



R&D off-shoring strategies and performance: summary of evidence

Lukasz Grzybowski
FEEM & University of Cape Town
Brussels
9th December 2011

INGINEUS "Impact of Networks, Globalisation, and their INTERaction with EU Strategies"
is sponsored by the 7th Framework Programme of the European Commission. www.ingineus.eu





Outline

- Policy objectives with respect to R&D activity.
- Sources of evidence on R&D internationalization.
- R&D internationalization strategies.
- Results based on case studies.
- Results based on empirical studies.
- Policy conclusions.





Europe 2020 flagship initiatives

Europe 2020 flagship initiative: **"Innovation Union"**

- "to improve framework conditions and access to finance for research and innovation so as to ensure that innovative ideas can be turned into products and services that create growth and jobs."

EU *measurable* headline target:

- 3% of the EU's GDP should be invested in R&D by 2020.

How does R&D off-shoring relates to these objectives?

- Impact on R&D investments and employment in the EU.





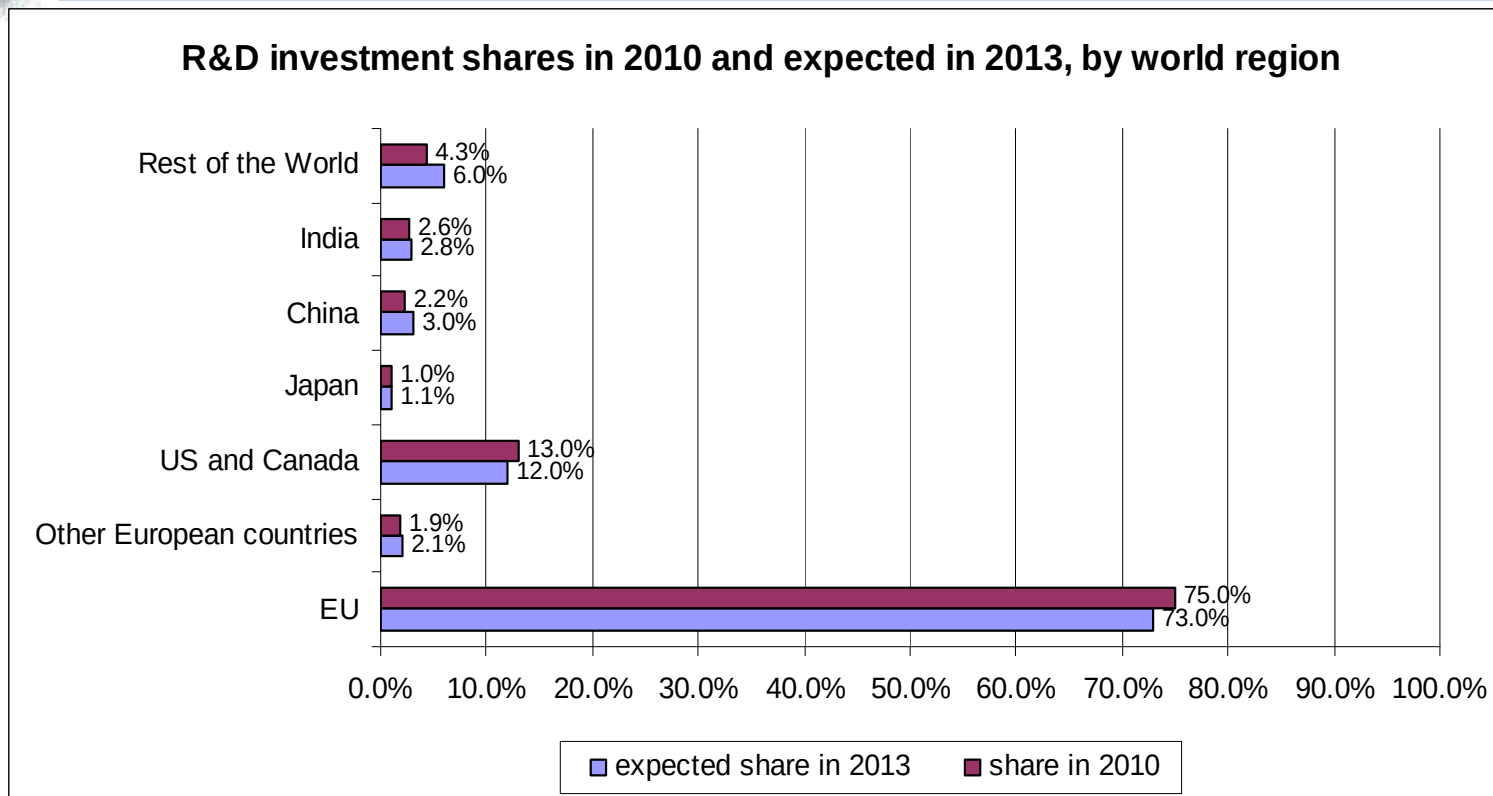
Sources of evidence

- Surveys: the European Commission's initiative:
 - “*EU Industrial R&D Investment Scoreboard*” analyzes private R&D of 1000 companies and shows ex-post trends (but no information on the place where R&D is actually performed).
 - Complemented by “*Survey on R&D Investment Business Trends*”, which collects ex-ante expectations and qualitative statements on R&D activity.
- Case studies, such as those conducted by EU-sponsored research projects INGENEUS and LOCOMOTIVE.
- Empirical academic studies using patent and R&D expenditure data (also conducted within INGENEUS), or more recently using patent citation analysis.





"2010 EU Survey on R&D Investment Business Trends"



Note: The figure refers to 163 out of the 205 EU companies in the sample, weighted by R&D investment. Other EU countries include Switzerland, Norway and others, while the rest of the world includes a heterogeneous set of countries such as South Korea, Taiwan, Brazil.

Source: European Commission JRC-IPTS (2011)





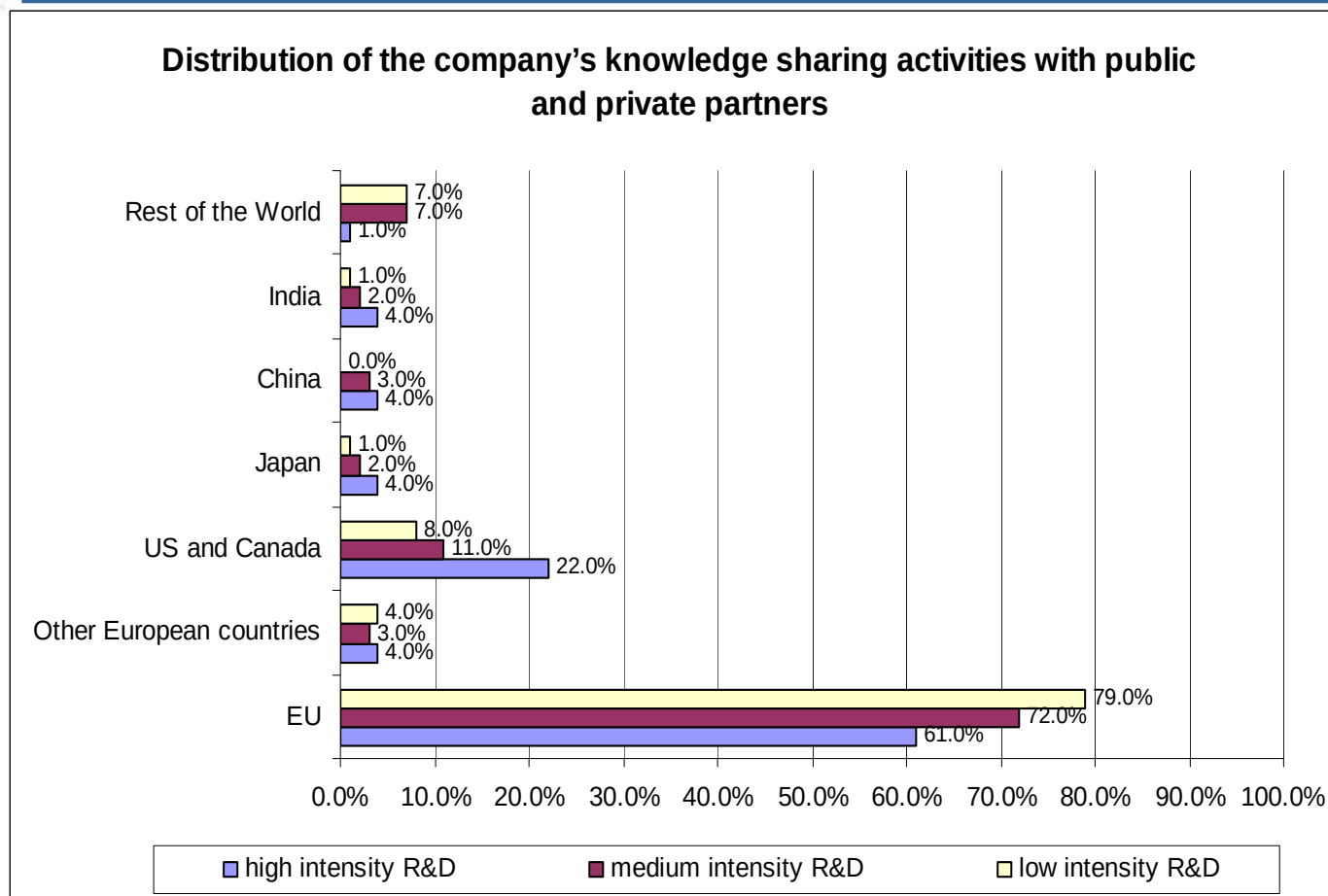
"2010 EU Survey on R&D Investment Business Trends"

- More than two-thirds of companies chose their home country as the most attractive location for R&D, and identified the US, China, Germany and India as the most attractive locations outside their home country.
- These preferences were similar in the previous two surveys.





"2010 EU Survey on R&D Investment Business Trends"



Note: The figure refers to 113 out of the 205 companies in the sample. Other EU countries include Switzerland, Norway and others, while the rest of the world includes a heterogeneous set of countries such as South Korea, Taiwan, Brazil.

Source: European Commission JRC-IPTS (2011)



"2010 EU Survey on R&D Investment Business Trends"

- The results of the survey suggest that a relatively small share of R&D carried out by EU firms in China and India (ca. 5%) and other developing countries (ca. 4%).
- This is unlikely to change in the nearest future.





Case studies

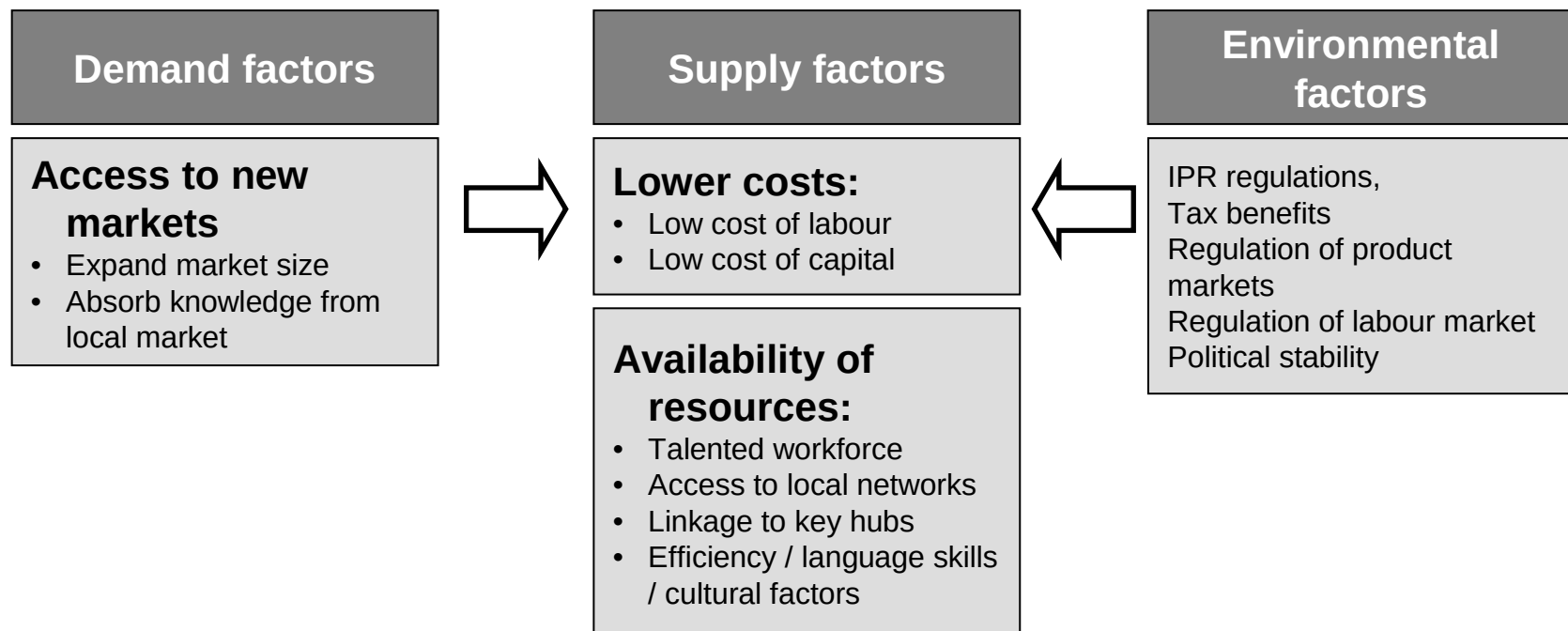
- **ENGINEUS**, project sponsored by the 7th Framework Programme of the EC:
 - 12 EU companies (4 ICT, 7 Automotive, 1 Agro-food) with R&D activities in emerging countries.
- **LOCOMOTIVE**, project sponsored by the 6th Framework Programme of the EC:
 - 8 companies including: Airbus, Siemens, Philips, Nokia, Volkswagen, Motorola, GlaxoSmithKline, Shell.





Drivers of R&D location

Motives for carrying out R&D abroad commonly found in surveys, case studies:





Theory of R&D internationalization

Unit types	R&D activity		Employment
Technology transfer units (TTU)	linked to manufacturing units and established to adapt a products and processes to local conditions in host countries	'home-base exploiting' (Kuemmerle 1996) 'asset-exploiting' (Dunning and Narula 1995)	Complementary / positive effect on employment
Indigenous technology units (ITU)	established to develop new and/or improved products for local markets drawing on local technology	'home-base augmenting' (Kuemmerle, 1996)	Complementary / neutral effect on employment
Global technology units (GTU)	established to develop new products for the global market	'asset-seeking' R&D activity (Dunning and Narula, 1995)	Substitute / negative effect on employment





Example 1: ICT industry - Phillips

- Headquarter in the Netherlands, Amsterdam, founded in 1891.
- Multinational workforce of ca. 114,000 employees end of 2011.
- Active in the areas: Consumer Lifestyle, Healthcare and Lighting.
- Manufacturing sites in 28 countries, sales outlets in 150 countries.
- 2010 R&D expenditure of ca. €1.600 billion (6.2 % of sales).
- 12,800 R&D staff in 25+ countries.

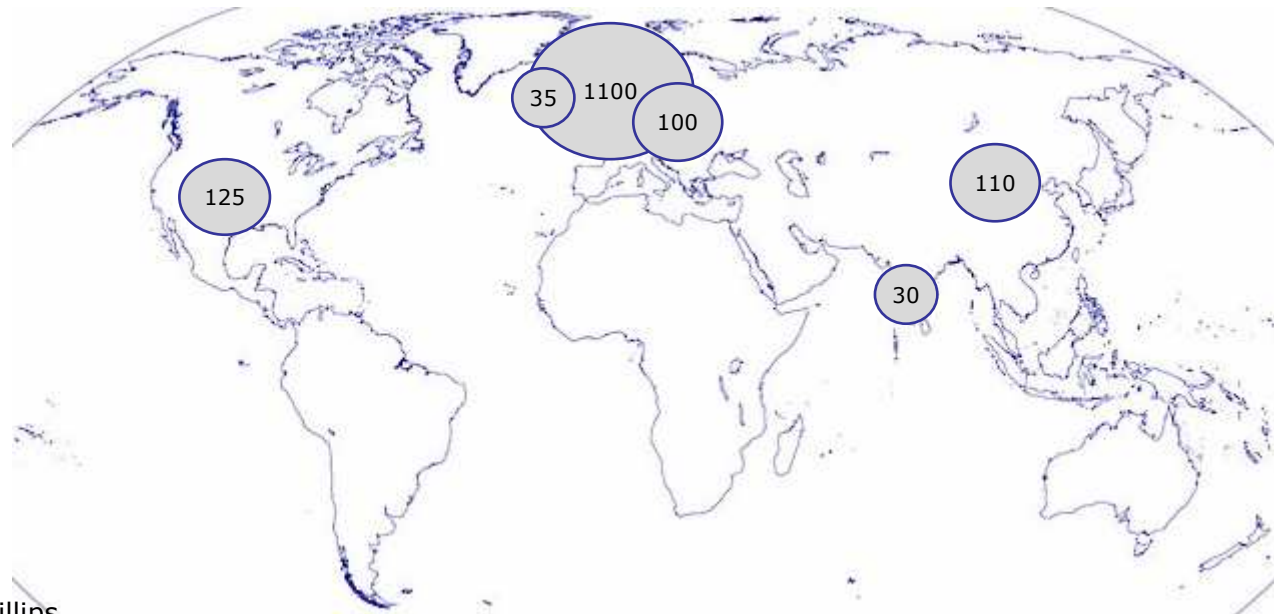
Source: Phillips





Example 1: ICT industry - Phillips

- Philips Research, one of the legs conducting R&D, employs ca. 1,800 researchers at 7 labs in: Netherlands, Germany, UK, US, China and India.



Source: Phillips





Example 1: ICT industry - Phillips

Location	R&D employees	Set-up date	Location driver	R&D activity	Final product market
Netherlands Eindhoven	1100	1914	HQ	Healthcare, Lighting, and Consumer Lifestyle	Global
Germany Hamburg	100	1957	Research capacity	Healthcare, including X-ray imaging science	Global
US Briarcliff	125	1942	Research capacity	Healthcare and Lighting	Global
India Bangalore	30	2000	Research capacity	Healthcare and Energy for the emerging markets	Global/local
UK Cambridge	35	2008	Research capacity	Home Healthcare, Indoor and Outdoor location technologies, microbiology and hygiene.	Global/local
China Shanghai	110	2008	Market	Healthcare, Lighting, and Consumer Lifestyle	Global/local

Source: Phillips





Example 1: ICT industry - Phillips

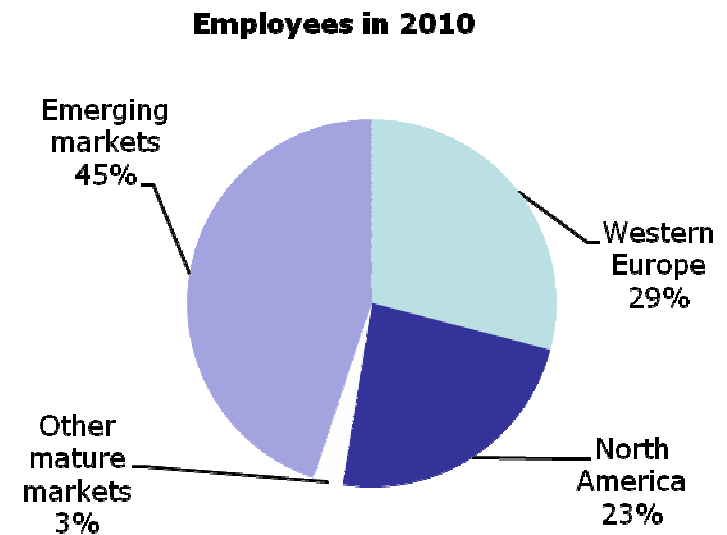
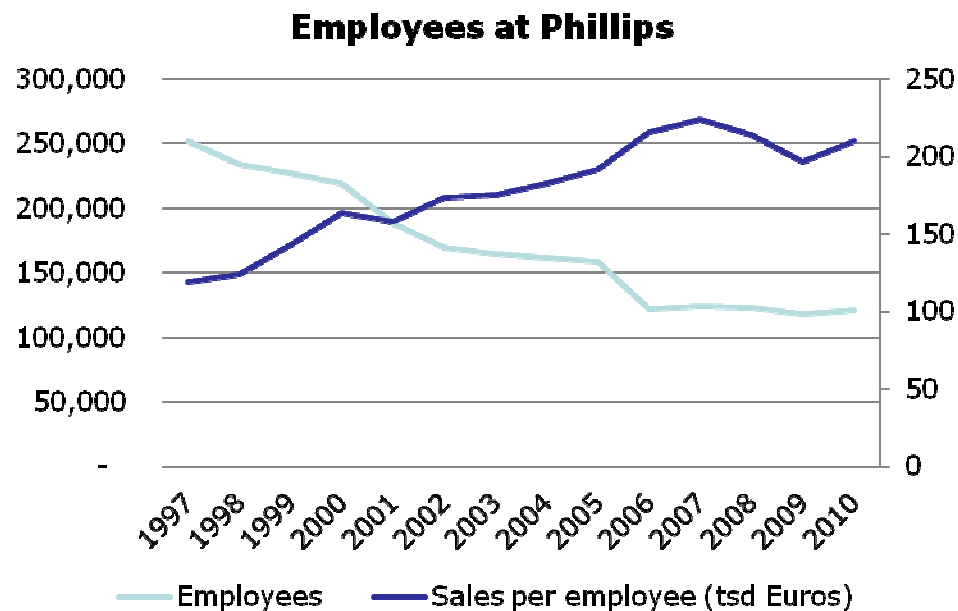
- Philips Research units support local Philips organizations in selected geographies with “high growth opportunities”, such as Asia Pacific.
- For example, “Philips Research East Asia was established in 2000 in Shanghai, serving Philips’ rapidly growing business in the East Asia region.”
- Philips is “convinced that the combination of innovation and market focus is the key to profitable growth.”

Source: LOCOMOTIVE





Example 1: ICT industry - Phillips



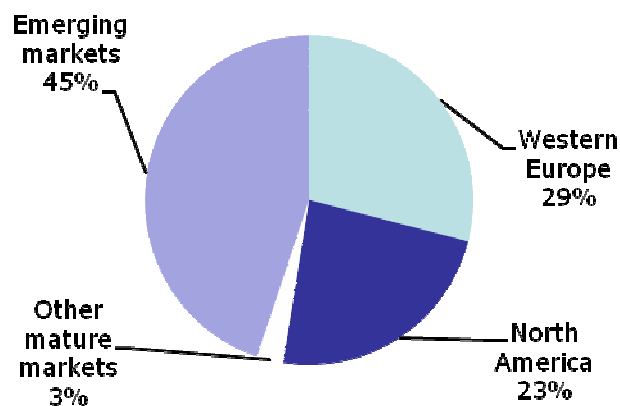
Source: Phillips



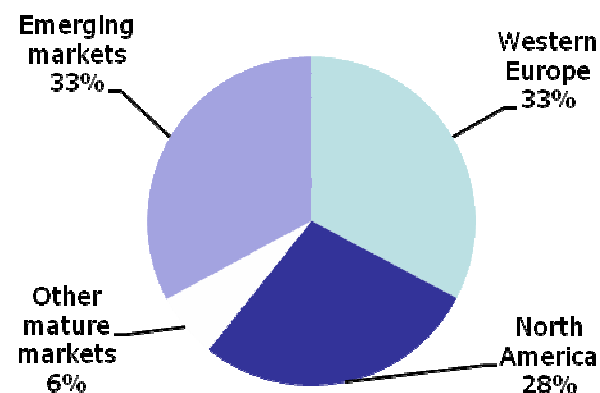


Example 1: ICT industry - Phillips

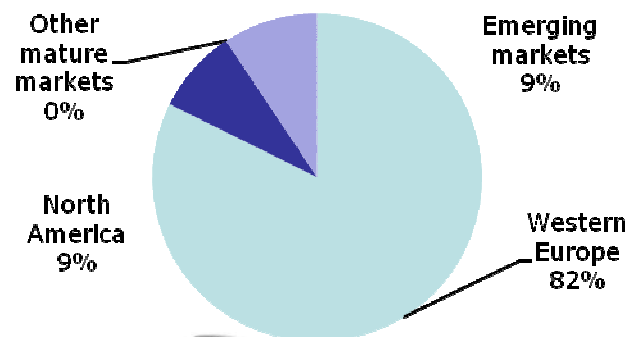
Employees in 2010



Sales in 2010



Phillips Research employees in 2010



Source: Phillips





Example 2: Automotive – Volvo

- Headquarter in the Sweden, Gothenburg, founded in 1927.
- Multinational workforce of about 105,000 employees as of end of 2010.
- Active in the production commercial vehicles including trucks, buses and construction equipment, as well as provider of marine and aerospace components and financial services.
- Manufacturing sites in 19 countries
- 2010 R&D expenditure of ca. €1,5 billion (4% of sales)
- About 50% of the Volvo Group R&D is performed in Sweden

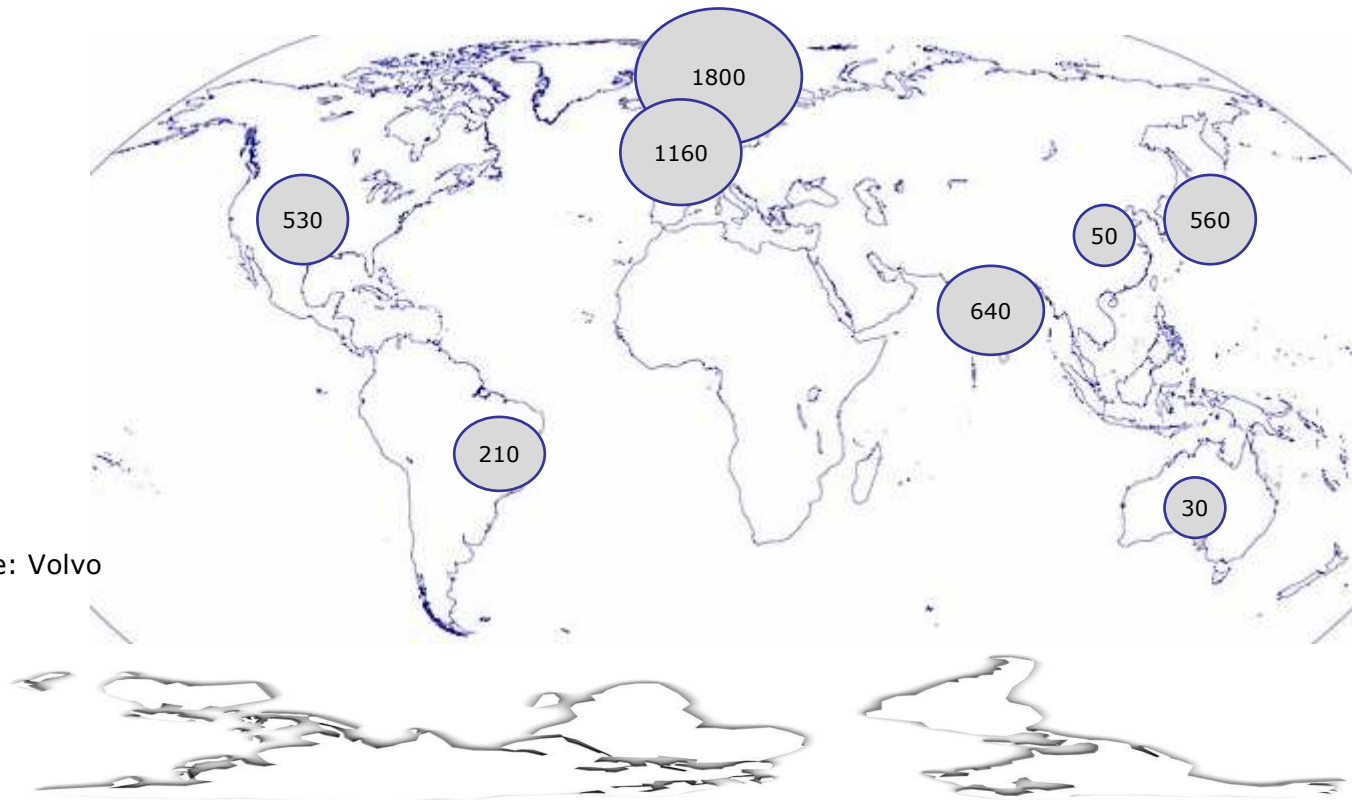
Source: Volvo





Example 2: Automotive - Volvo

- Business units which develop new technologies and services: Volvo 3P, Volvo Powertrain, Volvo Technology, Volvo Technology Transfer, Volvo Information Technology.
- Volvo 3P: product development for four truck brands.



Source: Volvo



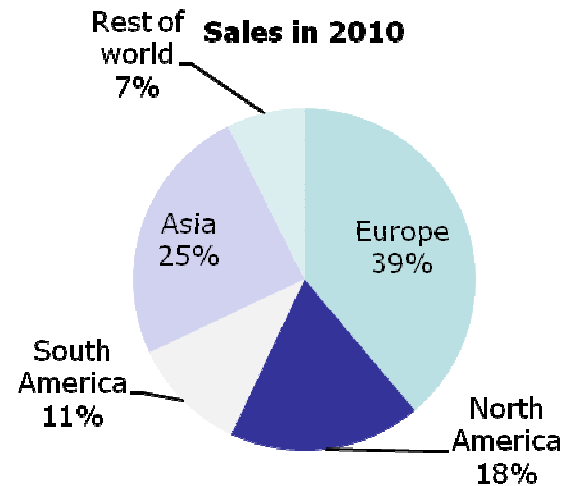
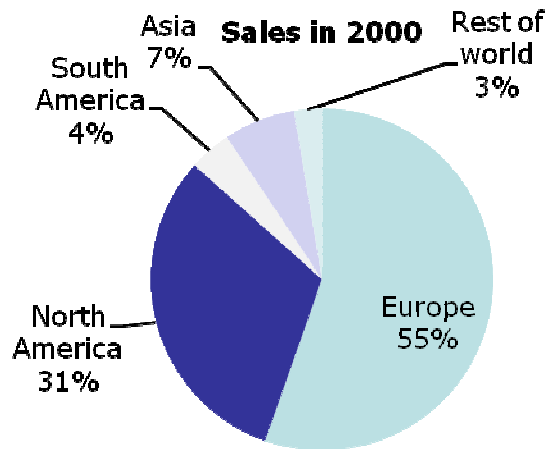
Example 2: Automotive - Volvo

Location	R&D employees	Set-up date	Location driver	R&D activity	Final product market
Sweden Göteborg	1800	1927	Headquarter	Global development center	Global
France Lyon	1160	2001	Acquisition of Renault	Global development center	Global
US Greensboro	530	2001	Acquisition of Mack by Renault	Global development center	Global
Japan Ageo	560	2007	Acquisition of Nissan Diesel	Global development center	Global
India Bangalore	640	2006	Research capacity / cost / market size / culture	Hub of product development and IT sourcing for Asia	Asia
Brazil Curitiba	210		Next to plant		Global/local
China Shanghai	50		Research capacity / cost / market size	Development of models for China	Local
Australia Brisbane	30		Next to plant		Local

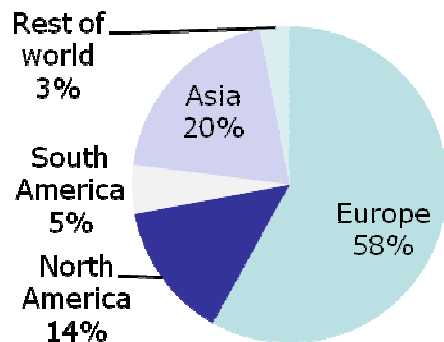
Source: Volvo



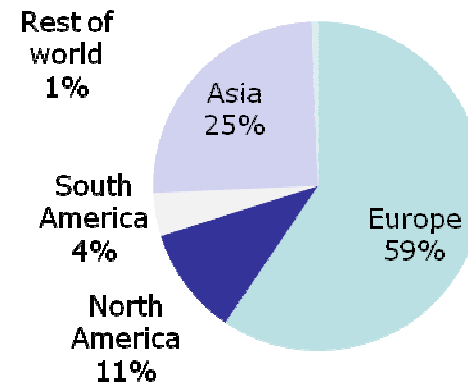
Example 2: Automotive - Volvo



Employees in 2010



Volvo 3P employees in 2010



Source: Volvo



Evidence from LOCOMOTIVE cases

Sector	Firms	Drivers of outsourcing	Focus of outsourcing
Automobile	VW	Low-cost manufacturing Market access	Materials innovations, sub-components, process innovation
Electronics	Phillips, Siemens	Market access Access to R&D centres	Electronic & component design, process innovations, new materials
Pharmaceuticals & biotechnology	GSK	Outsourcing of non-strategic process Contract research	Clinical trials, testing, molecule-processing
Aerospace	Airbus	Access to business systems Access to engineers	Special engineering skills, software design, new engines
Telecom equipment	Nokia, Motorola	Market access Purchase of best-in-breed	Convergence, software development, imposing standards

Source: Private Sector R&D: Global View, Erasmus / Interlace-Invent 2007





R&D strategies and industry characteristics

R&D strategy	Industry	Economies of scale / scope	Standard ization	Product life-cycle	Character of R&D	Impact on R&D & employment at home
Global sales from single R&D location usually in home country	Aerospace, Pharmaceuticals	Large	High	Long	Complement	Positive
Development from a location in home country + local adaptation (TTU)	Automotive Agro-food, High-tech, Software	Large	Flexible	Medium	Complement	Positive
Relatively independent R&D activity in different locations for global markets (GTU)	Electronics, Telecom equipment, High-tech, Software	Medium	High	Short	Substitute	Negative
Relatively independent R&D activity in different locations for local markets (ITU)	Electronics, telecom equipment, software	Medium	Low	Short	Complement	Neutral



Examples

- Airbus:
 - Centres of Excellence in Europe; customer services like training and technical support in Middle East, Japan, Russia; R&D contracts granted to manufacturers in China and US.
- GlaxoSmithKline:
 - R&D activity concentrated in Europe, US and Japan but plans to expand in China and India due to lower cost for clinical trials.
 - “GSK estimates that it takes on average upwards of 10-15 years and costs more than EUR 750M to discover and develop a new drug.”





ENGINEUS: empirical studies

Authors	Data	Summary
University of Sussex	365 MNC from US, EU and Japan	• Evidence that more profitable firms offshore more innovation. • No evidence of negative effect of offshoring of innovation on firm profitability.
Centro Studi Luca d'Agliano	EU NUTS2 regions	• Positive and significant effect of the extent of R&D offshoring on home region productivity growth.
Centro Studi Luca d'Agliano	9 EU15 members, 20 industries, 10 years	• Service offshoring has small (weakly positive) effect on the level of labour demand in Western Europe.





Policy conclusions

- Is R&D off-shoring a problem from the perspective of Europe 2020 objectives?
- European companies offshore a relatively small share of their R&D activities; ca. 4% to India and China and ca. 5% to other developing countries.
- In most of the cases/industries, R&D activity is internationalized for the purpose of product adaptation to local needs, with core R&D conducted in the HQ.
- The empirical studies conducted within the project INGENEUS do not find that offshoring has a negative effect on performance.
- On this basis we can conclude that offshored R&D is in most of the cases complementary to R&D activity conducted at home and as such should not have a negative effect on R&D activity and employment at home countries.





Policy conclusions

- On the basis of these results we can conclude that policies aiming to discourage offshoring may reduce the competitive standing of EU firms in global market.
- Further quantitative evidence to support this conclusion is desirable.
- Most of the empirical evidence is based on some sort of cross-industry analysis. As common in microeconomic studies, cross-sectional analysis of industries tends to be unsatisfactory due to idiosyncratic characteristics of industries, and even of firms.
- More detailed firm-level panel data is required to test empirically some of the hypothesis discussed.





Thanks for your attention.

Lukasz Grzybowski
lukasz.grzybowski@uct.ac.za

ENGINEUS "Impact of Networks, Globalisation, and their INTERaction with EU Strategies"
is sponsored by the 7th Framework Programme of the European Commission. www.ingineus.eu

