“Higher education institutions: Ivory Towers or lead collaborators in the regional economy?”

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Abstract:

In recent years higher education institutes (HEIs) have assumed a central role in innovation-led economic development and have become an increasingly important ingredient in high tech economies. According to Etzkowitz (2008) innovation is understood to be a resultant of a complex and dynamic process related to interactions between HEIs, industry and government. The Triple Helix approach, developed by Etzkowitz and Leydesdorff, is based on the perspective of higher education institutes as a leader of the relationship with industry and government, to generate new knowledge, innovation and economic development. This paper explores how key people within these higher education institutions affect the transfer of technology and knowledge into regional economies.

This current research is focused on institutes of technology (IoTs) in Ireland. During the course of this study an examination into the impact that these IoTs have on the regional economy was explored through their number of spin-ins, spin-outs, patents, licenses and jobs created. However, it is only in the last 10 years that the IoTs have been funded by the government agency Enterprise Ireland (EI) in order to improve the actual transfer of technology and knowledge from these institutions out into the regional economy. Even though the current research found that the higher education institutes (HEIs) examined did not have exceptional statistics as regards these measurements, they still made a positive impact on their local regional economies. This impact was made not by patents and spin-outs but by the contacts and network associations of the key people, within the HEIs, who are the actual drivers, either directly or indirectly, of the transfer of technology and knowledge from the institutions to outside communities.

It was also found during the course of interviewing key informants in the IoTs that the key driver backgrounds and educational qualifications did not have an impact on technology and knowledge transfer however, it was through the people that the key drivers' knew and networked with that influenced the process. This paper describes how it is the key drivers in HEIs that make an impact on the regional economy and how these

key drivers utilize their networks, both internally and externally, as a conduit through which HEIs have an impact on their local economies.

Introduction:

In the Strategy for Science, Technology and Innovation (SSTI) Report (2006) the Irish government acknowledged that the development of a knowledge economy was one of the key challenges and opportunities facing Ireland. This report was the first report to outline the importance of research and innovation in Ireland, including Technology and Knowledge transfer. The report went on to emphasise that the country's success will be marked by the "increased participation in the sciences, increased number of people with advanced qualifications, enhanced contribution by research to economic and social development and increased trans-national research activity" (p.8). The SSTI report went on to say that it envisaged a significant number of advanced researchers moving into the enterprise sector which shows how important and crucial the HEI sector is to the regional economy and thus contributing to the Knowledge Economy which Ireland is striving towards.

It is interesting to note that the debate about the importance of the knowledge economy has been the focus of the government long before the SSTI report was published. In 2004 the government report "Ahead of the Curve: Ireland's place in the Global Economy" stated that investment in higher education and research was essential to generate the intellectual capital required to fuel an innovation-driven economy (p.74). The report also stated that in order for this change to take place the way that higher education institutions are funded, governed and managed will need to be transformed.

Today this debate still goes on with experts and strategy groups emphasising how important it is that Ireland embraces the transformation of the country from an economy focused on multinationals to one that embraces indigenous enterprises and the transfer of technology and knowledge from universities to industry and vice versa (Forfas, 2007). The HEIs have laid the foundations of the knowledge society through facilitating the

collaboration between industry, both local and national, and it is crucial that they are funded properly in order to ensure that this relationship is sustained (Sutherland, 2008).

As regards building up Ireland's knowledge base it was suggested that Ireland increase its investment in PhD students because the advanced skills that these students hold are of particular importance not only to the creation of new knowledge in Ireland but also to ensure the capacity to absorb new knowledge elsewhere in the world (Forfas, 2009). The collaboration between higher education institutes and industry is also of interest and importance to the Irish economy. Enterprise-academia collaboration can enable firms to access knowledge and technical know-how both domestically and internationally. Through collaborating with academia, enterprise can access world class skills and knowledge which will aid both the innovation of the firm and the economy as a whole (Innovation Ireland, 2008).

However, despite many existing initiatives, collaboration between firms and universities has been limited in Ireland in contrast with other European countries such as Finland and Denmark where collaboration and networking are common and established practices between enterprise and academia (European Innovation Scoreboard, 2006). The Strategy for Science Technology and Innovation (STI) (2006) agreed and stated that higher education institutions contain the largest pool of researchers and scientists and the universities key innovation strategy is to encourage industry to utilise this resource more effectively.

Collaboration between academia and industry was emphasised again in the report to The Committee on Science, Technology and Innovation (2004) where it was stated that the real success and growth of Ireland's economy will depend on the country's ability to transfer knowledge generated domestically into goods and services for world markets. This will require effective on-going relationships between enterprise and academia. The relationship between industry and higher education still remains low in Ireland and a change in the levels of collaboration is essential to the sustaining of the Knowledge Economy. This calls for a broad based approach to develop networks and reinforce

clusters through linking enterprise and applied research competencies in the research base (STI, 2004). According to the Irish Action Plan (2004) it is only through linking enterprise and higher education research together that the research which is developed in higher education institutions can be transferred and used within the enterprise sector. At the moment, there still exists some problems with regards to institutions sharing the information that they have to the industry sector, thereby enhancing the "ivory tower" syndrome that was referred to by Ezkowitz (1997).

Theoretical Framework

The triple helix function outlined by the Ezkowitz and Leydesdorff explains the interaction between government, university and industry. According to Leydesdorff and Etzkowitz (2000) the triple helix model recognises that the future location of research and technology resides in a triple helix of university-industry-government relations. Godin (2005) also stated that the triple helix is comprised of various linkages that take place at numerous parts of the innovation process and is categorised by the spiralling of the three spheres which become increasingly involved in each others actions. He added that the triple helix model has evolved over the years to become an important analytical tool to assess the interaction between universities, industries and governments.

According to Lawton-Smith, Glasson and Chadwick (2005) the higher education institute is the source of new knowledge and technology, the generative principle of knowledge based economies. Lester (2005) stated that as local communities focus on the importance of innovation and an educated local workforce to their long term prosperity, attention has naturally turned to the contribution of local HEIs. These institutions are a primary source of the most valuable assets in the knowledge economy: highly educated people and new ideas. HEIs in a region can also attract other key economic resources to the region which can include firms, educated individuals, financiers, entrepreneurs and others seeking to exploit new business opportunities from the institute (Lester, 2005). More recently in America, state governments have become increasingly active in pressing public universities within their jurisdictions to contribute to local economic development

(Lester, 2005). The rising interest in the university's economic development role has been fuelled by high profile examples of successful regional economies in which the university contribution is easily identified such as, Silicon Valley and the region around Oxford University. Oxford University is the archetypal knowledge based economy. It is one of Europe's leading centres of enterprise and innovation and the fastest growing high-tech economy in Europe. In recent years universities have assumed a central role in innovation-led economic development and have become an increasingly important ingredient in the high tech economy (Lawton-Smith, Glasson and Chadwick, 2005).

However, while the HEIs may be been to have a central or lead role as a collaborator in the regional economy there can be obstacles such as the *Ivory Tower* syndrome that can often be endemic in HEIs. The 'ivory tower' theory, commented on by Etzkowitz, Webster, Gebhardt and Terra (2000), stated that universities once thought of themselves as an institute that provided teaching and a place to learn for academics and a place where the academics refused to share their knowledge with the business world. Industry sectors traditionally have difficulty accessing knowledge embedded in universities, thus the degree of transference of this knowledge is low. However, Etzkowitz et al (2000) proposed in their research that the 'ivory tower' that did exist in many universities is now been replaced by an entrepreneurial outlook. Universities and their faculty are now more willing to engage with industry and vice versa. Universities are now no longer seen by industry as secretive and the knowledge that the university holds is very much sought after. However, there is the argument amongst scholars that higher education institutes have been naively viewed as engines of innovation (Etzkowitz et al, 2000).

Florida (1999) was of the opinion that there was a danger of undermining the value of research universities if they are regarded simply as sources of technology. Florida's (1999) research was based in the United States where Silicon Valley, Stanford University and MIT were the most successful technology transfer specialists in the world. He was of the opinion that since the movement to a more knowledge based society there is much more to do than simply enhance the ability of higher education institutions to commercialise technologies. The talent that exists in the higher education institutes will

have to be leveraged as they are the ones that possess the ideas. Therefore, it could be said that it is not the higher education institutes that impact on the regional economy but the key people that exist within the institute who drive and affect the technology and knowledge transfer process in higher education institutes.

Higher Education Institutes in Ireland

In order to understand the effect that key players have on the technology and knowledge transfer process it is necessary to examine the higher education system in Ireland. A historian of Irish education once wrote "memories are long in Ireland…..the weight of history is a burden that is difficult to unload (Lydon, 1991). The influential Cardinal John Newman the founder of the Catholic University of Ireland, was regarded as one of the strongest proponents of the ideals of liberal education. In effect his ideal was that while the university would cultivate the intellect of young gentlemen through the sharing of knowledge, it would not necessarily pursue a critical paradigm or the production of new knowledge (Readings, 1997; Blackmore, 2001). In more recent years any remnants of Newman's vision have been transformed by the now dominant model of economic growth driven through science, technology and innovation. While Newman was carefully shaping the minds of a few Catholic men in the mid nineteenth century he could have scarcely imagined the role that universities would come to play in Ireland in what has now been widely recognized as a knowledge based society (Coate and Labhrainn, 2009). Indeed the rhetoric of the knowledge economy (Bullen, Robb and Kenway, 2004; Bullen, Fahey and Kenway, 2006) has been the key defining feature of recent change and at the core of current government policy with regards to higher education.

In 2006 the OECD called Ireland's economic performance 'exemplary' and in the period known as the Celtic Tiger from 1993-2001 the Irish economy grew at an unprecedented rate. The investment in education is cited as being a key factor in Ireland's economic growth (OECD, 2004). But Ireland has a binary system of higher education with a traditional university sector and an Institute of Technology (IoT) sector. As mentioned in

the article by Lillis (2007) the IoTs were established in the 1970s with the mission of contributing to the technological, scientific, commercial, industrial, social and cultural development of the state with reference to the particular region in which they are situated. Dispersed as they are throughout Ireland, the IoTs have a key role to play as engines of growth. Three years ago national policy suggested that the research role of the IoTs was set to take on increasing importance in coming years however there is no official research policy that relates specifically to IoTs although there are references in the underpinning legislation and other documents that IoTs should focus on applied research with a regional focus (Lillis, 2007; Hazelkorn and Moynihan, 2010). It is important to remember that the IoT mission is to integrate research and teaching in order to share, apply, test and create knowledge. However, IoT academics are contractually obliged to teach 560 hours per year or 16 hours per week which is often re-interpreted by some academics and their trade unions as only doing 16 hours work per week (Hazelkorn and Moynihan, 2010) thereby hampering the actual amount of research ie: technology and knowledge transfer been undertaken by the IoT. So any actual technology transfer that is undertaken by IoTs is done by certain key players (gatekeepers) within the IoT that are dedicated and passionate about collaborating with regional economies.

So who are these dedicated key players in the IoTs? According to Allen (1977) gatekeepers are “a small number of key people to whom others frequently turned for information. These key people differ from their colleagues in the degree to which they exposed themselves to sources of technological knowledge outside their organization. Their characteristics are such as they constitute a small community of individuals, they are at the core of an information network, they are exposed to external sources of information, and the linkages they develop with external actors are more informal” (p.145). In a study completed by Jerrams and Donovan (2005) into Irish academic research they stated that the future of Irish academic research will depend on building multidisciplinary clusters of top researchers, working in high quality facilities and niche disciplines.

Research and Innovation in Ireland.

Since the early 1950's Ireland has relied heavily on Multinational Enterprises (MNEs) to boost its economy. In more recent times Ireland has maintained its att4ractiveness for MNEs through lower tax rate on corporate profits, the ongoing supply of highly educated workforces, and its high technology adoption rates. But as competitiveness increases and profit margins tighten, many of these MNEs are transferring operations to lower cost, higher technology based regions. Therefore, now more than ever before, Ireland must concentrate in its indigenous industry base and its highly skilled graduates who are capable of adapting to and competitively exploiting existing and new knowledge (McDonagh, 2009) Therefore, the education system plays a vital role in the strengthening of the regional economy and should be open to working with industry in order to boost academic-industry relationships. This current research examined the IoT (Institutes of Technology) sector in the Irish education system and the effect that they have on the regional economy as a whole. These institutes are listed in Table 1.

Regional economic development is a key aspect of government policy in Ireland, and the Institutes of Technology play an important role in regional innovation processes and thus economic development. It has been stressed in many government documents that the IoTs, in Ireland, are more open to industry collaboration than the universities (SSTI, 2006). The IoTs represent an important resource to the regional economy because of their excellence in industrial links. Their multi-regional location and openness to working with industry provides a platform upon which real industrial impact can be built upon (SSTI, 2006). In a research report by the Department of the Taoiseach [1](2008) it was emphasised that HEIs were crucial as Ireland needs to have the means of converting research and development and innovation into commercialised products and services.

[1] Taoiseach is the word used in Ireland for Prime Minister.

Institute	Identifier	Region in Ireland
Waterford Institute of Technology	WIT	South East
Carlow Institute of Technology	Carlow IT	South East
Cork Institute of Technology	CIT	South West
Tralee Institute of Technology	Tralee IT	South West
Limerick Institute of Technology	LIT	Mid West
Galway-Mayo Institute of Technology	GMIT	West
Athlone Institute of Technology	MIRC	Midlands
Sligo Institute of Technology	Sligo IT	Border
Letterkenny Institute of Technology	Letterkenny IT	Border
Dundalk Institute of Technology	DKIT	Border
Dublin Institute of Technology	DIT	Dublin
Blanchardstown Institute of Technology	Blanchardstown IT	Dublin
Tallaght Institute of Technology	Tallaght IT	Dublin
Dun Laoghaire Institute of Technology	Dun Laoghaire IT	Dublin

Table 1: Institutes of Technology in Ireland (Source: Current Research)

Due to the fact that the funding given to Higher Education Institutes in Ireland by the government has been decreasing as a consequence of the economic environment, the higher education institutes are now relying on European funding to maintain their research and enable more research to be completed by academics and students. Table 2

shows a summary of the key facts and figures from the IoTs and Universities as regards EU funding which was compiled by the Irish Universities Association (IUA). As can be seen from the table the eight universities in Ireland are represented and receive a lot more research funding then the 14 IoTs. Only four of the IoTs managed to make this list and they were located in four separate regions in Ireland, the South East, South West, Dublin and the West. The table also shows that Trinity College (TCD) received more funding on its own then all four of the funded IoTs combined. This is a situation that has caused unrest in the IoT sector as the Institutes of Technology Ireland (IOTI) have stated that it is unfair to expect the institutes to make an impact on research and innovation in Ireland when they are not receiving the funding or the guidance to help them to drive technology and knowledge transfer process. This argument also refers to the binary education system that exists in Ireland and how IoTs are seen to the industry contacts and the universities are the research institutions.

Higher Education Institution	Acronym	University/IoT	Region in Ireland	EU Funding Received (Euros)
Trinity College Dublin	TCD	University	Dublin	14,035,129
University College Cork	UCC	University	South West	10,550,713
University College Dublin	UCD	University	Dublin	10,045,132
National University of Ireland Galway	NUIG	University	West	7,264,577
University of Limerick	UL	University	Mid West	6,143,017
Dublin College University	DCU	University	Dublin	2,328,046
National University of Ireland Maynooth	NUIM	University	Midlands	974,600
WIT	WIT	IoT	South East	4,461,733
DIT	DIT	IoT	Dublin	563,372
CIT	CIT	IoT	South West	317,050
GMIT	GMIT	IoT	West	246,560
IT Tallaght	IT Tallaght	IoT	Dublin	-
Sligo IT	Sligo IT	IoT	Border	-
Dundalk IT	DKIT	IoT	Border	-
LIT	LIT	IoT	Mid West	-
Blanchardstown IT	Blanchardstown IT	IoT	Dublin	-
Tralee IT	Tralee IT	IoT	South West	-
Athlone IT	Athlone IT	IoT	Midlands	-
Letterkenny IT	Letterkenny IT	IoT	Border	-
Carlow IT	Carlow IT	IoT	South East	-
Dun Laoghaire IT	Dun Laoghaire IT	IoT	Dublin	-

Table 2: Higher Education Institution Funding (Source: Irish Universities Association)

Approximately €273million in research and innovation funding from 2004-2009 was received by the IoTs from the 3 main funding bodies in Ireland which are Science Foundation Ireland (SFI) , Higher Education Authority (HEA) and Enterprise Ireland. The 14 IoTs in Ireland receive the majority of their funding from the main funding body Enterprise Ireland. In the last ten years Enterprise Ireland has provided 50 million Euro to the construction of campus incubation centres at the Institutes of Technology and Universities across Ireland. This funding has been used to support campus incubation centres at the 14 institutes of technology and five universities (Enterprise Ireland, 2008). By 2008 the campus incubation programme had 240 companies located in the centres of which two thirds were outside of the Dublin region and had nearly 1000 people employed in these companies. According to Innovation Ireland (2008) the principal reason for investing in these centres is to develop skilled, qualified people with the potential to become innovators in the industry sector.

Impact of IoTs in Regional Economies

The reason for choosing to start this current research by contacting the campus incubation centres within IoTs was due to the fact that they were considered to be the hub of technology and knowledge transfer and were set up and funded by Enterprise Ireland for that reason and they also impacted positively on the regional economies they were situated in. In order to establish the impact of Institutes of Technology on regional economies the number of spin-ins, spin-outs, patents, licenses and jobs created were explored and examined in all 14 IoTs. The first problem that the current researchers faced was obtaining a suitable source of information of best practice benchmarks in technology and knowledge transfer in Ireland. As far as the authors of this paper could establish, no criteria exists that establishes what constitutes successful technology and knowledge transfer. Therefore, a combination of sources such as Proton Europe, OECD and Enterprise Ireland were used to establish a set of criteria for this current research. These are highlighted in the first row of Table 3.

Once the list of criteria was drawn up, the campus incubation centres, within the 14 IoTs, were contacted. The campus incubation managers were then interviewed and asked a set of questions as per the criteria set down by the current research. The reason for choosing to interview the managers was because research literature also indicated that the managers of the campus incubation centres were the drivers of the success of the technology and knowledge transfer process. Harayama (2004) identified that the campus incubator manager is central to the success of the campus incubator by bridging gaps and developing relationships between the academic and enterprise communities while Chrisman (1989), Manning et al (1989) and Rice (2002) suggested that firms choose incubators more often to gain access to the incubator manager who is typically a professional with enterprise development experience and possesses a network of professional consultants.

In order to measure IoTs' impact on their respective regional economies a specific set of criteria was used in this current research study Technology transfer was measured using the following benchmarks: Years in business, number of spin-ins, spin-outs, start-ups, licenses and patents while, knowledge transfer was measured using statistics such as number of jobs created, number of clients, occupancy rate, tenancy rate in the incubation centre, number of employees and the number of academic researchers engaging in technology and knowledge transfer. Athlone IT (MIRC) and Tralee IT incubation centres were not taking part in the current research.

Region	Benchmarks	5	10	2	5	8	11	18	20-50	20-30	85%	36 months	6	6
		Years	Spin-ins	Spin-outs	Start-ups	Patents	Licenses	Invention disclosures	Jobs created	No. Clients	Occupancy rate	Tenancy rate	Employees per company	Academic Researchers
South East	WIT	3.5	7	3	16	3	8	0	56	25	80%	33	6	6
	Carlow	3	7	0	22	6	2	0	26	18	100%	36	4	0
	Total		14	3	38	9	10	0	82	43			10	6
South West	CIT	3	42	0	42	40	4	0	160	40	100%	33	3	0
	Tralee IT				Not Taking Part in this current research									
	Total		42	0	42	40	4	0	160	40			3	0
Mid West	LIT	3	20	2	22	2	0	0	60	8	90%	33	4	8
	Total		20	2	22	2	0	0	60	8			4	8
West	GMIT Castlebar	3	0	4	20	4	0	0	42	20	80%	33	1 to 7	1
	GMIT Galway	4	18	5	18	5	2	0	30	70+	80%	33	4	4
	Total		18	9	38	9	2	0	72	90+			11	5
Midlands	MIRC				Not Taking Part in this current research									
	Total													
Border	Sligo	11	18	2	16	2	4	3	120	27	75%	36	3	6
	Letterkenny	9-reopened in June 09	11	1	8	2	0	2	0	30	70%	48	4	7
	Dundalk	20	15	0	12	5	0	5	500	25	80%	36	3	6
	Total		44	3	36	9	4	10	620	82			10	19
Dublin	DIT	17	32	1	32	Did not know	Did not know	Did not know	1000	32	100%	12	3	5
	Blanchardstown	3	5	1	5	0	1	1	15	6	100%	33	3	4
	Tallaght	2.5	30	0	25	7	1	0	50	30	100%	36	6	15
	Dun Laoghaire	2.5	3	15	14	0	0	0	42	18	100%	33	5	0
	Total		71	17	76	7	2	1	1107	86			17	24
MidEast														

Table 3: Technology and Knowledge Transfer Statistics (Source: Current Research)

In order to examine the impact that the IoTs had on their regional economies the 14 IoTs in Table 2 are divided into their respective regions (See Appendix One). If we look at the number of spin-ins that were generated by each region it can be seen that Dublin, Border and South West regions performed highly in this measure of technology transfer. Dublin had a total number of 71 spin-in companies with DIT producing total of 32 companies Similarly the Border region performed well as regards the number of spin-ins with a total of 44. The South West also had 42 spin-in companies which were all attributed to CIT. As can be seen from Table 2 a vast majority of the regions performed well as regards the patent benchmark. Again the South West dominated this metric with CIT obtaining 40 patents. The South East also faired well in this area managing nine patents with Carlow IT contributing 6 of those.

As regards jobs created, the benchmark figure for this metric is 20-50 and this was achieved by almost all of the 14 IoTs. Consequently the figures by region show that the Dublin, Border and the South West were the best performing as regards the number of jobs created. The IoTs located in the Dublin region created a total of 1107 jobs with DIT alone creating 1000 of those jobs. In the Border region, Dundalk IT created 500 of the 620 jobs created in the region. In the South West region CIT again excelled in its performance where the IoT alone created 160 jobs in its region.

As can also be seen from Table 3 the benchmark for the number of academic researchers that were active in the IoTs as regards technology and knowledge transfer was six. Dublin was the best performing region with Tallaght IT possessing the highest number of researchers engaging with research going on in the institute. LIT, the only IoT in the Mid West region, performed well against the benchmark with eight researchers engaging in the TT and KT process. The South East also performed well due to WIT's six researchers engaged in TT transfer. The Border region also performed well with Sligo IT possessing 6 academic researchers and DKIT also having six active researchers. Some of the regions' IoTs did not have any active academic researchers engaging in TT and KT, these low numbers could be due to the fact that researchers are often not comfortable with publishing their research. The attitude of academic faculty and the publication of research

is highlighted by Thursby and Thursby (2002) in their research into United States faculty members and their participation in the technology transfer process within their institutions. Through their research they found that faculty members may not participate in technology transfer activities due to the fact that there are established norms with regards to open academic science that favour publication of results over the patenting process. Bercovitz and Feldman (2003), in their own research into academic entrepreneurs and participation in technology transfer in universities, found that the academic researchers would only involve themselves in the process if there were leaders there to help influence and guide them. They continued that if the chair of technology transfer in the higher education institute is active in the process then other members of the department are likely to pursue the process, they further added that if the academic entrepreneur can observe others partaking in the process then it will encourage them to also play a part in the process. In summary by inference IoTs are contributing to their regional economies because they are performing above par with the benchmarks set out by Proton Europe, Enterprise Ireland and OECD.

Higher Education Institutes- Ivory Towers or Lead Collaborators

This research is based on a qualitative approach as the current researchers wanted to understand to what extent the IoTs were lead collaborators in the regional economy. It is the opinion of these current researchers that the IoTs do have a positive impact not because they are IoTs but because of the key people (drivers) located within the IoTs.

From the results presented in Table 3 six IoTs were selected to be part of this current research as they were seen to be the best performing institutes who came close to matching the technology and knowledge transfer measurements. These institutions were WIT, CIT, LIT, DKIT, IT Tallaght and Sligo IT (See table 1). The six incubation managers within the IoTs were then interviewed in order to find out who the key drivers (gatekeepers) of technology and knowledge transfer process where in their respective institutes. The reason behind interviewing the campus incubation managers were due to

the fact that Duff (1994) stated that the campus incubator centres within IoTs were the source of technology and knowledge transfer. Duff also suggested that the incubation manager is just a manager and not the key driver (gatekeeper) of technology and knowledge transfer within the incubator. However, the incubation centre managers were interviewed as it was felt that they would be able to direct the authors to the real gatekeepers within their respective institutions. It was found in this current research that only one incubation manager saw themselves as a key driver in the technology and knowledge transfer process, the rest saw themselves as facilitators of the process with their role being the day to day running of the centre.

In all 23 key drivers were identified in the 6 IoTs that were examined. In all cases the key drivers had management roles such as Head of ARE (Applied Research Enhancement) Centre, Industry Liaison Manager (ILM), Head of Research, Incubation Manager and Head of Development were just some of the roles of the key drivers that were stated by the campus incubation manager's. This corresponds with research completed by Etzioni (1964) in his work on modern organisations; he was of the opinion that the power of an organisation to control its members rests in specific positions such as department head, a person, or a combination of both.

As is shown in Table 4 the industry liaison managers (ILM) were the most referred to as key drivers in the process with five of the six institutes naming their ILM as a key driver. The Head of ARE was the next popular key driver with three of the six institutes stating them as a key driver of the process. Two of the institutes formed new positions in order to concentrate more effectively on transferring technologies from the college. LIT formed the roles of Head of Research and TT and Head of Graduate Studies in order to help drive the process forward while Sligo IT formed the role of Head of TT and Innovation. Out of the six IoTs interviewed only WIT had a dedicated technology transfer officer located on the college.

	Head of ARE	Industrial Liaison Mgr	Commercialisation Specialist	Head of Research	Programme Manager	TTO	Incububation Manager	Head of Development	Head of Graduate Studies	Head of Research and TT	Head of TT and Innovation
WIT											
KD 1						×					
KD 2		×									
KD 3					×						
KD 4			×								
KD 5				×							
CIT											
KD1	×										
KD2	×										
KD3		×									
KD4			×								
KD5	×										
LIT											
KD1								×			
KD2		×									
KD3					×						
KD4										×	
KD5									×		
Sligo IT											
KD1											×
KD2				×							
KD3	×										
Dundalk IT											
KD1				×							
KD2		×									
IT Tallaght											
KD1							×				
KD2		×									
KD3	×										

Table 4 Key Driver Roles (Source: Current Research)

What is interesting to note here is that all of the institutes interviewed had from two to five key drivers of the technology and knowledge transfer process and while some of the institutes had similar people involved in the process it was noted that they all had other roles in the institute and that their role in the technology and knowledge transfer process was additional to their regular role and therefore, was not given the amount of attention and detail that was required to make it as successful as it could have been.

Even though, as can be seen from Table 5, the key drivers all possessed exceptional educational qualifications with ten PhDs, ten Masters degrees and three degree qualifications the key drivers felt that their education qualifications were useful for getting them the job in the first place but did not help them in their role in the TT and KT process *" I think other than getting me the job I really don't think my [masters] has helped"* (WIT KD 2). While Sligo IT KD 1 was of the opinion that his Masters qualification helped him get the role he did admit that *"[I] would be wasting my time coming into a role like this unless you have a masters degree…academic institutions are snobs and if you don't have a hard currency like a PhD then you have to have a masters"*. In other words without having good educational qualifications (a) you would not get the job and (b) you would not be accepted by the institute faculty. This was mirrored by WIT KD 1 who stated that *"because I have a PhD means that some academics take me more seriously here and closer to being an equal"*.

	Education			Experience										
WIT	PhD	Masters	Degree	Engineering	SMEs	Electronics	Manufacturing	Int. Business	Ind. Labs	Science	Software	Marketing	Army	Academia
KD 1	×								×					
KD 2		×						×						
KD 3		×						×						
KD 4		×									×			
KD 5	×						×							
CIT														
KD1	×													×
KD2		×		×										
KD3			×		×									
KD4		×				×								
KD5	×					×								
LIT														
KD1	×									×				
KD2		×		×										
KD3			×								×			
KD4	×									×				
KD5	×											×		
Sligo IT														
KD1		×											×	
KD2	×									×				
KD3			×			×								
Dundalk IT														
KD1	×													×
KD2		×			×									
IT Tallaght														
KD1		×										×		
KD2	×			×										
KD3		×								×				

Table 5 Background and Education of Key Driver (Source: Current Research)

	Area of Expertise					
Institute	Computing Software	Electronics	Science	Engineering	Renewable Energy	Medical Devices
CIT	×	×				×
WIT	×			×		
LIT			×	×		
Sligo IT	×				×	
Dundalk IT		×	×		×	
Tallaght IT	×	×	×			×

Table 6 Area of Expertise in IoTs (Source: Current Research)

Table 5 also shows the key driver's backgrounds were wide and varied. As can be seen from the table the majority of the key drivers came into the institute with industry backgrounds both domestic and international. Science, Engineering and Electronics were the most common backgrounds amongst the key drivers in this current research. Science, the highest cited background, was the main background for four key drivers in Sligo IT, LIT and IT Tallaght. Interestingly the areas of expertise (see Table 6) in these institutes were located in computing software, renewable energy, electronics, and science, engineering and medical devices. The backgrounds of these key drivers did not always align with the expertise of the institute. The key driver's were of the opinion that it was the experience that they gained in their previous roles that helped them to drive the areas of expertise that the institute possessed. Sligo IT KD 2 stated that his background in Science did not help him drive the science technology in the institute but helped him in areas such as *"project management and in consultancy getting access to all areas in companies and understanding the ego system associated with it"*. Similarly LIT KD 4 did not use her experience in science to help her in her role but her background experience helped her to *"appreciate where other researchers are coming from and be there to support them"*.

Electronics and engineering were the next highest background experiences with a total of six key drivers citing them. These key drivers were from IT Tallaght, LIT, CIT, and Sligo IT. The areas of expertise (see Table 6) in the IoTs were again not linked to the key drivers background experience however, the key drivers found the experience and skills that they had gained were invaluable to them in their key driver roles. IT Tallaght KD 2, who came from an engineering background, stated that his experience had helped him in his TT and KT role in *that "[my] first major role was all about project management, people management was part of all those skills so it has helped me in my management role in the TT and KT process here"*. Likewise CIT KD 4, who had a background in electronics, stated that the key skill that they took with them from their background experience was *"that I understand what is necessary from taking what is coming out of here and turning that into a product"*. The key driver did admit that he found it difficult to switch their brain from one area to another as being Commercialisation Manager

requires you to do that *"it is something that you have to get used to…I found it difficult to switch my brain from one to another in one day"*.

Therefore, it is interesting to note that while the education qualifications and background experience were not an attribute to the key drivers' role in their respective institute it was the experience and skills that they had learned that had made an impact on their role in the technology and knowledge transfer process. When asked how their background experience had helped them in their role in the institute WIT KD 2 stated that *"my role is very much dealing with a huge variety of people internally and externally from industry to government agencies…..in my background I worked with project teams and pulling teams together"*.

Another key point that was observed by the current researchers was that while the key drivers in the IoTs had other roles apart from the one in the TT and KT process the direct knowledge the key drivers felt that that they had learned since they became involved in the process was valuable. IT Tallaght KD 2 stated that *"it has been a learning curve since I came into this role"*. IT Tallaght KD 3 had a background in academia and felt that their involvement in commercial projects had helped them in the TT and KT process. *"I got exposed to IP know-how, patent process….and that really peaked my interest in this whole process"*. Sligo IT KD 1 felt that since he had assumed his role in the process he had learned that *" you need to be savvy, aware and the power of positively influencing people, if you go at things enthusiastically, over time if you maintain it you will bring people along"* with you. Likewise DKIT KD 1 had the role of Head of Research as well as their role in the process and stated that *"maybe not I ever got training in it. The only thing I would say is that I started thinking about IP, KT about 4 years ago…before that I was committed to publishing papers and going to conferences"*. This shows that DKIT KD 1 had learned valuable on the job training since he took up his role in the technology and knowledge transfer process. He used the skills and experiences that he had learned from his previous roles to help him in his current role.

The importance of network contacts in helping key drivers in their role in TT and KT was mentioned by LIT KD 2 where he stated that his background and education qualifications would not really help him in his role *"unless it was in my particular discipline"* however, his *"experience in dealing with the myriad of agencies has helped me in my role….a lot of it is having contacts, knowing a contact person in the funding agencies to talk to who can recommend a person who is a specialist in Technology ….so it is knowing the people as well"*.

Therefore, it could be said that the key drivers within the IoTs have an impact on the regional economy, not because of their education and background experience but by the networks that they possess to guide them in their role in the TT and KT process in their respective institutes. Allen (1977) stated that the gatekeeper develops linkages with external actors to help them drive the technology and knowledge transfer process in their respective IoTs. Pavitt (1998) stated that knowledge can be more easily and effectively transferred through the communication of tacit knowledge through personal mobility and face-to-face contacts. Therefore, the networks of contacts that the key drivers within the IoTs possess are highly effective to help them drive the technology and knowledge transfer process.

As LIT KD 2 said it is *"all about the people that you know and what they can do for you"*. Whereas all the key drivers have between three and eight nodes in their networks, as can be seen from Table 7 EI was a prominent member of the key driver networks with 20 of the 23 key drivers citing the funding agency as a key part of their TT and KT network. Interestingly WIT KD 1 did not mention EI as key to their network and only possessed two network nodes, internal staff and legal. The key driver relied on few people to help him in his role as they had the collection of things that he needed and were able to track down what he wanted or needed. CIT KD 2 also did not regard EI as a key part to his network as he mainly relied on industrial contacts and building on them all the time. His networking functioned on *"you meet one person and before you know it you have met ten more"*. In contrast CIT KD 5 stated that EI was important to their network

and that they worked *"closely with EI and they have been very good advocates for us as well"*.

						Organisations in Networks									
Institute	Key Driver	Number of Network Nodes	Enterprise Ireland	Outside Ind.	Internal TT Staff	Head of Department	Other Uni.	Other IoTs	Researchers	Other State Agencies	Former Contacts	Legal	Int. Industry	Personal	TT Networks
CIT	1	6	×	×	×		×		×	×					
	2	5		×	×				×		×			×	
	3	3	×		×				×						
	4	4	×		×		×								×
	5	7	×	×	×		×		×		×			×	
Total		**25**	**4**	**3**	**5**		**3**		**4**	**1**	**2**			**2**	**1**
WIT	1	2			×							×			
	2	8	×	×	×	×	×	×		×					×
	3	8	×	×	×			×		×	×		×	×	
	4	6	×	×	×				×	×			×		
	5	7	×	×			×	×	×	×				×	
Total		**31**	**4**	**4**	**4**	**1**	**2**	**3**	**2**	**4**	**1**	**1**	**2**	**2**	**1**
LIT	1	5	×	×	×					×		×			
	2	4	×	×	×							×			
	3	6	×	×		×				×	×		×		
	4	6	×		×	×	×	×	×						
	5	5			×	×	×	×						×	
Total		**26**	**4**	**3**	**4**	**3**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	
Sligo IT	1	4	×	×	×								×		
	2	4	×				×	×		×					
	3	7	×		×		×	×					×	×	×
Total		**15**	**3**	**1**	**2**		**2**	**2**		**1**			**2**	**1**	**1**
Dundalk IT	1	7	×		×	×	×	×		×		×			
	2	5	×	×			×				×	×			
Total		**12**	**2**	**1**	**1**	**1**	**2**	**1**		**1**	**1**	**2**			
Tallaght IT	1	6	×	×	×				×	×				×	
	2	7	×		×	×	×	×				×			×
	3	4	×	×				×						×	
Total		**17**	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**1**		**1**		**2**	**1**
All Totals		**126**	**20**	**14**	**18**	**6**	**12**	**10**	**8**	**10**	**5**	**6**	**5**	**8**	**4**

Table 7 Network of Key Drivers (Source: Current Research)

Internal TT staff were also cited as key network members by 18 of the 23 key drivers. IT Tallaght KD 2 stated that he would consider the other internal TT staff as crucial to his network *"my own staff i.e. the campus incubation manager and Head of ARE would be very active in supporting me and finding new invention disclosures and trying to get research groups to think about commercialisation"*. CIT KD 3 also considered internal TT staff to be important to her network *"the key people internally would be the people producing the IP, the centre managers and obviously the commercialisation manager here which I would deal with on a daily basis"*. LIT KD 3 did not cite internal TT staff as part of his network stating that he would only talk to *"Heads of Department as they happen to be the people that are in the particular positions I need to talk to"*. He considered dealing with people on a lower level to be difficult to work with.

Industry was cited by 14 of the 23 key drivers as a key entity in their network. CIT KD 5 relied heavily on his industry backgrounds to help him in his role as centre manager stating that*" we have put together an advisory board so we have chosen people with specific skills, our chairperson comes from a pharmaceutical background so we are using that to contact more experts in our area"*. Similarly DKIT KD 2 stated that *"I would be in touch with my previous bosses because they are linked into very good networks and involved in state agencies and even with the companies that I have worked for in industry"*. However, DKIT KD 1 did not use industry contacts in his network as he came from an academic background and mainly used funding agencies and contacts in other higher education institutions to help him in his role in the TT and KT process.

Just over half of the key drivers (12) cited other universities as an integral part of their network. CIT KD 1 stated that *"I know a lot of people in Tyndall University College Cork and I would have links to the electronics department in UCC and the computer science department so from an academic point of view there are quite a few wide ranging networks there"*. CIT KD 1 would use the university networks as they would be able to help him with issues that would arise in his academic research and he could avail of their expertise when he needed it. WIT KD 5 also stated that *"I can pick up the phone to*

anybody in Ireland working in a university……that I would have met at a conference and ask them a question".

It was a similar result for other IoTs where ten of the twenty-three key drivers cited other IoTs as a key part of their technology and knowledge transfer networks. WIT KD 2 stated that other IoTs as a crucial part of their network *"I would be part of a network of ILMs in the IoTs and I would also tend to talk to Heads of Department, people in my role and the TT office in IoTs"* the key driver did also stress that "*it is not so much a network but it is individuals within an organisation"*. LIT KD 4 also saw other IoTs as important to their network and was of the opinion that *"we do look to other IoTs and see how they do it and I would have no qualms about picking up the phone and speaking to others in CIT or even UL and say what would you do in this situation…"* This again shows the characteristics of a gatekeeper where they take on a leadership role and use their initiative to help drive the technology and knowledge transfer process in their respective institutes. Sligo IT KD 2 also stated that *"on the TT and KT side you have all of the higher education institutes in Ireland. I use them for everything from teaching, research, idea generation for research management and the commercialisation of particular research"*. This also shows how the utilization of key driver networks both external and internal can both help a key driver in his/her role in the process and also help drive technology and knowledge transfer within the institute.

Conclusion:

As can be seen from the current research results the Institutes of Technology do have an impact on their regional economies as regards number of patents, spin-ins and jobs created. For example CIT had an impact on the South West region of Ireland creating 160 jobs and 42 start-up companies while WIT also made an impact on the South East region creating 56 jobs and having 6 active researchers engaging in technology and knowledge transfer activities in the institute. Therefore, because of these results, it was concluded that the IoTs were not ivory towers but lead collaborators in their respective regional economies.

However, the authors also concluded from the current research results that it was because of the activities of the key drivers (gatekeepers) within the institutes that played an important part in the technology and knowledge transfer process. It was also shown that the backgrounds and the education qualifications of the key drivers had no influence on their role in the technology and knowledge transfer process however it was the experience and the skills that they had learned which they found guided them in their role. It was through the collaboration and networking between the key drivers and their networks that improved the amount of expertise leading to increases in patents, licenses and jobs created that influenced the technology and knowledge transfer process in each institute and impacted on their regional economies.

The key drivers within the IoTs such as the Head of Research, Heads of ARE and the Industrial Liaison Managers and the networks that they have formed have helped create links with funding agencies such as Enterprise Ireland, IDA Ireland and other state agencies such as SFI and HEA. They have also formed outside links with Irish and international industry sectors. The transferability aspect of this process may enhance the economic, social and cultural development of their respective regional economies. The technology and knowledge transfer that is occurring in IoTs in Ireland could be used as a mechanism to attract further investments, more PhD researchers, more undergraduates, entrepreneurs and enterprises and set the platform for higher levels of spin-outs and spin-ins within the IoTs and their regions. The Innovation Task Force (2008) and the SSTI (2006) have stressed that if these targets are reached they will add to the economic, social and cultural development of the IoTs and their regional economies.

Appendix One: Regions of Ireland.

Ireland is split into eight regions. These are not related to the four traditional provinces but are based on the administrative counties.

The regions are divided as follows:

1. Border: The counties of Cavan, Donegal, Leitrim, Louth, Monaghan, Sligo
2. West: The counties of Galway, Mayo and Roscommon
3. Midland: The counties of Laois, Longford, Offaly and Westmeath
4. Mid-East: The counties of Kildare, Meath and Wicklow
5. Dublin: the city of Dublin, Dun Laoghaire-Rathdown, Fingal and South Dublin
6. South-East: The counties of Carlow, Kilkenny, South Tipperary, Waterford and Wexford
7. South-West: The counties of Cork and Kerry
8. Mid-West: The counties of Clare, Limerick and North Tipperary

(Source: Irish Regions Office 2010)

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