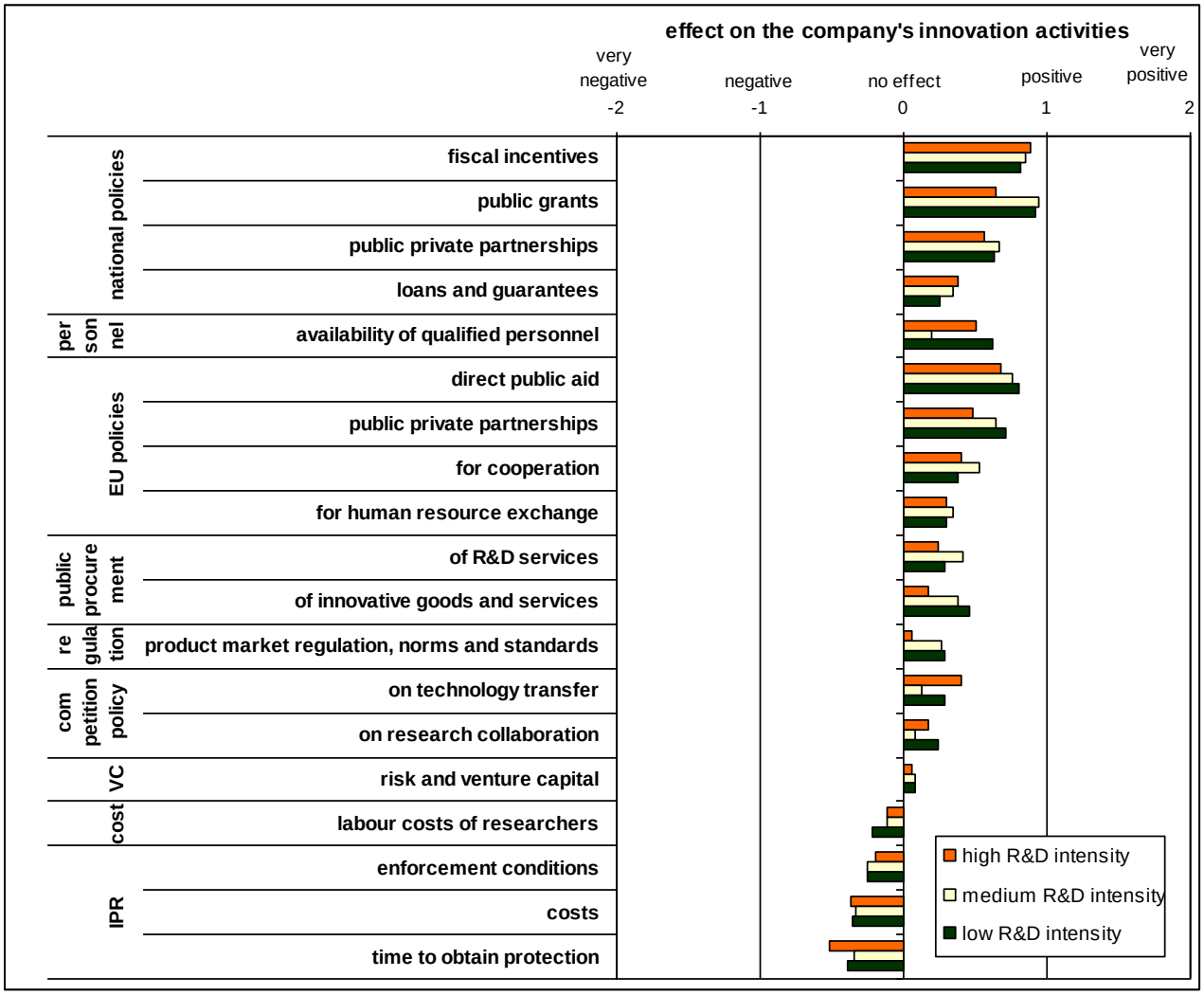
Compared to our past year's survey, which addressed a wider range of knowledge sources, the order of the collaboration and licencing factors was in general very similar except for a slightly higher relevance of collaboration with higher education institutions, e.g. Universities. However, this year's questionnaire covered collaboration agreements, which constitute a more formalised way of collaboration than collaboration in general as addressed in last year's questionnaire.

With regard to knowledge sharing, some respondents stressed the strengths of European companies in system design and integration of know-how from different areas, which some companies reflect in their R&D organisation via systematic networking of their labs in different geographical areas, technological cultures and markets.

The survey participants rated factors and policies external to the firm according to their impact on the company's current innovation activities. As shown in Figure 9, national public support had on average a positive effect[34], especially fiscal incentives and public grants. Availability of qualified personnel (scientists, engineers, designers and technology transfer experts), EU public support (especially as direct public aid[35] and public private partnerships[36]), public procurement and product market regulation were also considered to promote innovation[37]. Distinguishing between direct and indirect policy measures, direct support (especially fiscal incentives and national and EU grants) were seen as the main positive factor for the company's innovation activities, and then closely followed by public-private partnerships (both at national and EU level). The indirect measures, like cooperation policies, loans and guarantees, and cooperation and human resource exchange policies, were seen as less positive for innovation than the direct ones.

[34] A positive effect means that the average rating on the scale was above 0.5.
[35] e.g. from the Framework Programme or Structural Funds
[36] e.g. European Technology Platforms or Joint Technology Initiatives
[37] Factors promoting innovation were those with a somewhat positive effect, which means that the average rating on the scale was between 0.2 and 0.5.

Figure 9: Factors and policies affecting the company's current innovation activities.



Note: Effects on the company's innovation activities listed by average relevance of the major items in the survey. The figure refers to 186 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

Product market regulation had a somewhat positive effect in a number of sectors (mainly in software & computer services, aerospace & defence, automobiles & parts, general industrials, construction & materials, electricity and oil & gas producers), while it had a slightly negative effect in pharmaceuticals & biotechnology, health care equipment & services and banks.
Competition policy requirements on technology transfer agreements had a slightly positive effect (mainly in leisure, personal goods, media, and oil & gas producers), as well as research collaboration (mainly in media and personal goods) on the company's innovation activities. Access to risk and venture capital had almost no effect.
Very similar to last year's survey, labour costs of researchers and different aspects related to Intellectual Property Rights (IPRs), namely the conditions for putting them into force, the costs, and the time to obtain protection, were perceived as negative[38] for all sectors. The Commission is addressing this in its implementation of the Innovation Union flagship through the proposal, amongst others, for a Unitary EU patent.
Respondents from companies in France, Italy and Spain saw a much stronger positive impact of EU and national direct and indirect policy measures than the average on innovation activities. Those from Germany, The Netherlands and Finland saw a relatively stronger negative impact of the IPR related aspects (conditions for putting them into force, costs and time to obtain protection) on innovation.
Among the comments to this question, product market regulation was perceived as a burden due to the high number of regulations (technology hardware & equipment), but the potentially positive effect on innovation

[38] A negative effect means that the average rating on the scale was between -0.2 and -0.5.

was also recognised if the regulatory burden is not too heavy (automobiles & parts and industrial engineering). The need for exploiting public procurement for the consumer market (leisure goods), sector-specific support (alternative energy) and mobility of qualified personnel (automobiles & parts, food producers) was emphasised. For utilities, it was mentioned that changes of framework conditions had a negative effect on innovation investments due to the shift of risks to the private sector. It was also pointed out that the resource-intensity and lengthy process of the EU patenting process make it especially cumbersome for SMEs and new market entrants.

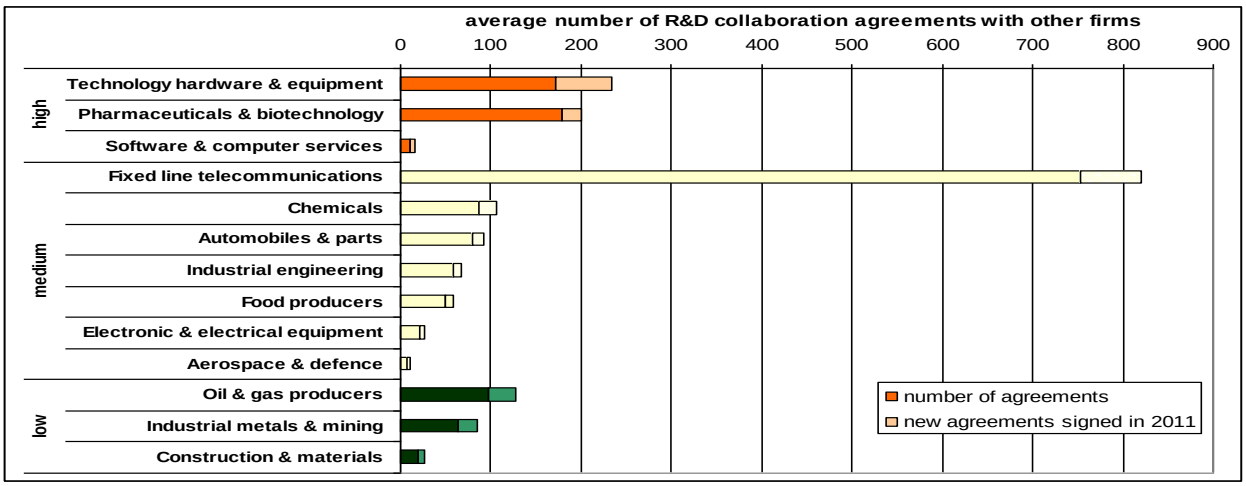
4 Intellectual Property Rights

4.1 Collaboration and Outsourcing

The Commission's Innovation Union contains commitments for promoting openness and capitalising on Europe's creative potential[39] by increasing the flows of Intellectual Property Rights (IPRs) via collaboration and outsourcing. Our survey questionnaire therefore addressed R&D collaboration agreement numbers, preferred countries for IPR (out-) sourcing, as well as types, measures and expenditures for licencing activity.

With respect to the number of R&D collaboration agreements, 116 respondents reported a total number of over fifteen thousand, corresponding to an average 134 collaboration agreements per company[40]. The average number of R&D collaboration agreements with other firms was somewhat higher in the high and medium R&D intensity sectors compared to the low ones[41]. Figure 10 shows differences by sector of the number of firms' R&D collaboration agreements with other companies.

Figure 10: Average number of R&D collaboration agreements with other firms per company



Note: Only for sectors with at least five responses. The figure refers to 110 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

The fixed line telecommunications sector (medium R&D intensity) stands out with over 800 R&D collaboration agreements with other companies, followed by technology hardware & equipment and pharmaceuticals & biotechnology (high R&D intensity) with more than 200 agreements. The figure also shows the number of new agreements signed in 2011, which varied between 10 and 40% depending on the sector. Sectors with at least five responses and more than 25% of new agreements in 2011 were software & computer services and technology hardware & equipment (high R&D intensity), electronic & electrical equipment and general industrials (medium R&D intensity) and construction & materials and industrial metals & mining (low R&D intensity).

99 out of the 187 respondents also stated how many R&D collaboration agreements involved customers/suppliers or competitors. More than 90% of the R&D collaboration agreements were with customers/suppliers (vertical agreements), and less than 10% agreements with competitors (horizontal agreements). The share of agreements with competitors in the low R&D intensity sectors was 15%, around three times bigger than in the high and medium R&D intensity ones.

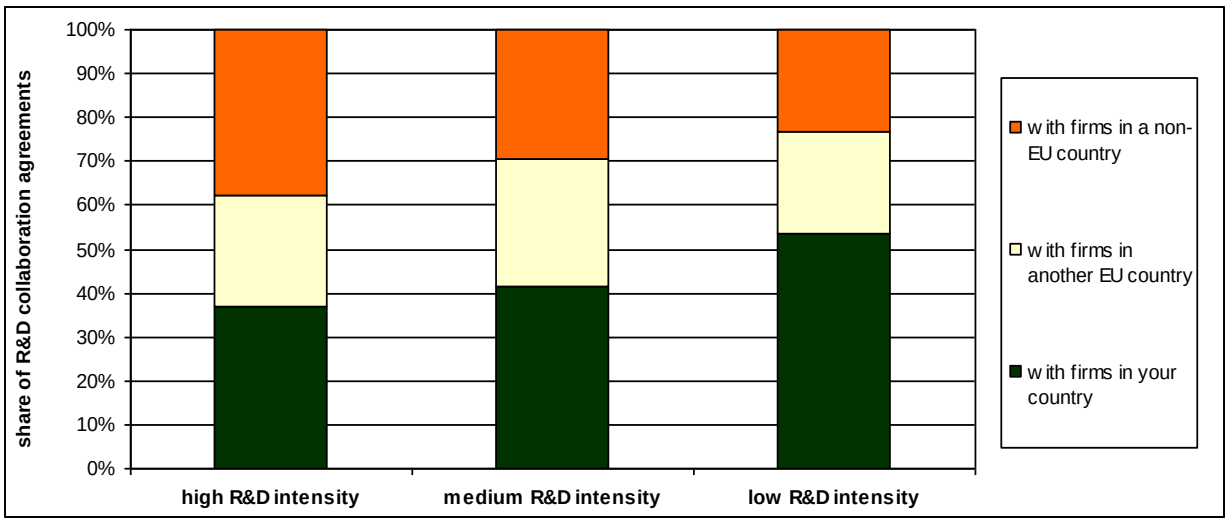
Some respondents commented that there is a link between the level of innovation, collaboration and licencing. Market pressure for innovative products leads to increased collaboration, much of which is formalised in formal collaboration and licencing agreements.

Regarding the location of the other company involved in the R&D collaboration agreement, the high R&D intensity sectors are the most internationalised with almost 40% of collaboration partners outside the EU, followed by the medium and low ones (with around 30% and 20% R&D collaboration outside the EU,

[39] See commitments 21 and 22 of European Commission: "Europe 2020 Flagship Initiative: Innovation Union", SEC(2010) 1161, http://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication-brochure_en.pdf.
[40] This reflects the large size of the companies in the sample.
[41] The average number of R&D collaboration agreements with other firms was 144 in the high and medium vs. 94 in the low R&D intensity sectors.

respectively, Figure 11). The low R&D intensity sectors have nearly 80% of their R&D collaboration agreements with other firms in the same country or another EU Member State.

Figure 11: Share of R&D collaboration agreements with other firms in other countries

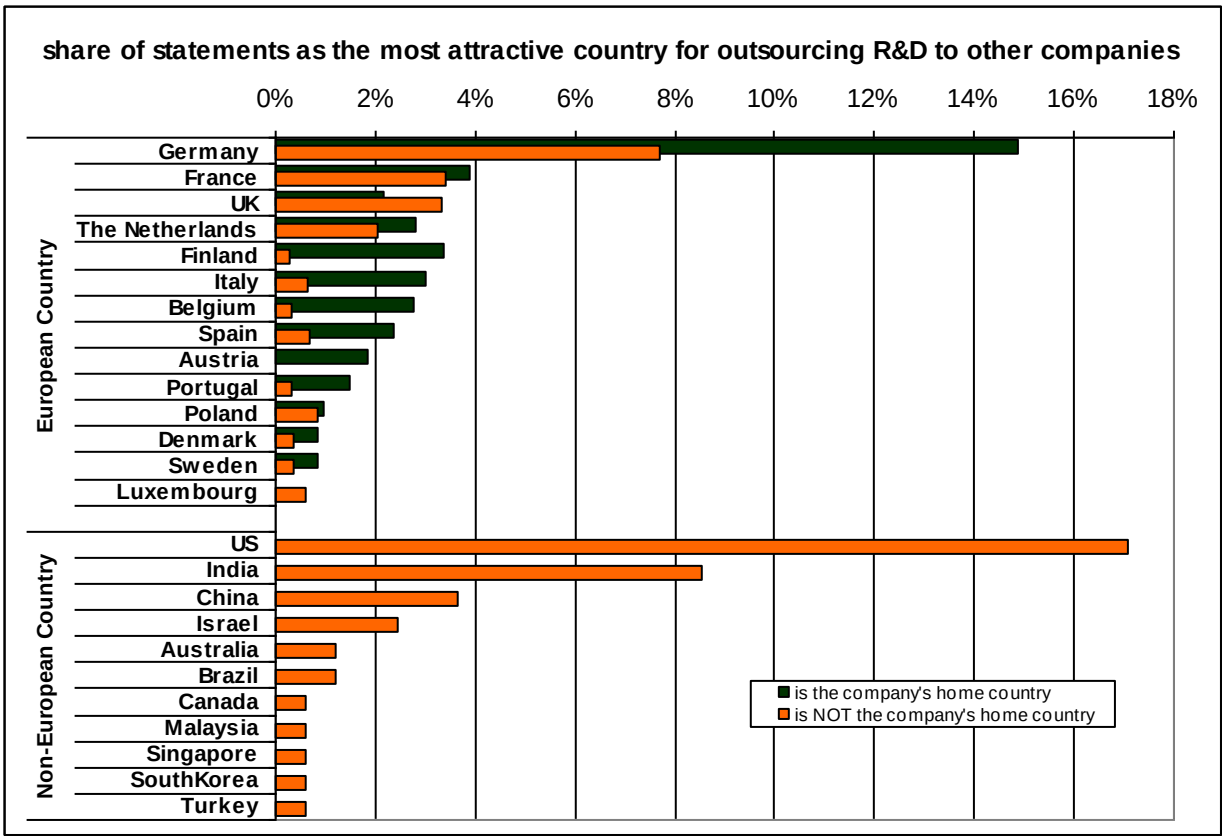


Note: The figure refers to 118 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

All respondents being from EU-based companies, R&D collaboration with firms located in the same EU country plays an especially important role in low R&D intensity sectors, while intra-EU collaboration is the most frequent in the medium R&D intensity ones.

The questionnaire also included two questions that focus more on the geographic dimension of IPR flows: the most attractive country for outsourcing R&D and the most attractive country as a source for IPRs. Concerning the most attractive country for outsourcing R&D to other companies, higher education institutions and public research organisations, Germany was preferred overall by more than one fifth of the respondents, mostly because of a very high share of statements from the home country, followed closely by the US. Figure 12 shows the countries preferred by home country, other EU and non-EU countries..

Figure 12: Most attractive country for outsourcing R&D



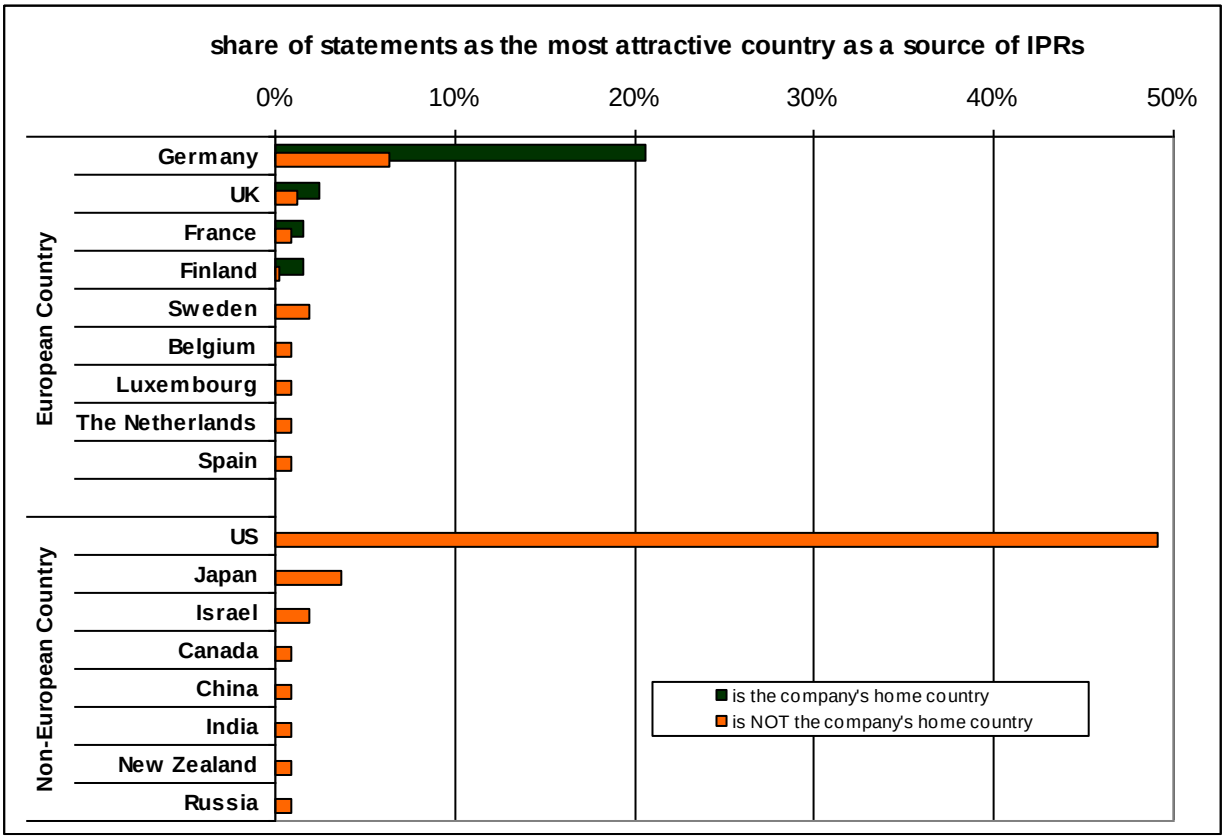
Note: The figure refers to 138 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

Among the respondents, which are all from EU-based companies, almost a third considered the company's home country the most attractive. Less than a third chose another EU country and the remaining ones chose a non-EU country. The preferred locations for outsourcing R&D to other companies have a high degree of preference for EU locations due to the distribution of the company headquarter locations in the sample.[42]
Germany was however somewhat more often stated as a preferred country for outsourcing R&D to other companies compared to the share of German companies in the sample, while the other EU countries (including France or the UK) were slightly less often mentioned. Some countries were mentioned at least four times as the most attractive country for outsourcing R&D: Germany for companies based in Italy and The Netherlands, and the US for companies based in France, Germany, and the UK.
In case of choosing a non-EU country, the US and India ranged clearly before China. Similar country preferences have been observed in the context of the most attractive location for the company's R&D in three previous surveys[43], where the US, China, Germany and India were the top four locations.
On average, the lower the R&D intensity the higher was the preference for the home country as the most attractive for outsourcing R&D. Whereas 41% of the respondents in the low R&D intensity sectors preferred their home country for outsourcing R&D, this was 22% for the medium and 11% high intensity ones.

[42] See Table 3 in Annex A: The Methodology of the 2012 Survey
[43] See the 2007, 2008 and 2010 survey.

Regarding country attractiveness as a source of IPRs through licencing or acquisition of intangible assets, the US was preferred by almost half of the respondents (Figure 13). Germany was mentioned by over one fourth of the respondents, while Japan, the UK and France were stated by only 3-4% of the respondents.

Figure 13: Most attractive country as a source of IPRs through licencing or acquisition of intangible assets



Note: The figure refers to 110 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

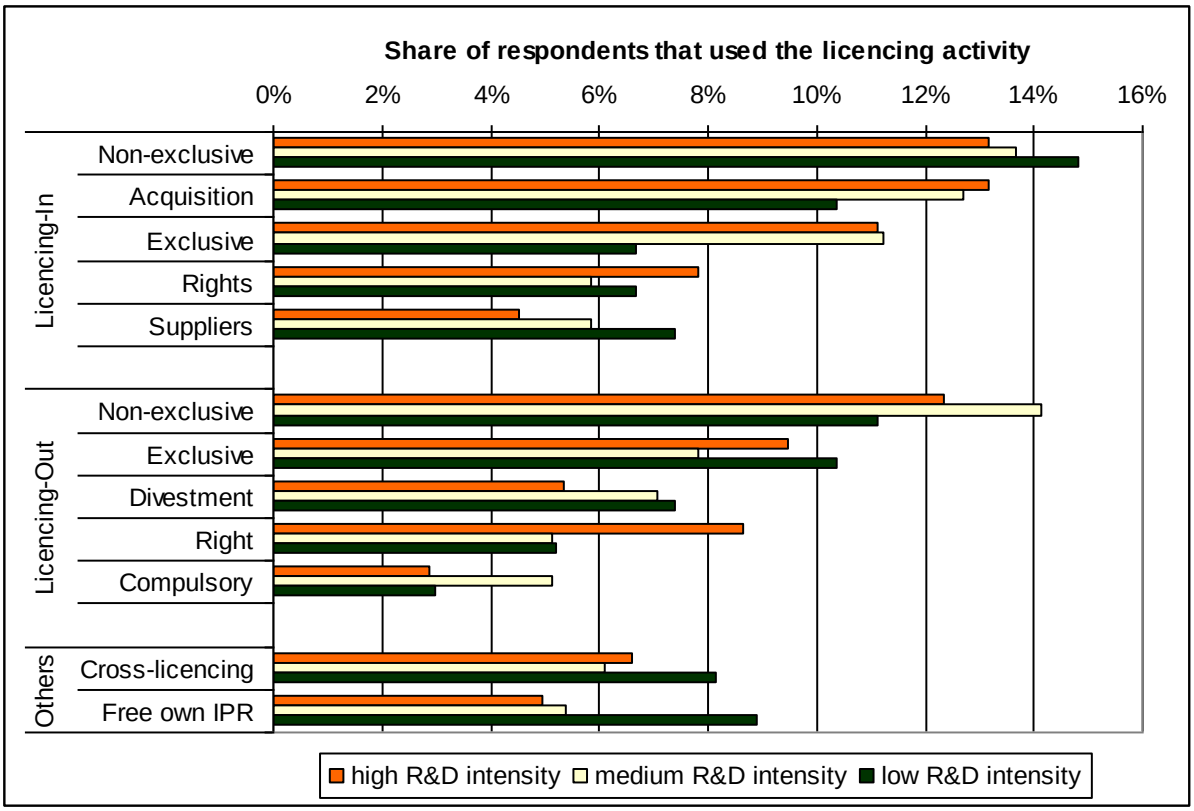
All the other countries, including China or India, were mentioned by less than three percent of the respondents.
Among the EU countries, preference for Germany as a source of IPR was higher than the country share in the respondents, while it was much lower for the other ones, including France and the UK. Some countries were mentioned at least four times as the most attractive source of IPRs: Germany for companies based in Denmark and the US for companies based in Germany, Finland, Sweden, Spain and the UK.

4.2 Licencing Intellectual Property Rights

Participants were asked to state the licencing activities they have used during the past three years (2009, 2010, and 2011). The most frequently named were licencing-in instruments (Figure 14), stated by nearly half of the respondents (48.8%). These are followed by licencing-out activities. Free-usage of firms' IPRs by the public and participation in cross-licensing activities were less-often mentioned.
Examining licencing-in activities only, non-exclusive licencing is followed by the acquisition of intangible assets of another firm through mergers and acquisitions and exclusive licencing. Less often used instruments to acquire IPRs were licenses of rights and compulsory licensing from suppliers.
Switching to the assignment or licencing-out of Intellectual Property Rights (IPRs), the most often mentioned type was non-exclusive licencing (13.1%), followed by exclusive licencing, the disposal through the sale of intangible assets to another firm in a divestment, licences of rights, and compulsory licensing to customers.
Analyzing the usage of all licencing activities together non-exclusive licencing-in (13.7%) and non-exclusive licencing-out activities (13.1%) were mentioned the most.

Comparing firms of different R&D-intensity, companies from high R&D-intensity sectors had a lead with respect to licencing-in through M&As, licencing-in rights, and licencing-out rights. Medium R&D intensity companies focused on non-exclusive licencing-out, non-exclusive licencing-in, licencing-in through M&As and exclusive licencing-in. The most important instruments for respondents from low R&D intensity sectors were non-exclusive licencing-in and non-exclusive licencing-out. Moreover, firms in low R&D intensity sectors took a lead with respect to compulsory licensing from suppliers, cross-licencing activities, and allowing free-usage of firms IPR for the public.

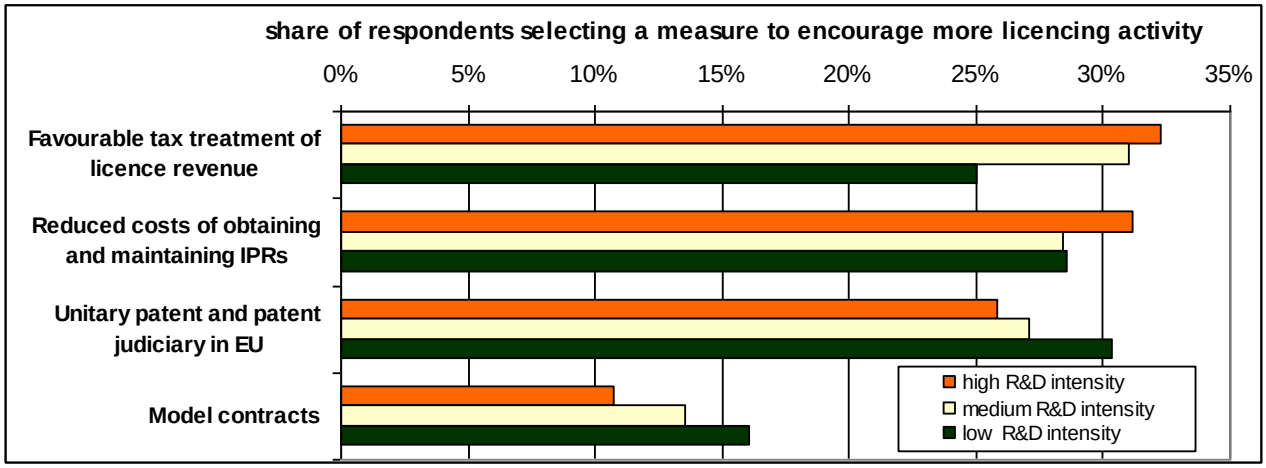
Figure 14: IPR licencing activities used in the past 3 years



Note: The activities are listed by average relevance of the major items in the survey sorted by licencing-in, licencing-out and other activities. The figure refers to 159 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

Another question addressed measures to encourage more licencing activities. The most frequently mentioned one was favourable tax treatments of licence revenues (30.3% of the respondents, Figure 15). This was closely followed by reduced costs of obtaining and maintaining IPRs and a unitary patent and patent judiciary in the EU. Model contracts were by far less important (13.1%).
By R&D intensity, companies from high R&D-intensity sectors demonstrated the highest interest for favourable tax treatments and reduced costs of obtaining and maintaining IPRs. On the contrary, they had the lowest interest in model contracts and unitary patents. For these two cases (unitary patent and model contacts) companies from low R&D intensity sectors demonstrated the highest concentration.

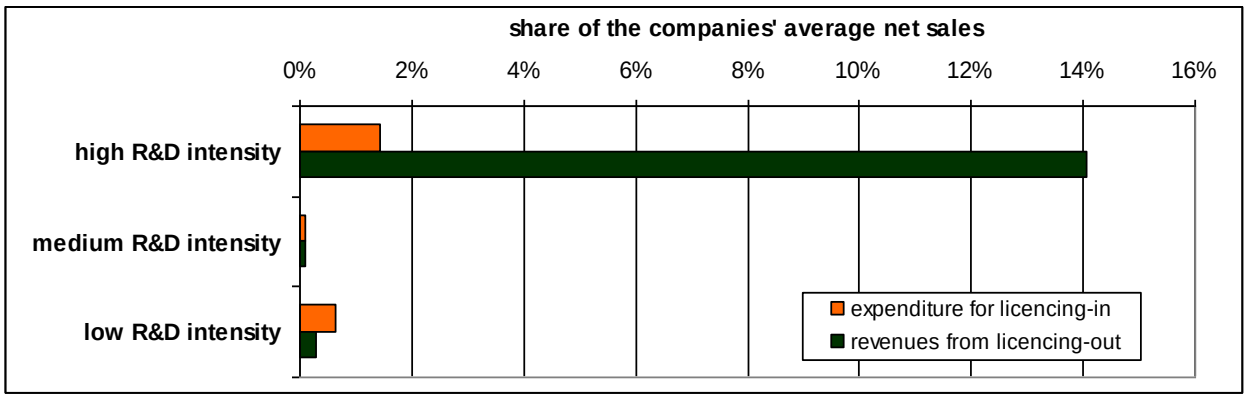
Figure 15: Measures to encourage licencing activities



Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 148 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

Examining the expenditure for licencing-in Intellectual Property Rights (IPRs), few respondents filled in this question (67 out of 187). Compared to net sales, the results demonstrate that companies from high R&D-intensity sectors have spend the highest share for licencing-in IPRs (Figure 16). However, companies in low R&D intensity sectors reported a higher share of expenditures for licencing-in efforts on net-sales than respondents in the medium R&D intensity sectors. The higher share for firms in low R&D intensive sectors was mainly driven by one company in the mobile telecommunications sector (R&D intensity below 1%). Excluding this company, the average share of licencing-in expenditure on net sales revenues in low R&D intensity sectors was below the average for medium R&D intensity sectors.
Looking at absolute licencing-in expenditures we found a triple-header on top of the ranking. While the highest absolute expenditure was claimed by a company from the medium R&D-intensity sector, place number two was occupied by a company from a high R&D-intensive sector, followed by a company from a low R&D-intensity sector on place number three.
Switching to revenues from licencing-out IPRs, again few companies responded to this question (66 out of 187). The results demonstrate that licencing-out revenues were very important for companies in high R&D intensity sectors, but less important for firms in medium or low R&D intensity sectors. For example, companies in high R&D intensity sectors generated on average 14% of their sales revenues by IPR licencing-out. The share for companies in the medium R&D intensity sectors is 0.11% and 0.65% for firms in low R&D intensity sectors. The higher share for firms in low R&D intensity sectors was driven by one company in the mobile telecommunications sector (R&D intensity below 1%). Excluding this firm the average share of licencing-in expenditure on net sales revenues in low R&D intensity sectors was 0.087%, which was below the average of the medium R&D intensity sectors.
The ranking of the Top 5 firms by the share of licencing-out revenues on net sales revenues revealed three pharmaceutical companies and two companies from software & computer services and technology hardware & equipment (all of which are high R&D intensity sectors).

Figure 16: Licencing-In Expenditure and Licencing-Out Revenues



Note: The licencing-in expenditures and licencing-out revenues are divided by the average of firms' net revenues during the last 3 years. The figure refers to 67 out of the 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

Finally, comparing the licencing-in expenditure with licencing-out revenues shows significant differences between firms in the low, medium and high R&D intensity sectors. Whereas companies in the low and medium R&D intensity sectors demonstrated a higher share of licencing-in expenditures compared to licencing-out revenues, those in the high R&D intensity sectors demonstrated significantly higher licencing-out returns than licencing-in expenditure. Their licencing-in expenditure accounted for around 1.4 % of their net sales while their licencing-out revenues accounted for 14%.

5 Annex A: The Methodology of the 2012 Survey

Background and Approach

The rationale for the survey activities emerged back in 2002 in the context of the European Commission's "3% Action Plan" established to implement and monitor the 3% R&D investment intensity target of the Lisbon strategy. At that time, empirical evidence on private-sector R&D was scarce and official statistics on R&D and innovation, and some occasional country-specific statistics, were the main sources of these data.[44] Private sources existed but were rarely published, and there was a shortage of qualitative and prospective information on industrial R&D. Another mapping and analysis of available trans-national data sources on industrial R&D[45] from the European Commission, OECD and European industry associations, showed that data on business enterprise R&D essentially drew upon retrospective surveys and were based on differing approaches. Statistical offices generally collect R&D data in the form of Business R&D Expenditure (BERD), which defines R&D from a top-down perspective. Surveys by industrial associations were undertaken sporadically, their scope was limited and the results were not often fully disclosed. The perspective taken in most of these surveys did not permit cross-sector comparisons at a European level and policy making in this area was usually based on results of analysis based on partial or incomplete data.

In order to improve the understanding of industrial R&D and innovation in the EU and to identify medium and long-term policy implications, the European Commission established the Industrial Research and Innovation Monitoring and Analysis (IRIMA)[46] initiative, jointly carried out by the European Commission's Joint Research Centre (JRC) - Institute for Prospective Technological Studies (IPTS) and the Directorate General for Research - Directorate C, Research and Innovation. The overall purpose of this project is to monitor and analyse industrial R&D and innovation activities in order to support the implementation and monitoring of the European research and innovation agenda (the Innovation Union flagship, set in the context of the Europe 2020 strategy aiming at a smarter, greener and more inclusive economy). The evidence gathered might also contribute to policy-making related to other relevant Europe 2020 flagship initiatives such as the "Industrial Policy", the "Digital Agenda" and the "New Skills for New Jobs" ones.

The present survey tackles the information gap identified above through an approach at the European level by gathering qualitative information on factors and issues surrounding and influencing companies' current and prospective R&D investment strategies. The survey complements other R&D investment related surveys and data collection exercises (e.g. Innobarometer, Eurostat data collection and other ongoing surveys).

Link to the R&D Investment Scoreboards

The survey is part of the Industrial Research and Innovation Monitoring and Analysis (IRIMA) initiative[47] and complements the *EU Industrial R&D Investment Scoreboard.*[48] The Scoreboard is the main IRIMA product and serves as a tool for the European Commission to monitor and analyse company R&D investment trends, and to benchmark, inform and communicate developments in R&D investment patterns.

While the Scoreboard is based on the audited annual accounts of companies and therefore looks at trends ex-post, the Survey improves the understanding of the Scoreboard companies by collecting (ex-ante) information. In addition to forward-looking perspectives on future investments, issues such as location strategies, drivers and barriers to research and innovation activities, or perception of policy support measures are addressed with a questionnaire agreed between JRC-IPTS and DG-RTD. The Survey makes efficient use of the direct contacts established with the European Scoreboard companies by adding-on to the Scoreboard mailing when the report is officially released.

[44] See the results of the European Science and Technology Observatory (ESTO) study: “Mapping Surveys and other Data Sources on Industrial R&D in the EU-25 countries”, Seville, June 2004.

[45] See the results of the JRC-IPTS study: “Description of Information Sources on Industrial R&D data : European Commission, OECD and European Industry Associations”, Seville, July 2004.

[46] The rationale for the IRIMA activities emerged in the context of the European Commission's "3% Action Plan" established to implement and monitor the 3% R&D investment intensity target of the Lisbon strategy ("Investing in research: an action plan for Europe" (COM, 2003)) and in further Communications of the Commission ("More Research and Innovation – Investing for Growth and Employment – A common approach", COM (2005) 488 final, "Implementing the Community Lisbon Programme: A policy framework to strengthen EU manufacturing – Towards a more integrated approach for industrial policy", COM (2005) 474 final).

[47] See: http://iri.jrc.ec.europa.eu/. The activity is undertaken jointly by the Directorate General for Research (DG RTD C, see: http://ec.europa.eu/research) and the Joint Research Centre, Institute of Prospective Technological Studies (JRC-IPTS, see: http://ipts.jrc.ec.europa.eu/activities/research-and-innovation/iri.cfm).

[48] The Scoreboard is published annually and provides data and analysis on the largest R&D investing companies in the EU and abroad (see: http://iri.jrc.ec.europa.eu/research/scoreboard.htm).

Methodology

Outliers were detected by analysing the distribution of the dataset in scatter and boxplots and defining upper and lower quartiles ranges around the median, according to the variable(s) analysed. To maintain the maximum information in the data, outliers were eliminated only in extreme cases and after assessing the impact on the result.[49]

One-year growth is simple growth over the previous year, expressed as a percentage: 1yr growth = 100*((C/B)-1); where C = current year amount, and B = previous year amount. 1yr growth is calculated only if data exist for both the current and previous year. At the aggregate level, 1yr growth is calculated only by aggregating those companies for which data exist for both the current and previous year.

Three-year growth is the compound annual growth over the previous three years, expressed as a percentage: 3yr growth = 100*(((C/B)^(1/t))-1); where C = current year amount, B = base year amount (where base year = current year - 3), and t = number of time periods (= 3). 3yr growth is calculated only if data exist for the current and base years. At the aggregate level, 3yr growth is calculated only by aggregating those companies for which data exist for the current and base years.

Unless otherwise stated, the **weighted figures** presented in this report are weighted by R&D investment.

To improve response rates, the following measures were taken in the course of each survey cycle:

(1) The questionnaire was revised and streamlined with a view towards keeping it as short and concise as possible and minimise the burden for the respondent. The questionnaire however increased in size due to the inclusion of additional topics from question 10 onwards.
(2) The questionnaire was sent together with the Scoreboard report to take advantage of this occasion as a door-opener.
(3) As well as physically sending the questionnaire to each company, an online site was provided to facilitate data entry via the European Commission's Interactive Policy-Making (IPM) tool,[50] where a Word version of the questionnaire was downloadable for offline information input.
(4) The questionnaire was emailed to the respondents of previous surveys, together with a link to the electronic copy of the latest analysis.
(5) The contact database was continuously improved. Respondents who had already participated in previous surveys, or their substitutes in cases where they had left their position, were priority contacts. Returned questionnaires and reminder mailings were resent using the latest contact information on the internet or by contacting the company directly via email or phone.
(6) The response rate is closely followed on a regular basis during the implementation. If necessary, measures for improving the response rate are applied, e.g. by adjusting the number of reminders, allowing more time for questionnaire reception, following up selected candidates by e-mail and phone or searching support from former survey participants
(7) Personal contact, mostly by phone, was made with several dozen companies when the deadlines were close, especially for those which had participated in the past.

The response rate has been steadily high over the past five years, taking full advantage of the familiarity of the EU Scoreboard companies with the exercise and their mature approach[51].

[49] For the systematic detection of outliers, an adjusted methodology from the NIST/SEMATECH e-Handbook of Statistical Methods was applied, see: http://www.itl.nist.gov/div898/handbook/prc/section1/prc16.htm
[50] See: http://ec.europa.eu/yourvoice/ipm/index_en.htm
[51] The response rate of the present survey is 18.8%. Those of the last three surveys were 11.8% (2007), 13.0% (2008), 18.5% (2009) and 20.5% respectively.

R&D Investment Definition

The objective of the survey is to address R&D investment, and not R&D expenditure, due to its direct link to the Innovation Union headline target of 3% R&D intensity for overall R&D investment of a country as a share of GDP. To make the survey as easy to complete as possible and to maximise the response rate, only a short definition of R&D investment, which is as close as possible to accounting standards, is provided in the survey.[52] The definition refers mainly to R&D as reported in the company's most recent accounts. The definition used in the survey is thus closely related to the International Accounting Standard (IAS) 38 "Intangible Assets",[53] based on the OECD "Frascati" manual,[54] and the definition used in the EU Industrial R&D Investment Scoreboards.

Composition of the Responses

The 187 responses were classified according to the ICB[55] described in the questionnaire. Sector classifications of individual companies were cross-checked with the Scoreboards. The sectors were combined into three groups according to their average R&D intensities in the Scoreboard:

- **High (more than 5%) R&D intensity (54 companies)**: pharmaceuticals & biotechnology, technology hardware & equipment, software & computer services, health care equipment & services, and leisure goods.
- **Medium (between 2 and 5%) R&D intensity (93 companies)**: industrial engineering, chemicals, aerospace & defence, electronic & electrical equipment, automobiles & parts, general industrials, fixed line telecommunications, food producers, alternative energy, household goods & home construction, oil equipment, services & distribution, other financials, personal goods, beverages, and tobacco.
- **Low (less than 1%) R&D intensity (40 companies)**: industrial metals & mining, construction & materials, banks, electricity, oil & gas producers, gas, water & multi-utilities, industrial transportation, forestry & paper, mining, and mobile telecommunications.

Table 2 shows the distribution of the responses among the sectors with their respective R&D investment shares.

[52] See Annex B
[53] See http://www.iasplus.com/standard/ias38.htm
[54] See "Proposed Standard Practice for Surveys on Research and Experimental Development: Frascati Manual", OECD, Paris, 2002, http://www1.oecd.org/publications/e-book/9202081E.PDF
[55] ICB Industry Classification Benchmark (see: http://www.icbenchmark.com/docs/ICB_StructureSheet_120104.pdf)

Table 2: Distribution of the responses by sectors

ICB Sector	Number of responses	Number of Scoreboard companies	Response rate by sector	Total R&D investment share compared to the Scoreboard*	R&D intensity sector group**
Pharmaceuticals & biotechnology	24	126	19.0%	above 40 %	High
Technology hardware & equipment	13	48	27.1%	above 40 %	High
Software & computer services	10	109	9.2%	below 20 %	High
Health care equipment & services	5	28	17.9%	between 20 and 40 %	High
other high R&D-intensity sectors	2	11	18.2%		High
Subtotal high R&D intensity sectors	54	322	16.8%	57.8%	
Industrial engineering	18	101	17.8%	above 40 %	Medium
Chemicals	15	47	31.9%	between 20 and 40 %	Medium
Electronic & electrical equipment	10	65	15.4%	below 20 %	Medium
Aerospace & defence	9	28	32.1%	between 20 and 40 %	Medium
Fixed line telecommunications	9	14	64.3%	above 40 %	Medium
Food producers	9	33	27.3%	between 20 and 40 %	Medium
Automobiles & parts	8	43	18.6%	between 20 and 40 %	Medium
General industrials	5	21	23.8%	above 40 %	Medium
Other medium R&D intensity sectors	10	158	6.3%		Medium
Subtotal medium R&D intensity sectors	93	510	18.2%	29.7%	
Electricity	8	17	47.1%	above 40 %	Low
Construction & materials	7	34	20.6%	below 20 %	Low
Oil & gas producers	7	9	77.8%	above 40 %	Low
Industrial metals & mining	6	13	46.2%	above 40 %	Low
Banks	4	33	12.1%	below 20 %	Low
Other low R&D intensity sectors	8	62	12.9%		Low
Subtotal low R&D intensity sectors	40	168	23.8%	34.5%	
Total	187	1000	18.7%	39.8%	

Note: * For confidentiality reasons, R&D investment shares of individual sectors are shown in ranges and only shown for sectors with at least four responses.
** Sector group according to the average Scoreboard R&D intensity of each sector.
Source: European Commission JRC-IPTS (2012)

Exactly half of the responses were from the medium R&D intensity sectors, but the biggest share of R&D investment in the sample came from the high R&D intensity sectors (see also Figure 1 of the section on R&D Investments and Innovativeness
2.1 R&D Investment Expectations).
Table 3 below shows the number of responses by home country (registered office) of the company.

Table 3: Distribution of the responses by home country of the company

country	number of responses	share of responses
Germany	36	19.3%
UK	25	13.4%
France	20	10.7%
The Netherlands	17	9.1%
Italy	16	8.6%
Finland	15	8.0%
Belgium	13	7.0%
Spain	11	5.9%
Denmark	10	5.3%
Sweden	9	4.8%
Austria	5	2.7%
other EU countries	10	5.3%
Grand Total	187	100.0%

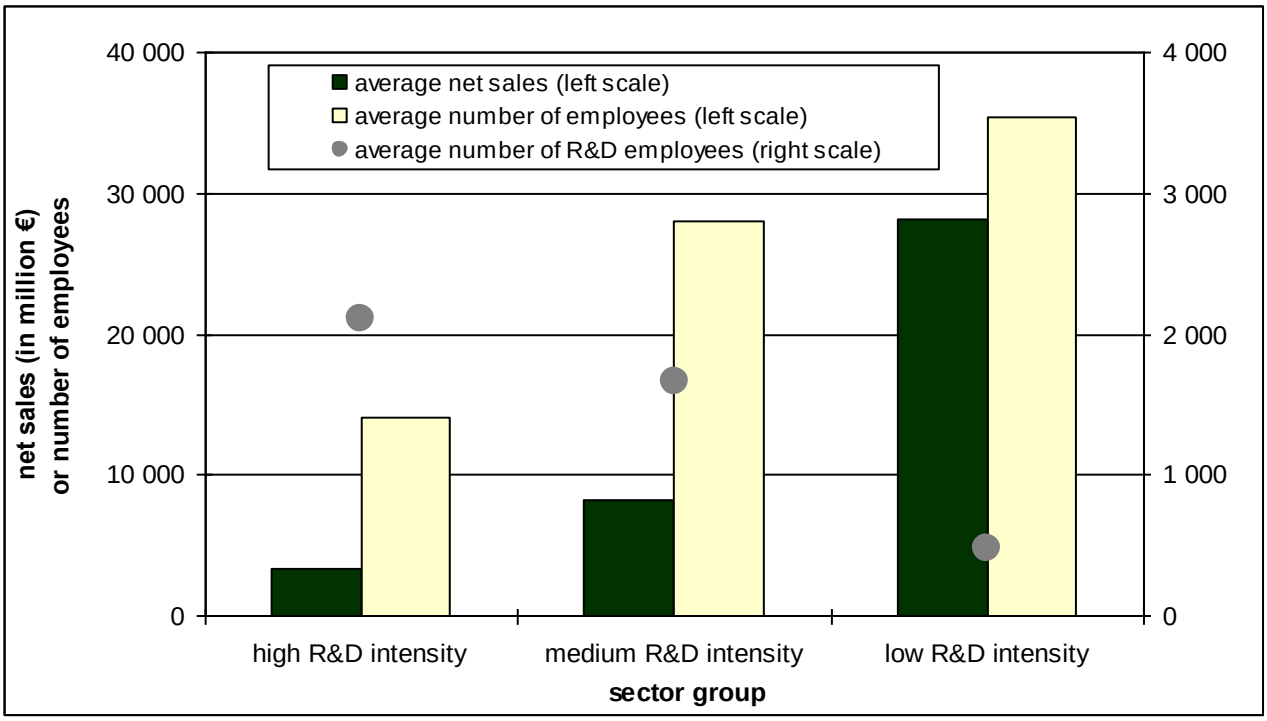
Note: For confidentiality reasons, only countries with at least four responses are shown.
Source: European Commission JRC-IPTS (2012)

The highest number of responses came from companies located in the three biggest Member States.

As shown in Figure 17, the average survey respondent is a very large company.[56] However, there are differences in company size between the sector groups.

[56] The average turnover of the responding companies was €10 billion, 25,500 employees, and 1,500 employees in R&D. Among the 187 respondents there were 5 medium-sized companies in the high R&D intensity sectors (according to the European Commission's SME definition, see: http://ec.europa.eu/enterprise/enterprise_policy/sme_definition/index_en.htm). Among the large companies in the sample, 61 had between 251 and 5,000 employees, 58 between 5,000 and 30,000 employees and 38 more than 30,000 employees.

Figure 17: Average turnover and employee numbers for the responding companies, by sector group



Note: The figure refers to all 187 companies in the sample.
Source: European Commission JRC-IPTS (2012)

The average net sales and employee numbers in the figure are inversely proportional to the R&D intensity of the sector group. The average number of R&D employees is considerably larger in the high and medium R&D intensity sectors than in the low one. This is the result of the high share of R&D employees in large companies that responded from pharmaceuticals & biotechnology and technology, hardware & equipment (high R&D intensity), automobiles & parts, chemicals and fixed line telecommunication (medium R&D intensity) sectors.

6 Annex B: The R&D Investment Questionnaire

We would appreciate your response by **deadline**, **preferably by using the questionnaire on our website** at: **http://iri-survey.jrc.es/2012/**. Alternatively, you may return this completed form by e-mail (Alexander.Tuebke@ec.europa.eu), fax (+34.95.448.83.26), or post[57].

The information in your response will be treated as **confidential**. It will only be used within this study and in an aggregated form. The European Commission is committed to the protection and privacy of data[58].

It will take about **35 minutes** to complete the questionnaire.

We will automatically inform you of the results of the survey when they are available (for that, please ensure that you have provided your e-mail address below).

Name of the company you are responding for: _____

Its primary sectors of activity: _____

Your name: _____

Job title: _____

E-mail: _____

Phone number: _____

The European Commission may follow up this survey by short-interviews to clarify major trends revealed in the analysis. Please **tick here** ☐ if you *do not* wish to be approached for this purpose.

Definition of R&D investment

For the purposes of this questionnaire, **'R&D investment' is the total amount of R&D financed by your company** (as typically reported in its accounts). It does not include R&D financed from public sources.

[57] European Commission, Institute for Prospective Technological Studies (IPTS), Attn.: Alexander Tübke, Edificio Expo, Calle Inca Garcilaso 3, E-41092 Seville, Spain, Tel.: +34.95.448.83.80

[58] See the Privacy Statement on the last page

A. Corporate background

1. How many employees in total work in your company?

   Around _____.

2. How many employees work on R&D in the company?

   About _____.

B. R&D investment levels and trends

3. What was your R&D investment in the past year (2011)?

   About € _____ million.

4. At what rate do you expect the company to change its overall R&D investment over the next three years (2012, 2013, 2014), in real terms?

   About _____ % per annum.

5. How much of your annual sales comes from innovative products and services introduced in the past three years (2009, 2010 and 2011)?

   About _____ % of total sales.

6. Which company do you consider the innovation leader in your sector? *Please state the name of the innovation leader.*

   ⇨_____

C. R&D and innovation

7. Which effect do the following policies and factors external to the firm have on your company's current innovation activities? *Please rate on a scale from -2 (very negative effect) to 2 (very positive effect).*

	Very negative effect -2	Negative effect -1	No effect 0	Positive effect 1	Very positive effect 2
(a) Availability of scientists, engineers, designers and technology transfer experts	☐	☐	☐	☐	☐
(b) Labour costs of researchers	☐	☐	☐	☐	☐
(c) Access to risk and venture capital	☐	☐	☐	☐	☐
(d) National public support in the form of:					
(d1) grants	☐	☐	☐	☐	☐
(d2) fiscal incentives	☐	☐	☐	☐	☐
(d3) loans and guarantees	☐	☐	☐	☐	☐
(d4) public private partnerships	☐	☐	☐	☐	☐
(e) EU public support in the form of:					
(e1) direct public aid, e.g. from the Framework Programme or Structural Funds	☐	☐	☐	☐	☐
(e2) public-private partnerships, e.g. European Technology Platforms[59] or Joint Technology Initiatives[60]	☐	☐	☐	☐	☐
(e3) policies that foster cooperation	☐	☐	☐	☐	☐
(e4) policies for the exchange of human resources	☐	☐	☐	☐	☐
(f) Competition policy requirements on:					
(f1) research collaboration	☐	☐	☐	☐	☐
(f2) technology transfer agreements	☐	☐	☐	☐	☐
(g) Public procurement of:					
(g1) innovative goods and services	☐	☐	☐	☐	☐
(g2) R&D services	☐	☐	☐	☐	☐
(h) Product market regulation, norms and standards	☐	☐	☐	☐	☐
(i) Intellectual Property Rights in terms of:					
(i1) costs of protection	☐	☐	☐	☐	☐
(i2) time to obtain protection	☐	☐	☐	☐	☐
(i3) conditions for putting them into force	☐	☐	☐	☐	☐

(j) Other (please specify):

⇨ _____

_____

_____

_____

[59] European Technology Platforms provide an industry-lead forum to define R&D priorities on strategically important issues in the medium to long term (see http://cordis.europa.eu/technology-platforms/home_en.html).

[60] Joint Technology Initiatives create partnerships between publicly and privately-funded organisations involved in R&D, focussing on areas where it can contribute to European competitiveness (see http://cordis.europa.eu/fp7/jtis/).

8. How relevant are the following activities for your company's innovations[61]? *Please rate on a scale from 1 (irrelevant) to 5 (highly relevant).*

	Irrelevant 1	2	3	4	Highly relevant 5
(a) R&D within the company	☐	☐	☐	☐	☐
(b) R&D outsourced to other companies:					
(b1) Inside the European Union	☐	☐	☐	☐	☐
(b2) In non-EU countries	☐	☐	☐	☐	☐
(c) R&D outsourced to higher education institutions or public research organisations:					
(c1) Inside the European Union	☐	☐	☐	☐	☐
(c2) In non-EU countries	☐	☐	☐	☐	☐
(d) Acquisition of new or highly improved machinery, equipment and software:					
(d1) Inside the European Union	☐	☐	☐	☐	☐
(d2) In non-EU countries	☐	☐	☐	☐	☐
(e) Purchase or licensing of intellectual property rights (patents, copyrights and designs) as well as know-how:					
(e1) Inside the European Union	☐	☐	☐	☐	☐
(e2) In non-EU countries	☐	☐	☐	☐	☐
(f) Training to support innovative activities	☐	☐	☐	☐	☐
(g) Design (graphic, packaging, process, product, service or industrial)	☐	☐	☐	☐	☐
(h) Market research, launch advertising, and related marketing activities for new product introduction:					
(h1) Inside the European Union	☐	☐	☐	☐	☐
(h2) In non-EU countries	☐	☐	☐	☐	☐
(i) Other (please specify):					

⇨ _____

_____

9. How important are the following sources of knowledge for your R&D and innovation activities? *Please rate on a scale from 1 (unimportant) to 5 (highly important).*

	Un-important 1	2	3	4	Highly important 5
(a) Knowledge sharing with other companies via:					
(a1) collaboration agreements[62]	☐	☐	☐	☐	☐
(a2) licensing in	☐	☐	☐	☐	☐
(a3) licensing out	☐	☐	☐	☐	☐
(b) Knowledge sharing with higher education institutions, e.g. Universities, via:					
(b1) collaboration agreements	☐	☐	☐	☐	☐
(b2) licensing in/out	☐	☐	☐	☐	☐
(c) Knowledge sharing with Public Research Organistions, e.g. public R&D bodies, via:					
(c1) collaboration agreements	☐	☐	☐	☐	☐
(c2) licensing in/out	☐	☐	☐	☐	☐
(d) Other (please specify):					

⇨ _____

_____

[61] Innovation is the introduction of new or significantly improved products, services, or processes.
[62] Including consultancy and R&D contracted in/out

10. Please indicate the number of R&D collaboration agreements which your firm has *with other firms* in the following categories:

	Number of R&D collaboration agreements *with other firms*
(a) Total number:	
(b) With firms in your country:	
(c) With firms in another EU country:	
(d) With firms in a non-EU country:	
(e) With customers or suppliers (vertical agreements):	
(f) With competitors (horizontal agreements):	
(g) Number of new agreements signed in 2011:	

(h) comments:

⇨ _____

_____

11. Which country do you consider the *most attractive for outsourcing R&D to other companies*, higher education institutes and public research organisations?

⇨ _____

12. Which country do you consider the *most attractive as a source of intellectual property rights (IPRs)* through licencing or acquisition of intangible assets?

⇨ _____

13. Please tick which types of intellectual property rights (IPRs) licencing your company has used in the past three years (2009, 2010 and 2011):

	tick if used by your company
(a) Acquiring or *licencing-in* IPRs from other firms via:	
(a1) exclusive licencing	☐
(a2) non-exclusive licencing	☐
(a3) licences of right	☐
(a4) compulsory licencing from suppliers	☐
(a5) acquisition of intangible assets of another firm through merger and acquisition	☐
(b) Assigning or *licencing-out* IPRs to other firms via:	
(b1) exclusive licencing	☐
(b2) non-exclusive licencing	☐
(b3) licences of right	☐
(b4) compulsory licencing to customers	☐
(b5) disposal through sale of intangible assets to another firm in a divestment	☐
(c) Allowing free-use of your IPRs by other firms, public organisations or universities	☐
(d) Participation in cross-licencing[63] of IPR with suppliers or customers	☐
(e) Other (please specify):	

⇨ _____

_____

[63] Cross-licencing is a contract between two or more parties where each party grants rights to their intellectual property to the other parties.

14. Which of the following measures would encourage more licencing activity?

	tick if licencing activity is encouraged
(a) Model contracts	☐
(b) Reduced costs of obtaining and maintaining IPRs	☐
(c) Unitary patent and patent judiciary in EU	☐
(d) Favourable tax treatment of licence revenue	☐

(e) Other (please specify):

⇨ _____

_____

15. Please indicate the level of expenditure for *licensing-in* intellectual property rights (IPRs):

About € _____ million.

16. Please indicate the level of revenue from *licensing-out* intellectual property rights (IPRs):

About € _____ million.

D. Final comments or suggestions

⇨ _____

_____

_____

_____

Thank you very much for your contribution!

Privacy Statement

The *2012 EU Survey on R&D Investment Business Trends* is carried out by the Industrial Research and Innovation (IRI) action of the European Commission's Joint Research Centre (JRC), Institute for Prospective Technological Studies (IPTS). The survey is directed at the 1000 European companies in the *2011 EU Industrial R&D Investment Scoreboard*.
The European Union is committed to data protection and privacy as defined in Regulation (EC) nº 45/2001. This survey is under the responsibility of the IRI action leader, Fernando Hervás Soriano, acting as the Controller as defined in the above regulation. The Controller commits himself dealing with the data collected with the necessary confidentiality and security as defined in the regulation on data protection and processes it only for the explicit and legitimate purposes declared and will not further process it in a way incompatible with these purposes. These processing operations are subject to a Notification to the Data Protection Officer (DPO) in accordance with Regulation (EC) 45/2001.

Purpose and data treatment
The purpose of data collection is to establish the analysis of the *2012 EU Survey of R&D Investment Business Trends*. This survey has a direct mandate from the Commission's 2003 Action Plan "Investing in Research" (COM 2003 (226) final, see http://ec.europa.eu/invest-in-research/action/2003_actionplan_en.htm). The personal data collected and further processed are:

- Company: name, primary sectors of activity, company size
- Contact Person: name, job title, phone number, e-mail

The collected personal data and all information related to the above mentioned survey is stored on servers of the JRC-IPTS, the operations of which underlie the Commission's security decisions and provisions established by the Directorate of Security for these kind of servers and services. **The information you provide will be treated as confidential and aggregated for analysis.**

Data verification and modification
In case you want to verify the personal data or to have it modified respectively corrected, or deleted, please write an e-mail message to the address mentioned under "Contact information", by specifying your request. Special attention is drawn to the consequences of a delete request, in which case any trace to be able to contact you will be lost. Your personal data is stored as long as follow-up actions to the above mentioned survey are necessary with regard to the processing of personal data.

Contact information
In case you have questions related to this survey, or concerning any information processed in this context, or on your rights, feel free to contact the IRI Team, operating under the responsibility of the Controller at the following email address: **jrc-ipts-iri@ec.europa.eu**.

Recourse
Complaints, in case of conflict, can be addressed to the European Data Protection Supervisor (EDPS) at www.edps.europa.eu.

European Commission

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Abstract

This report presents the findings of the seventh survey on trends in business R&D investment. These are based on 187 responses of mainly larger companies from the 1000 EU-based companies in the 2011 EU Industrial R&D Investment Scoreboard. These 187 companies are responsible for R&D investment worth almost €56 billion, constituting around 40% of the total R&D investment by the 1000 EU Scoreboard companies.

The main result is that these top R&D investing companies expect their global R&D investments to grow by 4% annually from 2012 to 2014. The average share of sales coming from new innovative products and services was 18%, varying from 33% in high R&D intensity sectors to 10% in low R&D intensity ones. The differences between the sectors were not in all cases related to R&D intensity or net sales of the companies but rather seemed to reflect different sectoral innovation cycles. Collaboration agreements are considered a more important form of knowledge sharing activities than licencing (except for high R&D intensity sectors), which could be a sign of the increasing importance of open innovation.

For the impact of factors and policies on the company's innovation activities, national public support had the most positive effect, followed by availability of qualified personnel and EU public support. As in previous surveys, labour costs and conditions of IPR (enforcement, time and costs) continued to be perceived as negative factors for company innovations. This reveals the importance of fostering an efficient IPR regime for companies' innovation activities.

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