

**Theme:** Place Based Innovations

**Implementing an ecosystem of open innovation: The ArcLabs story**

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Bill retains links with the business community, through research and mentoring entrepreneurs; a director of the South Eastern Business Innovation Centre (SEBIC), and the Dungarvan Enterprise Centre, a member of the Enterprise Development Team of the South Tipperary Chambers of Commerce, co-founder of the Irish Network for Teachers and Researchers in Entrepreneurship (INTRE), non-executive board member of a number of SMEs, and serves on a number of government round-tables for enterprise policy, development and education.

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The TSSG has established a cluster of High Potential Start-up companies in mobile services at its research centre at Arclabs which currently employs more than 120 people. He is a founding member of spin-out companies FeedHenry and Zolk C.

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### **Abstract**

In an era marked by phenomena such as globalization, unbundling of production cycles and processes, open innovation systems, and brain circulation, factors triggering and feeding innovation and regional development are increasingly found “elsewhere” rather than within the internal network of relations that have traditionally been the main focus of regional development (adapted from Bellini and Hilpert, 2013). In an environment where national, regional, institutional and organisational boundaries are blurring, economic policies of protectionism, self-sufficiency or containment are no longer tenable. No longer can boundaries be seen as impediments to the movement of goods, innovation, research nor the commercialisation of research (Fujita, 2010). Instead small countries and regions need to embrace a new step in the evolutionary process of enterprise policy progression and

development (see O’Gorman and Cooney, 2007). However, countries are made up of regions and most often is the case, especially in countries of centralised governance, a region’s sub-economy and particularly its capacity and capability to innovate and develop a regional innovation system is overshadowed by the nation’s capital and the greater economic domain surrounding the capital (O’Gorman, 2005). In such environments it is very difficult for regional players to design, develop and implement an ecosystem of open innovation. This paper is about the vision and determination of how a small group of actors gained national and international support to develop a successful ecosystem of open innovation. This is the story of ArcLabs Research & Innovation Centre and the creation and development of its model for an ecosystem of open innovation. This paper demonstrates that even in adverse economic conditions, in a centralised governance regime, regions and sub-regions, if they have catalysts with vision and drive, can create and develop an ecosystem of open innovation. In summary, the ArcLabs model is testimony to the fact that *the regional innovation paradox* (Oughton, Landabaso and Morgan, 2002) can be addressed successfully.

## **Introduction**

ArcLabs is a successful and unique, internationally recognised centre of excellence for research and innovation. It is Ireland’s only *ecosystem of open innovation*, and by leveraging on the technology, expertise and experience of its research and innovation process ArcLabs has made a significant positive contribution to the economy and sustainability of the sub-region within which it operates, South East Ireland. Since its foundation in 1996, up to and including 2012, ArcLabs research activities has secured over €80 million of state and European Union funding for basic and applied research and the commercialisation of research, has generated over 10 spin-out and 4 spin-in companies, and has mobilised active international networks consisting of in excess of 450 partners (a combination of industry,

government agencies, academic institutions and other leading research centres) spread across 35 countries worldwide. Additional to spin-out and spin-in companies ArcLabs, since 2004, has worked directly with 120 entrepreneurs, in year-long incubation programmes [the only such programmes in Ireland and the UK accredited to award a Level 9 qualification to entrepreneurs] to support them to create their own high-potential start-up businesses. Eighty-four of these entrepreneurs are successful to the extent that, between them they have generated over €29 million in sales (€8.5 million of which is in export sales), and have created in excess of 249 jobs over the last six years.

Currently ArcLabs Research & Innovation Centre is home to six Faculty members of Waterford Institute of Technology (WIT), fourteen post-docs, twenty-four PhD students, and seventy-three research engineers/project managers; and twenty companies employing a total of 120 people (average number of employees per company is six; range is 1 to 25).

ArcLabs has achieved all this success, in adverse economic conditions, by attracting highly skilled researchers from many countries around the world to work in the centre; by putting an effective funding process in place that has been extremely successful in competitive bids for funding from the Ireland government, European Commission, Venture Capitalists and other international sources; by encouraging and facilitating the process of spin-outs and spin-ins; by providing incubation, mentoring and educational support to these spin-outs/spin-ins; and by engaging with local, regional, national and international business communities. In effect a micro-system (ArcLabs) within a sub-region has overcome what Oughton, Landabaso and Morgan (2002) refer to as the 'regional innovation paradox'.

The innovation paradox refers to the concept whereby it is clear that certain regions and countries need to invest heavily in R&D, innovation and the commercialisation of research if they are to close the income and wealth creation gaps compared to ‘wealthier’, ‘more sustainable’ regions and countries, however these regions and countries do not have the capacity nor capability to effectively manage such investments. This may be due to a lack of experience and/or being at a stage of development whereby neither the region’s or country’s enterprises and innovation policies nor infrastructures are conducive to effectively utilise investments geared for R&D, innovation and the commercialisation of research. Specifically from a regional perspective the innovation paradox often exists as the result of centralised government and policies and/or a country’s economy being dominated by an advanced and well performing capital or region(s) which overshadow(s) weaker and underperforming regions (O’Gorman, 2005).

The TSSG (Telecommunications Software & Systems Group) was founded in 1996. It was from this specialist, high-tech research and innovation centre that ArcLabs came into being around 2004. This paper is the story of ArcLabs and its foundation stone TSSG. In particular the paper is about how TSSG’s management in combination with other leaders from WIT’s Research Support Unit (RSU), and the School of Business (through the Centre of Enterprise Development and Regional Economy (CEDRE)) envisaged, created, designed and implemented what is the ecosystem of open innovation, ArcLabs.

The structure of this paper is as follows: first of all in order to put the success of the ArcLabs model into context the paper describes the region within which it is based both from a structural and economic perspective. Next the theoretical frame is set for the for the paper. This is followed by an analysis of ArcLabs from its inception to its current modus operandi.

This section uses a number of diagrams to bring the reader through the different phases of ArcLabs' development. Finally the paper concludes with proposed steps for the creation, development and sustainability of ecosystems of open innovation.

### Setting the context of ArcLabs

ArcLabs Research & Innovation Centre is in South-East Ireland. Historically Ireland is divided into four provinces, Ulster, Leinster, Munster and Connacht. But from an EU economic perspective Ireland is divided into two regions, the Southern and Eastern (SE) region and the Borders, Midlands, and West (BMW) region. However, Ireland has further subdivided these regions into a total of eight sub-regions. One of which is the South-East (see Figure 1).



Fig. 1 Sub-regions of Ireland [source: South-East Regional Authority, 2006]

The South-East consists of five counties, and one major gateway centre (National Spatial Strategy, 2002). However, these five counties are in two different provinces (Munster and

Leinster). From a sporting, social and cultural perspective there is significant pride and rivalry between the two provinces. Equally there is considerable pride and rivalry between each of the counties constituting the South-East.

Policy, judicial and fiscal power in Ireland is centralised in its national government, thus the regional and local government authorities have little power over the jurisdiction of their respective sub-regions and counties, and each has to muscle its way to receive funds and other supports from national government. Even enterprise and education policies are centralised. Therefore the fiscal rivalry between the counties in the South-East is even more intense than the sporting and cultural rivalry. In 2012 the Ireland government published a policy to reform local and regional government (Government of Ireland, 2012). In the introduction to the policy document, the Minister for the Environment, Community and Local Government, Mr. Phil Hogan TD, stated that this is “...the most fundamental set of changes in local government in the history of the State [founded in 1922] from regional and county level through to the municipal level of governance.....[especially as] local government structures in Ireland have not been updated since the 19th Century..... [the purpose of this change is] also to promote local community, social and economic development, and collectively to maximise the strengths of our country as a place in which to live, to invest and to work. At a critical time for our country, local government has a crucial role to play in Ireland’s national recovery. The Action Programme empowers local government in an entirely new way, particularly in relation to economic development, and most importantly, sustaining and creating jobs.” (p. i and ii). The policy document presents the restructuring of regional governance from eight regional authorities and two regional assemblies to a total of three new regional assemblies. The document also outlines new governance structures and power of raising funds at municipal and county levels. However, experienced researchers in

economic development and industrial clusters such as VanEgeraat and Foley (2012) comment and question “unfortunately the document makes no reference to the logic behind this new division [of the regions]. Would it be too cynical to suggest that the main driver is to cut numbers rather than stimulate regional development?”. So even though this radical change in policy has been publicised the current regime that the South East still operates in is still very much led by central government.

From an economic perspective the South-East is still very much dominated by tourism and agriculture and, before the demise of the Celtic Tiger in 2008, the construction industries. The South East with a population of just under 500,000 people (about 11% of the national population) has always been underperforming compared to other regions in Ireland, and was the hardest hit region as regards household income and levels of employment after the demise of the Celtic Tiger; and even though there are signs of improvement in the economy over the last five quarters, the South-East is still performing poorly, for example see Table 1 Unemployment rates by region.

<b>Region</b>	<b>Q1 '11</b>	<b>Q4 '11</b>	<b>Q1 '12</b>	<b>Q2 '12</b>	<b>Q3 '12</b>	<b>Q4 '12</b>	<b>Q1 '13</b>
State	14.3%	14.5%	15.0%	15.0%	15.0%	13.7%	13.7%
Border	13.0%	13.9%	15.4%	16.65	17.7%	16.5%	15.5%
Midland	17.1%	18.7%	18.7%	18.3%	17.4%	16.9%	17.1%
West	16.6%	15.4%	16.2%	16.2%	15.3%	14.4%	12.9%
Dublin	12.7%	13.0%	13.2%	12.3%	12.9%	11.1%	11.3%
Mid-East	12.9%	12.4%	12.7%	13.8%	13.8%	12.4%	14.3%
Mid-West	15.7%	15.9%	16.0%	16.1%	16.6%	15.4%	15.6%
South-East	17.2%	19.2%	20.1%	19.0%	19.4%	18.8%	18.4%
South-West	13.9%	13.5%	13.6%	14.2%	12.9%	11.9%	11,1%

Table 1 Unemployment rates by region (source: CSO Ireland, 2013)

As can be seen from Table 1 the unemployment level in the South East is higher than that of the other regions in Ireland and significantly higher than the national average. All regions with the exception of Border, Mid-East and South-East are showing decreasing levels of unemployment; and whereas as the rate of increase in unemployment for the Border and Mid-East regions between Q1 2011 and Q1 2013 is higher than for the South-East, the rate of improvement in employment levels in these regions is better than that in the South-East.

As regards the index of disposable income per person, the latest figures available from the CSO are for 2010. If the State is taken at index 100 then the index for each of the eight regions is as per Table 2.

State	Border	Midland	West	Dublin	Mid-East	Mid-West	South-East	South-West
100	90.6	89.2	95.9	110.3	99.4	99.6	94.5	99.6

Table 2 Index of disposable income per person in 2010 (source: CSO Ireland, 2013a)

The lowest level of income per person is in the Border region and the next lowest is the South-East. Finally, as regards median annual household disposable annual income the South-East is third lowest of the regions, see Table 3.

State	Border	Midland	West	Dublin	Mid-East	Mid-West	South-East	South-West
€34,222	€31,928	€29,224	€33,347	€42,741	€38,139	€32,030	€30,951	€29,674

Table 3 Median annual household disposable in 2010 (source: CSO Ireland, 2012)

The South-East region has a lower than average participation rate in higher education amongst the labour force, for example only 23% of the population has a higher education qualification as opposed to 36% in Dublin and 29% nationally (CSO, 2013b). The number of multinational enterprises (MNEs) in the region is only 9% of the total number of MNEs in the Republic of Ireland. Also whereas, on a national basis, on average, the employment levels are

50 – 50 between MNE and Irish owned enterprises, only 40% of those employed in the South-East are employed by MNEs.

Based on the above statistics the South-East could be classed as a peripheral region and therefore considered to be inferior and lack the dynamics, actors and infrastructure to avail of inward investment to create and develop effective regional innovation systems. Also based on the scenario that the South-East consists mainly of traditional industries with low levels of innovation and R&D capacity, and somewhat over-reliant on FDI (where innovation and R&D are jealously guarded by those in the home nation's HQ) it could therefore be considered to be less developed in terms of possessing the resources, supports, networks, education infrastructure, or knowledge support systems to develop a cohesive, interactive triple helix of regional (or national) actors to internationalise and commercialise technology and knowledge transfer. Taking all this evidence into consideration it could be construed that the South-East region of Ireland would find it difficult to break out of the “innovation paradox” cycle (O’Gorman and Donnelly, 2013).

### **Theoretical frame**

Innovation and the commercialisation of innovation in themselves are not the keys to regional development but rather it is the process, supporting infrastructure, and environment within which innovation, the commercialisation and internationalisation of research outputs happens that are the ingredients of regional economic development. The locus and catalyst of innovation systems and the commercialisation of research is in fact within the region, as opposed to solely at a national or supranational level. Therefore supranational, national, regional and local innovation policies need to be aligned (Sternberg, 2009). In fact policy makers at all levels need to support both innovation and regional development at the same

time to ensure that regions can become functional agents of change, keeping pace with global markets and trends (OECD, 2011).

However, much of our understanding of regions as a locus of innovation comes from research into regions that are largely based on metropolitan areas or exemplary regions such as Silicon Valley, Emilia-Romagna, and Baden-Wurttemberg that are conducive to the development of innovation systems (Cooke and Morgan, 1998; Doloreux and Parto, 2005). On the other hand, peripheral regions are considered to be inferior and lack the dynamics, actors and infrastructure to avail of inward investment to create and develop effective regional innovation systems. Such regions consist mainly of traditional industries with low levels of innovation and R&D capacity, are often over-reliant on FDI (where innovation and R&D are jealously guarded by those in the home nation's HQ) and are therefore considered to be less developed in terms of possessing the resources, supports, networks, education infrastructure, or knowledge support systems to develop a cohesive, interactive triple helix of regional (or national) actors to internationalise and commercialise technology and knowledge transfer (O'Gorman and Donnelly, 2013). O'Gorman and Donnelly continue that even though these peripheral regions are operating in open economic systems they are still mostly "inward looking" and find it difficult to break out of the "innovation paradox" cycle.

Regional innovation systems that are successful make extensive use of endogenously generated as well as exogenously available knowledge to strengthen their competencies and to remain competitive in a global economic environment (Doloreux and Parto, 2005). One could posit that before the *information age*, the demarcation between endogenously and exogenously generated influencers on the development of regions was clearly evident. However, in the current high-tech, information age the endogenous-exogenous boundaries are

blurring. This is especially so when one considers the possibility and actuality of R&D, innovation, new product development commercialisation in multi(national) site locations. The world wide web (www), cloud computing and other technology and communication advances have enabled this multi(national) site feature of product development and commercialisation to become a reality. To the extent that the definitions of “region” becomes even more confusing and complex (O’Gorman and Donnelly, 2013). Indeed the role of local, regional and national politics and its influence over delineating and implementing innovation policies, taking local, regional and national nuances into consideration, becomes even more questionable. Thus there is the absolute need for the relevant triple helix of stakeholders of peripheral regions to generate RTD and innovation policies of cooperation and collaboration to create an environment whereby *eco systems of open innovation* can thrive (ibid).

In a globalised economy, where the boundaries between regions and economies are blurring, in order to remain competitive and to sustain their economies, regions need to realise that the capability and capacity to innovate and commercialise research is essential (See Montana, Reamer, Henton, Melville and Walesh, 2001). National and regional boundaries often generate restrictions to commerce, trade, innovation, technology development and the commercialisation of research. Therefore in order to develop an ecosystem of open innovation it is important to define ‘region’. A region can be defined as a territory less than its sovereign state, possessing distinctive supralocal administrative, cultural, political, or economic power and cohesiveness, differentiating it from its state and other regions (Cooke, Uranga and Etxebarria, 1998). Johansson (1992 and 1998) comments about a region having a high intensity of economic interaction and connectivity of nodes via economic networks and networks of infrastructure. Another suggestion as to what a region is, is that it is a territory in which the interaction between the actors and the flow of goods and services, create a regional

economic system whose borders are determined by the point at which the magnitude of such interactions and flows change from one direction to another (Andersson and Karlsson, 2004). Understanding these ‘interactions and flows’ is critical in visualising, designing and implementing a regional innovation process as an ecosystem of open innovation. However, In an era marked by phenomena such as globalization, unbundling of production cycles and processes, open innovation systems, brain circulation, factors triggering and feeding innovation and regional development are increasingly found “elsewhere” rather than within the internal network of relations that have traditionally been the main focus of regional development (Bellini and Hilpert, 2013). Bellini and Hilpert suggest that in order for a region to create, maintain, increase or reshape its ‘relational assets’ such aspirations must be added to a region’s objectives of their modern regional economic policy. They continue that regional development should be defined in terms of space: *economic space*, *innovation space*, *political space*, and *culture and identity space*.

Because regional innovation systems that are considered to be successful make extensive use of endogenously generated as well as exogenously available knowledge to strengthen their competencies and to remain competitive in a global economic environment (Doloreux and Parto, 2005), the focus of this paper is on *innovation space* and thus the determination of an ecosystem of open innovation for regions.

### **The ArcLabs story**

In the late 1980s and early 1990s Ireland and the world economy were going through a recession, not as severe as the recession that started in 2008 but none the less a recession. In 1993 Ireland began to creep its way out of recession and over the next five to six years began to experience phenomenal levels of economic growth, to such an extent that it was around

1996 when Ireland's GDP per capita surpassed that of the EU's average GDP per capita (Walsh, 2005). The phenomenal growth continued at such a rate that Ireland's economy was dubbed the 'Celtic Tiger' (Walsh, 1999). This phenomenal growth in the 1990s was also fuelled by an increase in the level of inward Foreign Indirect Investment (FDI) into Ireland (Sweeney, 1999), so much so that the growth in the economy was such that the rates of unemployment fell dramatically, the country neared rates of full employment, and Ireland began to experience immigration as opposed to emigration (O'Gorman, 2007).

The foundation for this success was a change by government as regards enterprise and education policies. In the early 1990s through the work of senior public servants in the Department of Enterprise Trade and Employment, Forfas<sup>1</sup>, and IDA<sup>2</sup>, it was clearly identified that the type of FDI solely directed at manufacturing and test, whilst at one time the cornerstone of Ireland's economy, was no longer sustainable in a global low-cost-labour economy. These public servants refocused on new emerging markets – services and information technology. As a result the mid-1990s in Ireland became an exciting, vibrant place to work and live, this churn is what fuelled the Celtic Tiger.

It was in 1996 that the executive at Waterford Institute of Technology (WIT) decided to hire into the organisation a specialist in the newly emerging field of telecommunications and utilities services industries. This experienced professional founded the Telecommunications Software & Systems Group (TSSG) at WIT in 1996, which has since grown from 3 to 120 people and has received over €80 million in competitive funding. The TSSG is now one of Europe's leading research centres in the Future Internet program. However, back in 1996,

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<sup>1</sup> Forfas is Ireland's government agency responsible for the development of enterprise and policy.

<sup>2</sup> The IDA is the Industrial Development Authority in Ireland and has the responsibility for implementing enterprise policy particularly as regards FDI into Ireland.

when Institutes of Technology in Ireland were not really involved in research, this appointment and creation of a centre involved in basic and applied research was ‘breaking the mould’ for tertiary education in Ireland. Subsequently this experienced professional became Vice-President for Research, Development & Innovation at WIT. From the very beginning the founder of TSSG always referred to it as an ‘open innovation business’.

Between 1996 and 2004 the three original founders of TSSG and a commercialisation manager developed a very successful research to commercialisation model (see Figure 2).

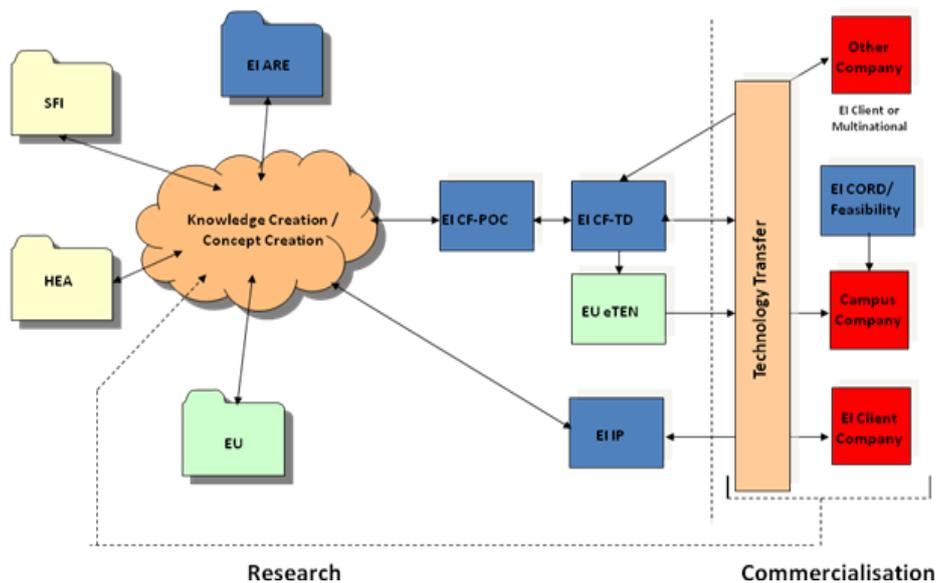


Fig. 2 TSSG’s original commercialisation model (source: Donnelly, 2008)

TSSG was so successful in winning competitive calls for funding from national and EU programmes that it moved to its own purpose built Research & Innovation Centre in 2004. But this was to be a location with a difference. Instead of it being a location for researchers alone it was also to accommodate the training, education and development of entrepreneurs, and the incubation of new high-potential start-ups. Thus the new Research & Innovation Centre was home for TSSG (which from its beginning in 1996 consisted of technology and engineering academics, researchers, and PhD students), the Centre for Entrepreneurship (now

renamed to Centre for Enterprise Development and Regional Economy (CEDRE)), and an incubation centre. These were three distinct entities in the one building, each reporting to different departments within WIT (see Figure 3).

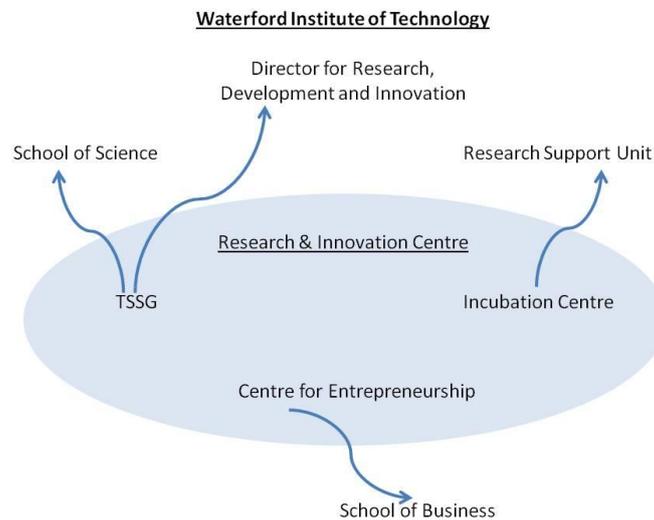


Fig. 3 Reporting structures of organisations in Arclabs in 2004

However, it was the meeting of minds of the leaders of these three entities that led to the ArcLabs ecosystem of open innovation model. The core concept of innovation in the ArcLabs model is the dynamics created by the co-location of academics (TSSG and the Centre for Entrepreneurship), engineers (TSSG) and entrepreneurs (Centre for Entrepreneurship and Incubation Centre). This is not unique in itself but what is unique is the balance created on the academic side. Traditionally academics are driven by academic metrics such as publications but what has been achieved in ArcLabs is the expansion of the academic base to include academics, post doctoral researchers, engineers, entrepreneurs and business all in the same team. So ArcLabs has created a positive tension between the traditional academic metrics of publications and PhD students with expertise in engineering and business acumen and development. In essence ArcLabs provided a one-stop shop for the commercialisation of research. As a starting point TSSG defined what industry needed and then identified the team

of researchers, academics, and engineers that could deliver that need. The second aspect was that TSSG focused on building teams that would spin-out with companies they created. Today there are 120 people in the TSSG alone, but four of the spin-out companies created by TSSG personnel, between them employ over 120 people. These four companies are now client companies based in the Innovation Centre and TSSG continues to deliver the engineering solutions and supports for these new spin-out (and also spin-in) companies. This phase of development of the ArcLabs ecosystem of open innovation model is depicted in Figure 4.

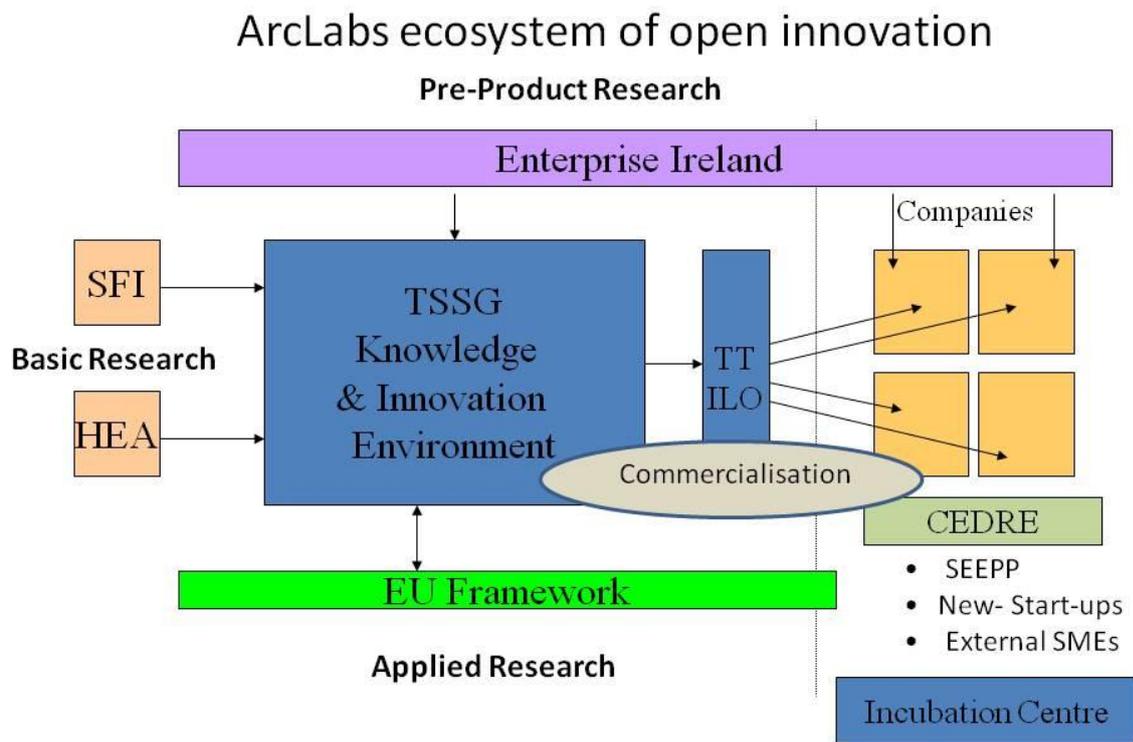


Fig. 4 ArcLabs ecosystem of open innovation model 2008 (source: adapted from Donnelly, 2008)

The interaction between key players in the TSSG (Telecommunications Software and Systems Group), CEDRE (Centre for Enterprise Development and Regional Economy (formerly the Centre for Entrepreneurship)), Incubation Centre and the Research Support

Unit office (which includes the manager for Technology Transfer and the Services to Industry Manager (formerly known as the Industrial Liaison Officer (ILO)) embellished the synergistic cohabitation of engineers, researchers, academics, entrepreneurs and business people. This led to the recognition that ArcLabs was indeed operating as an ecosystem of open innovation. The essence of the ecosystem is enhanced and sustained as the TSSG still “reports” into and receives guidance from both the School of Science and the Vice-President for Research, Development and Innovation; CEDRE is still a key research centre within the School of Business; and the Incubation Centre is still very much aligned to the manager for Technology Transfer and the Services to Industry manager. Each of these entities and the individuals working within them draws on its, and his/her, own extensive local, regional, national, and international networks to energise and sustain the core values of an ecosystem of open innovation. Thus the boundaries between the entities and ArcLabs and the ‘outside world’ are permeable and porous allowing the freedom to capitalise from ‘brain circulation’.

Figure 4 depicts this process. Through a competitive process the TSSG receives funding from Science Foundation Ireland (SFI) and the Higher Education Authority (HEA) to perform basic research. Through an equally competitive process the TSSG receives funding from the EU (through Framework Programmes (FP)) and Enterprise Ireland. At the core of the TSSG research and innovation model is the traditional academic focus on internationally peer reviewed scientific research and postgraduate education, However, the model incorporates reference points to ‘industry state of the art’ and engineering challenges confronting the creation of next generation industry solutions. The engagement between the scientific and engineering experts within the TSSG and industry leaders supports a more dynamic process of knowledge transfer from the research environment to industry. The resulting knowledge creation environment is not based on the traditional waterfall model but rather a spiral

supporting the oscillation of knowledge and innovation backwards and forwards between the academic and industry stakeholders. The funding model is optimised to support this environment with Europe providing the framework for prototyping and validation of engineering solutions in collaboration with European academic and industry partners. The more commercially orientated funding provided by Enterprise Ireland supported the market validation and the commercial development of product and services.

Combined, this funding helps to sustain the energised, dynamic knowledge and innovation environment within the TSSG. The Senior Executive, within the TSSG, who has the responsibility for commercialisation initiates the process that is supported by Enterprise Ireland to commercialise research. This leads to an engagement with the manager for Technology Transfer (TT) and the Services to Industry Manager (formerly known as the Industrial Liaison Officer (ILO)). A process of engagement that is supported by the CEDRE via its SEEPP<sup>3</sup> (South East Enterprise Platform Programme), links with external commercial and business networks, mentoring of entrepreneurs through the start-up process, and links into academic domain within WIT that can assist with business development, marketing, strategic planning, and so on. CEDRE, also through a competitive process, receives funding from Enterprise Ireland, EU Framework, and other ERDF programmes to support the centres activities.

A key nutrient to stimulate the innovation and creativity process is the, Enterprise Ireland supported, Incubation Centre itself. The centre is not merely a set of offices for entrepreneurs

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<sup>3</sup> SEEPP (South East Enterprise Platform Programme) is a year long incubation programme to assist entrepreneurs bring their business concepts into reality. The programme was delivered by academics with industry experience and practitioners. This programme was the only such programme in Ireland and the UK that was accredited to award entrepreneurs a Level 9 certification upon successful completion of the year long programme. This programme has been replaced by the New Frontiers Programme. It is similar to SEEPP without the academic content.

and enterprises, rather it is an environment containing lots of open spaces where people from all entities can congregate and chat, meeting rooms, and restaurant. The dynamic that the environment of the Incubation Centre creates is such that there is dialogue and interaction between engineers, researchers, entrepreneurs, academics and business people – all of which energises the synergy, knowledge and technology transfer, and the process of ‘brain circulation’.

A most recent representation of the ArcLabs ecosystem of open innovation model is as presented in Figure 5. This representation shows the addition of venture capitalists to the model and suggests a more integrated approach with the business community on a local, regional, national and international basis. Figure 5 also depicts the importance of aligning national enterprise and innovation policy with international enterprise and innovation policies. The figure also gets across the notion of overlap and the need for porosity and permeability between the boundaries of state, institutional and private fund financing, research, industry and the commercialisation of research.

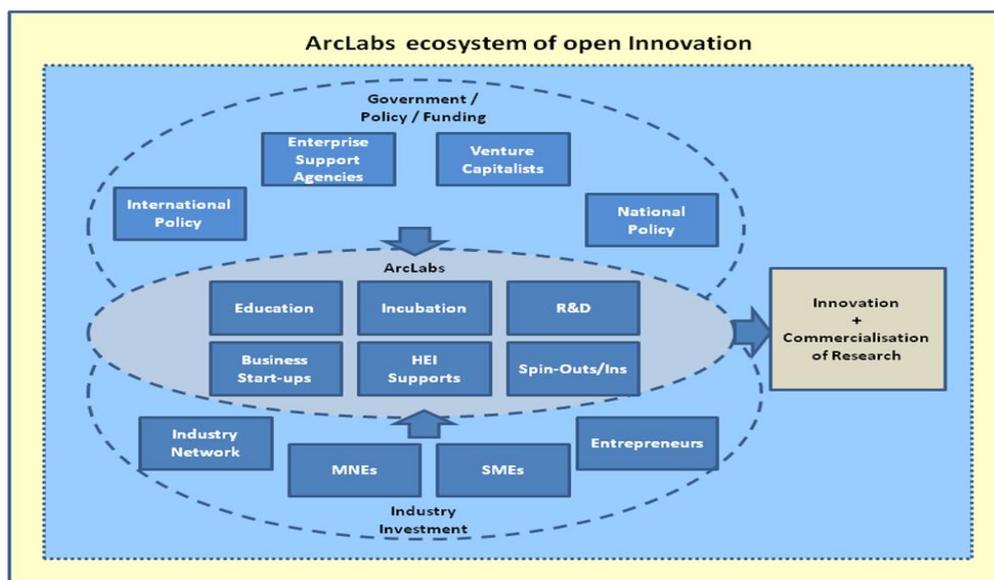


Fig. 5 ArcLabs ecosystem of open innovation concept 2011 (source: current paper)

Considering the political and economic environment within which it works, ArcLabs is being extremely successful. ArcLabs as a total 'virtual' entity, since 2004, has secured over €80 million of state and European Union funding for basic, applied, and social science research and the commercialisation of research. ArcLabs has generated over 10 spin-out and 4 spin-in companies, and has engendered active international networks consisting of in excess of 450 partners (a combination of industry, government agencies, academic institutions and other leading research centres) spread across 35 countries worldwide. Additional to spin-out and spin-in companies ArcLabs, since 2004, has worked directly with 120 entrepreneurs, in year-long incubation programmes [the only such programmes in Ireland and the UK accredited to award a Level 9 qualification to entrepreneurs] to support them to create their own high-potential start-up (HPSU) businesses. Eighty-four of these entrepreneurs are successful to the extent that, between them they have generated over €29 million in sales (€8.5 million of which is in export sales), and have created in excess of 249 jobs over the last six years.

ArcLabs has demonstrated that it is possible for a group of interested and relevant stakeholders to come together in a collaborative coalition to create, nurture and sustain an ecosystem of open innovation.

However, it has taken seventeen years to get to this stage of development, and we are acutely aware of limitations that could retard or hinder further necessary development of the model. In order to sustain the development of the Arclabs ecosystem of open innovation there is a need to expand its operations and reach. The model is proven so there is also a need to engage other regional stakeholders into the development and expansion model, especially to bring the model beyond the telecommunication and information technology sector and into agriculture, bio-sciences, health, services, environmental sciences, materials science, and advanced manufacturing. This will be achieved by amassing relevant regional stakeholders

into a cooperative coalition to strengthen research, technological development and innovation; to design and facilitate access to, and use and quality of, information and communication technologies; to enhance the competitiveness of small and medium-sized enterprises, as well as agricultural, fisheries and aquaculture sectors; support the shift towards a low-carbon economy in all sectors; and to promoting employment and supporting labour mobility, embracing social inclusion and combating poverty, and investing in education, skills and lifelong learning.

However, to achieve this there are a number of limitations that need to be addressed. Limitations such as (i) centralised governance and therefore the narrow restrictive role of regional authorities in stimulating and sustaining the innovation process, (ii) entrepreneurs and business people's perception of market – there is a need to enable these people to see Europe and the world as their markets, not just the confines of their region and national economy, (iii) stakeholders' views of 'regional attractiveness' being scenic and life style.

To address these, and other limitations, and to bring the ArcLabs ecosystem of open innovation model to the next stage of development the following is proposed.

### **Sustaining an ecosystem of open innovation, the next phase for ArcLabs**

According to Hilpert (2013), Islands of Innovation are centres of competence and locations where knowledge is applied and new knowledge is generated. They are also centres that attract innovation labour. But ecosystems of open innovation need to be more than this, they need to have porous and permeable boundaries that can, at the same time, absorb new knowledge and expertise while equally disseminate knowledge about its own specialism to international centres of research and trade. No periphery region, this also applies to South-

East Ireland, has the capacity or capability to efficiently develop the five-factors of ecosystems of open innovation (connectedness, infrastructure, environment, innovation culture, and governance (see O’Gorman and Donnelly, 2013)) on their own. To achieve this the region needs connectedness to national and international stakeholders and partners.

Therefore, in our opinion, for regions to become ecosystems of open innovation they need to embed themselves in a process of international mobility of innovative labour. There are probably three parallel processes that must be adopted to achieve this, (i) build a wealth of sought after knowledge of regional specialisms and nuances, (ii) increase the attractiveness of the region (or small country) by creating and continuously developing leading edge research centres, improving the quality of tertiary education beyond international standard levels, and providing high-value add, interesting jobs, and (iii) entering an arrangement with international partners whereby there is an equitable process of brain exchange.

However, the question is how can a lagging region or small country achieve such specialisms and open innovation systems ? Such ecosystems of open innovation take time to develop. Figure 6, which builds on previous ArcLabs models, depicts the upward positive spiral effect of the necessary interaction between government policy and funding, research, industry investment, and education needed to develop an ecosystem of open innovation. The dotted boundary suggests the need for porosity and permeability to facilitate the inward and outward flow of innovative staff.

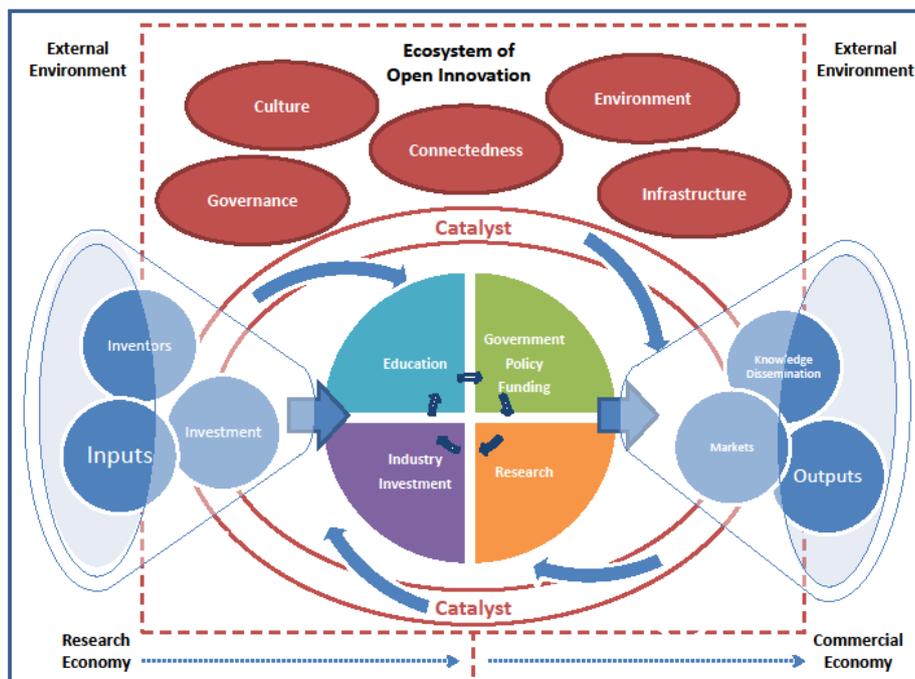


Fig. 6 Ecosystem Of Open Innovation for Small Countries and Regions (source: O’Gorman and Donnelly, 2013)

This flow of innovative staff consists of (i) brain drain where well educated scientists, researchers, engineers and other professionals leave the region/country; (ii) brain gain where ‘outsider’ scientists, researchers, engineers and other professional are attracted into the region/country; (iii) brain exchange whereby there are collaborative agreements for the mutual exchange of scientists, researchers, engineers and other professional between the region/country and relevant international partners; and (iv) ‘free’ brain circulation within, out of, and into the region/country. All of this leads to knowledge spillover, job mobility and wealth creation.

Coupled to this is the need to create a supportive, collaborative balance between the research economy and commercial economy. These are complementary, not mutually exclusive, economies. Finally immersing the regional/national community into an evolving entrepreneurial culture is essential, particularly policy makers, entrepreneurs, business owners, employers, and citizens have got to embrace the concept of job mobility, brain circulation and labour/skill circulation. Instead of putting barriers in place to hinder mobility

and free flow of personnel, stakeholders should encourage it knowing that the circulation of knowledge, skill and labour is what is required to build regional wealth and sustainability – it is the ecosystem of open innovation.

A central entity in making this happen is the *catalyst* (see Figure 6) which is needed to create and implement the policies to nurture the environment and provide the nutrients to develop the ecosystem of open innovation. The catalytic agent could be an institution, a group of institutions, an industry a group of industries or government. To date, in South-East Ireland the catalyst has been ArcLabs. However, in order to expand the ArcLabs model to make it a truly regional ecosystem of open innovation, it is the opinion of the authors of this paper, it is best if government (regional government) are the catalytic agent; but regional government must have the capacity, capability, authority and responsibility to create, develop and implement an all inclusive process of engagement of all regional stakeholders, supported by appropriate enterprise, research and innovation policies that encourage growth rather than hindering it.

If the Arclabs model is to have meaningful impact on the economic development of the South-East region beyond the entrepreneurial community in Waterford City and County alone then the issue of scale needs to be addressed. The TSSG is now one of the largest research centres in Ireland. However, it needs to grow to at least three times its present size with particular emphasis on a combination of trans-disciplinary skills across science, engineering, business and design. The physical space available to substantially grow the entrepreneurial programme and support more high potential start-ups is currently restrictive and therefore also needs to be addressed. There is also a need for stronger alignment and engagement with multinational industries (MNEs) and HPSUs (high-potential start-ups).

Equally there is a requirement for education and life-long learning to be enmeshed more fully into the ArcLabs model with emphasis on proactive planning and delivery of education, training and development at both undergraduate and postgraduate levels.

The ArcLabs ecosystem of open innovation model, to be a catalyst in ‘brain circulation’ needs to become even more dynamic in increasing the level of engagement of academic staff within industry. But also there needs to be greater opportunities for industry staff to engage with and work within the research centres to produce a new virtual innovation environment connecting people and resources with the regional, national and internationally delivery within new inter-disciplinary, international innovation value chains.

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