

# KNOWLEDGE INTENSIVE SERVICE ACTIVITIES IN THE IRISH SOFTWARE INDUSTRY

COUNTRY REPORT FOR THE OECD KISA PROJECT  
2002-2005

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## **1. Introduction**

The main purpose of this research is to analyse whether Knowledge Intensive Service Activities (KISA) are important for the innovation processes of the Irish software sector and, if so, whether the necessary conditions for their development exist. This paper presents the research carried out for the Organisation for Economic Co-operation and Development (OECD) KISA project (2002-2005). It was conducted in three steps as follows: Step 1: National statistics on the contours of the computer and related activities services in Ireland, Step 2: Government programmes and policies for the Irish Information and Communication Technologies (ICT) and software sectors, Step 3: Quantitative findings -analysis of KISA in the innovation processes of the software industry in Ireland. The final OECD KISA publication will show cross-country comparisons for Step 4: Policy implications of the development of KISA for the management of national innovation systems. The major primary and secondary national statistics sources were contacted to obtain the needed information for Step 1. Data contained in Step 2 was accessed from several other organisations through government reports, telephone inquires and the internet. Also the results of a postal survey to 808 software firms (with 40.1% response rate) and interviews with senior managers of 16 of these firms are presented in Step 3. A thoughtful literature review was conducted along the three steps of this project.

The software sector in Ireland is responsible for nearly 8% of Ireland's GDP and nearly 10% of its exports (HotOrigin 2001). According to the OECD Information Technology Outlook 2000, Ireland was the largest exporter of software goods in the world (IDA 2003). The ICT and software sectors have been identified as key sectors

for the future economic growth of Ireland (ETC 2001)<sup>5</sup>. According to the literature (e.g. Sweeney, Tansey 1998) suitable economic growth is only attained through the process of innovation<sup>6</sup>. Therefore, it is important to ensure that the conditions necessary for innovation development exist within these sectors. A vital element for economic growth that has been identified in the more recent literature is KISA in innovation systems. KISA are defined in this project as professional services provided internally or externally to a firm by private or public organisations that increase the innovative capacity of the company. Examples of KISA include R&D services, management, engineering, human resource, legal and accounting, financing, and marketing services. The present study identifies whether the necessary conditions are in place to encourage the KISA development in the software sector in Ireland. The results of this study will be compared with those of other OECD countries in a further publication.

## **Background**

The Irish ICT sector comprises more than 1,000 organisations of varying scale from indigenous hardware start-ups to the world's largest software companies. The ICT industry directly employs 100,000 people. 55,000 of these people are employed by overseas ICT companies; including IBM, Intel, Hewlett Packard, Dell and Microsoft operating in Ireland. In 2002, exports in this sector exceeded €28 billion, which accounts for one third of Irish exports (ICTIreland 2003, IDA 2003). Moreover, since the

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<sup>5</sup> Additional information was obtained from the “European Trend Chart on Innovation” country report (Ireland) published by the European Commission. The trend chart on Innovation in Europe is a practical tool for innovation organisations and scheme managers in Europe. It pursues the collection, regular updating and analysis of information on innovation policies at national and community level. This report is available at [http://www.trendchart.org/Reports/Documents/Ireland\\_CR\\_September\\_2002.pdf](http://www.trendchart.org/Reports/Documents/Ireland_CR_September_2002.pdf)

<sup>6</sup> The process through which productive resources are developed and utilised to generate higher quality, lower cost products than had previously been available; this process is generally described as innovation.

1980s, most leading US software vendors, including Microsoft, Oracle and Symantec, have based their European operation centers in and around Dublin and a thriving indigenous software development industry has developed in parallel. In total, there are more than 900 international and indigenous software companies located in Ireland, employing over 25,000 people and generating a combined turnover of over €7.6bn (HotOrigin 2003). The indigenous industry is characterised by a large number of relatively small firms with a strong export orientation. It comprises approximately 600 companies, about 250 of which have significant levels of overseas sales, principally to the US and EU. In 2002, their exports amounted to €1.5 billion, an increase of more than 5 per cent over the previous year. The indigenous sector employs more than 11,000 people and generates revenues of €1.27bn. In total, the software sector in Ireland is responsible for nearly 8% of Ireland's GDP and nearly 10% of its exports (HotOrigin 2001). According to the OECD Information Technology Outlook 2000, Ireland was the largest exporter of software goods in the world (IDA 2003).

A recent survey carried out by HotOrigin (2003)<sup>7</sup> found that Ireland's indigenous software market can be segmented into three broad categories based on the stage of development of the company. 74% of the companies surveyed fall into the start-up category (with up to 25 employees), 18% are defined as being in the build category (26-75 employees), and 8% of the companies surveyed can be categorised as Expansion firms (more than 75 employees) (HotOrigin 2003). It is important to bear in mind these industry characteristics when trying to understand the value of the

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<sup>7</sup> HotOrigin (2003) conducted an online survey of CEO's of indigenous software product companies and carried out in-depth interviews with CEO's of indigenous software companies that achieved sales success in 2002. A total of 416 indigenous software product companies were identified in Ireland. Of these, 50 were based in Northern Ireland. 166 CEO's responded to the survey representing a response rate of 40%. Companies in Northern Ireland represented approximately 10% of the respondents.

following innovation policies and programmes for Irish ICT and software sectors as shown in the following section.

**Table 1. General characteristics of the Irish ICT and software sectors**

	ICT		Software		ICT	Software
	Firms	Employees	Firms	Employees	Exports	Exports
<b>FDI</b>	300	55,000	200*	14,000*	28 bn	7.0 bn*
<b>Indigenous</b>	> 700*	45,000*	600	11,000		1.5 bn
<b>TOTAL</b>	> 1,000	100,000	800	25,000		8.5 bn *

\*Estimated value

(ICTIreland 2003, IDA 2003)



## **2. Step 1: National statistics on the contours of the computer and related activities services in Ireland**

As it was requested for the overall OECD KISA project- Step 1, data was collected on national statistics for the category of computer and related activities broader than software, since Ireland, as well as most countries do not gather data on software alone. Also, information about R&D investment and R&D services was obtained to better understand the conditions of innovation development in the software sector. The data presented herein thus provides a broader picture than that of the software sector alone but one that is important for understanding the activities of software firms. This statistical data was the most recent data available for these sectors at the time of the analysis (2003) (OECD 2003). The study found that the computer and related activities industry has grown considerably in Ireland. The number of firms in this sector has increased by five hundred percent from 1992 to 1998. The computer and related activities sector contributes significantly in terms of exports, employment and growth (see Table 2 and Table 3). The turnover of these companies grew over six years (1992-1998)<sup>8</sup>, almost ten times (see Table 2).

The innovative development of the computer related services sector relies on the availability of R&D service providers. According to the statistics, the number of

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<sup>8</sup> MNCs pay 10% corporation tax on both manufacturing and export services in Ireland, which is considerably smaller than the US or other European countries. Foreign subsidiaries show large profits in Ireland, even though in reality a large proportion of transactions and processes of the MNC may not actually take place in Ireland (Barry 2002, Sweeny 1999).

private businesses providing R&D more than duplicated from 1995 to 1998 (see Table 4). The number of firms in this sector was still small relative to the number of firms they are supplying to in other economic sectors (e.g. there were 1,785 computer services firms in 1998). However, the available statistics at the time of the analysis (up to the year 1998) (CSO 2002) indicates substantial growth. Referring to the statistics on research and development expenditure it was found that the business expenditure on R&D in Ireland is €784m, of which 4% is financed by the government (see Table 5 and Table 6). However, the survey conducted for Step 3 of the OECD KISA project, shows that the proportion of the R&D financed by the government may be much higher for the software companies, since almost 50% of them obtain government grants for R&D related matters. This part will be explained in more detail further.

The total expenditure of Higher Education Research and Development (HERD) was around €228.1m in 1999 (Table 7). This quantity has more than tripled in ten years (See Table 5). However, some companies commented that there is scope for improvement in the HERD to provide support for the development of specific sectors that are crucial for the national economic growth, such as software. Finally, the statistics showed that the number of people involved in R&D grew considerably in business and academic fields from 1990 to 1999. Still a larger portion of R&D is carried out by the High Education sector than that conducted by the private sector in Ireland (ETC 2001) (see Step 2 for more details). However, the number of people working in R&D in the private sector is growing at a higher rate than that of the public sector, therefore reducing the gap between the sectors (see Table 8).

**STATISTICS LAYER 1: COMPUTER AND RELATED ACTIVITIES  
SERVICES INDUSTRY CHARACTERISATION**

**Table 2. Data on value added, employment and investment of computer services**

Year	Employees	VA (GVA) (£)	Businesses	Turnover exclu. VAT (£)
1990	-	-	-	-
1991	-	-	-	-
1992	4,186	140,646	304	259,162
1993	-	-	-	-
1994	-	-	-	-
1995	5,381	-	703	309,274
1996	7,015	265,056	956	473,853
1997	8,938	489,512	1,098	848,096
1998	15,507	775,867	1,785	2,132,704
1999	-	-	-	-
2000	-	-	-	-

(current prices)

(CSO 1997, 1999, 2002)

**Table 3. Data on value added, employment and investment of R&D services**

Year	Employees	VA (GVA) (£)	Businesses	Turnover exclu. VAT (£)
1990	-	-	-	-
1991	-	-	-	-
1992	-	-	-	-
1993	-	-	-	-
1994	-	-	-	-
1995	191	-	47	11,135
1996	290	10,921	69	18,945
1997	258	11,927	106	20,612
1998	339	20,486	115	45,636
1999	-	-	-	-
2000	-	-	-	-

(current prices)

(CSO 1999, 2002)

**Table 4. Exports in software (€m)**

Year	Exports
1990	-
1991	2,044
1992	-
1993	2,339
1994	-
1995	3,570
1996	-
1997	5,436
1998	-
1999	6,520
2000	8,500

(Enterprise Ireland's National Informatics Directorate 2000)

**STATISTICS LAYER 2: COUNTRY COMPARISONS –INNOVATION  
INDICATORS**

**Research and development expenditure and personnel**

**Table 5. Business research and development expenditure (€m)**

Year	Current Prices	Constant Prices <sup>1</sup>
1990	180.3*	-
1991	223.4	263
1992	270*	-
1993	344.4*	387
1994	424.5*	-
1995	504.5	505
1996	541.2*	-
1997	612	637
1998	698*	-
1999	784	784

<sup>1</sup>1999, \*non-published data

(FORFAS 2000, FORFAS 2002a)

**Table 6. Proportion of business sector R&D financed by government**

Year	%
1990	5.2*
1991	3.7
1992	3.2*
1993	10.6
1994	2.1*
1995	4.5
1996	6.2*
1997	6.5
1998	5.1*
1999	4.0*

\*non-published data (FORFAS 2000, FORFAS 2002a)

**Table 7. Higher total expenditure on HE research (HERD)**

Year	Current Prices €m	Constant Prices £m	Constant Prices 1998, £m
1990	70.5*	49,864	59,000
1991	81.6*	-	-
1992	92.7	72,968	81,000
1993	106.9*	-	-
1994	121.1	95,354	102,000
1995	137.1*	-	-
1996	153.1	120,570	124,000
1997	178.4*	-	-
1998	203.7	160,404	160,404
1999	228.1*	-	-

\* non-published data

(FORFAS 2000a, FORFAS 2002a<sup>1</sup>)

**Table 8. Total R&D personnel in industry and HE**

<b>Year</b>	<b>Total R&amp;D Personnel in industry and HE</b>	<b>Number of HE researchers (FTE)</b>
<b>1990</b>	-	6846.1
<b>1991</b>	3,970	8001.6
<b>1992</b>	-	8487.8
<b>1993</b>	4,500	7836.8
<b>1994</b>	-	8654.3
<b>1995</b>	5,680	9661.7
<b>1996</b>	-	9998.8
<b>1997</b>	6,970	10826
<b>1998</b>	-	11613.2
<b>1999</b>	8,321	12288.6

(FORFAS 2002, FORFAS 2002a)

### **3. Step 2: Government programmes and policies for the Irish Information and Communication Technologies (ICT) and software sectors**

This section of the report presents Step 2 of the KISA project: ‘Government Programmes and Policies for the Irish software sector, which is incorporated within the Information and Communication Technologies (ICT) sector. The objective of this work is to identify the key industry-specific innovation policies and programmes for the support, supply and promotion of KISA in the ICT and software sectors.

The National Development Plan (NDP) involves an investment of over €52 billion of Public, Private and EU funds (in 1999 prices) over the period 2000-2006<sup>9</sup>. The central challenge of this plan is the implementation of public policies and programmes that will increase the capacity of Ireland’s economy to maintain strong and sustainable output and employment growth (NDP 2000). Under the NDP, the Irish government has allocated a substantial investment in Research Technological Development and Innovation (RTDI). According to the European Trend Chart on Innovation (ETC 2001), the RTDI element amounts to €2.5 bn, some 5 % of the total expenditure in the Plan ([www.ndp.ie](http://www.ndp.ie)). The development and implementation of science, technology and innovation (STI) policy is organised on a departmental and sectoral basis (see Figure 1.). All government departments or ministries are responsible for STI within their respective portfolios. However, the bodies considered to be most relevant for this study are **1.** the Department of Enterprise, Trade and Employment and **2.** the

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<sup>9</sup> About 90% of the public funding for this Plan has been provided by domestic sources, mainly from the Exchequer. The contribution from the EU totals €6bn. The Plan will involve significant investment in health services, social housing, education, roads, public transport, rural development, industry, water and waste services (NDP 2000).

Department of Education and Science (ETC 2001).

1. The Department of Enterprise, Trade and Employment is responsible for promoting and assisting overall industrial development as well as innovation and competitiveness in the economy. The Office of Science and Technology (OST) is situated within this department. The OST is responsible for the development, promotion and co-ordination of Ireland's STI policy. This covers all aspects of the national system of innovation, including basic research, applied research, industry R&D, technology transfer, funding for innovation and public awareness of science and technology. The office is responsible for the Science and Technology budget including all Exchequer and EU funding for research and technological development for industry (<http://www.education.ie>, <http://www.entemp.ie>, ETC 2001).

2. Academic institutions play an important role in carrying out research and development activities in Ireland, and therefore the Department of Education and Science has a significant funding role. Approximately 90% of fundamental research is performed within the university sector. Neither indigenous industry nor foreign-owned industry, in its Irish operation, performs basic research. The Department's funds are channelled through the Higher Education Authority (HEA) which is a statutory body that analyses the funding and resource requirements of the third level institutions and ensures that they have the capability to interact with industry (ETC 2001).

Most of the identified policies and programmes for this study are conducted by organisations under the auspices of these departments. The primary and secondary information contained in this report was accessed from these organisations through

government reports, telephone inquiries and the internet. Sixteen innovation policies and programmes (relevant to KISA in the ICT and software sectors) have been identified in the course of this study (see Table 9). Nine of these policies and programmes are targeted at a broader number of industrial sectors, but are of potential benefit to the ICT sector. seven of the identified policies and programmes are more specific to the ICT sector while none of those identified were found to be explicitly created for the software sector<sup>10</sup>. These 16 innovation policies and programmes identified, with potential benefit to KISA in the ICT and software industries, are presented in more detail in the following section. They are organised in this study following the themes proposed at the OECD KISA focus group 2002, as it is shown in Table 10.

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<sup>10</sup> Some of the programmes covered under the heading of “ICT” also include software.



**Table 9. Number of Irish innovation policies and programmes for ICT and software**

Total number of policies and programs:	16
Generic policies and programs:	9
Specific to ICT sector:	7

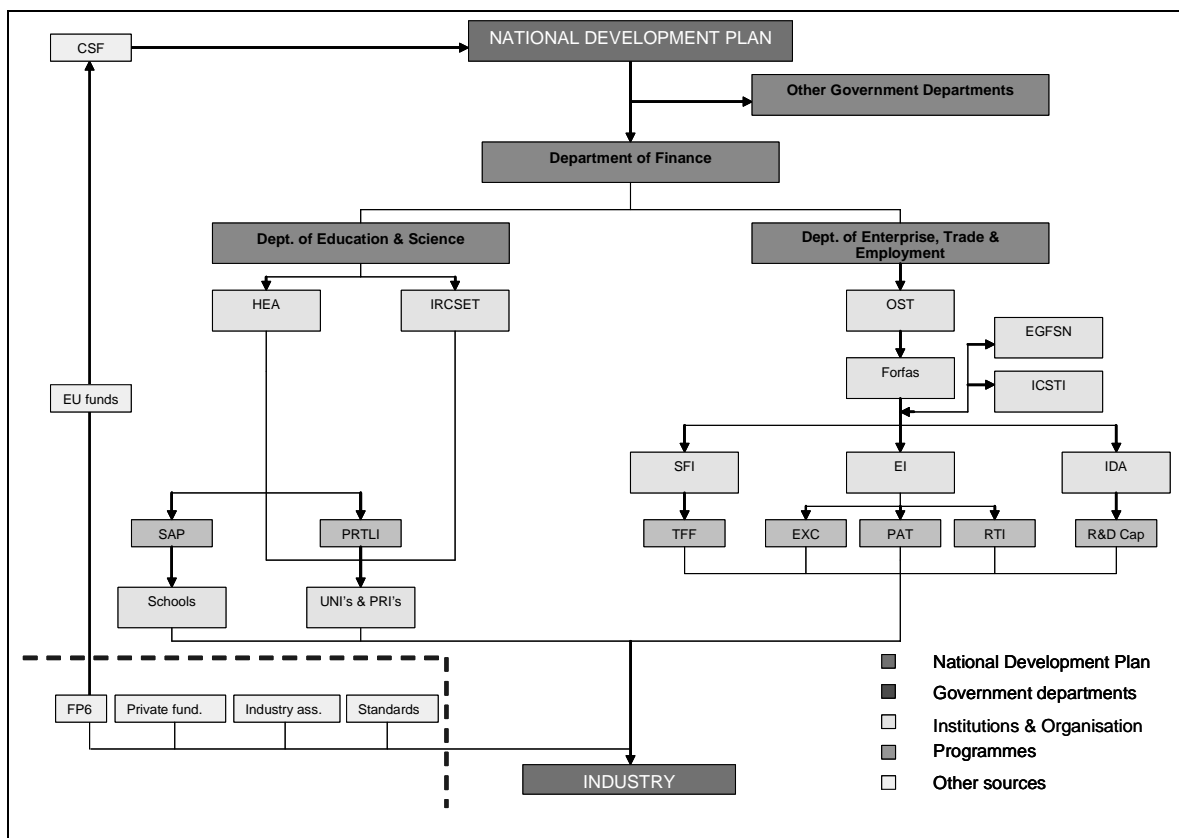
**Table 10. Policy themes encouraging knowledge intensive services innovation<sup>11</sup>**

<b>1. Research and development programmes and technologies for services</b> 1.1 Research and development programmes 1.2 Access to new technology
<b>2. Infrastructure underpinning innovation capability</b> 2.1 ICT innovation 2.2 Foresight 2.3 Knowledge and technology diffusion
<b>3. Innovation capability in firms</b> 3.1 Innovation management
<b>4. Knowledge and mobility of human resources</b> 4.1 Training 4.2 Inwards mobility 4.3 Industry associations
<b>5. Standards and regulations</b>
<b>6. Global marketing and exporting</b>
<b>7. Intellectual property protection</b>
<b>8. SMEs: entrepreneurship and development</b>

Source: Adapted from Ian Miles (2002) in OECD KISA focus group workshop, 2002

<sup>11</sup> The OECD KISA focus group recommended (December summary report) a list of innovation policies to services to be used as a guideline in the research process. However, some of the policies were not used in this study as they were deemed not to be relevant in the case of Ireland.

**Figure 1. Programs and policies for the Irish ICT and software sector**



See Abbreviations in Appendix

### **3.1 Research and development programmes and technologies for services**

The programmes currently available to encourage greater investment in R&D are outlined below:

#### **3.1.1 Research and development programmes**

There are a number of new research technology and innovation (RTI) measures contained in the NDP that seek to strengthen the research undertaken by companies. Two measures in particular, the Research and Development Capability and the Research Technology and Innovation (RTI) Competitive Grants Scheme, seek to provide funding for respectively building the capacity of firms to undertake R&D and promoting high-risk R&D projects.

*Research and Development Capability:* This initiative aims to build the capability of firms to carry out R&D at a significant and continuous level. It will support firms to make substantial new investment in RTDI and thus make them more competitive in global markets. The initiative is targeted at three categories of companies: Large companies, SME's and Technology based start-ups. The initiative covers additional resources- R&D staff, equipment and facilities, along with a programme of R&D projects. This scheme is administered by both Enterprise Ireland and the IDA and is operated on a competitive basis.

**Funding:** €75.5m (€29m Enterprise Ireland, €40m IDA, €6.5m SD).

*([www.enterprise-ireland.com/rdc/](http://www.enterprise-ireland.com/rdc/), ETC 2001)*

*Research Technology and Innovation (RTI) Competitive Grants Scheme:* This scheme supports R&D undertaken by manufacturing or internationally traded

service firms in Ireland. It is operated on a competitive basis and seeks to encourage and support high quality, high risk R&D projects; to encourage the continuation of an RTDI culture in firms; and to encourage company participation in collaborative R&D projects, both national and international. Particular focus is on established companies planning their first R&D projects and those significantly developing their existing R&D activity. The scheme is administered by Enterprise Ireland and projects are approved by the RTDI Committee, whose membership includes representation from the private sector, industrial development agencies, third level sector and the OST. **Funding:** €650,000 max.

*([www.enterprise-ireland.com/rtdi/](http://www.enterprise-ireland.com/rtdi/), ET C 2001)*

*Embark Initiative, Irish Council for Science, Technology and Innovation (IRCSET):* The Embark Initiative is operated by the Irish Research Council for Science, Engineering and Technology (IRCSET) (established June 2001 under the auspices of the Department of Education and Science) and is funded by the State under the NDP. The Embark Initiative is aimed at knowledge creation for the long term benefit of society and the economy. The Councils mission is to promote excellence across a broad range of research in science, engineering and technology. Its programmes do not target research projects with an industrial or economic focus but instead the emphasis is on innovative, original and exploratory research, aimed at generating new knowledge and energising Ireland's future growth, development and national competitiveness. **Funding:** €95m

*([www.ircset.ie](http://www.ircset.ie))*

*The National Microelectronics Research Centre (NMRC)* is a public research institution and part of University College Cork (UCC). It is funded by the HEA, Enterprise Ireland and EU funds. The centre has a dual mission: 1. to be a world-class centre of excellence in ICT and 2. to be a key part of the national STI infrastructure; supporting existing indigenous and multinational industry, providing highly skilled staff for Irish industry and stimulating new indigenous industry and inward investment from foreign companies.

**Funding:** €16m (2001).

[www.nmrc.ie](http://www.nmrc.ie)

*Taxation* is a primary incentive for foreign investment in Ireland and can also contribute to the development of a healthy indigenous sector. [www.ictireland.ie](http://www.ictireland.ie). Ireland offers one of the most beneficial corporate tax environments in the world. From January 1 2003 a corporate tax regime of 12.5% applies to all Irish trading profits in all sectors, including manufacturing and international services. In addition the old rate of 10% will still apply to existing qualifying ‘manufacturing’ trades until 31 December 2010 provided the trade was a qualifying trade before 23 July 1998.

[www.ida.ie/whyireland.taxation.asp](http://www.ida.ie/whyireland.taxation.asp)

### **3.1.2 Access to new technology**

*Programmes in Advanced Technology (PATs):* The PATs are partnerships between Enterprise Ireland, industry and third level colleges. They help industry to access new technology; improve the competitiveness of existing production; move into new higher value areas. They also assist industry in

attracting overseas and domestic investment in high technology areas that lead to the establishment of new technology based start-up companies. Three of the six PATs are in the area of electronics, communications and information technologies. Optronics Ireland offers contract research, design, development of consultancy services in optoelectronics technologies. They have five centres of expertise. PEI Technologies offer design, development, training and consultancy services in electronic systems and components. Their extensive client base includes indigenous, multinational and foreign-owned companies. The third PAT is the Informatics Research Initiative, which will be discussed separately in the report under the heading of ICT Innovation. **Funding:** €23m (2001-2002 period).

*([www.enterprise-ireland.com/industry-programmes.asp](http://www.enterprise-ireland.com/industry-programmes.asp))*

*Computer Integrated Manufacturing Research Unit (CIMRU)* is based at the National University of Ireland, Galway (NUIG). CIMRU consists of high level graduates and engineers with research and development activities that include enterprise planning, systems modelling and applications for digital business solutions. The activities of CIMRU involve the application of information technology and manufacturing systems knowledge in the development of enterprise systems solutions. The overall objectives of CIMRU are to support high quality research work in integrated enterprise systems; to encourage and support small and medium sized enterprises in the application of appropriate enterprise systems technology; to transfer technology, developed under European or government aided research programmes, to local industry through joint projects; and to provide opportunities for graduates and others to carry out

research in enterprise systems integration.

*(<http://cimru.nuigalway.ie>)*

*Irish Council for Science, Technology and Innovation (ICSTI):* The ICSTI is an independent council under the auspices of Forfas. ICSTI provides advice on the strategic direction of policy, embracing all aspects including scientific research, education at all levels, technology and R&D in industry, financing for innovation, public awareness of science and technology (S&T), and prioritisation of state spending. The views of the Council are an important input into the work of the Inter-Departmental Committee. The membership of ICSTI is drawn from industry, academia and state agencies.

*([www.icsti.ie](http://www.icsti.ie) , ETC 2001)*

### **3.2 Infrastructure underpinning innovation capability**

The following programmes are designed to encourage innovation in the service sector and for ICT and software more specifically.

#### **3.2.1 ICT Innovation**

*Informatics Research Initiative:* The Informatics Research Initiative - one of Enterprise Ireland's PATs – is managed by the agency's National Informatics Directorate. It is a key element in Enterprise Ireland's strategy for the development of the informatics sector in Ireland. Informatics is taken to include the traditional software sector, the development of products and technologies for the telecommunications industry and the development of

technologies which are at the core of emerging sectors, such as digital media and e-business. The initiative is designed to strengthen the research base of the Irish informatics sector by supporting academic research and its subsequent commercial exploitation. It focuses on applied research and the initiative is intended to be of benefit both to industry and to third level education bodies. In third level institutions, the Initiative will promote an increase in R&D – particularly applied research which is of immediate and direct relevance to Irish industry. The Initiative facilitates new entrepreneurs, existing companies, and researchers in accessing a range of relevant services, supports and expertise within Enterprise Ireland.

*([www.nsd.ie/hm/comm\\_rad/informatics/informatics2003.pdf](http://www.nsd.ie/hm/comm_rad/informatics/informatics2003.pdf))*

*Intel Capital Fund:* Through the Intel Capital Fund, the Intel Corporation invests private funds in technology companies developing networking and communications solutions. The fund supports the development of technologies for intelligent, programmable network processing; handheld and cellular components, applications and solutions; and components, applications and solutions supporting the rapid deployment of wireless networking, including support of Intel's mobile platform.

**Funding:** €30m internationally (1999-2003).

*([www.intel.com/capital/portfolio](http://www.intel.com/capital/portfolio))*

### **3.2.2 Foresight**

Foresight policies aim to give strategic guidance and assistance with priority setting to



both industries and policymakers who are considering investment decisions.

*Technology Foresight Fund, Science Foundation Ireland (SFI):* SFI was established to manage the €635m Technology Foresight Fund which will support excellence in strategic technologies particularly the development of world-class capabilities in the areas of ICT and Biotechnology. The Technology Foresight Fund is an open and ambitious funding scheme which aims to fund proposals that link highly sophisticated research with a vision for the ICT of tomorrow. In particular, SFI are interested in research programmes that will carry evolution of ICT forward in the areas of software and applications; components and devices; networks; and systems. **Funding:** €635m, (€317.5 to ICT sector).

*([www.sfi.ie](http://www.sfi.ie))*

*Expert Group on Future Skills Needs* is an independent council under the auspices of Forfás. Its remit is to advise the government on skills and manpower issues. The Expert Group on Future Skills Needs has been addressing the issue of shortages in the supply of research graduates and post-doctoral researchers.

*(ETC 2001)*

### **3.2.3 Knowledge and technology diffusion**

Ireland has two programmes oriented towards the diffusion of new knowledge within the Software Sector.

*Programmes for Research in Third Level Institutions (PRTLTI):* The PRTLTI is a joint public private (HEA, universities and industry) programme which was designed to draw on public private partnerships to develop the breadth and quality of research activity in third level institutions. The main objective of the programme is to promote the development of high quality research capabilities in third level institutions.

**Funding:** €59m (€40.4m NDP, €18.6m private sources)

(HEA 2002)

*Strategic Action Plan:* The governments three year Strategic Action Plan sets the parameters for the use and further support of technology in primary and second-level education. In broad terms, the Plan seeks to advance the use of ICT in education by expanding the ICT capital provision to schools; increasing access to and use of Internet technologies; further integrating ICT into the school curricula; and improving professional development for teachers.

The new initiative places a strong emphasis on the need for planning at school level. Principals and teachers will be given support, throughout the period of the Plan, to develop ICT plans to meet the infrastructure and needs of their individual schools.

**Funding:** €107.92m.

[www.ncte.ie/abouttheNCTE/ICTPolicy/d247.PDF](http://www.ncte.ie/abouttheNCTE/ICTPolicy/d247.PDF)

### **3.3. Innovation capability in firms**

#### **3.3.1 Innovation management**

*Benchmarking Initiative:* Though not directly related to innovation, Enterprise Ireland's Benchmarking Initiative is a management tool which the

organisation uses to facilitate client companies in achieving process improvement and total quality in production.

*(ETC 2001)*

*Innovation Management Initiative:* The Innovation Management Initiative which is administered by Enterprise Ireland, is targeted at first time R&D performers and at firms with a track record in R&D where the firm would benefit from better management systems. The Initiative recognises that as enterprises increase their R&D spend there is a need to develop their management ability to control the process and absorb the benefits from this increased spend.

Under the Initiative, training and consultancy is provided to small and medium enterprises (SMEs) to enhance their skills and to ensure that the best practice tools and techniques are embedded in company operations.

*(ETC 2001)*

### **3.4 Knowledge mobility and human resource**

#### **3.4.1 Training**

*Task Force on Life-Long Learning:* The Task Force was established under the Program for Prosperity and Fairness (PPF) framework and has been led by the Department of Enterprise, Trade and Employment following the publication of the Green and White Papers on Life Long Learning. The White Paper objectives were the development of specific initiatives to upgrade the skills of workers; and initiatives to significantly increase training, learning and progression opportunities for people faced with the challenge of rapid

technological change, taking due account of the work of the Expert Group on Future Skills Needs.

*(www.fas.ie/FAS Review/lifelong.html, ETC 2001)*

### **3.4.2 Inwards mobility**

The shortage of research graduates available to Ireland's scientific community had been a concern to Forfás and the Expert Group on Future Skills Needs. The latter has carried out a study, which has identified that the supply of research graduates leaving the Irish third level education system is insufficient to meet the needs of the Irish research system. The Expert Group has highlighted the urgent need to attract foreign research graduates and postdoctoral researchers to Ireland. The Expert Group commissioned Technopolis to undertake a report to examine strategies and mechanisms that have been put in place by best practice and competitor countries by national governments, science and technology organisations and third level institutions to attract foreign researchers.

*(ETC 2001)*

### **3.4.3 Industry associations**

*Irish Business and Employers Confederation (IBEC):* IBEC provides a wide range of services to over 7,000 member businesses and organisations from all sectors and of all sizes is the umbrella body for Ireland's leading sectoral groups and associations is the national voice of Irish business and employers. IBEC works to shape policies and influence decision-making in a way that develops and protects members' interests and contributes to the development and maintenance of an economy that promotes enterprise and productive employment. IBEC represents members' interests to government, state agencies, the trade unions, other national

interest groups, and the general public. Through the Brussels office, the Irish Business Bureau (IBB), IBEC works on behalf of business and employers at European level to ensure that European policy is compatible with its objectives for the development of the Irish economy.

Economic affairs, employee relations, pay, employment, taxation, competition, the environment, trade, transport, and sectoral matters are some of the issues IBEC addresses. IBEC develops and reviews policy on such topics through consultation with members, undertaking its own research, and seeking expert advice and opinion. There are over 60 sector associations, federations and affiliated associations within IBEC.

[www.ibec.ie](http://www.ibec.ie)

*ICTireland:* In 2001 following extensive consultation with industry leaders in the high- tech sector IBEC took a decision to establish a major new representative lobby group for the sector. ICT Ireland was launched in May 2001 and brings together under one banner the following organisations each of which are active across this diverse sector: Audiovisual Federation – AF, Consumer Electronic Distributors Association – CEDA, Federation of Aerospace Enterprises in Ireland – FAEI, Irish Cellular Industry Association – ICIA, Irish Software Association – ISA, Music Industry Group – MIG, Telecommunications and Internet Federation – TIF.

[www.ictireland.ie](http://www.ictireland.ie)

*Irish Software Association (ISA):* The ISA is the principal trade association for the software industry in Ireland. The core mission is to promote the common

interests of the software sector as a whole as well as serving as a key resource to member companies by providing an organised forum for the exchange of ideas, sharing of resources and promotion of industry goals and influencing public policy. The ISA assists software companies to start, manage and grow their companies and to help them to be successful in global markets. The ISA is an affiliate association to ICT Ireland and IBEC.

*([www.isa.ie](http://www.isa.ie))*

*ITAG, KERRYSOFT, SHANNONSOFT* (regional associations): IT professionals representing both multi national and indigenous IT companies.

### **3.5 Standards and regulations**

*National Standards Authority of Ireland (NSAI)*: The NSAI is responsible for the development and publication of standards to meet European and Irish demands. The NSAI represents the Irish interests in European and international Standards bodies – groups that work towards the harmonisation of standards and the removal of technical barriers to trade. The Information and Communications Technology Standards Consultative Committee (ICTSCC) was established

- (i) To advise NSAI and government on matters related to the introduction of information and communications technology standards;
- (ii) To review the general operation of European and international information and communications technology standardisation programmes and co-ordinate national participation in such

programmes;

- (iii) To initiate and co-ordinate industrial participation in European and international technical programmes relating to ICT standardisation.

*([www.nsai.ie](http://www.nsai.ie))*

### **3.6 Global marketing and exporting**

*Excellerator* is organised as a public-private partnership between Enterprise Ireland, Shannon Development and Ernst & Young to assist high potential start-up companies to quickly gain the capability to enter international markets. Ernst & Young is responsible for the design and content of the programme which was built to address specific skills and knowledge gaps identified amongst entrepreneurs by Enterprise Ireland and Shannon Development.

Excellerator involves the provision of a comprehensive business life-cycle range of on-line and off-line tools to empower selected high potential companies to learn, review, challenge and accelerate their business. Enterprise Ireland is targeting Excellerator at industry sectors that trade on an international platform such as informatics, health and life sciences, digital media and e-business.

*(ETC 2001)*

### **3.7 Intellectual property protection**

The government has enacted a number of critical Acts to underpin the development of a knowledge-based economy including the Electronic

Commerce Act 2000, the Copyright and Related Rights Act 2000 and the Communications Regulation Act 2002.

(ETC 2001)

### **3.8 SMEs: entrepreneurship and development**

*Border, Midland and Western Region (Sub-Programme 1)* provides for financial assistance towards the establishment and development of microenterprise participating in appropriate capability development programmes, and especially in remote and peripheral areas of the Regions. The main responsible bodies of this programme are the Local County Enterprise Boards and the Department of Enterprise, Trade and Employment. **Funding:** € 89.25m

[www.ndp.ie](http://www.ndp.ie)

*Incubators:* Funding is provided to establish Incubators within the Institutes of Technology. The incubators incorporate start-up space and facilities to allow joint research and development activities to take place between college researchers and local enterprises. Eight such incubators were funded in 2001. The main responsible bodies of this programme are the Local County Enterprise Boards and the Department of Enterprise, Trade and Employment. **Funding:** €18.28m.

(ETC 2001)

*Technology Transfer Initiative:* The Technology Transfer Initiative is an innovative support structure for small to medium sized companies in the West, Midwest and Southwest regions of Ireland. This initiative is an inter-regional collaborative project involving the three primary universities of the Atlantic University Alliance (AUA) – University College Cork (UCC), National University of Ireland, Galway (NUIG), and



University Limerick (UL). The main objectives of the Technology Transfer Initiative are:

- (i) To develop the capability of indigenous industry in the target regions.
- (ii) To make available to Irish companies the combined research resources of the three participating universities
- (iii) To encourage and facilitate interaction between industry - industry and academia – industry
- (iv) To facilitate regional and inter-regional “technology transfer”
- (v) To encourage companies to engage in R&D projects that will ultimately enhance their competitiveness.

The Technology Transfer Initiative will target the ICT, engineering, biomedical and food sectors which are the four industrial sectors that represent the main growth sectors within the Atlantic seaboard regions. **Funding:** €1.2m

*[www.technologytransfer.ie](http://www.technologytransfer.ie)*

Enterprise Ireland, the state agency for the development of indigenous industry, is currently undertaking a number of initiatives to assist the development of new technology start-ups in other sectors. An example of this is the further development of regional clusters of technology companies and the continued roll-out of the Webworks initiatives. The Webworks initiatives are part of Enterprise Ireland’s ITS 2007 strategy for developing high technology internationally traded service enterprises. They are a series of infrastructural initiatives aimed at generating a critical mass of high technology start-up companies.

*(ETC 2001)*

#### **4. Step 3: Quantitative findings- analysis of KISA in the innovation process of the software industry in Ireland**

The main purpose this section –Step 3- is to present quantitative analysis that enables us to identify the main characteristics of KISA for the innovation processes of software firms in Ireland. A sample of 808 firms in the Irish software industry was used for this research, of which 125 were located in the Atlantic Technology Corridor –ATC (Counties Galway, Limerick and Clare), and 683 in the South East Coast – SEC (Counties Dublin, Wicklow, Waterford, Wexford and Cork). The ATC and the SEC (particularly the greater Dublin area) regions are the primary centres for software industry activity in Ireland in terms of number of employment (see Crone 2002). The final list of 808 (125 ATC and 683 SEC) companies was obtained by updating<sup>12</sup> an original list compiled in March 2003 from primary and secondary sources (Enterprise Ireland and the Industrial Development Agency (IDA) Ireland). After three mail shots (by monthly intervals since April 2003), a 40.1% (274) response rate<sup>13</sup> was obtained, which represents 30.4% of the estimated entire population of the Irish software sector at the national level (900 firms)<sup>14</sup>.

The main data generation method was a postal questionnaire survey (addressed to the directors of the companies), which contains ten multiple-option type questions grouped in four main sections that provide information on industry background, ‘Innovation Process’, ‘Service of Innovation’ and ‘Barriers to Innovation’. The questionnaire was developed by adapting and combining the questionnaire designed

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<sup>12</sup> After sending the questionnaire three times, 125 envelopes were returned undeliverable and these companies were deemed to be no longer operating and therefore removed from the sample list.

<sup>13</sup> The percentage of companies that answered the questionnaire was higher in the ATC (48.5%) than in the SEC (38.5%), which may be due to the fact that the ATC companies were also contacted by telephone before sending them the first two mail shots.

<sup>14</sup> Source: [www.nsd.ie/hm/ssii/stat.htm](http://www.nsd.ie/hm/ssii/stat.htm)

by the Australian Expert Group in Industry Studies (AEGIS) and questionnaires of former surveys from the authors. While the questionnaire allows the analysis of KISA in the Irish software sector, it also enables us to acquire other information about the Software Sector in Ireland that is not currently found in the literature, as is presented in the following sections.

#### **4.1 Overview of firms**

This section presents the main characteristics of the sample in terms of the region of location, nature of investment and the size of the company. The companies are located in two regions, with 18.6% of the sample located in the ATC and 81% of the sample located in the SEC region (0.4% is unknown). In terms of company ownership, 73.7% of the survey respondents are fully Irish-owned, while just 10.9% are wholly foreign-owned, 9.9% foreign minority holders, 3.6% joint venture and 1.5% have other forms of investment (see Figure 2). The industry consists predominantly of micro-sized (less than 10 employees) and small-sized firms (between 10 and 49 employees) characterising 86.1% of our sample, while medium-sized companies (between 50 and 249 employees) represent 10.2% and large-sized companies (more than 249 employees) only 1.5% (see Figure 3).<sup>15</sup>

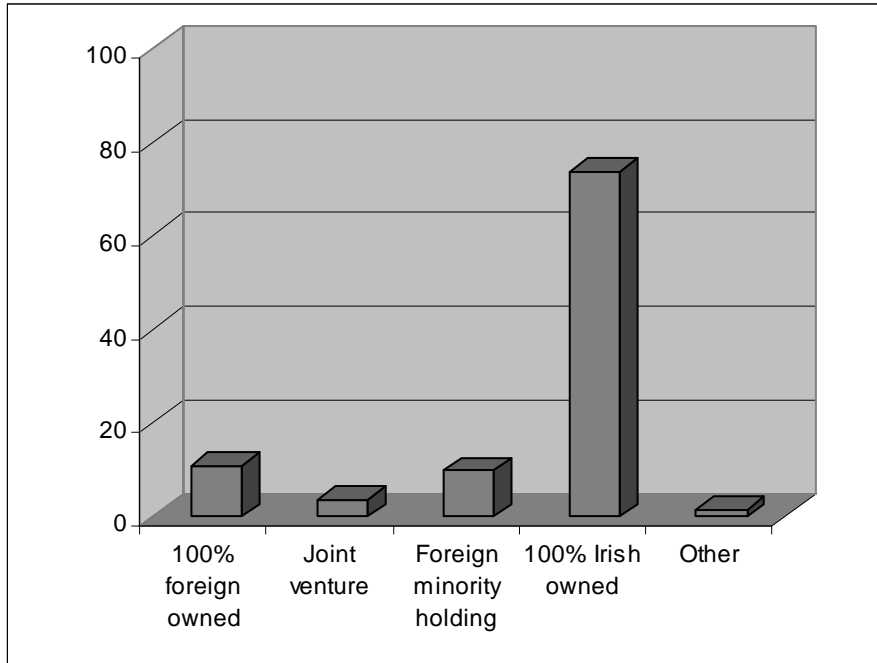
When cross comparisons are made between nature of investment and firm size, it is observed that 93.1% of the Irish owned firms are micro (54%) or small-sized, but none of them are categorised as large-sized. The largest Irish-owned firm in our sample employs 180 people. In general terms, the foreign-owned firms have larger numbers of employees than the indigenous companies and while 67% of the wholly owned foreign firms are micro (26.7%) or small, 26.7% are classified as medium and

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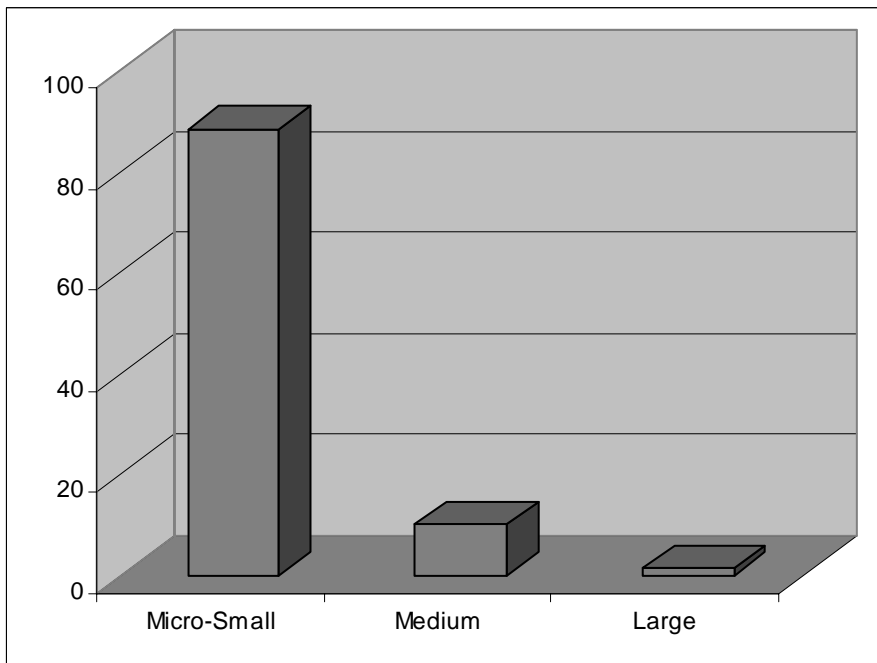
<sup>15</sup> The classification for the size of companies is sourced from the “OECD Small and Medium Enterprise Outlook”, 2000 Edition, p.7.

6.6% as large (see Figure 4). The largest wholly foreign-owned company has 890 employees.

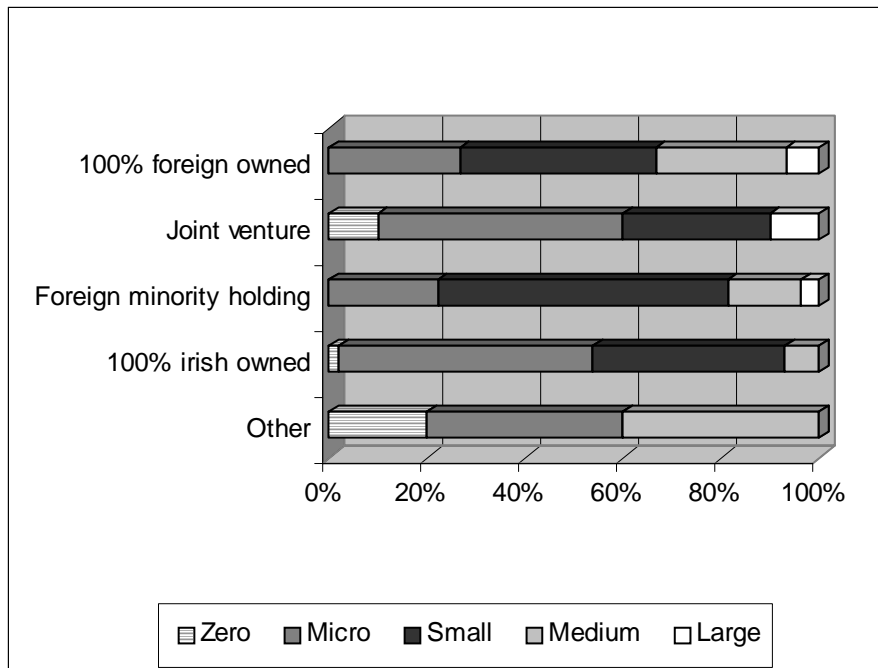
**Figure 2. Survey respondents classified by nature of investment [% of companies]**



**Figure 3. Survey respondents classified by size of company [% of companies]**



**Figure 4. Survey respondents classified by size of company and nature of investment**



## 4.2 Innovation activities within the firm

### 4.2.1 Product and services based on knowledge intensity and competitive position

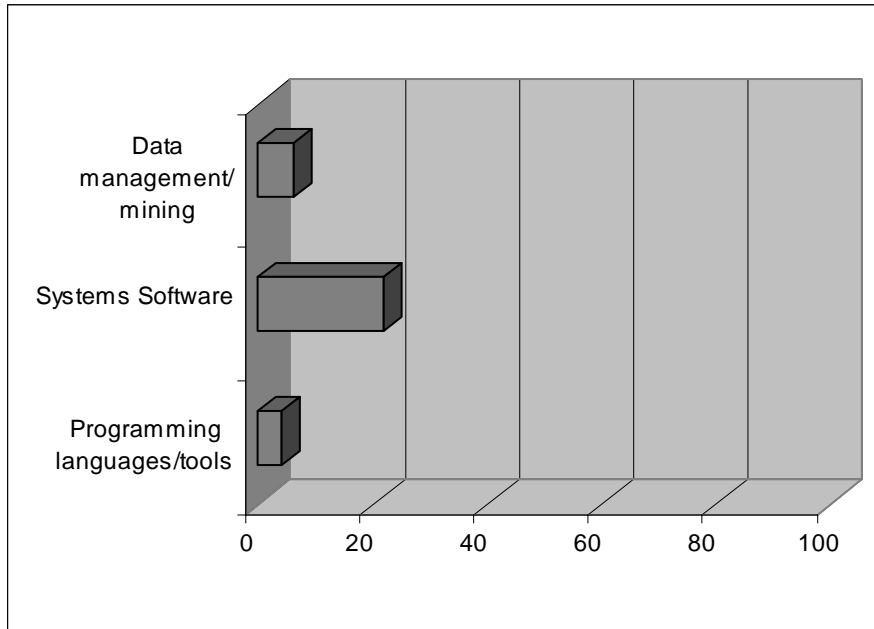
Based on a PWC report (1999), the study classifies software firms according to their ‘knowledge intensive and competitive’ positioning. The firms are categorised according to core (systems software, programming languages and tools, data management/data mining) and non-core (software services and bespoke development, applications software, localisation services) software technologies. The core technology category is considered to be of the highest value to the Irish Software Industry by providing the potential to build internationally competitive firms in terms of their global positioning, market share and growth (Crone 2002). The number of companies participating in the core technology sectors is significantly lower than that in the non-core technology sectors. Within the core technologies categorisation, 21.9% of respondents develop systems software while 6.2% engage in data

management and data mining and 4% of respondents develop programming languages and tools. However, it was observed that a higher percentage of firms engage in non-core technologies with 50% of companies developing applications software, 26.3% offering bespoke software development and services and just 3.3% engaging in localisation activities (see Figure 5 and Figure 6).

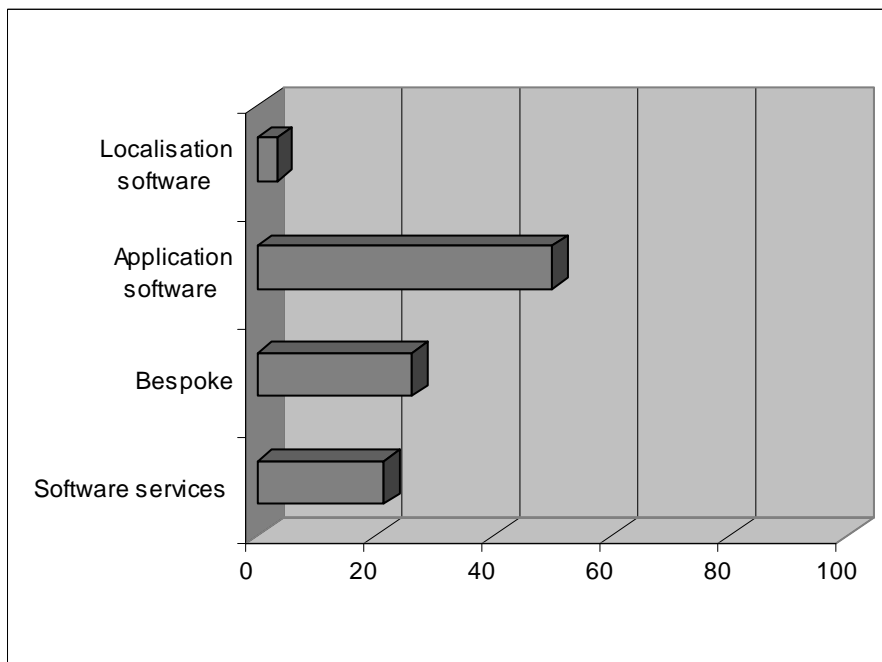
Differences between the indigenous and foreign companies of the Irish software industry were observed when analysing their core and non-core technology product and services. In general, the Irish firms surveyed provide both core and non-core technologies but are more heavily involved in non-core technology sectors. In the core technologies, 17.8% offer systems software technology, 7.9% data management and 4.5% programming languages. In the non-core technology, a significant number of Irish firms (51%) offer applications software, but also 25.7% sell bespoke software, 21.3% software services, and 3% localisation software. In contrast, foreign firms do not participate in the whole range of identified technology sectors. Within the core technology sector, they specialise highly in systems software technology (40%) but none of them sell the other two core technologies. However, within the non-core categorisation, foreign firms have some participation in all areas since one third (33.3%) operate in the localisation software sector, 26.7% in the bespoken software and 6.7% in the localisation software (see Figure 7). It was also observed that the size of the company is related to whether the company is involved in core or non-core technology activities. Most of the Irish companies involved in the core technologies are micro and small-sized, while medium and large indigenous firms are mainly involved in the non-core technology sectors. However, in the case of foreign firms the results were slightly different. Foreign involvement in the core (system software) technology sector consisted of mainly small and medium-sized firms, while most

micro and medium-sized companies were involved in non-core technology. In fact, 63% of foreign companies that participate in the non-core (application software) technology were medium-sized (see Figure 8 and Figure 9).

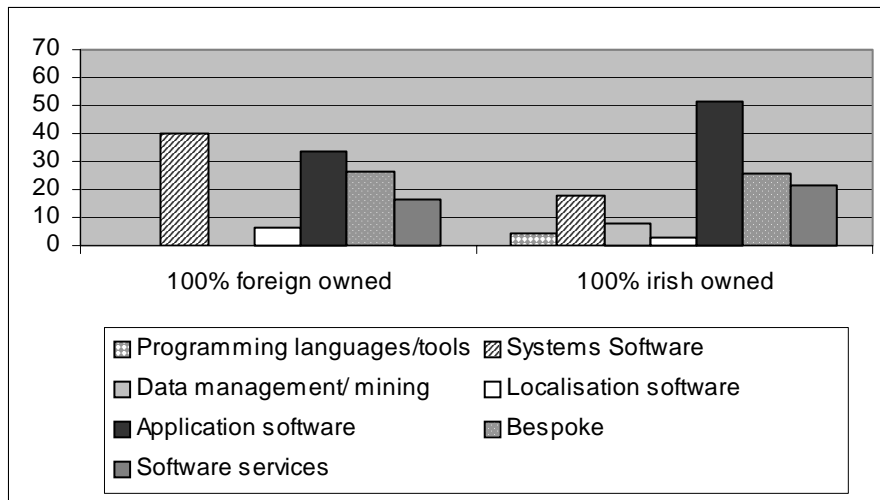
**Figure 5. Survey respondents classified by core technologies [% of companies]**



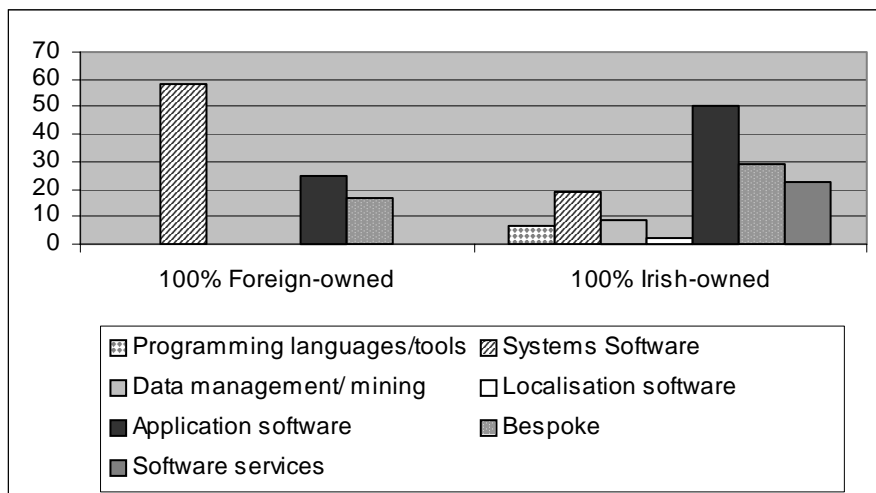
**Figure 6. Survey respondents classified by non-core technologies [% of companies]**



**Figure 7. Core and non-core technology companies classified by nature of investment [% of companies]**

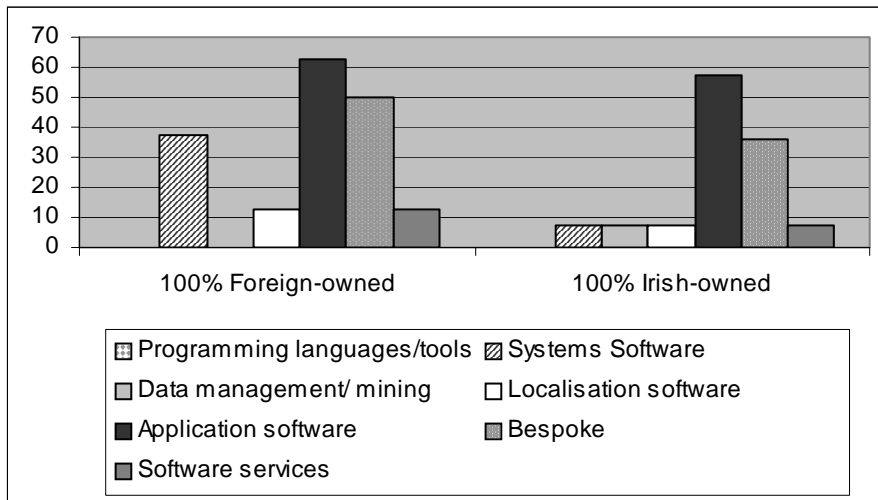


**Figure 8. Small-sized core and non-core technology companies classified by nature of investment [% of companies]**





**Figure 9. Medium-sized core and non-core technology companies classified by nature of investment [% of companies]**

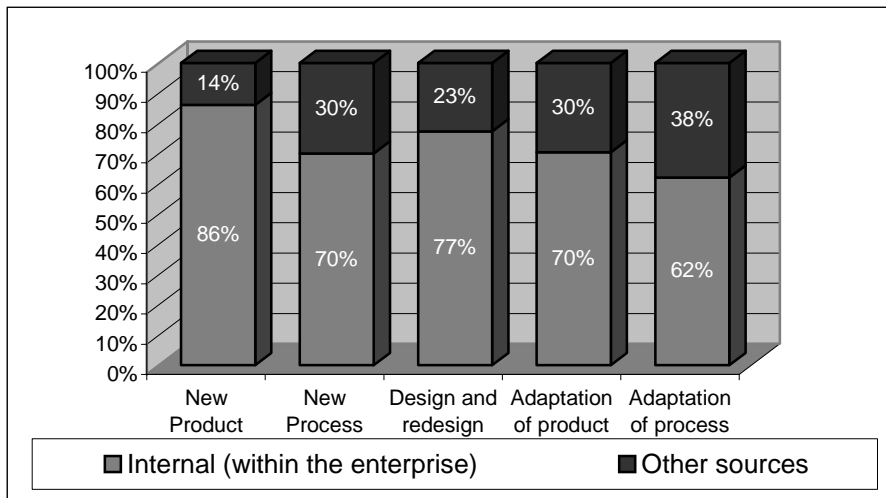


#### **4.2.2 Innovation processes**

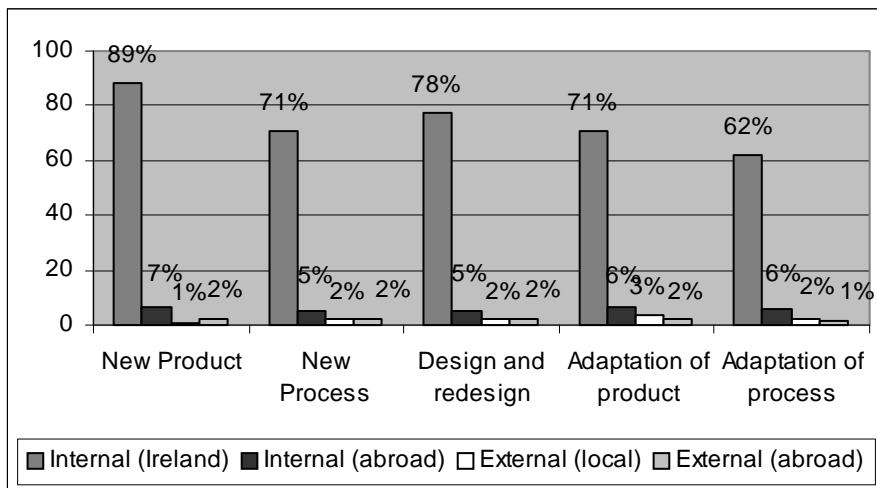
The survey indicates that the majority of the Irish software firms conduct their innovation processes (new product, new process, design and redesign, adaptation of product, adaptation of process) in-house within Ireland. In the case of new product development and the design and re-design of products, 83% and 77% of the firms respectively, use their in-house facilities. However, it is observed that an increasing number of firms also use other sources (either solely or in combination with their internal capabilities) for the remainder of their innovation processes. For instance, approximately one third of respondents are already using other sources for process development (30%), adaptation of product (30%) and adaptation of process (38%) (see Figure 10).

Analysing the different internal sources (Irish unit or foreign-based sites of the corporation) for KISA, it was found that the type of ownership greatly influences the extent to which a firm uses other units of its Multinational Corporation (MNC) to source its innovation processes. In the case of new product development 40% of foreign-owned firms use other parts of their MNC (e.g. parent company, centres of innovation, other subsidiaries), while only 7% of Irish firms do so for this innovation process (see Figure 11 and Figure 12).

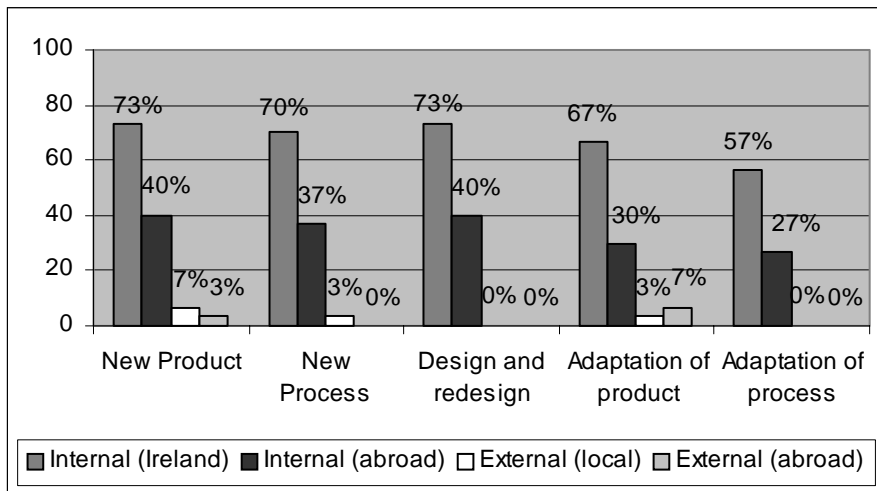
**Figure 10. Internal and external sources for innovation processes**



**Figure 11. Internal and external sources for innovation processes, 100% Irish-owned firms [% of companies]**



**Figure 12. Internal and external sources for innovation processes, 100% foreign-owned firms [% of companies]**

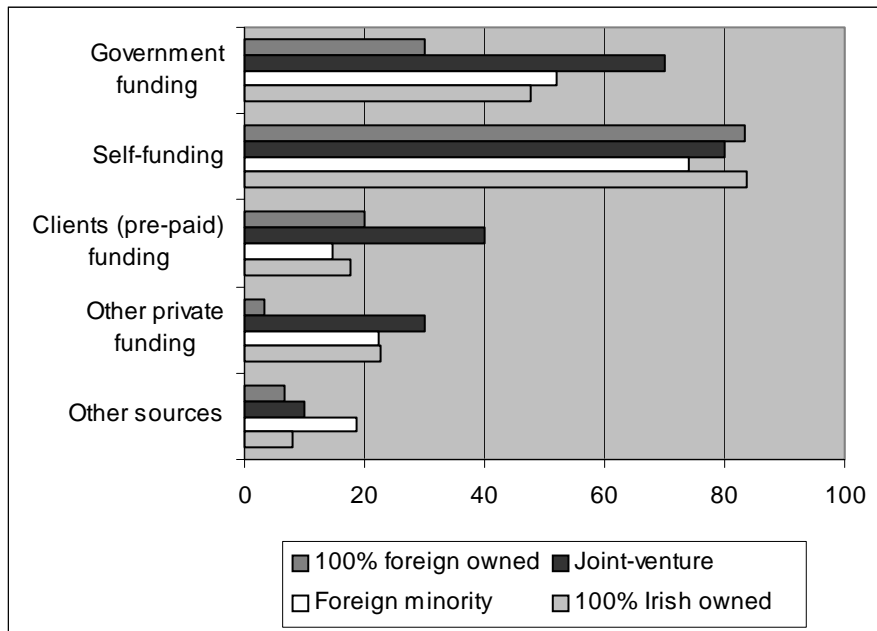


### **4.3. Use of different services**

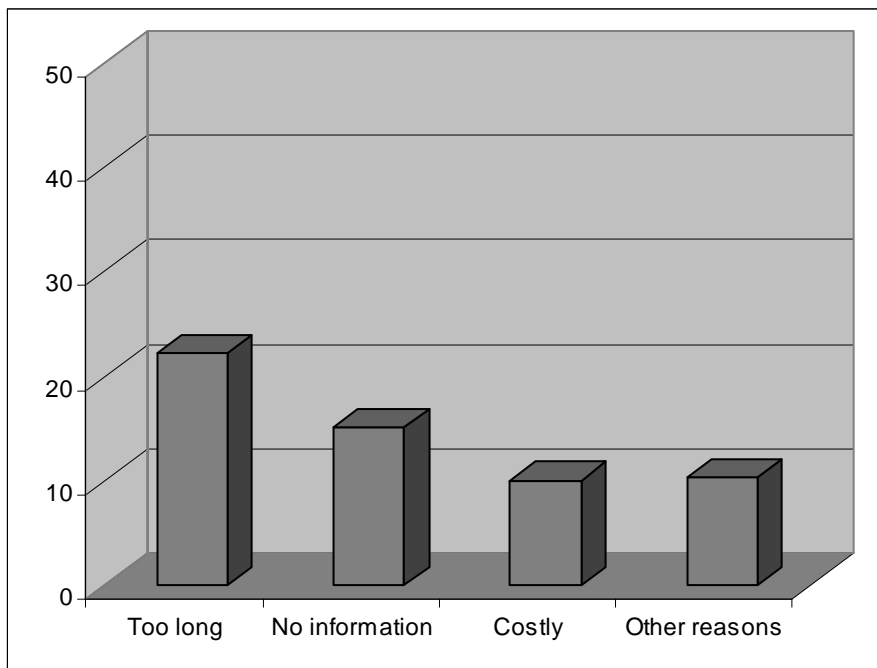
#### **4.3.1 Government funding and other financial sources**

It was found that the government plays a crucial role in financially supporting the innovation processes of the software sector with almost half (47%) of the analysed firms obtaining government grants in addition to private funding. While 70% of joint ventures access government funding, only 48% of Irish companies and 30% of foreign firms do so. In terms of the size of the companies, whereas 44% of micro and 53% of small-sized companies access government funding for their innovation process, all the large-sized and 86% of the micro-sized companies rely on self-funding (see Figure 15). However, two of the main reasons cited for not availing of government financial support was the lengthy process involved (22%) and the lack of information available (15%) (see Figure 14). With regard to private funding, 82% of respondents self-fund their innovation process, 19% rely on pre-paid (client) funding and 21% use other sources of private funding (see Figure 13). It was observed that companies with foreign investment use a wider range of funding sources than the Irish-owned firms.

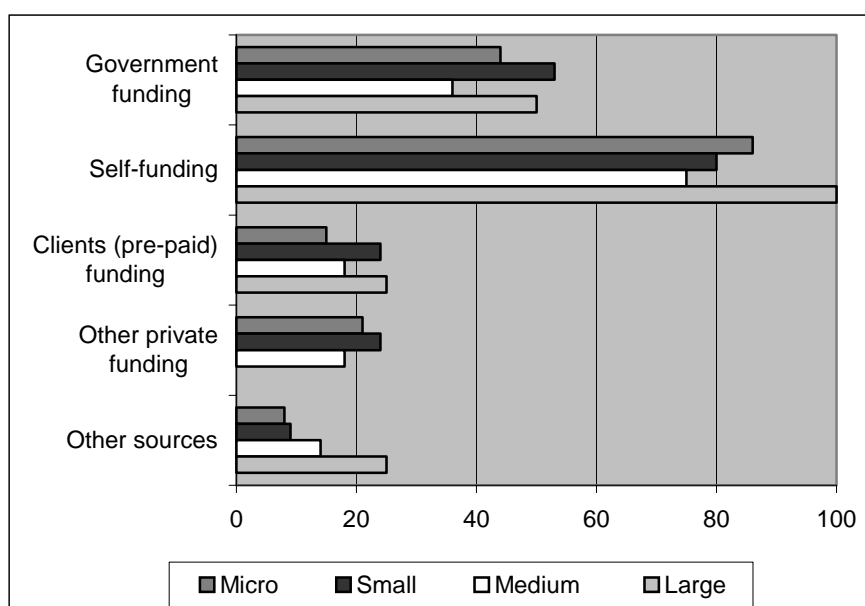
**Figure 13. Sources of funding accessed by companies, by nature of investment [% of companies]**



**Figure 14. Reasons for not accessing government funding [% of companies]**



**Figure 15. Sources of funding accessed by companies, by firm size [% of companies]**



#### 4.3.2 Internal sources for KISA

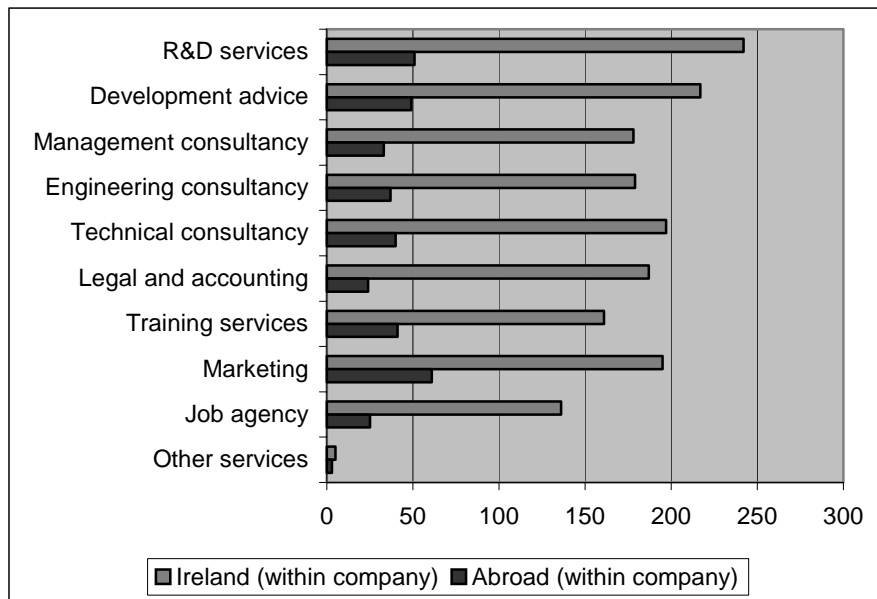
Generally, the companies access KISA internally within the Irish-based unit more than from any other source (including other units of their enterprise abroad and external public and private sources). Focusing specifically on internal sources for KISA (Irish base and other parts of the corporation), it was found that the surveyed companies use their Irish unit more than any other part of their corporation abroad. For instance, internal capabilities are accessed by 88.3 % of respondents for R&D services, 79.2% for development advice, 71.9% for technical consultancy and 71.2% for marketing services (Figure 16).

The nature of the company’s investment affects the extent to which the company uses foreign-based units of their corporation for KISA. While Irish owned firms access KISA primarily within their Irish base, foreign-owned companies rely to a greater degree on their units abroad for these professional services. Marketing services, engineering consultancy and management consultancy are accessed by foreign owned

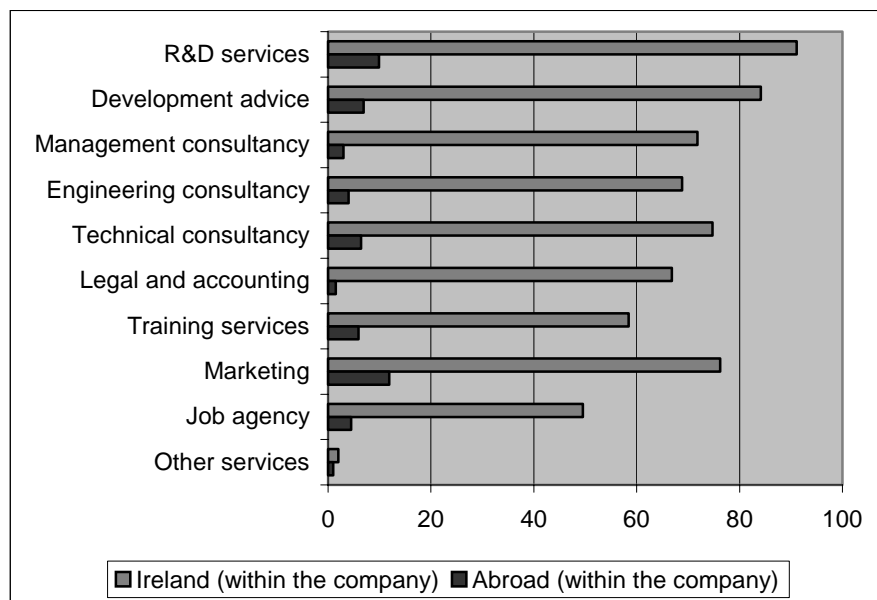
companies primarily in the units of their corporation abroad than in their Irish base, with 75% of foreign companies accessing marketing in their corporation sites abroad, 63% accessing engineering consultancy and 63% accessing management consultancy (Figure 17 and Figure 18). Combining the variables nature of investment and company size, the results show that there is a positive relationship between the size of the Irish-owned company and the extent to which it accesses KISA internally from parts of the corporation abroad i.e. the larger the company the higher the percentage of KISA accessed abroad. However, foreign micro and medium-sized firms rely more heavily on the units of the corporation abroad to source KISA than the foreign small-sized companies. The units abroad (within the company) are the principal internal source for most KISA of foreign micro-sized firms (see Figure 19).



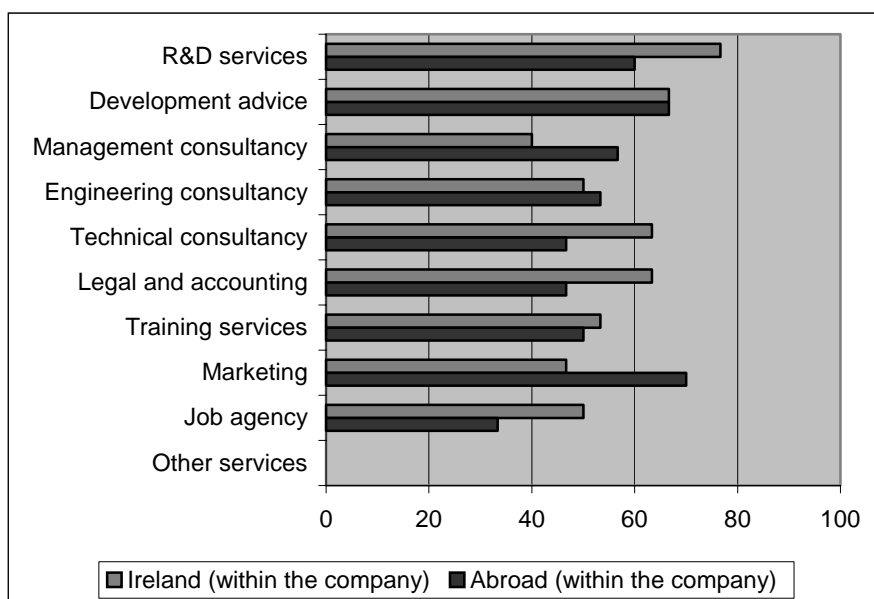
**Figure 16. KISA accessed from Ireland and abroad within the company [number of companies]**



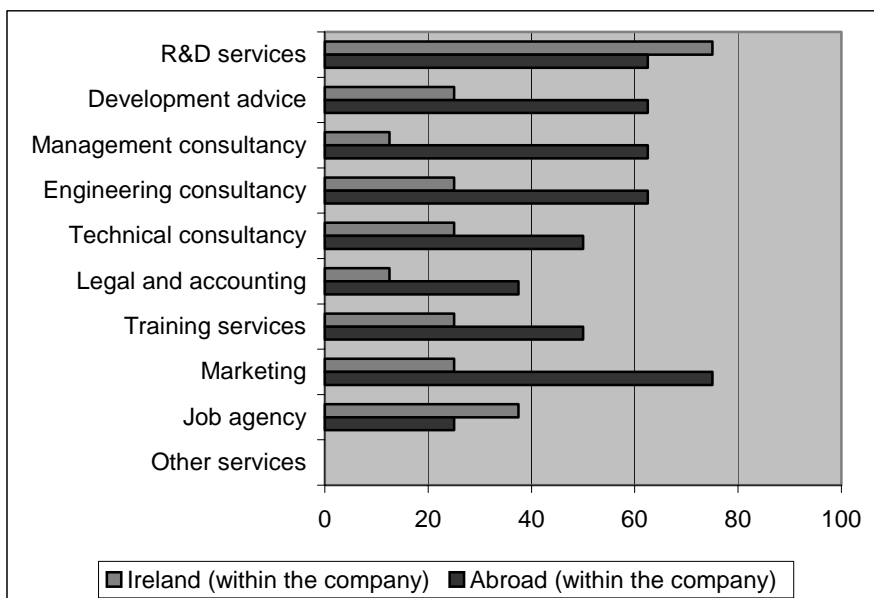
**Figure 17. KISA accessed from Ireland and abroad within the company, 100% Irish-owned firms [% of companies]**



**Figure 18. KISA accessed from Ireland and abroad within the company, 100% foreign-owned firms [% of companies]**



**Figure 19. KISA accessed from Ireland and abroad within the company, 100% foreign-owned micro firms [% of companies]**

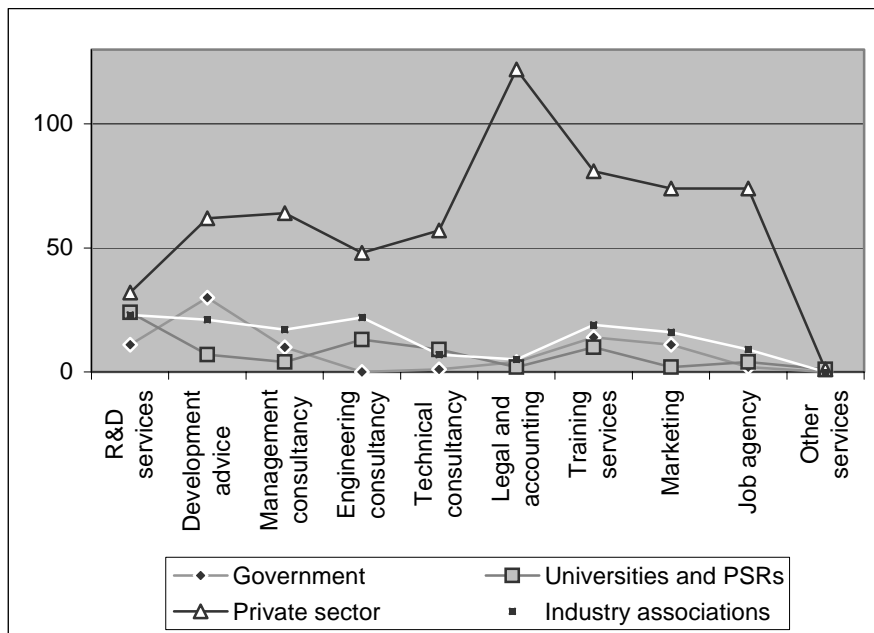


### 4.3.3 External sources for KISA

The private sector is the main external source for accessing KISA compared to other sources such as government, industrial associations, and universities and PSRs. Legal

and accounting services (44.5%), training services (29.6%), job agencies (27%), and marketing advice (27%) are the KISA accessed most from the private sector. In general, the other external sources are accessed much less frequently. Firms access the universities and PSRs most commonly for R&D services, engineering consultancy and development advice services and yet these only represent 8.8%, 4.7% and 2.6% respectively of respondents (see Figure 20). When the analysis is divided by nature of investment and company size, there is no significant difference observed, except in the case of R&D services, whereby 23.3% of foreign firms access universities and PSRs compared to 7.4% of Irish firms.

**Figure 20. External KISA accessed from the private sector, government, universities and PSRs and industrial associations [number of companies]**



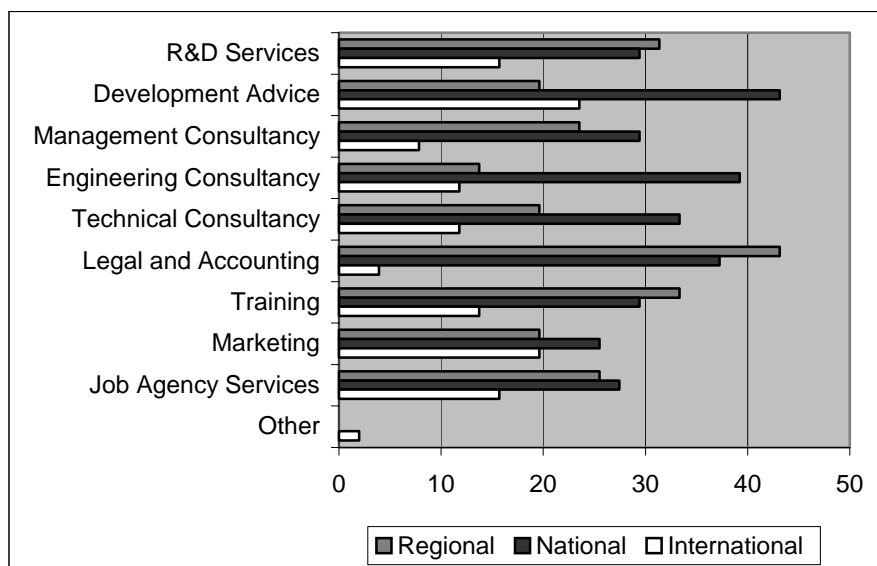
#### 4.3.4 Location of the external sources of KISA

Although KISA are accessed from a combination of external sources at regional, national and international levels, when each KISA is analysed individually it emerges that the external sources at the national level are the most widely used by respondents in general. However, when the respondents are divided into their respective regions, i.e. ATC or SEC, the analysis shows that those located in the ATC region access the

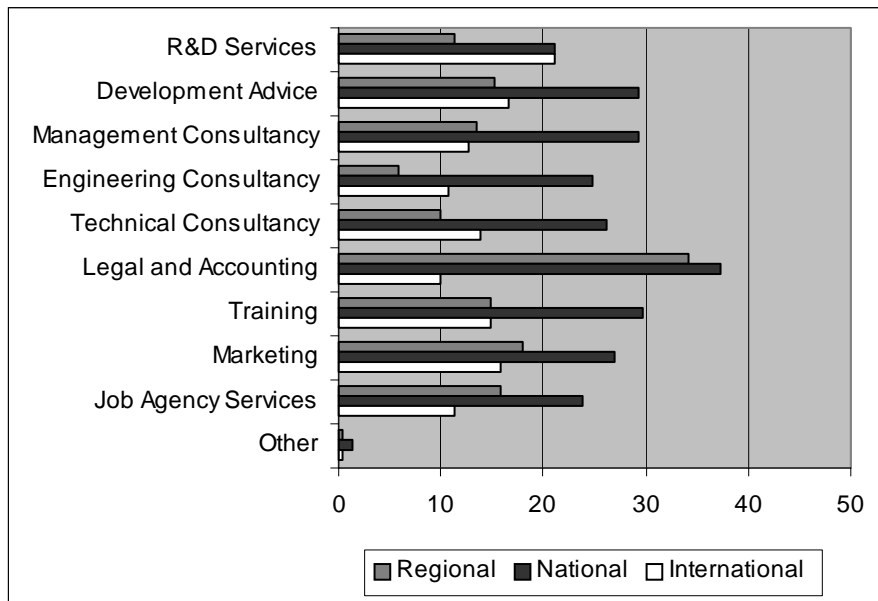
external regional base of services to a greater extent than the respondents located in the SEC region. In fact, in the case of R&D services 31.4% of the ATC respondents accessed this service regionally in comparison to 11.3% of SEC companies. Similarly, in the case of training services 33.3% of ATC companies obtained this service externally at the regional level compared to only 14.9% of SEC companies (See Figure 21 and Figure 22).

When foreign-owned companies are externally accessing KISA they generally rely on international sources more than regional or national sources. The international market is a much more important external source than the local market for R&D services, development advice, technical consultancy and marketing, with 43% of foreign-owned companies accessing R&D services internationally, 43% accessing development advice, 40% accessing technical consultancy and 37% accessing marketing internationally (Figure 23). Conversely, Irish-owned firms access the majority of their external services nationally.

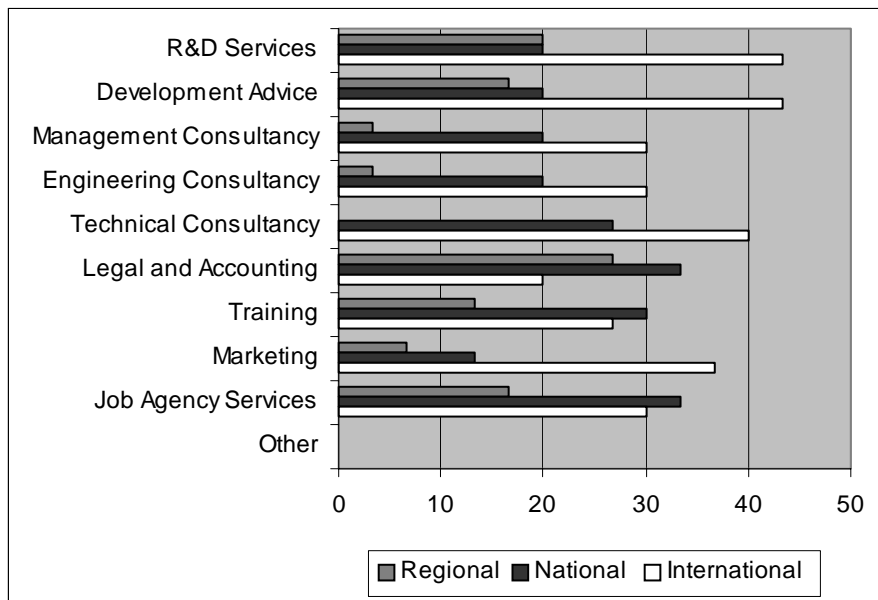
**Figure 21. External KISA accessed regionally, nationally and internationally by ATC region [% of companies]**



**Figure 22. External KISA accessed regionally, nationally and internationally by SEC region [% of companies]**



**Figure 23. External KISA accessed regionally, nationally and internationally by 100% foreign-owned companies [% of companies]**

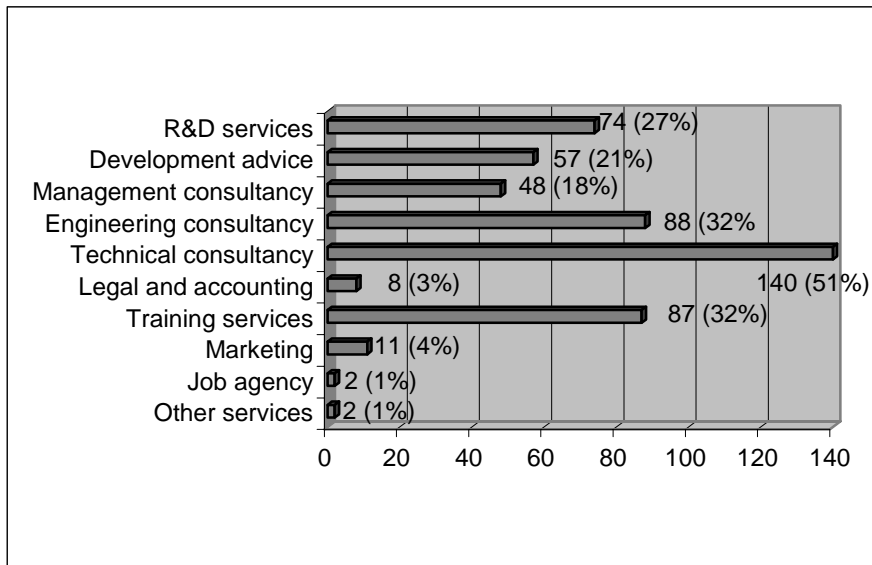


#### 4.3.5 KISA sold by the sample

Most of the respondents sell KISA, mainly in the areas of technical consultancy, training services, engineering services and R&D services with 51%, 32%, 32% and

27% of companies selling these services respectively (see Figure 23).

**Figure 24. KISA sold by survey respondents [number of companies]**



#### **4.4 Challenges and opportunities to the innovation process**

##### **4.4.1 Challenges to the innovation process**

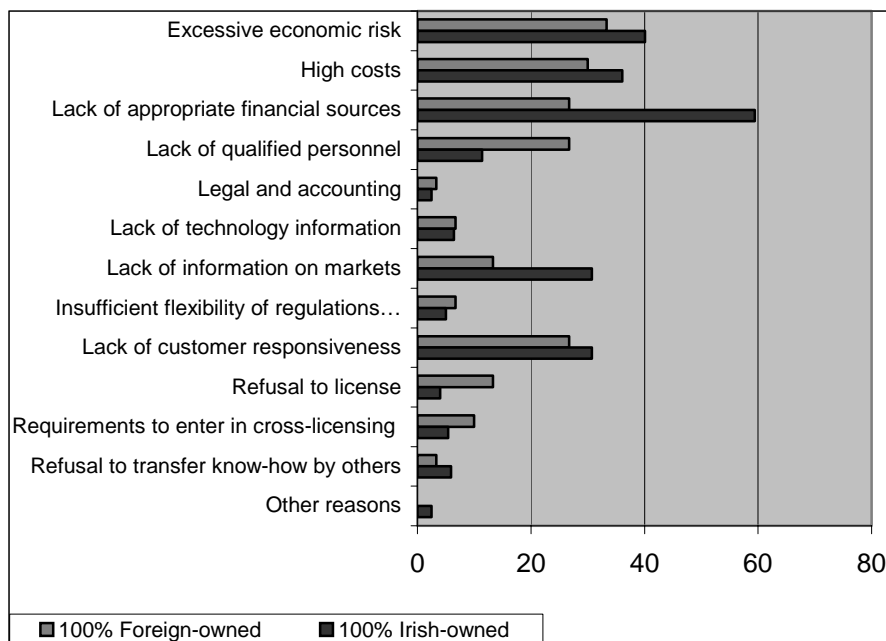
The main challenges to the innovation process identified as very important by firms were those of an economic nature, such as the lack of appropriate financial sources (52.9%), excessive economic risk (38.3%) and high costs (34.3%). Lack of information on markets (27%) and lack of customer responsiveness (29.6%) were also identified as major challenges by a lower but still significant number of respondents.

With further analysis of the indigenous and foreign sectors, the results indicate that the lack of appropriate sources of finance is of greater importance to Irish-owned companies than foreign-owned companies (59.4% of Irish-owned companies graded it as very important compared to 26.7% of foreign-owned companies). In addition, 30.7% of Irish-owned firms emphasised a lack of information on markets as a major challenge compared to 13.3% of foreign-owned companies. However, for the foreign-

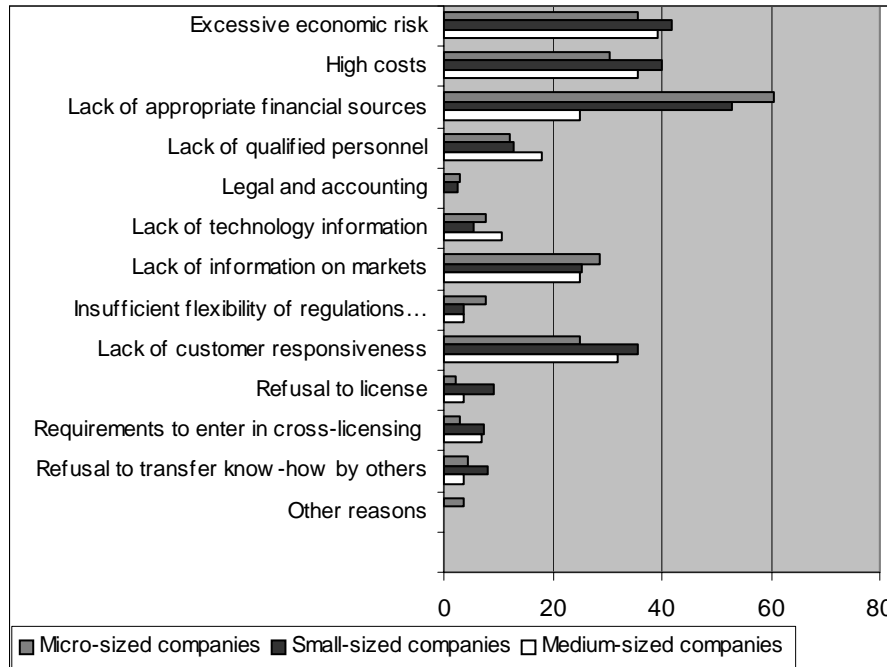
owned companies a lack of qualified personnel was cited as being very important for 26.7% of firms but for only 11.4% of Irish-owned firms (see Figure 25).

The fact that the sector is characterised by a large number of small-sized, self-funded firms may indicate that there are limited resources available for accessing external KISA for their innovation processes. The survey results support this idea as the lack of appropriate sources of finance for innovation becomes less important for larger companies. 60.6% of micro-sized and 52.7% of small-sized companies cited this challenge as very important while the percentage drops to 25% for medium-sized companies (see Figure 26).

**Figure 25. Challenges to the innovation process identified by respondents as ‘very important’ as classified by the nature of investment of the company [% of companies]**



**Figure 26. Challenges to the innovation process identified by respondents as very important as classified by the size of companies [% of companies]**

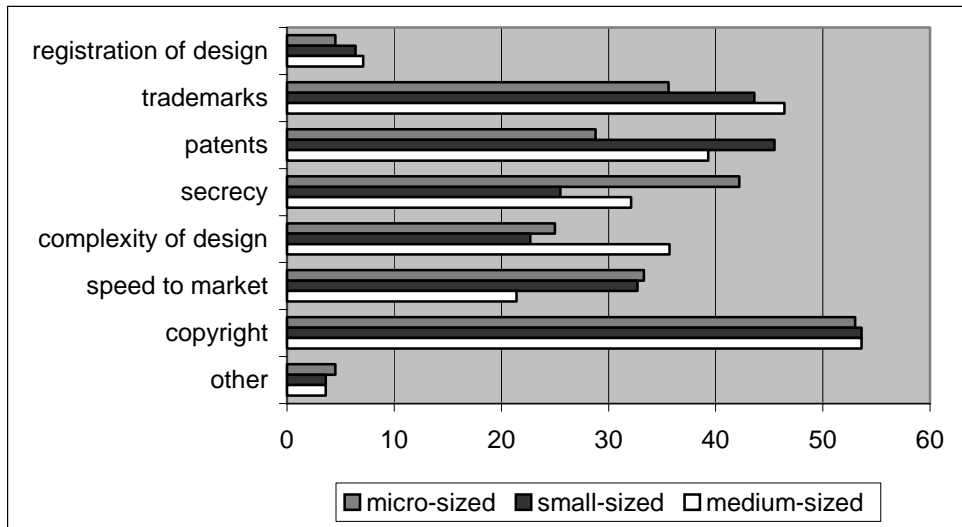


#### 4.5 Intellectual property protection

The survey results indicate that the firms use a variety of IPR (Intellectual Property Rights) policies to protect their innovations. Copyright is the main form of IPR policy used by respondents (53%), while trademarks and patents are used by more than one third of the analysed firms. Secrecy, complexity of design and speed to market are also used as intangible forms of IPR protection by 34%, 25% and 32% of respondents respectively (see Figure 27). Dividing the respondents by nature of their investment and company size does not reveal any major differences except in the case of secrecy whereby 36.6% of Irish-owned firms use this method compared to 16.7% of foreign-owned companies. This result is reinforced when the sample is divided by the size of company whereby the results show that 42.4% of micro-sized companies use secrecy as compared to 25.5% of small and 32.1% of medium-sized companies.



**Figure 27. IPR used by survey respondents as classified by size of company [% of companies]**



## **5. Step 3: Qualitative findings – use and integration of KISA in the Irish software sector**

In order to gain a deeper understanding of the innovation processes of companies and to analyse the integration of KISA, sixteen (7 indigenous and 9 foreign-owned companies) interviews were conducted with senior managers of product development and R&D departments of software companies in Ireland. The sample included firms located in the Atlantic Technology Corridor –ATC (Counties Galway, Limerick and Clare), and the South East Coast – SEC (Counties Dublin, Wicklow, Waterford, Wexford and Cork). The in-depth interviews covered four main sections as follows: overview of innovation in the software firm, the role of KISA in innovation in the software firm, barriers to the innovation process and control mechanisms, and opinions on policies and programs encouraging innovation. The interviews lasted for approximately one and a half hours. A more complete analysis of the interview results is presented in the document titled “ KISA in the Innovation Process of Irish Software Firms (Chapter 3 in: *The Role of Knowledge Intensive Service Activities (KISA) in Innovation of the Software Industry*, OECD 2005). This chapter is the first version of the analysis on the qualitative findings of the research.

### **5.1 The importance of KISA at different stages of the innovation process**

The software Product Cycle (PC) is divided into its three primary phases (Vernon 1966), in order to easily visualise the participation of each KISA in the innovation processes along it. The first, known as the innovation phase, is where the most radical innovations (creation of new products and processes) take place from product

conception to product market release. The product then enters the maturing phase where incremental innovations occur such as updated versions of the existing product. Finally, the product reaches the standardised stage where the focus shifts to cost competitiveness rather than incremental innovations. The findings confirm that the major innovations take place in the first phase of the product life cycle, and therefore, it was found there is a greater need for KISA in this phase rather than in the later phases. To fully describe the role of KISA within this period, this section segments into more distinct stages.

It was found that the development of a product from conception to market is a well studied and formalised process (see literature on organisational management and knowledge management<sup>16</sup>). Therefore, the innovation phase was further divided into a number of distinct stages: product conception, strategy and business development, product development, market testing and market release<sup>17</sup>. Figure 28 illustrates the participation of different KISA in each of these stages and shows that the process follows more a matrix rather than a linear form. The following section describes this figure in more detail.

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<sup>16</sup> Tidd, J. and Hull, F. *The organization of new service developments in the USA and UK*, SPRU/Fordham University, Graduate Business School, Brighton, New York, 2002. Krogh, G. V. and Roos, J. *Managing Knowledge, Perspectives on cooperation and competition*, Sage Publications, London, 1996.

<sup>17</sup> See Forssen et al 2004 for the division of the Product Release Cycle.

**Figure 28. Matrix: Participation of different KISA in each stage of the software product development process**

Product Development Phases/ KISA	Conception	Strategy	Business Dev't	Product Dev't	Market testing	Manufacturing	Market Release	Marketing & Sales
1. Research								
2. Development advice (strategic & business plan)								
3. Management (organization development)								
4. Engineering (product/process development)								
5. Technical consultancy								
6. Legal and accounting								
7. Training services (systems development)								
8. Marketing								
9. Other professionals								

Product conception can come from different KISA sources such as research laboratories, suppliers and customers. In fact it was found that the idea most commonly comes from the interaction between the company and the customer (*EC 2000*). It was found that the relationship the engineering and/or marketing departments develop with the customers allows them to identify new product ideas from applying software technology and learning the technologies of their customers' industrial sector (e.g. banking, insurance, biomedical). These customers are sometimes the company's own competitors that would work as partners to complement each other competitive advantage. The generation of new ideas can lead

to the formation of internal and external networks.

The 'strategy and business development' stage refers to the analysis of the idea in order for it to become a tangible and marketable technology. From the interviews it was found that the development advice (strategy and business plan) and management consultancy (organisation development) teams are the main KISA sources that work with the research laboratory, engineering consultancy department as well as the marketing and legal and accounting units to persuade the creation of the product, visualise its potential market and define the budget and other resource limits. Management consultancy is necessary to manage and coordinate efficiently the different resources needed to develop this product. In the case of the foreign companies this stage is mainly carried out at the HQ of the corporation located abroad.

It was found that engineers of the product development group (development managers, engineering managers, testing managers, and support engineers) are normally responsible for design, testing and in this way, developing the idea into a tangible product in the 'product development' stage<sup>18</sup>. In order to fulfil this role the group may gather information and feedback from other KISA sources such as advanced research services, technical consultancy (systems development), training services, marketing and professionals from the customers' industrial sectors.

The market testing phase, normally undertaken by the marketing unit, involves the release of an early version of the product from the product development group to a

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<sup>18</sup> See models for software product development in LC 1996, Rothman 1996, IPL 1996.

selected group of customers (who may be interested in being the first users of the technology for competitive advantage reasons). These customers offer feedback on the functionality of the product, which is filtered back to the engineering group. Once the product development group complete any major product changes to fulfil the expectations of customer and company, then the development advice/management consultancy team normally approves the release of the product. Legal and accounting service activities are required to establish particular intellectual property rights mechanisms for the product.

It was found that in the next phase of the product life cycle the engineers of the development group are more concerned with providing technical support (maintenance) to customers, which may lead to incremental innovation (or even give place to new product ideas). In this phase technology-based KISA are becoming less important than traditional-business-based KISA<sup>19</sup>. There are three levels of customer support from the following sources, call-centres, development groups and in rare cases support from the research laboratories for more complex technology problems. At this stage the marketing unit promotes the product and search for new market niches, while the sales and distribution unit would deal with all the logistical requirements to bring the product to the identified markets. Once again the foreign companies do most of these functions for their global-market products at the HQ, while the Irish firms will tend to perform these functions internally in Ireland according to their size as is explained further.

In the last phase of the product cycle, the product faces changing technologies and

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<sup>19</sup> See Miles et al 1994 for description of these KISA groups.

market saturation and therefore the company must compete on a cost basis rather than innovation. The expectations for the product are high quality, less customisation, and “...application straight out of the box at low cost...” Authors’ Interview. The findings indicate that the production may move to lower cost locations than Ireland, and the marketing department would look to expand the customer base. Although the focus is switched to cost competitive advantages rather than innovative technology advantages in the standardised phase, the literature says that the innovation process will continue happening (see Porter 1990, Taylor 1986, Hirschey and Caves 1981).

It was reported that the innovation phase of a product cycle could take from a couple of months up to two years. However, there are new methodologies (see as example the ‘Agile Methodology’ in Abrahamson 2002) that can enable the companies to reduce the product features release cycles up to two weeks. It was found that software products could exist in the market for more than twenty years without reaching the standardised phase. The common finding in this research is that the products created by the Irish units tend to stay ten years in the market before incremental innovations cease occurring. It was found in the interviews that the smaller Irish companies do not tend to have standardised products.

## **5.2 Integration of internal and external contributions to KISA**

### **Foreign software companies**

#### *Large software companies*

Since the interviews were mostly conducted with senior managers of the development

units of the Irish-based software MNC, the findings better explain the integrations of internal and external KISA of this unit rather than the ones of the entire Irish subsidiary. Following the description of the different stages of the innovative phase of the product cycle, it can be said that the development units participate mainly in the “product development” stage. The “strategy and business plan” is developed at the top hierarchical level in the HQ, which is normally located abroad. The MNC is organised by specific product areas, of which each one is headed by a Vice President (VP). The HQ defines the parameters by which each unit must work within (e.g. targeted technology, business strategy, budget limits). The Irish development unit (as well as other Irish subsidiary units) might take part in one or several of these product areas according to its business strengths (technological capabilities, costs, etc). Generally the Irish development unit specialises in developing a particular aspect within these product areas. The development unit in the Irish site of the MNC does not undertake advanced research but rather specialises in this specific aspect of a product area. In this way, they try to become centres of excellence within their corporation, while sourcing the other skills from elsewhere.

Consistent with our survey findings, the interviews confirmed that the Irish-based foreign units tend to source its engineering, management (organisation development) and marketing KISA from units located abroad within the MNC, rather than from the other units located in Ireland. From the interviews, it emerged that the engineers of the Irish-based foreign development unit are in constant contact with engineers of other units (abroad) within the MNC who participate in the same product area. They share and complement each others’ knowledge in order to develop their product areas. Since the Irish-based unit generally produces for the global market, it works

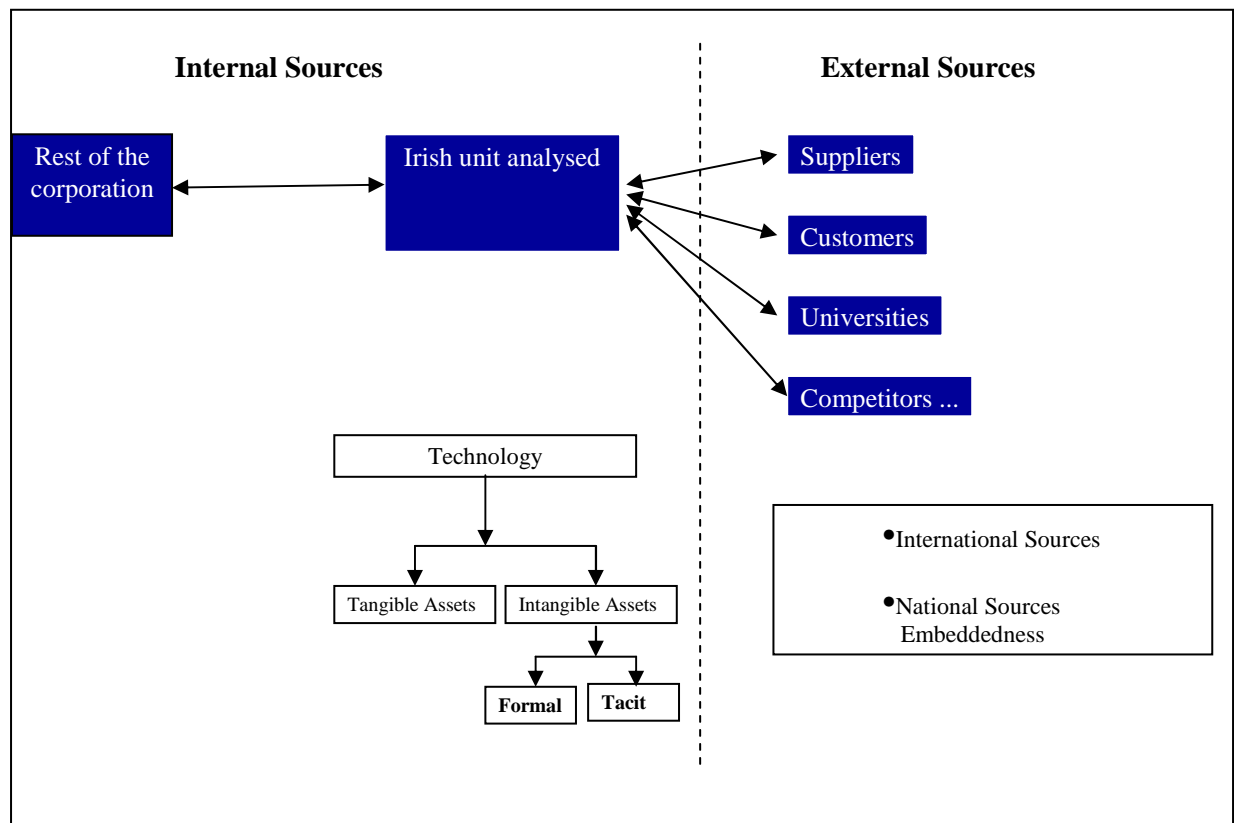


constantly with the marketing department located at the HQ abroad, giving each other feedback on product development and market testing.

The development units interviewed reported that their MNCs are self-sufficient in terms of the required KISA. However, companies have to form linkages with external KISA providers to be informed about state-of-the-art technology in the different KISA markets. Of the KISA accessed externally by these companies, they develop links with local suppliers to obtain lower technologies such as translations, technical writing and training. They tend to access higher technologies from suppliers (mostly MNCs), which are located abroad or represented by a subsidiary in Ireland. These software firms choose other MNCs as their high-technology suppliers as they can offer global production services. Most of the interviewees view the Irish universities as KISA sources for training and accessing third level graduates. While most of them are involved in R&D programmes with the universities, funded mainly by Science Foundation Ireland, none of them reported to have internalised this R&D. This could be due to the fact that many of these programmes are in an early phase.

The units interviewed acknowledged that they did not expect to integrate the skills of the KISA suppliers internally except in the case of training services. In this way they try to remain focused and not to be “contaminated” by learning new areas that they do not want to become involved in. Some are interested in understanding the KISA of their suppliers in order to 'exploit' opportunities. In only a few cases, they may consider learning from their KISA suppliers, especially R&D activities but it is not a common case reported.

**Figure 29. Sources of KISA contributions**



***Medium, Small and Micro foreign software companies***

Smaller Irish-based subsidiaries have fewer departments located in Ireland. These smaller foreign firms tend to focus on specific functions of the MNC in order to penetrate the regional market. They access most of their needed KISA internally from other parts of their MNCs located abroad (see survey findings in Step 3 –Quantitative findings). These small companies stated that they have some autonomy to develop links with local suppliers in order to obtain KISA relevant to the local market such as legal and accounting and job agencies.

## **Indigenous software companies**

It was found that most of the indigenous software industry is comprised of micro (1-9 employees) and small (10-49 employees) companies. These companies are often better described as software development 'units', centred on technologists (mainly engineers) or innovators who create solutions to technical problems. The software development unit has to master the performance and integration of different engineering related KISA, such as development management, engineering management, testing engineering and support engineering, in order to develop a new idea into a marketable product. To successfully compete in the international market both the complex knowledge of product development (often in the form of the above mentioned engineering related KISA), and also the accumulation of unique skills in a specific and highly specialised technological area of the software industry are required. Such specialisation is highly sophisticated and may take several years to achieve.

Moreover, in order to be innovative and competitive in the software market, firms have to access and combine several KISA not only from engineering, but also from other professional fields such as management, marketing, finance, legal, accounting, and so on. Since most of the indigenous software companies are of a small size they are not as self-sufficient as the large foreign firms and therefore, they must look for external sources to obtain or complement their internal KISA. Indigenous software firms then focus on performing core KISA in-house, and outsourcing those at the periphery from specialised firms. More indigenous firms use external sources for high technology KISA than the foreign firms such as, R&D, marketing, legal and

accounting, sales and distribution, training, engineering, and technical support. The interviews show that legal and accounting and training services are accessed at the national level. These interview findings are consistent with the survey results (see Step 3). Commonly the interviewed indigenous firms access external KISA, looking to internalise them especially the ones related to their core technologies, however, due to limited resources, this is not always possible or convenient. The interviewees reported that they try to build long term relationships with their KISA providers since it facilitates knowledge transfer based on reliability and trust.

## **6. Conclusions**

The research objectives of this paper are to understand the importance of KISA in the innovation process of the Irish software sector and to analyse whether the appropriate conditions exist for their development. As it was required in the overall OECD KISA project (2002-2005), the analysis was divided in three steps as follows: Step 1: National statistics on the contours of the computer and related activities services in Ireland, Step 2: Identification of government programmes and policies for the Irish Information and Communication Technologies (ICT) and software sectors, Step 3: Quantitative findings -analysis of the KISA in the innovation process of the software industry in Ireland, and Qualitative findings –use and integration of KISA in the Irish software sector. Major primary and secondary national statistics sources were contacted to obtain the needed information for Step 1. Data contained in Step 2 was accessed from several other organisations through government reports, telephone inquires and the internet. Also the results of a postal survey to 808 software firms (with 40.1% response rate) and interviews with senior managers of 16 of these firms are presented in Step 3. A thoughtful literature review was conducted along the three

steps of this project.

It can be concluded that the providers of KISA are the carriers of knowledge that lead to innovation within the software sector, as is evident from the breakdown of the product life cycle, which shows that the majority of KISA are performed in the innovation phase. As the aim of the Irish software firms are to be highly specialised in developing a particular product area they therefore concentrate on these KISA that are core to their technology and source the peripheral service activities externally. In terms of accessing these KISA, many of the firms find that long distance communication (specially with knowledge sources located abroad) is a problem for the transfer of tacit knowledge that is crucial for innovation. More institutionalised knowledge networks would allow for the flow of knowledge among actors such as universities, government and the private sector, and facilitate the identification of KISA providers that exist at the national and international levels. It was observed (in Step 1) that more complete statistical information from national primary sources about the software industry and its required services can facilitate the conduction of in-depth analyses (such as the present one) on the innovation development of the software sector. These studies will facilitate the formulation of more customised policies for the software sector that can complement the existing horizontal innovation policies (some of them are shown in Step 2). These policies concern, in particular, patterns of R&D of the various institutions involved in fostering co-operation and innovation among private and public entities in the regional network.

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[www.education.ie](http://www.education.ie)

[www.entemp.ie](http://www.entemp.ie)

[www.enterprise-ireland.com/industry-programmes.asp](http://www.enterprise-ireland.com/industry-programmes.asp)

[www.enterprise-ireland.com/rdc/](http://www.enterprise-ireland.com/rdc/)

[www.enterprise-ireland.com/rti/](http://www.enterprise-ireland.com/rti/)

[www.fas.ie/FAS\\_Review/lifelong.html](http://www.fas.ie/FAS_Review/lifelong.html)



[www.ibec.ie](http://www.ibec.ie)

[www.icsti.ie](http://www.icsti.ie)

[www.ictireland.ie](http://www.ictireland.ie)

[www.ida.ie/whyireland.taxation.asp](http://www.ida.ie/whyireland.taxation.asp)

[www.intel.com/capital/portfolio](http://www.intel.com/capital/portfolio)

[www.ircset.ie](http://www.ircset.ie)

[www.isa.ie](http://www.isa.ie)

[www.ncte.ie/abouttheNCTE/ICTPolicy/d247.PDF](http://www.ncte.ie/abouttheNCTE/ICTPolicy/d247.PDF)

[www.ndp.ie](http://www.ndp.ie)

[www.nmrc.ie](http://www.nmrc.ie)

[www.nsai.ie](http://www.nsai.ie)

[www.nsd.ie/hm/comm\\_rad.informatics/informatics2003.pdf](http://www.nsd.ie/hm/comm_rad.informatics/informatics2003.pdf)

[www.sfi.ie](http://www.sfi.ie)

[www.technologytransfer.ie](http://www.technologytransfer.ie)

## **Appendix: Abbreviations**

AF: Audiovisual Federation

AUA: Atlantic University Alliance

CEDA: Consumer Electronic Distributors Association

CIMRU: Computer Integrated Manufacturing Research Unit

CISC: Centre for Innovation and Structural Change

CSF: Community Support Framework

EGFSN\*: Expert Group on Future Skills Needs

EI: Enterprise Ireland

EU: European Union

EXC\*: Excellerator Programme

FAEI: Federation of aerospace Enterprises in Ireland

FDI: Foreign Direct Investment

FP6: Sixth Framework Programme

GDP: Gross Domestic Product

HEA: Higher Education Authority

IBB: Irish Business Bureau

IBEC: Irish Business and Employers Confederation

ICIA: Irish cellular Industry Association

ICSTI: Irish Council for Science, Technology and Innovation

ICT: Information and Communication Technology

ICTSCC: Information and Communications Technology Standards Consultative Committee

IDA: Industrial Development Authority

IRCSET: Irish Research Council for Science, Engineering and Technology

ISA: Irish Software Association

ITAG: Information Technology Association Ireland

KISA: Knowledge Intensive Service Activities

MIG: Music Industry Group

NDP: National Development Plan

NMRC: National Microelectronics Research Centre

NUIG: National University of Ireland, Galway

OECD: Organisation for Economic Co-operation and Development

OST: Office of Science and Technology  
PAT: Programmes in Advanced Technology  
PPF: Program for Prosperity and Fairness  
PRI\*: Public Research Insitutions  
PRTL: Programmes for Research in Third Level Institutions  
R&D Cap\*: Research and Development Capability  
R&D: Research and Development  
RTDI: Research Technological Development and Innovation  
RTI: Research Technology and Innovation  
S&T: Science and Technology  
SAP\*: Strategic Action Plan  
SFI: Science Foundation Ireland  
SME: Small and Medium Enterprise  
STI: Science, Technology and Innovation  
TFF\*: Technology Foresight Fund  
TIF: Telecommunications and Internet Federation

TTI\*: Technology Transfer Initiative  
UCC: University College Cork  
UL: University Limerick  
UNI: Universities

Note: These abbreviations were created by the writers of this report for convenience when creating Figure 1 and are not official abbreviations of the organisations or policies and programmes involved.