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# Open Innovation in Cumbria: who knows what, where and why?

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# Open Innovation in Cumbria: who knows what, where and why?

## Who knows what in Cumbria?

- Our businesses today (Industries)
- Our employees today (Occupations)

## Who shares what in Cumbria and how is it shared?

- Unpicking proximity
- Cognitive distance
- Open innovation and the role of intermediaries

## Discussion – implications for regional strategy

# Who knows what in Cumbria?

## Knowledge-intensive sectors?

A group of specific sectors within the economy that are knowledge intensive in their activity. They deal extensively with information/information technology and their business is all about the distribution or exchange of the information that they hold.

Usually defined in broad terms, but often applied in a more narrow sense to give precedence to RTD – key enabling technologies (KET) such as knowledge of electronics, telecoms, biotech, nanotechnology, advanced materials

# “Knowledge-Intensive” Activities

## **Research & Development**

72 Scientific research and development

## **ICT related**

61 Telecommunications

62 Computer programming, consultancy and related activities

631 Data processing

262 Manufacture of computers and peripheral equipment

## **Media related**

18 Printing and reproduction of recorded media

58 Publishing activities

263 Manufacture of communication equipment

591 Motion picture, video and television programme activities

60 Programming and broadcasting activities

639 Other information service activities

# “Knowledge-Intensive” Activities

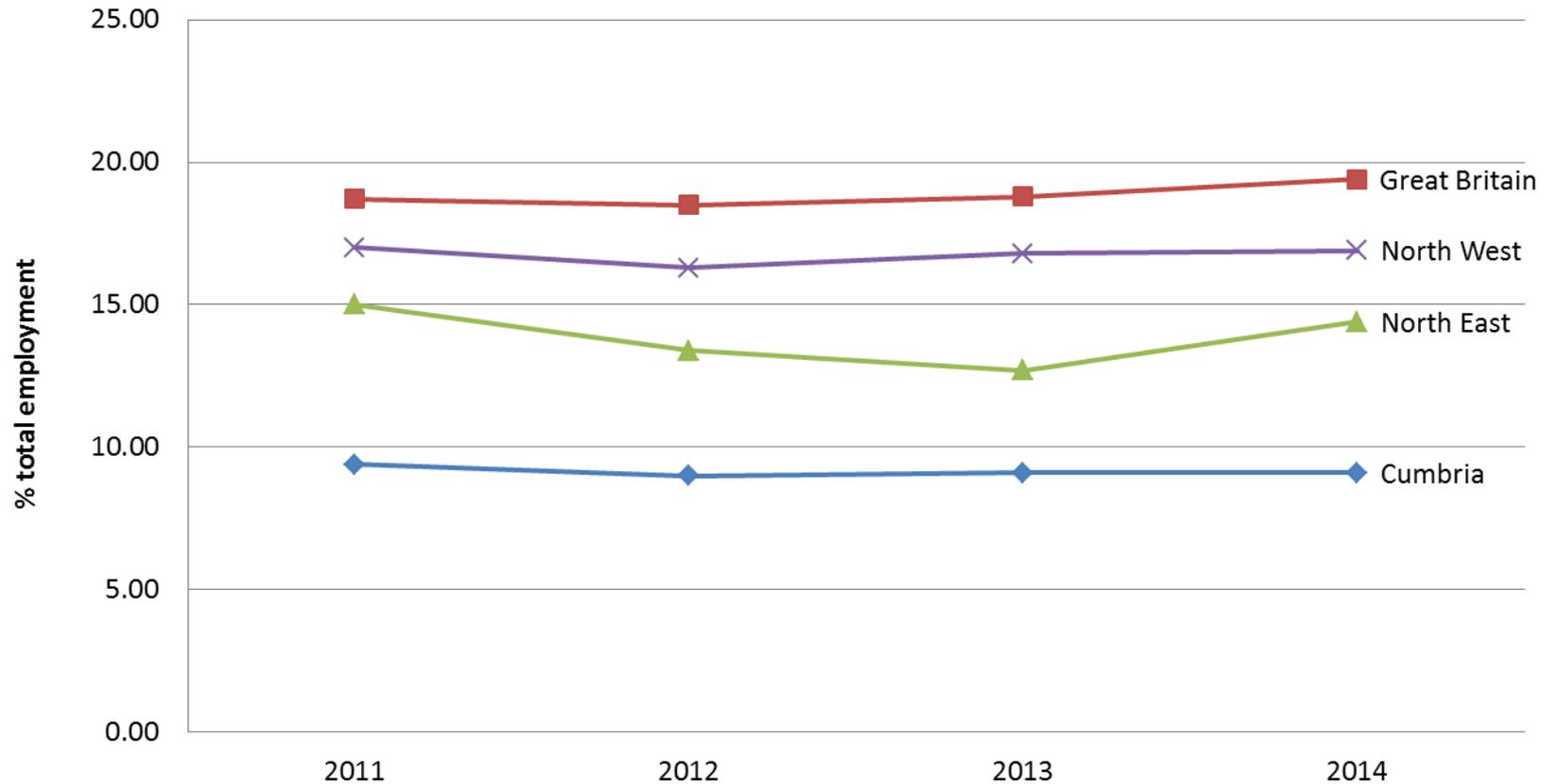
## **Knowledge-intensive services**

- 64 Financial service activities, except insurance and pension funding
- 65 Insurance, reinsurance and pension funding, except compulsory soc security
- 66 Activities auxiliary to financial services and insurance activities
- 69 Legal and accounting activities
- 70 Activities of head offices; management consultancy activities
- 74 Other professional, scientific and technical activities
- 82 Office administrative, office support and other business support activities
- 91 Libraries, archives, museums and other cultural activities
- 732 Market research and public opinion polling
- 711 Architectural and engineering activities and related technical consultancy
- 712 Technical testing and analysis
- 731 Advertising

## **Higher Education**

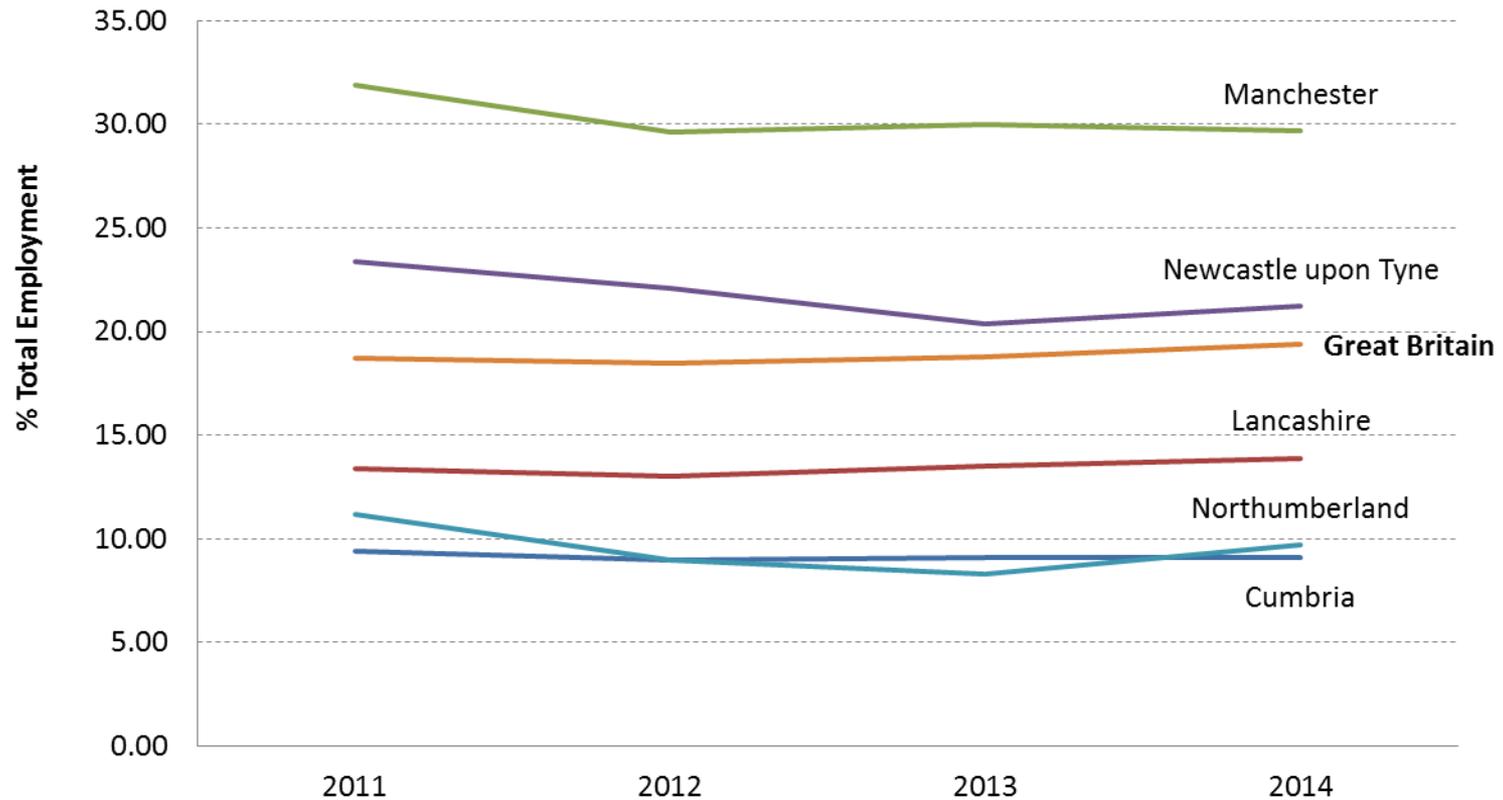
- 854 Higher education

# Percentage Employment in knowledge intensive activities



Source: Businesses Register and Employment Survey (BRES)

# Employment in “knowledge-intensive” businesses 2011-14



Source: Businesses Register and Employment Survey (BRES)

| Area                      | % Employment in Knowledge-intensive Businesses |
|---------------------------|--|
| Manchester                | 29.7   |
| Trafford                  | 23   |
| Salford                   | 22.9   |
| Cheshire East             | 22.5   |
| Cheshire West and Chester | 22.2   |
| Stockport                 | 19.6   |
| Liverpool                 | 19.4   |
| <b>Great Britain</b>      | <b>19.4</b>                                    |
| Halton                    | 18.8   |
| Warrington                | 18.4   |
| Bolton                    | 15.9   |
| Bury                      | 14.8   |
| Lancashire                | 13.9   |
| Sefton                    | 12.9   |
| Wirral                    | 12.2   |
| Blackburn with Darwen     | 11.1   |
| Wigan                     | 10.8   |
| Oldham                    | 9.6  |
| <b>Cumbria</b>            | <b>9.1</b>                                     |
| St. Helens                | 9  |
| Rochdale                  | 8.8  |
| Tameside                  | 8.6  |
| Blackpool                 | 8.5  |
| Knowsley                  | 8.3  |

Source: Businesses Register and Employment Survey

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# Employment in “knowledge-intensive” businesses in Cumbria

|  |       |
|--|-------|
| 70 : Activities of head offices; management consultancy activities               | 3,780 |
| 711 : Architectural and engineering activities and related technical consultancy | 3,240 |
| 69 : Legal and accounting activities   | 3,143 |
| 64 : Financial service activities, except insurance and pension funding          | 1,751 |
| 82 : Office administrative, office support and other business support activities | 1,696 |
| 62 : Computer programming, consultancy and related activities                    | 1,211 |
| 74 : Other professional, scientific and technical activities                     | 1,162 |
| 91 : Libraries, archives, museums and other cultural activities                  | 923   |
| 854 : Higher education   | 911   |
| 712 : Technical testing and analysis   | 871   |
| 58 : Publishing activities   | 662   |
| 66 : Activities auxiliary to financial services and insurance activities         | 647   |
| 61 : Telecommunications  | 417   |
| 18 : Printing and reproduction of recorded media                                 | 316   |
| 591 : Motion picture, video and television programme activities                  | 251   |
| 72 : Scientific research and development   | 169   |

Source: Businesses Register and Employment Survey (BRES)

# UK Standard Occupational Classification 1-3

| <b>Major group</b>                               | <b>General nature of qualifications, training and experience for occupations in the major group</b>   |
|--|---|
| Managers, directors and senior officials         | A significant amount of knowledge and experience of the production processes and service requirements associated with the efficient functioning of organisations and businesses.  |
| Professional occupations                         | A degree or equivalent qualification, with some occupations requiring postgraduate qualifications and/or a formal period of experience-related training.  |
| Associate professional and technical occupations | An associated high-level vocational qualification, often involving a substantial period of full-time training or further study. Some additional task-related training is usually provided through a formal period of induction. |

Source: ONS

# UK Standard Occupational Classification Group 1

## **1 MANAGERS, DIRECTORS AND SENIOR OFFICIALS**

111 Chief Executives and Senior Officials

112 Production Managers and Directors

113 Functional Managers and Directors

115 Financial Institution Managers and Directors

117 Senior Officers in Protective Services

118 Health and Social Services Managers and Directors

119 Managers and Directors in Retail and Wholesale

121 Managers and Proprietors in Agriculture Related Services

122 Managers and Proprietors in Hospitality and Leisure Services

124 Managers and Proprietors in Health and Care Services

125 Managers and Proprietors in Other Services

# UK Standard Occupational Classification Group 2

## **2 PROFESSIONAL OCCUPATIONS**

211 Natural and Social Science Professionals

212 Engineering Professionals

213 Information Technology and Telecommunications Professionals

214 Conservation and Environment Professionals

215 Research and Development Managers

221 Health Professionals

222 Therapy Professionals

223 Nursing and Midwifery Professionals

231 Teaching and Educational Professionals

241 Legal Professionals

242 Business, Research and Administrative Professionals

243 Architects, Town Planners and Surveyors

244 Welfare Professionals

245 Librarians and Related Professionals

246 Quality and Regulatory Professionals

247 Media Professionals

# UK Standard Occupational Classification Group 3

## **3 ASSOCIATE PROFESSIONAL AND TECHNICAL OCCUPATIONS**

- 311 Science, Engineering and Production Technicians
- 312 Draughtspersons and Related Architectural Technicians
- 313 Information Technology Technicians
- 321 Health Associate Professionals
- 323 Welfare and Housing Associate Professionals
- 331 Protective Service Occupations
- 341 Artistic, Literary and Media Occupations
- 342 Design Occupations
- 344 Sports and Fitness Occupations
- 351 Transport Associate Professionals
- 352 Legal Associate Professionals
- 353 Business, Finance and Related Associate Professionals
- 354 Sales, Marketing and Related Associate Professionals
- 355 Conservation and Environmental associate professionals
- 356 Public Services and Other Associate Professionals

|                        | Managers,<br>directors + senior | Professional<br>occupations | Associate prof &<br>tech occupations | Total        |
|------------------------|---------------------------------|-----------------------------|--------------------------------------|--------------|
| Lancashire             | 50900                           | 94400                       | 63400                                | 208700       |
| Manchester             | 19000                           | 54000                       | 24400                                | 97400        |
| Cheshire East          | 23700                           | 39000                       | 26200                                | 88900        |
| <b>Cumbria</b>         | <b>26700</b>                    | <b>34200</b>                | <b>23900</b>                         | <b>84800</b> |
| Liverpool              | 15600                           | 45600                       | 21400                                | 82600        |
| Cheshire W and Chester | 18700                           | 29400                       | 23200                                | 71300        |
| Stockport              | 15600                           | 34000                       | 18200                                | 67800        |
| Trafford               | 13800                           | 32100                       | 16800                                | 62700        |
| Wirral                 | 11500                           | 30900                       | 17000                                | 59400        |
| Wigan                  | 13800                           | 19800                       | 22000                                | 55600        |
| Sefton                 | 13300                           | 21800                       | 18400                                | 53500        |
| Bolton                 | 12300                           | 22300                       | 15400                                | 50000        |
| Warrington             | 11700                           | 19600                       | 16100                                | 47400        |
| Salford                | 11600                           | 16000                       | 14400                                | 42000        |
| Bury                   | 8500                            | 18000                       | 13100                                | 39600        |
| Tameside               | 8100                            | 16600                       | 12700                                | 37400        |
| Rochdale               | 7800                            | 14100                       | 9500                                 | 31400        |
| Oldham                 | 7500                            | 13300                       | 10400                                | 31200        |
| St. Helens             | 6500                            | 12700                       | 8100                                 | 27300        |
| Blackburn with Darwen  | 5000                            | 9500                        | 6500                                 | 21000        |
| Knowsley               | 3500                            | 8700                        | 7500                                 | 19700        |
| Blackpool              | 5300                            | 7800                        | 6100                                 | 19200        |
| Halton                 | 3900                            | 7100                        | 7800                                 | 18800        |

Source: Annual Population Survey 2014-15

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|                           | Managers, directors<br>+ senior | Professional<br>occupations | Associate prof &<br>tech occupations | Total      |
|---------------------------|---------------------------------|-----------------------------|--------------------------------------|------------|
| Trafford                  | 12%                             | 28%                         | 15%                                  | 55%        |
| Stockport                 | 11%                             | 24%                         | 13%                                  | 48%        |
| Cheshire East             | 13%                             | 21%                         | 14%                                  | 48%        |
| Warrington                | 12%                             | 19%                         | 16%                                  | 47%        |
| Bury                      | 10%                             | 21%                         | 15%                                  | 46%        |
| Cheshire West and Chester | 12%                             | 19%                         | 15%                                  | 46%        |
| Wirral                    | 8%                              | 23%                         | 12%                                  | 43%        |
| Manchester                | 8%                              | 24%                         | 11%                                  | 43%        |
| Sefton                    | 10%                             | 17%                         | 15%                                  | 42%        |
| Liverpool                 | 8%                              | 23%                         | 11%                                  | 42%        |
| Bolton                    | 10%                             | 17%                         | 12%                                  | 39%        |
| Lancashire                | 9%                              | 17%                         | 12%                                  | 39%        |
| Tameside                  | 8%                              | 16%                         | 13%                                  | 37%        |
| Salford                   | 10%                             | 14%                         | 13%                                  | 37%        |
| Rochdale                  | 9%                              | 16%                         | 11%                                  | 36%        |
| Wigan                     | 9%                              | 13%                         | 14%                                  | 36%        |
| <b>Cumbria</b>            | <b>11%</b>                      | <b>14%</b>                  | <b>10%</b>                           | <b>35%</b> |
| St. Helens                | 8%                              | 16%                         | 10%                                  | 34%        |
| Blackburn with Darwen     | 8%                              | 15%                         | 10%                                  | 34%        |
| Oldham                    | 8%                              | 14%                         | 11%                                  | 33%        |
| Blackpool                 | 9%                              | 13%                         | 10%                                  | 33%        |
| Knowsley                  | 6%                              | 14%                         | 12%                                  | 32%        |
| Halton                    | 7%                              | 12%                         | 13%                                  | 32%        |

Source: Annual Population Survey 2014-15

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## So, what do we know about who knows what?

There are many people employed in businesses in Cumbria that might be regarded as “knowledge-intensive” and significant for technological development (20,700)

While there are many, they represent a lower proportion (9%) of all workers compared to northern conurbations

There are many people employed in scientific, professional and technical occupations (84,400)

But again this is a lower proportion (35%) compared to northern cities

Conclusion – there is perhaps more scientific, technical and professional work happening in Cumbria than may be commonly assumed..... but not as much as might be hoped

We know much less about how knowledge is exchanged

# Boschma (2005) Proximity and innovation

Critical of “fixation with geographical proximity”

**Geographic proximity** – Short distance brings people together to “favour information contacts and facilitate exchange of tacit knowledge” (p.69)

**Social proximity** – Economic exchanges are embedded in social relations. Social ties affect economic outcomes. Closely linked to concepts of trust and social capital (p.66)

**Institutional proximity** – organisational arrangements (arrangement of firms and organisations in networks) – can both enable and block knowledge exchange (p.64)

**Cognitive proximity** – other forms of proximity may bring actors closer together, but whether or not any useful knowledge is exchanged depends fundamentally of “cognition” (p.63)

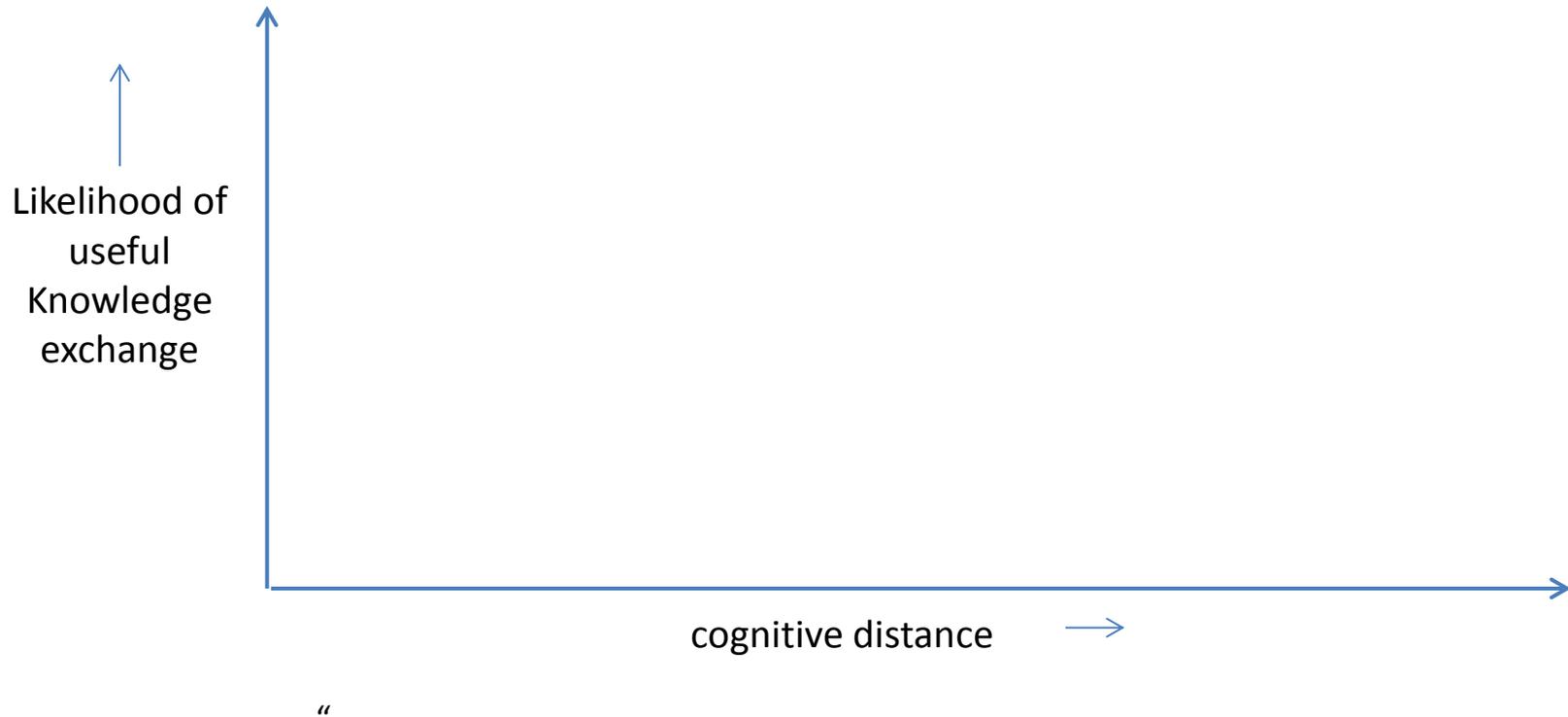
# Innovation and Cognitive Proximity

- “Some degree of cognitive proximity is required to ensure that effective communication and interactive learning takes place” (Boschma, 2009, p. 293)
- Cognition? – “mental processes involved in acquiring knowledge”
- Cognition has been grounded in different theoretical perspectives:
- As a means of comprehending patterns in terms of “bounded rationality” within a neo-classical economic framework and equilibrium –
  - Innovation actors lack perfect knowledge, therefore -
  - Actors seek to reduce uncertainty by adopting routine behaviour, customs and social practices
  - Cognition therefore refers to the way in which innovation actors identify, interpret, exploit or generate new knowledge
  - This process has both conscious and unconscious elements that affect the selection or “filtering” of large amounts of complex information

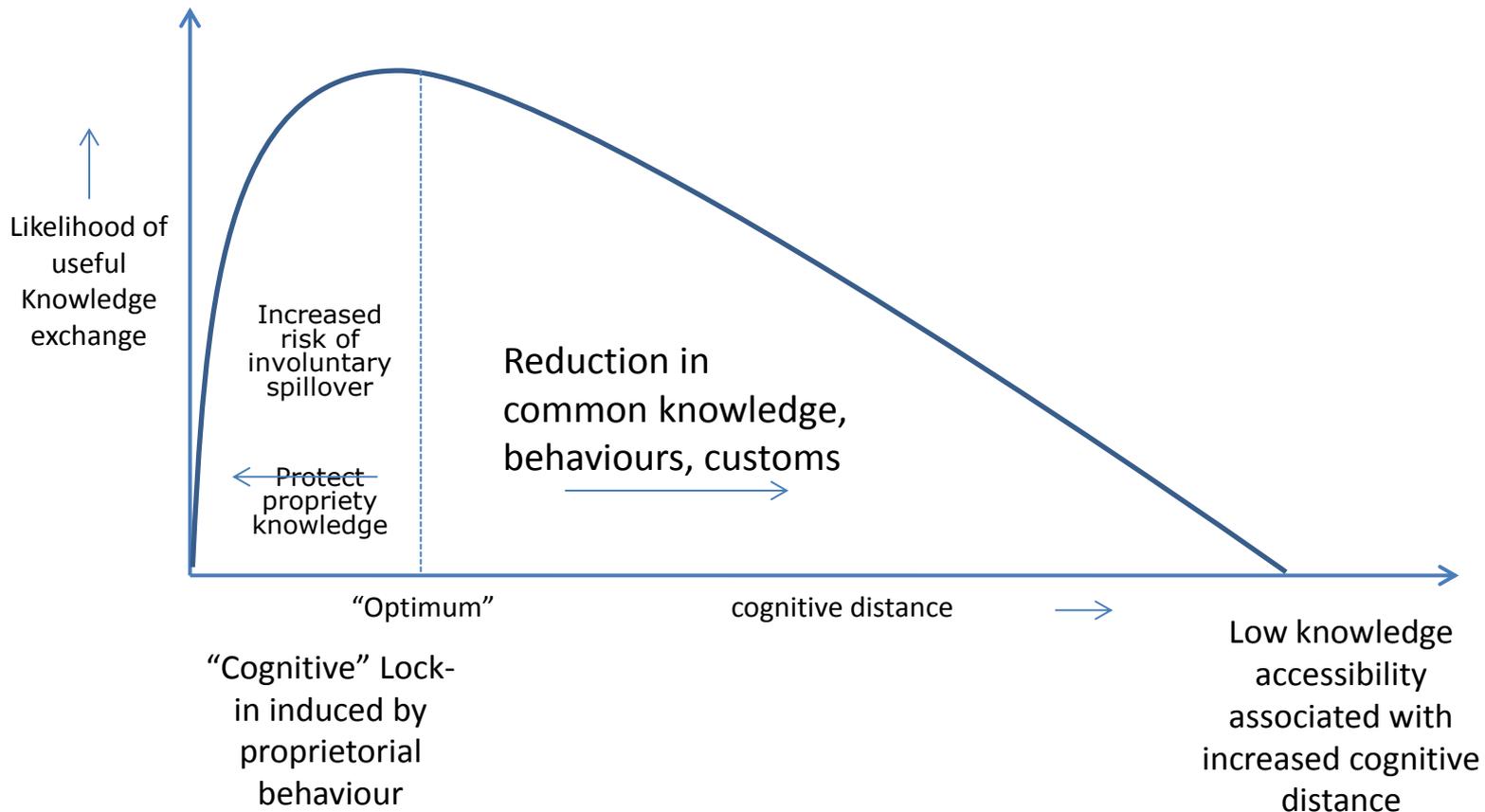
# Cognitive Proximity and Unintended Spillovers

- Cognitive distance – “extent to which two actors share the same knowledge” - “cognitive fields” around individual actors that need to overlap with others for meaningful and useful knowledge exchange to take place between them
- BUT also about behaviours, routines, assumptions - Lorenzen (2006) firms in agglomerations ... “share language and codebook that holds down misunderstandings and renders knowledge coordination more efficient” (p.77)
- And also about shared capabilities and ambitions - Antonelli (2007, p.9) Where innovation actors have very similar capabilities, capacities and ambitions “knowledge is characterised by substantial rivalry in exchange..... In such circumstances, “knowledge-holders have a clear incentive to delay dissemination and leakage of knowledge to third parties”.
- Relationship between efficiency of knowledge exchange and cognitive distance is therefore non-linear. Cognitive distance is also multifaceted.

# Cognitive distance



# Cognitive distance – micro scale



## Moving to the Meso-Scale

- Simple case of 2 actors (dyadic) can be extended to *communities of actors* in networks – first, a triadic configuration where two actors become more proximate because they both learn from a third actor (indirect ties).
- Then extends then to complex systems within networks that cut across industries, sectors, regions.
- Simple model at micro level lacks dynamic element – Knowledge base of actors changes continuously over time – through interactive learning, actors can reduce their cognitive distance – “where both partners jointly learn something new leading to more similar knowledge bases” (Balland et al 2014 p.912) – (cognitive convergence)

## Meso-scale analysis of Cognitive space

- Scaling up the concept of “cognitive space” is challenging both empirically and conceptually.
- Conceptual – complex landscape of overlapping and disconnected cognitive spaces woven through networks and institutional settings
- Empirical approaches - examples:
  - Analysis of groups of industries - measuring “relatedness” using SIC digit codes (e.g. SIC 4 digit codes in the Same 2 digit codes are “Related”)
  - Co-occurrence of SIC codes - how often two industry codes are found in the same economic entity

# Open Innovation

Henry Chesbrough (2006) Open Innovation: the New Imperative for creating and profiting from technology. Harvard Business School Press

- Closed innovation paradigm
- Open innovation paradigm
- Connecting internal and external innovation
- Innovation leadership
- Examples of IBM, INTEL

## Closed innovation

Hire (and hoard) the best and brightest people

Discover and develop new products and processes ourselves

Be the first to make discoveries

The company that discovers things soonest will get to market first and win

THEREFORE

We need to control our intellectual property so our competitors do not benefit from our ideas

Paradigm worked for those that proved successful at it for most of the 20<sup>th</sup> century

# Open innovation

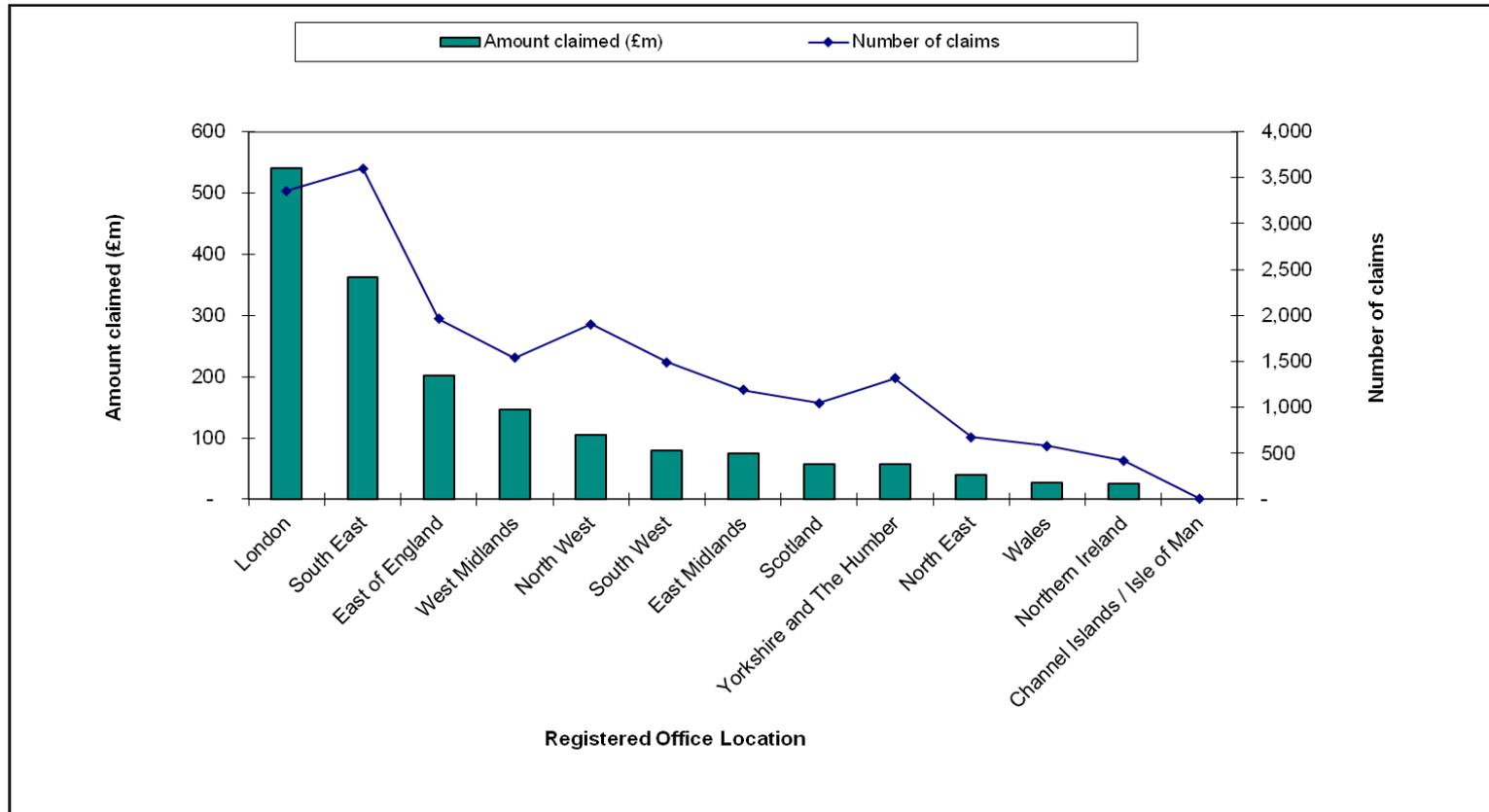
## Challenges to the “closed” model – erosion factors

- Hugely increased levels of geographical and institutional mobility of highly qualified workers
- Hugely increased pace of technological change and shorter product life cycles
- Increasingly knowledgeable customers and suppliers upon whom firms depend in complex supply chains
- Increased complexity of the knowledge landscape

# Open innovation principles

- Not all the smart people work for us
- We need internal R&D for credibility and having something to offer, but its value is diminished by being disconnected to external R&D
- We do not need to author research in order to benefit from it
- If we combine the best internal and external R&D, we will win
- THEREFORE – we can profit from use of the IP of others and access IP of others for our own benefit. Encourage licensing agreements, spinouts.
  
- Paradigms co-exist and represent tension in innovation systems
- It is not a linear shift from one to the other but iterative and marked by oscillation

# Registered office regional analysis of R & D tax credit claims, 2013-14



Source: HMRC

[www.cumbria.ac.uk](http://www.cumbria.ac.uk)

# MEASURES OF REGIONAL INNOVATION

|  | <b>NW<br/>England</b> | <b>NE England</b> | <b>SE England</b> |
|--|-----------------------|-------------------|-------------------|
| <b>Public R &amp; D expenditures</b>                 | 0.4                   | 0.37              | 0.52              |
| <b>Business R&amp;D expenditures</b>                 | 0.67                  | 0.46              | 0.67              |
| <b>Non-R &amp; D innovation expenditures</b>         | 0.49                  | 0.47              | 0.54              |
| <b>SMEs innovating in-house</b>                      | 0.52                  | 0.49              | 0.51              |
| <b>Innovative SMEs collaborating with others</b>     | 0.37                  | 0.43              | 0.38              |
| <b>EPO patents</b>                                   | 0.43                  | 0.43              | 0.57              |
| <b>Technological (product or process) innovators</b> | 0.54                  | 0.51              | 0.53              |

# Corporate responses in the past

Shift from Branch economy to knowledge economy

Reintegration of research, production and markets

Reinsertion of high level functions in local sites

Shift from “global outpost” (cost driven) to global listening post (knowledge driven)

The move to create “developmental branches” with continental or global product mandates

Reinvestment and restructuring of industrial north – a “hidden revolution”?

**Table 7: Respondents by overall production system**

|             | High volume<br>production line | Low volume<br>flexible<br>production | One-off to order<br>/Prototypes | Processing<br>bulk materials | Totals |
|-------------|--------------------------------|--------------------------------------|---------------------------------|------------------------------|--------|
| Foreign TNC | 8                              | 4                                    | 1                               | 2                            | 15     |
| UK TNC      | 8                              | 3                                    | -                               | 4                            | 15     |
| UK national | 6                              | 3                                    | 1                               | 3                            | 13     |
| Totals      | 22                             | 10                                   | 2                               | 9                            | 43     |

Source: authors' survey 1997

**Table 10: Employment structure of establishments - % scientific workers**

| % scientific and technical | Foreign TNCs | UK TNCs | UK Nationals | Total |
|----------------------------|--------------|---------|--------------|-------|
| Less than 5%               | 6            | 9       | 7            | 22    |
| 5-10%                      | 3            | 4       | 4            | 11    |
| 11-20%                     | 4            | 1       | 0            | 5     |
| Over 20%                   | 1            | 0       | 2            | 3     |
| Total                      | 14           | 14      | 13           | 41    |

Source: authors' survey, 1997

**Table 13: Functional characteristics of survey plants**

|                                    | Foreign TNCs | UK TNCs | UK Nationals | Total |
|------------------------------------|--------------|---------|--------------|-------|
| Purchasing                         | 14           | 13      | 12           | 39    |
| Personnel Training                 | 15           | 13      | 10           | 38    |
| Personnel Recruitment              | 14           | 13      | 10           | 37    |
| Accounts                           | 14           | 12      | 11           | 37    |
| Financial Management               | 13           | 9       | 10           | 32    |
| Product Development                | 11           | 10      | 8            | 29    |
| Sales Management                   | 8            | 8       | 10           | 26    |
| Marketing                          | 10           | 5       | 7            | 22    |
| Innovative Process Research        | 9            | 6       | 7            | 22    |
| Innovative Product Research        | 7            | 6       | 6            | 19    |
| Total number of plants in category | 15           | 15      | 13           | 43    |

Source: authors' survey 1997

**Table 15: Change in functions at survey sites**

|                                    | Foreign TNCs |      | UK TNCs |      | UK Nationals |      | Total |      |
|------------------------------------|--------------|------|---------|------|--------------|------|-------|------|
|                                    | Gain         | Loss | Gain    | Loss | Gain         | Loss | Gain  | Loss |
| Personnel Training                 | 2            | 0    | 1       | 0    | 0            | 0    | 3     | 0    |
| Purchasing                         | 2            | 1    | 1       | 0    | 0            | 0    | 3     | 1    |
| Sales Management                   | 2            | 1    | 2       | 1    | 0            | 0    | 4     | 2    |
| Personnel Recruitment              | 1            | 0    | 1       | 0    | 0            | 0    | 2     | 0    |
| Accounts                           | 0            | 0    | 1       | 0    | 0            | 1    | 1     | 1    |
| Product Development                | 1            | 0    | 3       | 0    | 0            | 0    | 4     | 0    |
| Innovative Process Research        | 1            | 0    | 1       | 1    | 0            | 0    | 2     | 1    |
| Innovative Product Research        | 0            | 1    | 2       | 2    | 0            | 0    | 2     | 3    |
| Marketing                          | 2            | 1    | 2       | 2    | 0            | 0    | 4     | 3    |
| Financial Management               | 0            | 1    | 1       | 1    | 1            | 1    | 2     | 3    |
| Column totals                      | 11           | 5    | 15      | 7    | 1            | 2    | 27    | 14   |
| Total number of plants in category | 15           |      | 15      |      | 13           |      | 43    |      |

Source: authors' survey 1997

**Table 11: Re-investment in externally-owned plants in the past five years**

|  | Foreign<br>TNCs | UK TNCs | UK<br>Nationals | Total |
|--|-----------------|---------|-----------------|-------|
| General plant upgrade of premises, technology & capacity       | 3               | 7       | 3               | 13    |
| Major investment in production technology                      | 4               | 3       | 2               | 9     |
| Investment in additional production capacity/new product lines | 4               | 4       | 4               | 12    |
| Investment in modernisation of premises                        | 3               | 0       | 1               | 4     |
| Other purpose  | 1               | 0       | 0               | 1     |
| No substantial new investment                                  | 0               | 1       | 3               | 4     |
| Total sites  | 15              | 15      | 13              | 43    |

Source: authors' survey, 1997

# Contemporary Cumbria and open innovation

- Several of our key sectors have significant barriers (defence industries, nuclear safety)
- Previous attempts to encourage spinout from nuclear industry limited until recently
- Prospects for open innovation in the supply chain – may be fewer issues with various forms of “proximity”. SMEs technical partnerships to expand globally (REACT, Forth Engineering, Safety Critical)
- Some examples from our corporate sector – Pirelli interaction with supply chain, James Cropper innovation through customer interaction, Innovia Films partnership with Swedish optics firm
- The need for intermediaries to bridge cognitive/institutional divides
- Role of HEIs in the region
- Specialist organisations with mixed public-private funding – Innovus model – public-private funding to support prototype development

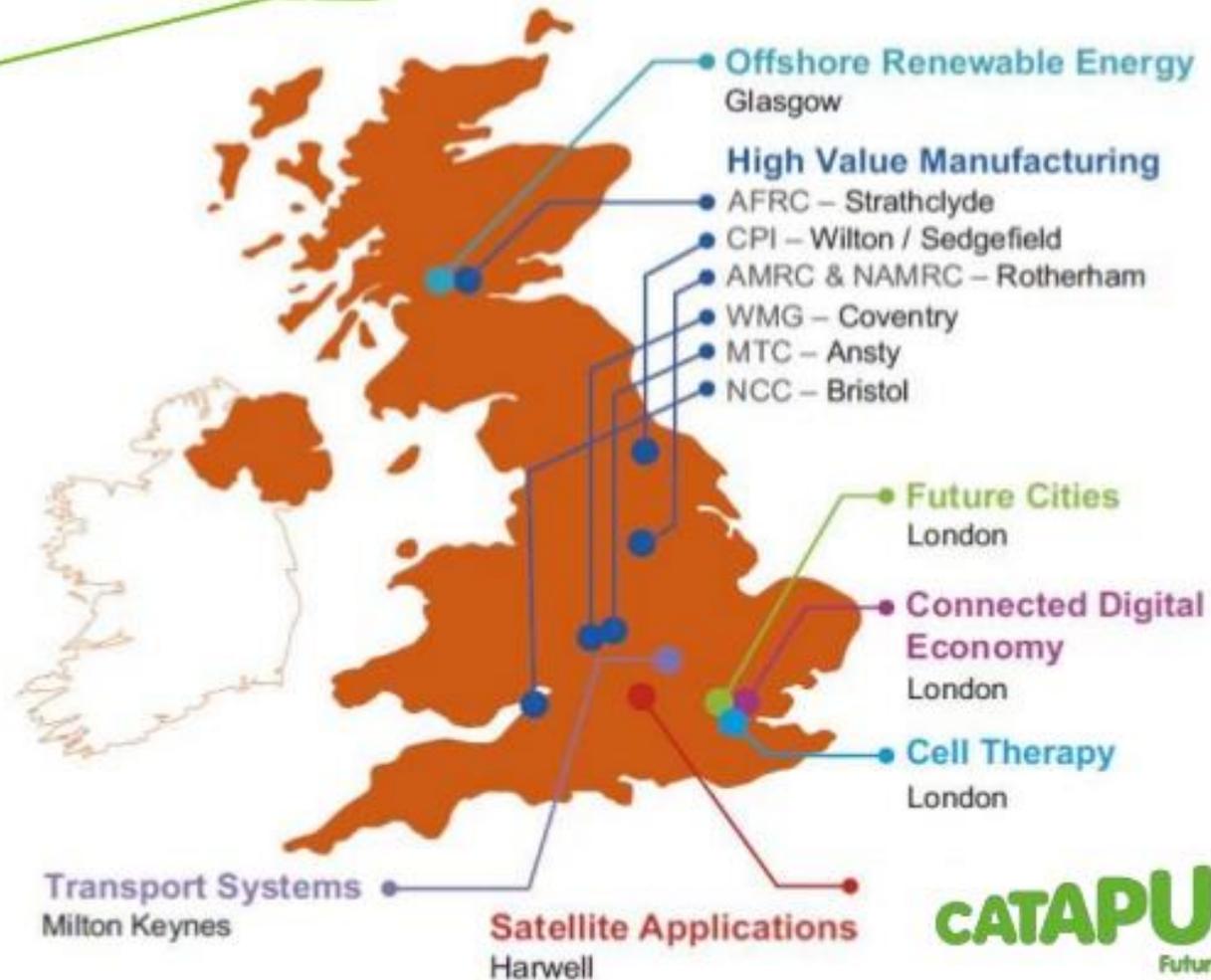
# Innovation Intermediaries Typology

|                                  |  |
|----------------------------------|--|
| Linkage / Liaison office or unit | Acts as an institutional and cultural intermediary between actors. Takes responsibility for managing the interface between organisation and external institutions  |
| Interface agency                 | Institution that provides an interface between public sector and industry  |
| Bridging institution             | Acts as intermediary for transfer of knowledge   |
| Technology Broker                | Facilitates transfer of knowledge between organisations. Creates direct links with government, universities and industry, maintains short communication channels and limited number of links to retain value of information<br>Facilitates transfer of discoveries that are incompatible with firms current product mix or process capabilities to other firms |
| Gatekeeper                       | Facilitates internal dissemination of knowledge acquired in the collaboration. Parties should carefully design and implement interface to avoid information appropriation by key individuals   |
| Transfer agent                   | Administers and manages cooperative research programmes. Build a research network of contacts  |

# National Interventions – Innovate UK

- The Catapult centres are a network of world-leading centres designed to transform the UK's capability for innovation in specific areas and help drive future economic growth.
- They are a series of physical centres where the very best of the UK's businesses, scientists and engineers work side by side on late-stage research and development - transforming high potential ideas into new products and services to generate economic growth.
- The Catapults network has been established by Innovate UK, and is one of the ways we support innovation by UK business. They will do this by providing access to expert technical capabilities, equipment, and other resources required to take innovative ideas from concept to reality.

# UK Catapult centres



# Local and Regional Interventions?

- Local and regional scales generally overlooked
- What is already happening at this scale?
  - Development of intermediaries on West Coast
  - Use of Growth Fund
  - Pipeline projects in Structural Funds
  - HEI initiatives
- Is there scope for a more systematic approach to fostering innovation in Cumbria?
  - Sector-based
  - Working in supply chains
  - Connecting with Catapults
  - Ground level approaches with groups of SMEs

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