



The European Commission's science and knowledge service

Joint Research Centre

Towards a better understanding of firms' R&D and innovation value chains: insights from qualitative and quantitative evidence

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GLORIA workshop : "Global corporate value chains & innovation networks in the 4th industrial era: new models of production and work organisation"



- R&D internationalisation/globalisation
- Structural changes in the international organisation of R&D and innovative (RDI) activities (fragmentation, disintegration, outsourcing)
- New directions for collection of evidence and for qualitative database

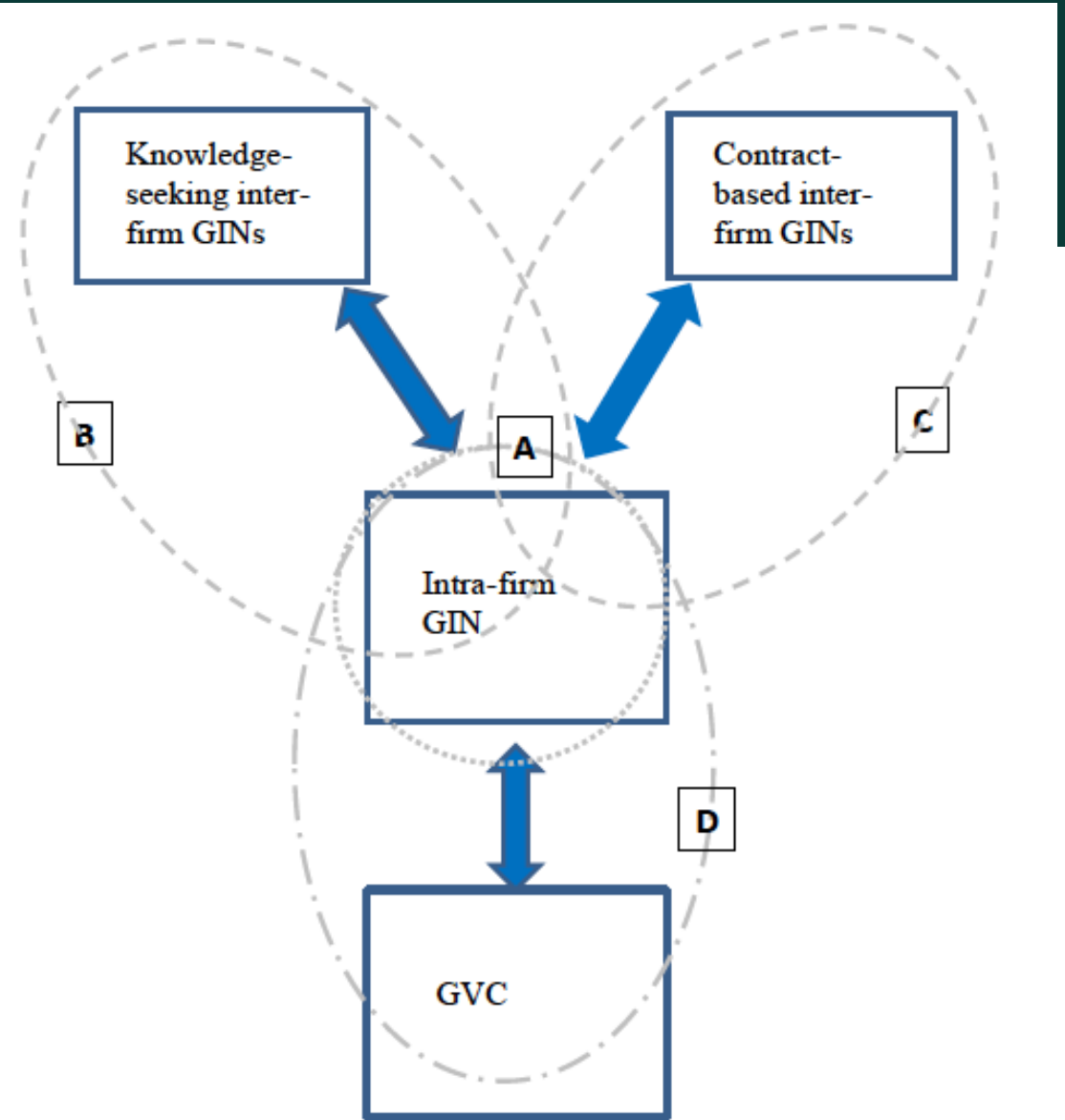
Literature Review (1/2)

- R&D/Innovation often examined as homogenous
- Focus : patents, R&D expenditure, strategic alliances
 - ➔ Linkages with science-base (hence patents) much less to R&D linked to development or production (e.g. Castellani et al 2013)
 - ➔ Foster science-base to attract R&D FDI ... manufacturing less important But...
- Innovation literature ➔ scientific advances + important source of innovation
- Most firms do industrial R&D, DDT rather than Science (Pavitt 1989)
- R&D = different activities... **but little is known about the organisational or geographical configuration**

Cantwell and Mudambi 2011; Narula and Zanfei 2005; Iammarino and McCann 2013; Alcácer et al 2016; Dachs et al 2014; Moncada-Paterno-Castello et al 2011; OECD 2008; Dernis et al 2015

Literature Review (2/2): different types of corporate GINs

Ramirez (2018), *Global Innovation Networks: State of the art and issues at stake for GVCs*.
GLORIA Research collaborations, JRC



Methodology (1/3): Mix Methods

Structured interviews (IDEA/VDI on R&D across GVCs; Dosso, Potters & Tübke 2019)

60 interviews with RDI managers from 10 MNEs : pharmaceuticals, automotive, aerospace, ICT (2017)

Technology Readiness Levels (TRLs) → guide to understand the partitioning of RDI

Semi-structured interviews (Dosso & Ramirez)

European MNEs: electric equipment & appliances, pharma firm - Senior R&D managers

Industry expert from Automotive industry

Cross-border greenfield FDI data (creation of new unit(s)) : R&D, DDT, Education & Training, Maintenance & Servicing - fDi Markets database (Financial Times)

TRL1 - Basic principles observed	Scientific research is at initial stages. Initial results are being translated into future research and development plans.
TRL 2 - Technology concept formulated	Once the basic principles are studied & initial findings can be applied to practical applications. At this stage the tech is very speculative as there is little or no experimental proof of concept.
TRL 3 - Experimental Proof of concept	When active research and design begin. Generally both analytical & lab studies are required at this level to see if a technology is viable & ready to proceed further via the development process. Often during TRL 3, a proof-of-concept model is constructed.
TRL 4 - Technology validation in lab	At this stage multiple component pieces are tested with one another.
TRL 5 - Technology validation in relevant environment	Continuation of TRL 4, but, at this stage a technology must undergo more rigorous testing . Simulations should be run in environments that are as close to realistic as possible.
TRL 6 - Demonstration in relevant environment	At this stage a technology has a fully functional prototype or representational model.
TRL 7 - Demonstration in operational environment	The technology requires that the working model or prototype be demonstrated in a space environment.
TRL 8 - System complete and qualified	The technology has been tested and is ready for implementation into an already existing technology or technology system.
TRL 9 - Successful missions ops	Once a technology has been proven

TRL: generic R&D value chain

Semi-structured interviews

Methodological framework (3/4)

Examples of greenfield FDI project description

Research and Development (R&D): *“an pharmaceutical company, has opened a new global medicines development facility in Bangalore, India. The centre, which is one of nine worldwide, will focus on oncological, respiratory, cardiovascular and metabolic diseases. It will create 30 new jobs.”*

Design Development and Testing (DDT): *“a power and automation specialist, has set up a new robotics application centre in China. The centre, ..., aims to integrate resources in south-west China by providing robots, application, system integration and related customer service. The centre will develop robots for its clients from various industries, including automobiles, computers, communications, consumer electronics, equipment and consumer goods manufacturing.”*

Source: fDi Markets database, Financial Times (access in October 2018)

Note: the description of the project is only available for some projects

Methodological framework (4/4)

Examples of greenfield FDI project description

Maintenance and Servicing: “ *an engine manufacturer, has opened a new service delivery centre in Bangalore, India. It is the company’s first such facility in the country and **provides support for more than 750 defence engines used by the Indian Armed Forces.** Located in Manyata Technical Park, the facility provides fleet management, service engineering and supply chain co-ordination as well as serving as a base for field service representatives to provide technical support across the country.* ”

Education and Training: “*a supplier of photolithography systems for the semiconductor industry, has signed a memorandum of understanding with **China-based public research consortium Shanghai Integrated Circuit Research & Development Center** to establish a training centre in Shanghai, China. The facility will provide training to the local customer support workforce as well as to existing and potential customers in the local IC industry.*”

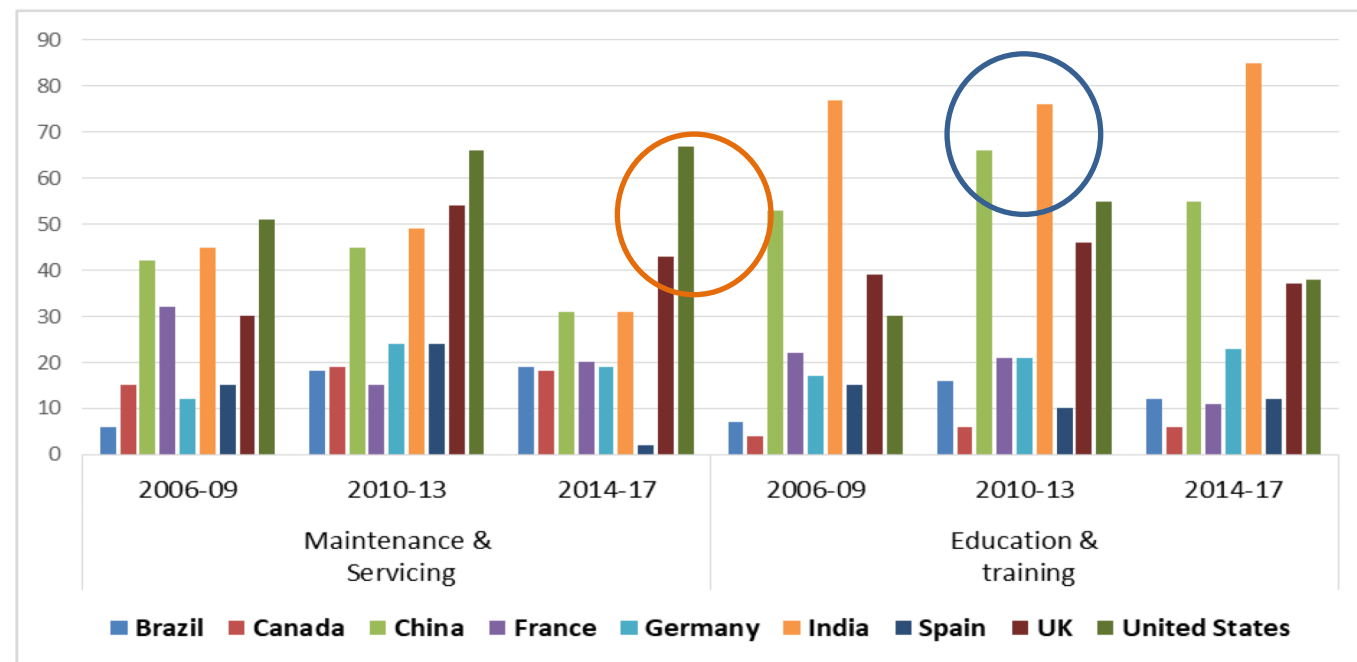
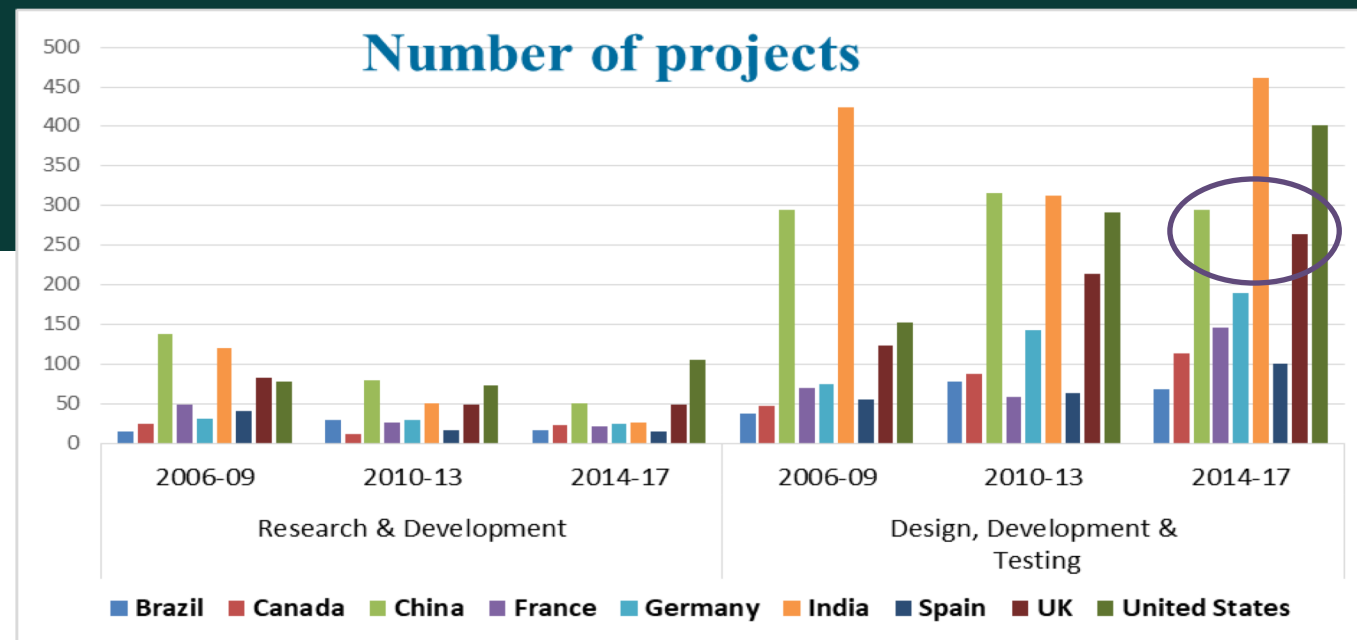
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RESULTS

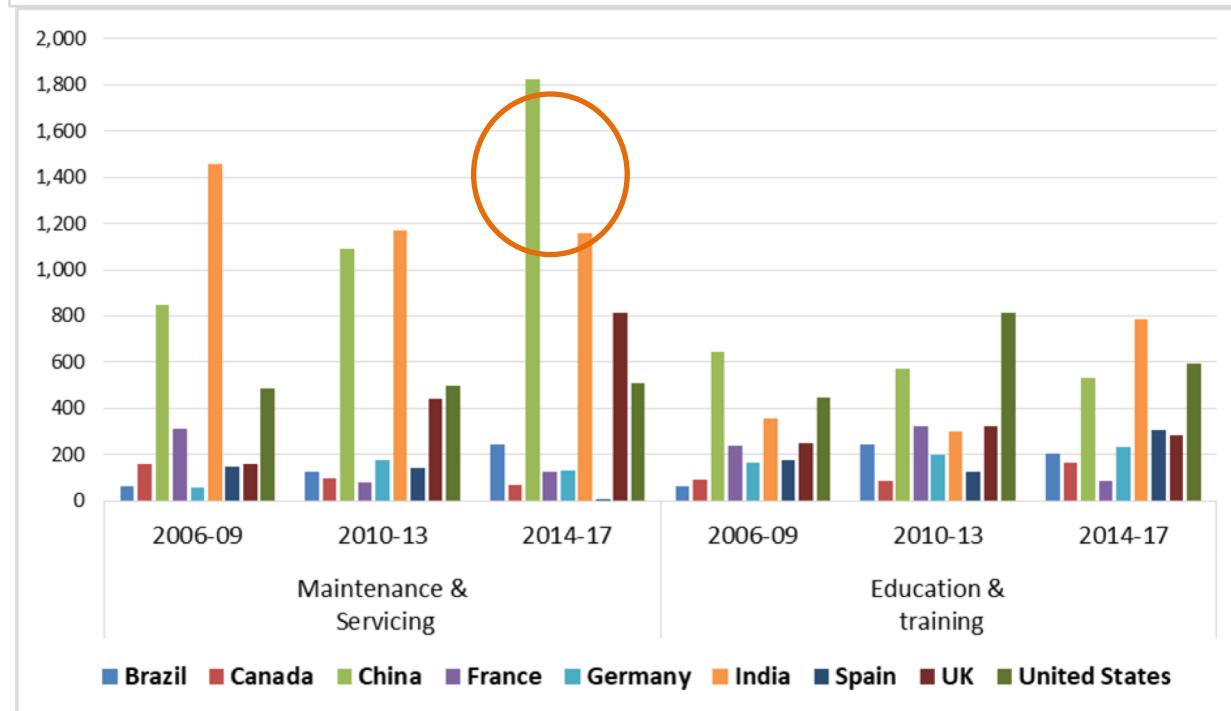
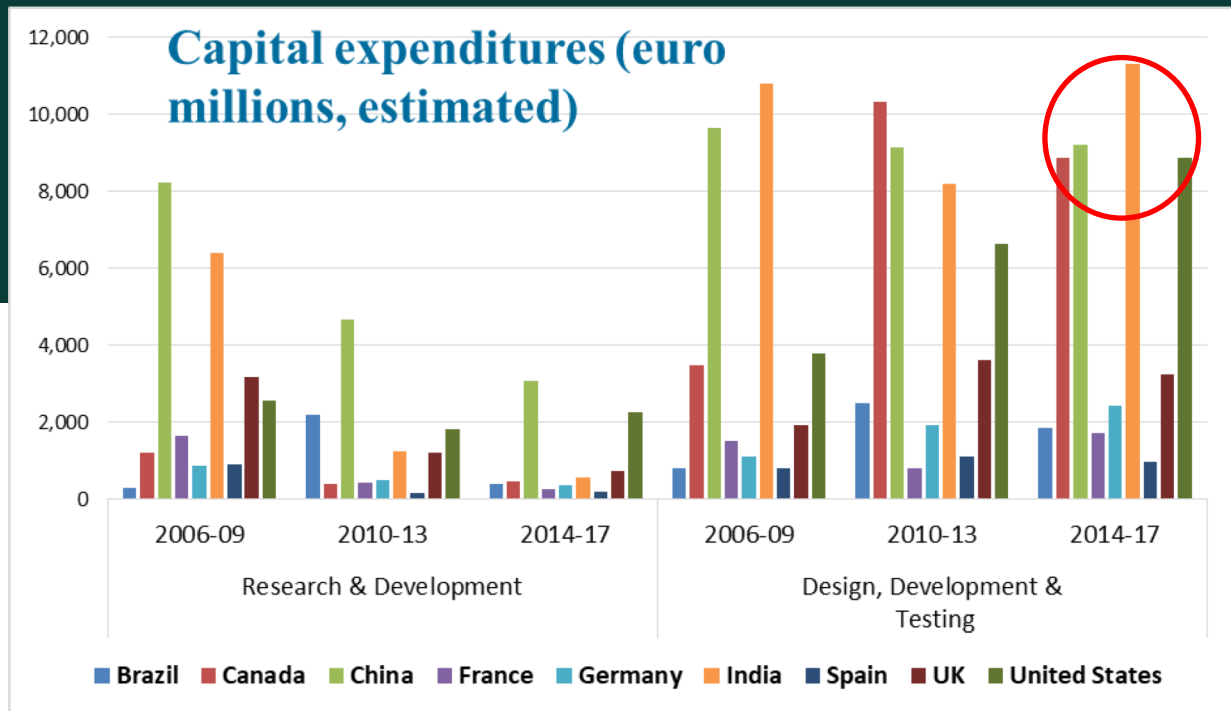
Greenfield FDI by destination countries in

- R&D
- Design, Development and Testing
- Maintenance & Servicing
- Education & Training,



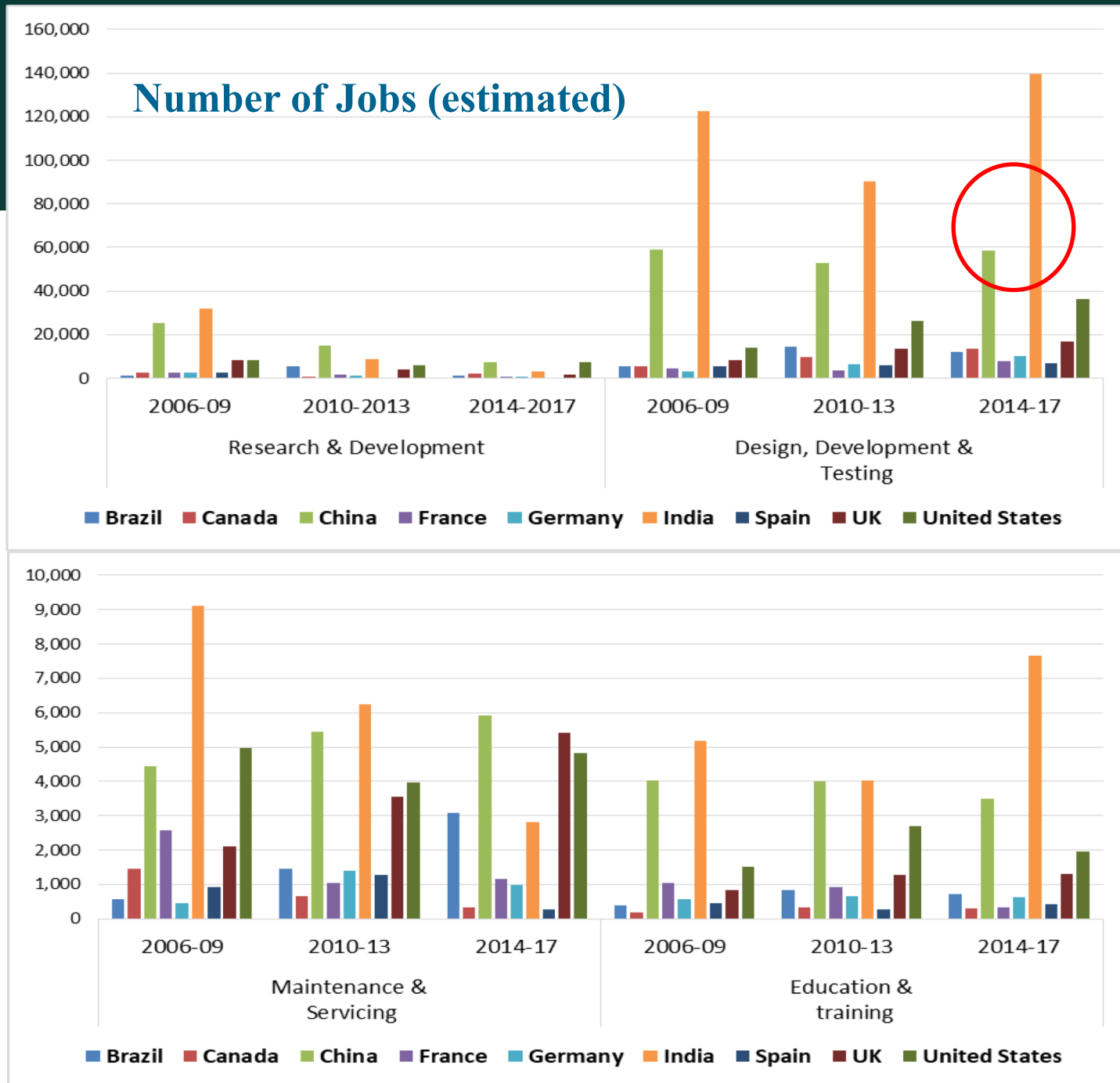
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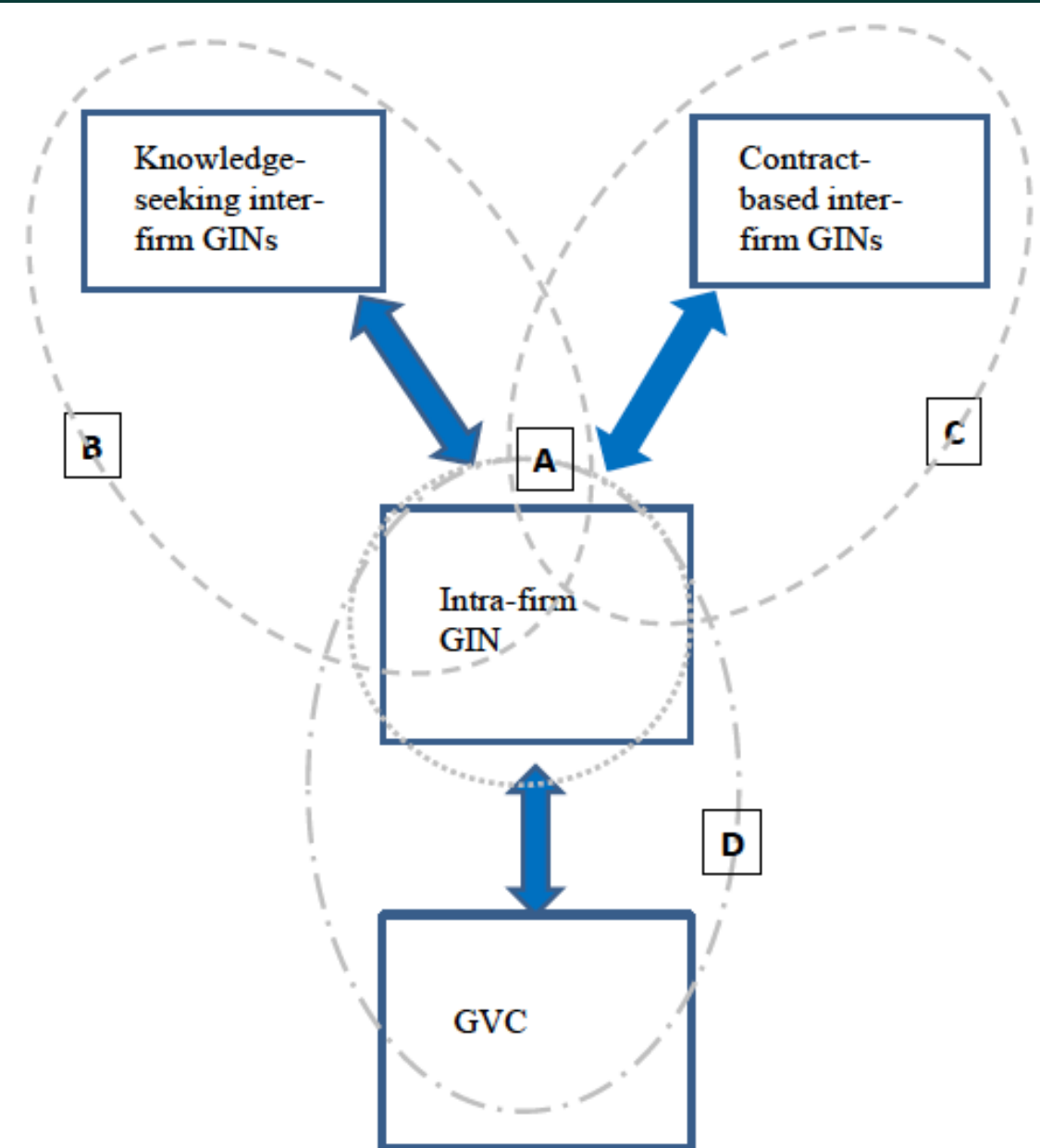


TRL and Structured interviews suggest that most firms do DDT

- Even within the same industry, firms aggregate R&D expenditures in different ways so not always possible to identify exactly what percentage of a company's total R&D expenditure goes to which specific TRL stage
- All companies interviewed: the **maximum that these high-technology firms spend on TRL1** (that is discovery research where patenting is most likely to take place) is 10% of their total budget
- Most of the firms interviewed spend **most of their R&D budgets in activities related to product testing and demonstration**

Different types of corporate GINs

- Intra-firm GINs
- Inter-firm GINs
 - ✓ Alliances with universities and research organisations
 - ✓ Outsourcing relationships with contract research organisations
 - ✓ Collaborations with manufacturers → Links GIN and GVCs



Semi-structured interviews

- GINs based on universities and research institutes wide spread
- Scope & magnitude of collaboration changing
- CRO: GINs based on collaborations with geographically spread CROs exist; More geographically dispersed, new players...Not captured in existing indicators.

→ but little is known about them.....

- ✓ Role in the innovation strategy of firms,
- ✓ Integration in the MNCs' R&D value chains
- ✓ Effects on geographical configuration of R&D function of these large firms.
- ✓ Changes in the patterns of labour of innovative activities & knowledge production... what implications for NSIs?

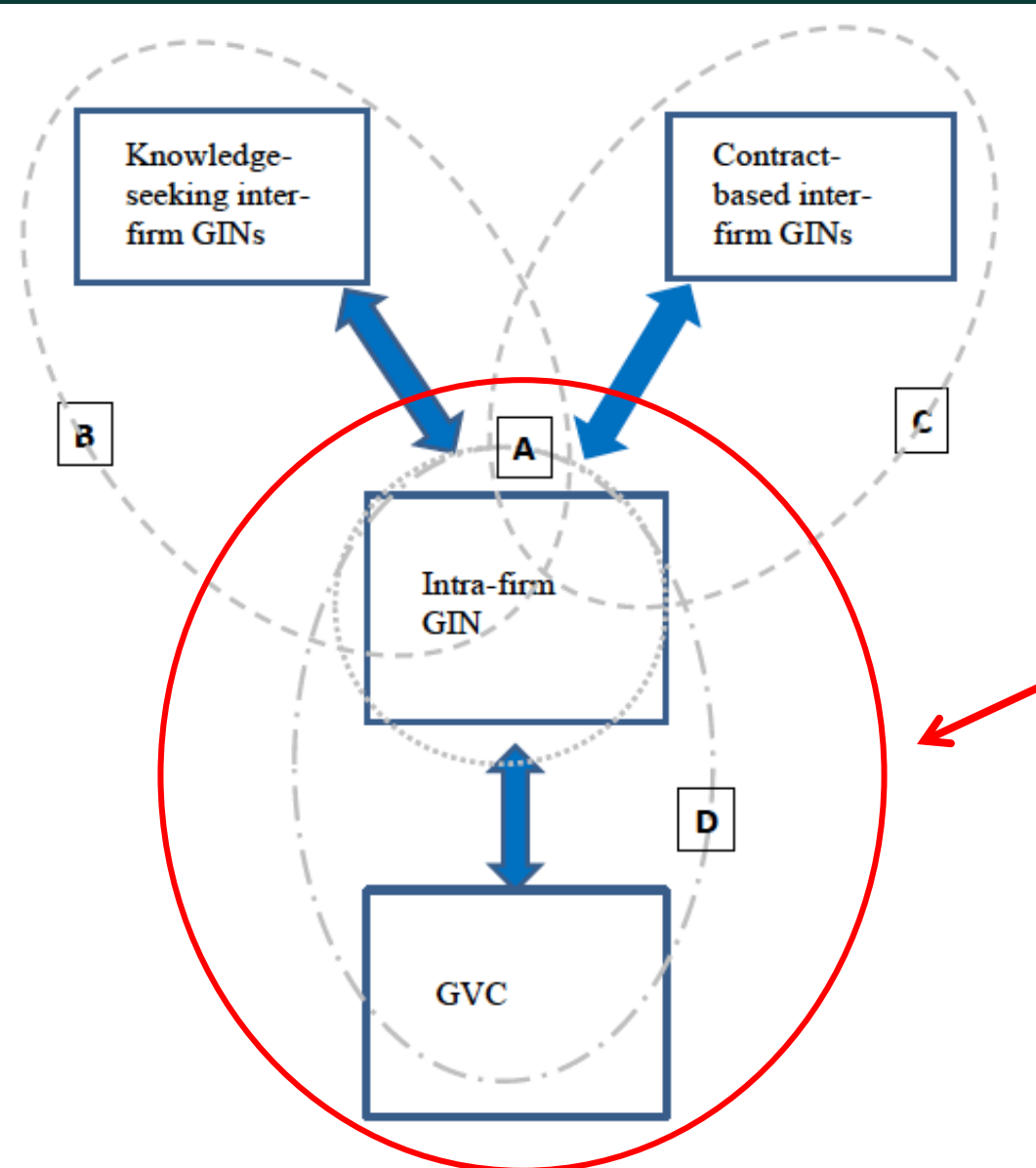
Semi-structured interviews

- Process of vertical disaggregation of production has resulted in increasing importance of suppliers of components and sub-systems in the R&D of final products.
 - ➔ As a result MNE's GINs now includes top tier suppliers.
- This more important in modular products such as electronics and automotive than in more integral industries such as pharmaceuticals.

Why does it matter for policy, for regions?

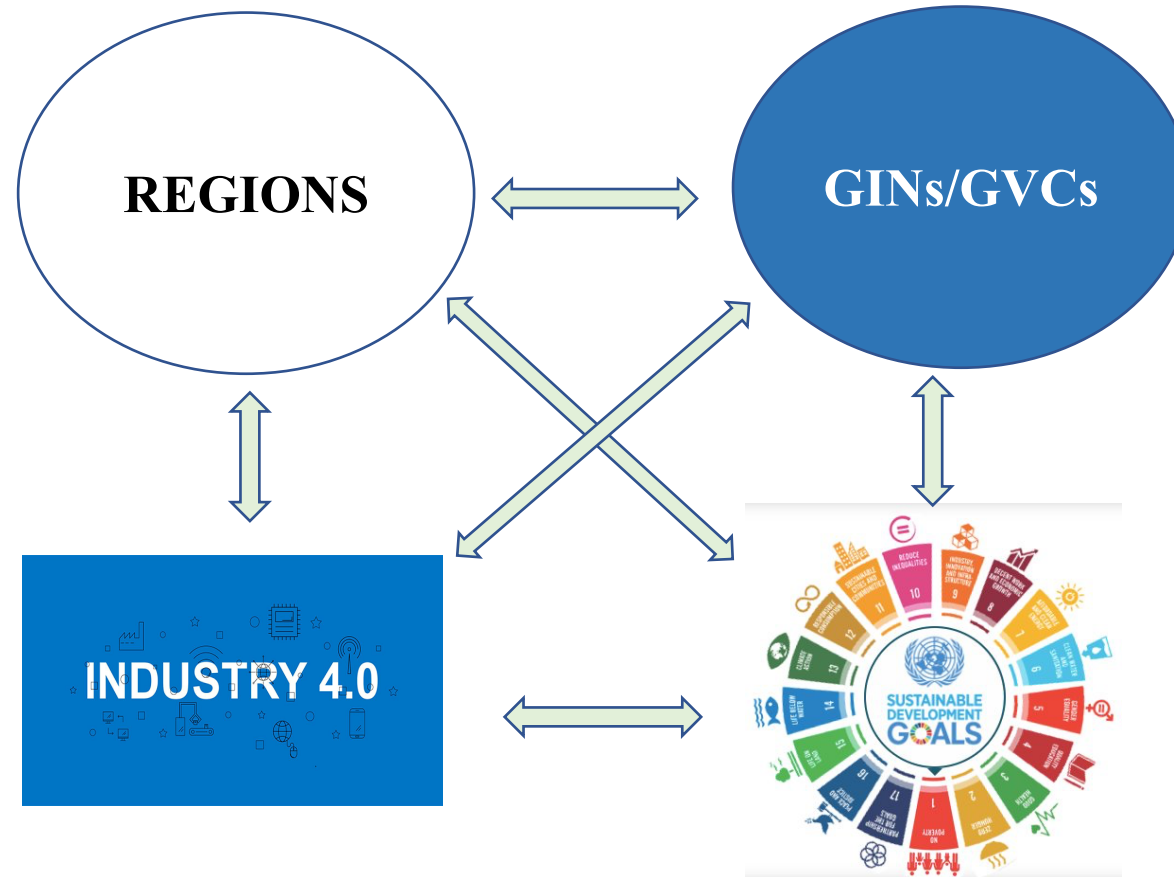
- Science-base of countries/regions very important for early stage innovation but...
- Structured interviews suggest: Most industrial R&D activity is DDT... to attract gFDI in R&D territories need development & manufacturing capabilities as well as strong science base... **Importance of territorial systems of production**
- ‘Knowledge economy’ discourse which focused on strong science diverted attention from importance of manufacturing base
- **Good science-base not enough to create jobs in R&D and innovation**
- The rise of GVCs & GINs... intensifies the disconnection between a strong science-base, R&D and economic growth?

**I4.0 will have an impact in all lead firms' GINs
BUT above all it is the relationship between GINs and GVCs (production) that will be affected**



Most important part of the GIN/GVC affected by I4.0

THANK YOU FOR YOUR SUSTAINABLE ATTENTION



GLORIA Workshop, May 17th, Brussels

*Corporate GVC & GIN in the 4th industrial era: new models of
production and work organisation*