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'Islands of Innovation' and diversities of innovation in the UK and France

"Islas de Innovación" y diversidades de innovación en el Reino Unido y Francia

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1. INTRODUCTION

This paper compares the development over the last thirty years of Oxfordshire in the UK and Grenoble in France as Islands of Innovation (Hilpert 1992). These twin towns, have at the core both research intensive universities and a high density of government research laboratories. Both host nuclear energy laboratories. Their respective research bases provide the starting point for analyses of why they have had several periods of innovation, dating back to the 1920s in France and the 1950s in Oxfordshire.

Since the early 2000s, there have been a number of changes in national policies. These have had a direct effect on the dynamics of local technology-led economic development, particularly those concerning to inter-relationships between the national laboratories and major local firms 'anchor organisations'. We show that a major difference lies in the orchestration of research-based networking in Grenoble as a consequence of French cluster policy, whereas in Oxfordshire the government's direct role of funding the research base remains that of sustaining the engagement. Hence, different forms of coordination are found. Thus we show that there is evidence that diversities of innovation are a necessary outcome of different processes at both locations.

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EXECUTIVE SUMMARY

This paper explores diverging patterns of innovation and regional development in two 'islands of innovation'. In the early 2000s the growth trajectories of Grenoble and Oxfordshire were compared (Lawton Smith 2003). The focus was on national laboratories as territorial actors in the clustering of high-tech firms. Building on longitudinal data collected since 2003 the theme shifts in this study to the forms that government intervention takes through investments in knowledge organisations in high tech economies and how that leads to particular specialisations of technological advance. While there are many similarities, there are differences in starting points and structures, leading to diversities in innovation. The analysis shows how both are embedded in their national situations and opportunities for development.

We focus on two key elements in sustaining clusters of innovation, those of highly skilled labour and networks. We show that in Grenoble, the clusters are orchestrated information and project-based while in Oxfordshire they are labour market dominated and organic. We demonstrate complementary relationships between the national and regional level policy formation and implementation. In both cases importance of place is sustained over time but for different reasons.

RESUMEN DEL ARTÍCULO

Este documento explora patrones divergentes de innovación y desarrollo regional en dos "islas de innovación". A principios de la década de 2000 se compararon las trayectorias de crecimiento de Grenoble y Oxfordshire (Lawton Smith 2003). La atención se centró en los laboratorios nacionales como actores territoriales en la agrupación de empresas de alta tecnología. Basándose en los datos longitudinales recopilados desde 2003, el objeto de análisis cambia en este estudio a las formas que la intervención gubernamental adopta a través de inversiones en organizaciones de conocimiento en sectores de alta tecnología y cómo eso conduce a especializaciones particulares del avance tecnológico. Si bien hay muchas similitudes, hay diferencias en los puntos de partida y las estructuras, lo que conduce a las diversidades en la innovación. El análisis muestra cómo ambos están integrados en sus situaciones nacionales y oportunidades de desarrollo.

Nos centramos en dos elementos clave para sostener grupos de innovación, los de trabajadores altamente cualificados y redes. Demostramos que en Grenoble, los clusters se organizan entorno a la información y proyectos, mientras que en Oxfordshire están dominados por el mercado de trabajo y son de carácter orgánico. Demostramos relaciones complementarias entre la formación y aplicación de políticas a nivel nacional y regional. En ambos casos, la importancia del lugar se mantiene en el tiempo, pero por diferentes razones.

2. ISLANDS OF INNOVATION, CLUSTERS AND REGIONAL INNOVATION-LED GROWTH

Islands of Innovation are centres of competence where knowledge is applied or the kind of new knowledge is generated which again maintains both their position as islands and their situation within the networks (Hilpert 2012). Clusters can be seen as agglomeration of opportunities, some of which are taken while others are missed. While many islands of innovation appear to start spontaneously, in practice in many their emergence is associated with various forms of state investment in Oxford and Grenoble as has also as in the US's Silicon Valley (Lawton Smith 2003). This relationship does not always hold: for example Lowe and Feldman (2015) have shown that in the case of the bioscience cluster in the North Carolina Research Triangle, knowledge and practice improve when industrial recruitment and entrepreneurial development intentionally and institutionally cooperate.

...there is evidence that diversities of innovation are a necessary outcome of different processes at both locations.

We start with public policy and the creation and function of anchor organisations (e.g. national laboratories, universities, and major firms). These are of primary importance as territorial actors in creating innovation-led places. We then review labour markets as key components of the functioning of successful clusters. Finally, we examine the conditions under which linkages and networks are an outcome of geographical coincidence or purposeful brokerage

2.1. Islands of innovation and the location of research and expertise

Public sector organisations, such as national laboratories and universities, are conceptually important with respect to relationships between two organisations. Smallbone et al. (2015) note that the concept of 'anchor institution' emerged in the 2000s as a new way of understanding the role that place-based institutions could play in building successful local economies and communities. Their characteristics include spatial immobility; embeddedness in the local economy and community; and having a large resource base that is manifested in local purchasing, employment and business support across large and small actors alike.

Feldman (2003) introduced the concept of 'anchor firms' to explore the locational concentration and specialisation of the emerging biotech industry. Existing firms can serve as anchors that attract

skilled labour pools, as specialised intermediate industries and as providers of knowledge spillovers that benefit new technology intensive firms in the region.

Anchors may have a formal coordinating role, an indirect role of promoting two-way relationships or both. Within the scientific and technological based region, big science facilities often take an anchor role. Autio (2014) categorised them into, on the one hand, research-oriented and service-oriented missions; and on the other, fundamental research and solutions-oriented missions. In practice, while many big-science facilities exhibit elements of each, the emphasis is likely to vary over time. Thus, these organisations provide information resources through interactive relationships of various kinds. For example, in the UK as elsewhere, public sector research organisations' roles have moved beyond that of pure science with some 'leakage' in the form of local recruitment (OECD 2011). Such developments are at the heart of understanding broader patterns of technological advance and how they are localised and embedded in the local community driving economic outcomes, such as product and service innovations.

KEY WORDS
Technological Change, Regional Innovation Systems, Clusters, Research and Innovation Policy.

PALABRAS CLAVE
Cambio Tecnológico, Sistemas Regionales de Innovación, Clústers, Política de Investigación e Innovación.

2.2 Islands of innovation, labour mobility and networking

Kasabov and Sundaram (2016) conceptualise clusters as dynamic and path-dependent pools of skills. A pool of skills enables places to sustain the economic ability to withstand external adverse factors and go through periods of development and transformation. Those with high skill sets are potentially able to create superior value. Thus, building bodies of knowledge through regional innovative labour market are fundamental to processes of innovation (Hilpert 2014, Huggins and Thompson 2017) For places to become islands of innovation, their organizations have to embrace all kinds of talent, knowledge and capabilities that are needed to deliver high value to customers with respect to key emerging technologies (KETs) (see Assimakopoulos et al. 2016, Evangelista et al. 2018). These highly innovative technologies are knowledge and capital intensive, linked with the intensity of R&D, swift and integrated innovation cycles and require high skill employment. For this reason, networks of knowledge flows are needed in order to bring together complementary expertise and resources, and to promote cooperation (or/and competition) among companies, academic

institutions and public authorities. Innovation networks are a major source for acquiring new information and knowledge, supporting innovation processes (Koschatzky et al. 2001).

Networks involved in the creation and diffusion of technology operate both locally and across geographical distances. A key factor is that islands of innovation are simultaneously involved in exchanges of personnel with other places in the world rather than the labour being bound to one place (see Hilpert 2014, Trippl 2014).

Both the quality of the labour market and inter-organisational mobility are fundamental for network development and functioning because of their coordinating roles in innovation at the regional level (Lawton Smith and Waters 2011). Specific human capital refers to skills or knowledge that increases a worker's productivity overall though possibly differentially in different tasks, organizations, and situations. The concept of human capital has been broadened to competences as well as knowledge and skills (Gillies 2017). Thus, in the context of anchor organisations and their knowledge exchange relationships, their role goes beyond users of skills into the production of new competences, for example, for innovation and the mobility of that knowledge. At the same time, networks are heterogeneous in timing and function, sometimes meeting short-term goals and sometimes establishing long-term networks.

In summary, two strands represent the framework for understanding the different types of agency involved in clustering of innovative activity. These are:

- The capacity for public policy to play a role in building successful regional economies.
- Labour skills and mobility and networking in underpinning relationships

3. THE STUDY: ISLANDS OF INNOVATION: GRENOBLE AND OXFORDSHIRE

Each has both public and private sector anchor institutions and increasingly highly qualified labour markets. **Table 1** shows the science base in Grenoble and **Table 2** that in Oxfordshire.

3.1 Anchor institutions and their labour markets

In 2014, Grenoble was ranked the second most innovative city in Europe[1] and in 2013 the fifth most innovative city in the world. Grenoble stands out for its focus of research, university and industry, its partnerships with successful manufacturers, internationally renowned research laboratories and higher education courses.

Table 1. **Grenoble's research base**

GRENOBLE		
LABORATORIES AND UNIVERSITIES	**EMPLOYMENT**	**SCIENTIFIC RESEARCH ACTIVITIES**
Atomic Energy Agency (CEA) CEA LETI, Laboratoire d' électronique des technologies de l'information' LETI	1,700 scientist and engineers, more than 250 graduate research students.	Nanotechnologies and their applications, within a broad range from wireless devices and systems, to biology, healthcare, energy and photonics.
Centre National de la Recherche Scientifique (CNRS)	32,544 staff members located in laboratories throughout France	Nine scientific institutes, focusing on Mathematics, Nuclear Physics, Chemistry, Biology, Science of Universe, System Engineering, Information and Interactions, Humanities, and Environment.
Université Joseph Fourier (UJF), (now part of the University of Grenoble Alps),	5000 students per year	Science and medicine
Major firm		
STMicroelectronics STM	c. 8,700 people working in its eighty R&D facilities worldwide.	Electronics – semiconductor solutions

The concentration of expertise means that it has a very highly skilled labour market. The Grenoble science base as a whole (four universities, five EPIC laboratories, 10 engineering schools and five European research centres) employs almost 10,000 public researchers. Over time, universities, laboratories and firms have increased their demand and supply of labour thus increasing the quality and diversity of the local labour market.

The Oxfordshire research base includes Oxford University, with outstanding research and teaching, and Oxford Brookes University. The county also has a unique grouping in the UK of government funded 'big science' and other research facilities. It also has a number of leading high tech (anchor) firms[2], three of which were chosen as case studies.

The organisation of the science base had already begun to change by 2003, with the privatization of some public laboratories following the introduction of the successful Public Sector Research Exploitation Fund in 2001[3]. Thus, as in Grenoble, there has been a blurring of the roles of big-science facilities as missions have changed (Autio, 2014).

Table 2. **The Oxfordshire science base**

OXFORDSHIRE		
LABORATORIES AND UNIVERSITIES	**EMPLOYMENT 2014/5**	**SCIENTIFIC RESEARCH ACTIVITIES**
Rutherford Appleton laboratory (RAL) Science and Technology Facilities Council (STFC) (a government research funding body)	c1200	Applied and fundamental science supports work in a range of areas including space science and astronomy, particle physics, nanotechnology and developing new materials, Diamond Light Source, the UK's synchrotron facility. ISIS, a centre for research in the physical and life sciences, the Medical Research Council's facilities, and the Satellite Applications Catapult Centre.
Harwell United Kingdom Atomic Energy Authority (UKAEA)		UKAEA was restructured in the 1990s, following the launch in 1989 of AEA Technology (AEAT) as its commercial arm, which was then privatised in 1996. UKAEA is now responsible for managing the environmental restoration programmes including decommissioning redundant nuclear facilities and the managing radioactive wastes from decommissioning, remediation of contaminated land and management and development of land and property assets. Renamed as Harwell Science and Innovation campus in 2006. Other laboratories on the Harwell site or nearby include the former National Radiological Protection Board now part of Public Health England; NERC Centre for Ecology & Hydrology and MRC Harwell.
Culham Centre for Fusion Energy (CCFE) (formerly UKAEA Culham)	150	UK's national fusion research laboratory
JET	500	Facilities are collectively used by European fusion scientists
Oxford University	Total 22,602 students Total 12,510 staff	Mathematical, Physical and Life Sciences
Oxford Brookes University	Total 17,864 students Total 3000 staff	Subjects allied to medicine e.g. nursing and advanced engineering e.g. motorsport

Case study firms		
Oxford Instruments PCL Established 1959	330 (over 2000 worldwide) (335 in 1987) (456 in 2002/3).	Leading provider of high-technology tools and systems for industry and research specialised in cryogenics. It is the industrial founder of Oxfordshire cryogenics cluster, 'cryogenics valley'. Has spun-out a number of companies including Oxford Magnet Technology, Oxford Analytical Instruments, and Oxford Medical. Oxford Metrics and Oxford Research Systems also have their origins in Oxford Instruments.
Siemens Magnet Technology (SMT)		Oxford Magnet Technology (OMT), a spin-out from Oxford Instruments, became a joint venture between Siemens (51%) and Oxford Instruments (49%). In 2003 Siemens bought the remaining 49% and it became (SMT). SMT is the world's leading designer and manufacturer of superconducting magnetic resonance imaging magnets for medical applications.
Sophos	480 (1600 worldwide)	Antivirus software

This grouping including Culham forms part of Science Vale UK, a partnership of two local district councils (Vale of White Horse and South Oxfordshire), the Oxfordshire Local Economic Partnership, Oxfordshire County Council and STFC[4]. It includes another important business park, Milton Park hosting more than 160 companies that form one of the UK's foremost science communities. The 6,500 people on the site work for companies of all sizes and ambitions, from start-ups to world-class public limited companies, with particular strengths in the biotech and ICT sectors. It is home to 13,800 jobs and is the only location in the country with two Enterprise Zones - designated areas providing tax breaks and government support. Other major locations are the Oxford Science Park and Oxford University's science park at Begbroke.

The pattern of high tech activity in Oxfordshire is one of specialization in a relatively small range of sectors: publishing, motor vehicles, computer/electronic equipment/ instruments (including medical instrumentation). Of particular relevance to this discussion is the exceptional concentration of cryogenics, a KET that evolved around Oxford and is unmatched anywhere else in the world, which has resulted in sought-after specialists at all levels. Oxfordshire has pioneered cryogenic-enabled developments such as MRI scanners, and is playing a leading role in the new technologies[5].

The two universities in Oxford and the 7 public sector laboratories collectively employed 18,500 nearly twice as many as in Grenoble. In student populations there was a similar disparity, this time in Grenoble's favour. Grenoble had 55,000 students compared to Oxfordshire's 35,000. The main difference was that Oxfordshire's nuclear laboratories have far fewer students.

3.2. Relationships

Grenoble

Four research institutions in Grenoble which were known to have strong ties with the CEA were selected – LETI, CNRS, UJF and STM. These organisations form major relationships with it (and among themselves) for the creation, sharing and diffusion of knowledge inside a local innovation system and in particular, within its MINALOGIC cluster. As innovation becomes more collaborative, networks and partnerships have grown in strategic importance[6]. Since 2005, the cluster has given birth to emerging technologies fuelling growth for large and small companies alike.

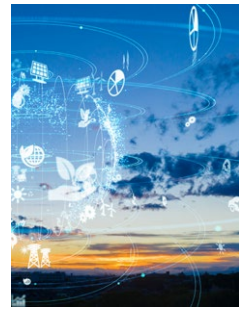
All have CEA LETI as one half of partnerships. CNRS has worked closely with CEA LETI for decades in major public research projects; a combination of central and regional forces. Thus both national and regional policies interact in the Rhone-Alps region in order to promote innovation in the field of semiconductors and embedded software. STM, an anchor firm, has been described as a leading meta-national innovator (Doz et al. 2001).

Relationship no.1: CEA-LETI and CNRS

CNRS is active in maintaining partnerships in projects with important knowledge creating institutions (as the University of Grenoble). Its EU and international partnerships are part of the portfolio of wider CNRS research organizations at the national and European levels. In this partnership CNRS is an integral part of the national research centre/NIS, while CEA LETI is the local/regional anchor fairly independent from other parts of the CEA (they specialize in other types of KETs). CNRS research activities and projects are often complementary to those of CEA LETI. As a result, they inter-changeably lead and co-ordinate numerous collaborative projects taking place under the MINALOGIC aegis. They also participate both in many EU and international projects and in the diffusion

of scientific knowledge within the cluster and across regional boundaries to other leading European clusters, such as the one focusing on micro-electronics and nano-technologies in Dresden, Germany. This allows them to cooperate, coordinate and participate in collaborative projects independently from each other.

CEA LETI intensively promotes the cooperation with local SMEs within the MINALOGIC cluster. CNRS cooperates more with big industrial groups and a range of large and small companies. CNRS appears as the national innovation system in the region, concentrating knowledge from big firms (national and international). CEA LETI includes more local small and medium firms, fostering further development of the local innovation system. When these two research organizations cooperate, they create and share expertise for the production of new knowledge in KETs. As they cooperate widely their direct ties are surrounded by a large number of additional ties, facilitating knowledge flows inside the region and multiple paths connecting an array of other players in the MINALOGIC cluster.



Partnership no.2: CEA LETI and STM

STM has established a strong culture of partnership and a far reaching network of strategic alliances with important customers, suppliers, competitors, and universities and research institutes around the world. It has a wide product portfolio with customers across the spectrum of micro- and nano-electronic applications with innovative semiconductor solutions in technological areas for smart devices, MEMs, health, etc. This is supported by its extended series of emerging technologies, design expertise and the combination of an intellectual property portfolio, strategic partnerships and manufacturing strengths in many countries.

The largest research and new product design and development facility is still located in Grenoble with more than one thousand scientists and engineers, coupled with a large state of the art manufacturing fabrication facility. The latter is a 3 billion euro joint venture of STM with Philips semiconductors and IBM. STM has recently focused its product strategy on sensor and power technologies, automotive products and embedded processing solutions. The Grenoble division of STM is the largest industrial employer in ICT in the region (both CapGemini in software, consulting and services and Schneider Electric in electrical and

electronics engineering have gradually moved to Hong Kong). In this partnership a leading public research lab (CEA LETI) has helped form a multinational industrial group, specialised in the design and production of semiconductors. The cooperation of CEA LETI and STM ensures the encouragement of the private sector in knowledge production with a clear market orientation for developing knowledge near to the market and the commercialization of products. The participation of local SMEs and smaller industrial groups is encouraged by MINALOGIC. This is further enhanced because CEA LETI is supporting the local firms, and STM's business units located in Grenoble outsource the development of several designs and components to local small firms.

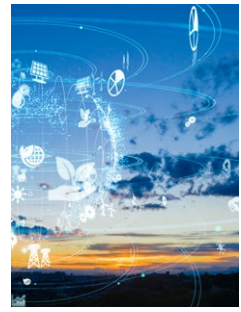
This encourages the transfer of knowledge inside the cluster between private and public institutions in a two directional flow through multiple paths, thus changing the structure of networks and positions of actors within them (Ferraro and Iovanella 2017). Various programmes have enabled employees to start their own firms, receiving support from STM for the first few years and, in case of failure, they are offered their previous job back at STM. Its existence facilitates the creation of flows of knowledge inside the region and worldwide. This can increase the participation of local firms in knowledge creation and reinforce CEA LETI as a knowledge broker. Without this relationship, private actors could miss out on local and international knowledge production and transfer processes. Another possible consequence could be an isolation of entire industrial projects.

Partnership no. 3: CEA LETI and UJF

UJF is one of the leading French universities in science, technology and healthcare related disciplines. UJF is now part of the University of Grenoble Alps. It has fifty laboratories in all fields related to medicine, science and technology, as well as close partnerships with national and international research universities. It has three research foundations with foci on nanoscience and nano-electronics, innovations in infectious diseases and disability, as well as neurology and cognitive science. It promotes the research outputs through a private subsidiary, which manages the university-industry relationships. In the last fifteen years, 35 start-ups have been created by UJF scientists and researchers.

In this relationship, there is CEA LETI as a public research centre and the UJF as a leading academic institution. The university adds co-operations with national and international academic institutions, and some local SMEs. UJF is a broker of the academic knowledge encouraging flows towards research centres and from them to industry, or directly to the local firms. Projects in which they both participate involve local firms, either SMEs or industrial groups, as well as other French universities. Hence UJF is an indispensable node in the network and a collaborator of CEA LETI, facilitating MINALOGIC in collecting the knowledge produced in academia.

To summarise, the combination in partnerships and networks of public actors, either with other research centres or universities, produces expanded networks that can reach almost 80% of the entire cluster network. The combination of a research centre and a university produces networks that can connect the most peripheral parts of the initial network.



Oxfordshire

Partnership no. 1: Oxford Instruments and Oxfordshire's research institutions

Oxford Instruments' relationships with the big research laboratories are variously of labour market exchanges, customer-suppliers, and knowledge generation and exchange based on innovation. For example, Oxford Instruments and STFC (and its predecessors) have collaborated for over 30 years on the development of many KETs including superconducting wire and magnets, particle accelerators and applications of cryogenic technology (STFC 2017). For the company, these relationships are now more important than in 2003. This is a change in approach from big science to a more commercial operation. The company built the world's largest Tesla magnet; which resulted in a 2006 decision to double the business size through new products and acquisition.

Skilled labour and access to universities and research institutions are the bases for current relationships rather than knowledge transfer. The most important relationship is recruitment. The firms' workforce is highly skilled: over half have at least first degrees. A recent interest in life sciences has changed the profile of the company's workforce. It recruits strongly from the local labour market, especially for production skills having a stable local recruitment pattern. The company has a graduate programme

designed to encourage mobility within the firm, increasingly bringing in overseas talent. A feature of the local labour market is poaching from the local laboratories, Harwell, Culham, RAL and SMT. Links with universities as a whole have stayed the same over time but those with Oxford University have declined: only one joint project is with Oxford.

Partnership no.2: SMT and Oxfordshire Research Laboratories

The company is a centrally important company in the Oxfordshire cryogenics cluster. The company benefits from local knowledge excellence and access to skilled labour necessary to produce and develop its products. Its relationships take the form of market relationships with its former parent company (Oxford Instruments), local recruitment, and knowledge exchange with local research institutions.

The Oxfordshire site is the design authority for all products and services. Components for magnets are bought in and assembled in Oxfordshire. The main collaboration with local firms is through buyer-supplier relationships. A policy in mid-1990s was of sole supplier relationships with about 50 local firms. Over time local subcontracting has decreased substantially. Two thirds of production is now carried out in Oxfordshire with the rest in Shenzhen, China.

The company recruits undergraduate interns: many are then employed permanently. It also recruits 10-15% of its engineers and cryogenicists from overseas, while 75% of the shop floor and white collar staff are recruited from within Oxfordshire.

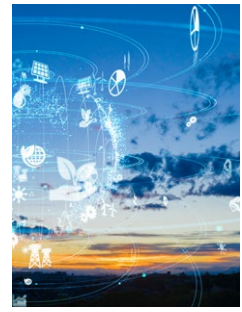
Relationship no.3: Sophos and Oxford University

Sophos has grown continuously over the three decades becoming a multinational data security company producing anti-virus software. It was established by 2 post-docs in the Department of Engineering, Oxford University, and became a PLC in 1993. The underlying driver for growth has been innovation which has enabled Sophos to introduce new products, often based on new technologies.

Its main relationships within the county are through recruitment. The Oxfordshire workforce includes about half who are software developers or malware analysts, an area where Sophos is continually seeking staff. Frequently, new recruits have been previously employed in the Thames Valley, where labour markets for both software engineers and commercial staff have been created

by European HQs of major US companies such as Oracle and Microsoft. Some 15-20% of staff are recruited internationally.

Links with local universities and research centres are limited to the University of Oxford and University Oxford Brookes. In the former case, the connection is enduring network relations (Klaster et al. 2017), based on the company founders' links with academics, some part-time lecturers working in the company and academics on the board. In the case of Oxford Brookes, the connection is shorter-term based on links with the university career service. Sophos has no formal collaboration with Oxfordshire-based firms, has never subcontracted activities to Oxfordshire-based firms and does not belong to any business network. As well as being the home location, other cluster benefits as in Cambridge (Huber 2012) are to do with branding and reputation. Most of the physical growth of the company is now likely to be outside Oxfordshire, especially since in 2019 the company was acquired by US group Thomas Bravo. By then it had 3,400 employees worldwide[7].



4. DISCUSSION AND CONCLUSIONS

This paper focused on diversities of innovation in two 'islands of innovation', one in the UK (Oxford) and one in France (Grenoble). The evidence shows that such diverging patterns of innovation and consequent regional development are a necessary outcome of the different processes at both locations. In both cases, the importance of place as sites of agglomerations of opportunities is sustained over time but for different reasons.

We suggest that explanations for how innovation processes have diverged lie in how relationships are formed and coordinated, having both positive effects and limitations. In these two contexts, differing patterns are connected to the ways that anchor institutions and firms (Smallbone et al. 2015, Feldman 2003) function as a consequence of national policy agenda for sustaining innovation in KETs. At the same time, divergence is associated with changing characteristics of the individual places (e.g. the knowledge base, labour markets, collaboration and networking).

Major differences are found in the structure of networks and positions of actors within them (Ferraro and Iovanella 2017). While in each location networks which provide knowledge and information resources are important, they are the primary focus

of relationships only in Grenoble, particularly through the role of MINALOGIC, a construct of public policy as the creator of anchors and communication.

In Oxfordshire local recruitment is the main driver of relationships in all three cases with knowledge and information resources and networks being less important. Here as in Grenoble, links with the group of research laboratories have remained important relationships for two of the leading firms, based on the local concentration of expertise in cryogenics. Another theme emerging is that interactions are increasingly non-local and increasingly international. This is especially true of Sophos, whose links with the locality are weakening, except for a key relationship with Oxford University.

The models are information, labour market and policy dominated. These are not mutually exclusive but how they intersect diverges between the two locations. Moreover, the drivers of relationships between the anchor organizations and partners also differ. Public policy has had an impact on the role of anchor institutions and relationships within the locality. France is characterised by top down big spending, public sector-led development, taking advantage of government labs as 'anchor institutions'. Continuing cluster funding sustains these relationships as well as purposeful brokerage and networking.

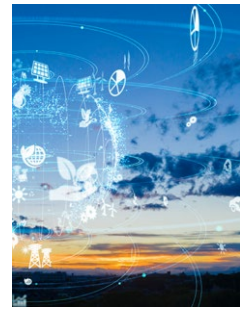
Oxfordshire's inter-organisational relationships are coordinated more by public-private partnerships and privatisation of national assets, and particularly by that of labour markets (Lawton Smith and Waters 2011). This is alongside still dominant national research funding, thus knowledge and information resources continue to be shaped by previous local developments. This difference has increased over time.

In Grenoble, the French state is of paramount importance. It is responsible for the coordination of relationships and influences the generation and flow of knowledge within and towards the cluster. The French government defines the cluster, hence the 'island of innovation' and the importance of place. Firms have to demonstrate that they are members of the cluster in order to bid for government funding, in this case under MINALOGIC.

In the UK, the state and public policy is important because of access to high level knowledge and information resources arising from government funding of research rather than systematic,

regionally organised initiatives. The dominant model is that related to mobility within local, national and international labour markets as well as sustained concentrations of skills in technologies such as cryogenics.

Finally, in both places ‘branding’ is important. Both are world leading ‘islands of innovation’. This in itself is an anchor to firms in key emerging technologies.



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NOTES

1. http://www.grenoble-inp.fr/grenoble-in-press-/grenoble-the-second-most-innovative-european-city-600825.kjsp
2. The focus is on three major long established firms and their relationships with the science base. A series of studies on the Oxfordshire high-tech economy dating back to the mid 1980s, with follow up studies in the mid-1990s and mid-2010s forms the basis of the Oxfordshire evidence. In 1985, 182 local firms were identified as advanced technology firms and hence formed the population of the study. Of these, 164 firms agreed to be interviewed. In 2015, 170 companies were traced and data collected and 15 were interviewed.
3. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/380908/bis-14-1254-7th-survey-of-knowledge-transfer-activities.pdf (accessed May 26 2016)
4. http://www.sciencevale.com/ (Accessed May 25 2016)
5. http://www.oxfordshirebusinesssupport.co.uk/content/cryogenics.
6. http://www.ey.com/Publication/vwLUAssets/ey-is-collaboration-the-new-innovation/$FILE/ey-is-collaboration-the-new-innovation.pdf (accessed August 20 2017)
7. https://www.sophos.com/en-us/press-office/press-releases/2019/10/thoma-bravo-makes-offer-to-acquire-sophos.aspx