Skills Requirements of the Digital Content Industry in Ireland: Phase 1

A study by FÁS, in conjunction with STeM Research Centre, DCU, for the Expert Group on Future Skills Needs

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February 2005

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ISBN No: 0-947776-34-6

Executive Summary

1 Introduction

In 2002 Forfás published a report on the digital content industry entitled 'A Strategy for the Digital Content Industry in Ireland' based on a detailed report by Price Waterhouse Coopers (PwC). The report identified the opportunities this new industry represents for Ireland and identified a number of sectors with particularly good growth potential. These included the games, e-learning and wireless sectors. It was felt that there was a shortage of technical skills in Ireland in these high growth areas, in addition to a lack of business skills in many companies in the sector. It was, therefore, suggested that a further study was required to provide an assessment of the employment and skill needs of the industry. The Expert Group on Future Skill Needs decided that such a study should be carried out and FÁS agreed to conduct the study on behalf of the Expert Group. FÁS was assisted in certain parts of the study by Professor P. Preston and researchers from the STeM Research Centre in Dublin City University.

The study consisted of a review of relevant literature, interviews with companies in the industry in Ireland, the gathering of information on existing education and training provision in Ireland and discussions with relevant agencies and representatives of the industry. Three particular sectors, games, wireless and e-learning, were given particular attention for analysis. It is noted that the study did not include interviews with overseas multi-nationals that might, in the future, consider investing in Ireland. This, it is suggested, should form a follow-on to this study.

Globally, it is expected that the digital content industry will be worth $434 billion by 2006 (PwC, 2002). The digital content industry is considered to have significant growth potential for Ireland[1]. The Irish government has identified this, and has already committed a significant amount for the setting up of the Digital Hub to develop an international digital enterprise area in Dublin. The Enterprise Strategy Group report has identified the increasing importance of internationally-traded services in Ireland, specifically including creative services, educational services and e-services. It has also emphasised that marketing and R&D are key to success in these areas. For Ireland to capitalise on the potential growth it is necessary to ensure that the skill sets required are in place.

There are 4,000-4,500 persons employed in the digital content industry in Ireland. Following a period of very buoyant demand in the late-1990s and up to 2001, the industry has since remained broadly static in employment terms. Somewhat more than half of employment is in foreign-owned companies. The majority of the indigenous companies are small, employing less than 10 people. For this reason, there is often a need for individuals who are multi-skilled. As a company expands, however, the need for specialised skills will increase. These issues need to be considered when examining the future skills needs of the industry. The industry comprises both companies making new

[1] Note: the Forfás report did not include forecasts of the extent of future growth in the digital content industry in Ireland.

products/services (e.g. downloading ring tones) and developing existing products/services using digital means (e.g. animation). Thus, convergence with existing industries such as publication and film is on-going and the boundaries between digital content industries and other industries is very fluid. Many persons with education and skills suitable for the digital content industry would also be suitable for other industries. This makes education/training planning very difficult.

2 Occupation profile and employment outlook

Nine families of skills were identified through both the interviews and the literature review. These were:

Software Development	Content Authoring	Management
IT and Systems Support	Media Authoring and Design	Sales and Marketing
Quality Assurance and Testing	Other Specific Skills	Generic Skills

Although most employees would have jobs within one of the nine areas, it is a feature of the industry that employees need to be able to work across a range of activities. Thus, an ideal employee would be competent in technical, creative and business areas.

The majority of employees in the companies interviewed were in the Media Authoring and QA testing families. Over a quarter of companies interviewed stated that they would need more media authors in the coming three to five year period, with 22% expecting to recruit more software developers. The larger multinationals, operating in Ireland, predicted employment to increase in the areas of project management, QA testing and customer support. Further study will be required to assess the views and needs of international companies that are hoping to invest in Ireland in coming years.

Over the last couple of years companies in Ireland have not faced significant recruitment difficulties and there still remains a substantial level of uncertainty about the future prospects of the industry in Ireland. There is general agreement that in the medium and longer-term there should be considerable growth in output and employment. However, take-off will depend both on a much improved performance from indigenous industry and the attraction of a number of large overseas investments. The report forecasts an increase of 2,000 jobs by 2008 under these circumstances.

3 Education and training provision

Enrolment and graduation data were collected for digital content-related courses in third-level institutions in Ireland. There are currently over 200 courses in Universities and Institutes of Technology that produce graduates who are suitable to work in the digital content industry, with nearly half of these at Degree level[2]. The majority of courses are

[2] Of course, the majority of these graduates will enter other industries (eg ICT).

in the computing/IT field although a further 44 courses relate to multimedia applications and technologies. Nearly 14,000 students enrolled in the academic year 2002/2003, with enrolments increasing by 15% in the multimedia application courses from the previous year. Over 11,000 students graduated between 2000 and 2002, the majority in the computing/IT and engineering (electronic/computing/software) fields.

There are a number of initiatives currently running in second-level education to encourage the uptake of digital media. These include the Liberties Learning Initiative, FÍS (the film project for primary schools), the Technology Integration Initiative and Scoilnet.

The provision of training is essential for the development of the digital content industry in Ireland so as to keep up to date on technological advancements. At present, the majority of small companies in Ireland depend mostly on in-house training and do not generally have a training plan for staff. The larger companies and/or branches of multi-national companies tend to have a more structured training approach. The availability of training services provided for the film and TV sector by FÁS/Screen Training Ireland (STI) has been invaluable for the skills development of that sector. A similar service is required for the broader digital content industry. There is, therefore, a need to broaden FÁS/STI's remit to include the digital content industry.

4 Main conclusions

Although the availability of staff is not considered to be a major concern at present among companies in Ireland, there are areas where skills gaps occur. A general theme of the research was the need for a mixture of technical, business and creative skills. In most cases, businesses were established by technical/creative people with little management or business knowledge or experience. A lack of sales skills is also an issue for the development of the indigenous industry. In addition, specific skills such as game console programming and knowledge of software packages such as Maya, are in short supply at present, resulting in companies often having to recruit abroad to meet their needs. As the industry progresses in Ireland demand for specific skills will increase. Also, the attraction of multinational companies to Ireland is more difficult when the skills required are not readily available in Ireland.

One method of meeting the future needs for specialised software development employees, while also benefiting the broader computing industry in Ireland, is to revise a number of existing computing courses so as to encompass elements of the digital content industry, such as wireless or games. This would aim to increase uptake of computing courses, currently in decline, while also producing graduates with specific skills who are suitable for work both in the digital content industry and the ICT industry.

There is a need for business and communication skills to be included in the curriculum of both technical and creative courses, along with the option of sales and marketing modules. A post-graduate qualification in 'Digital Media Management' would benefit the industry in this regard and should contain modules in the above areas. FÁS/STI

should arrange for courses in business-related skills to be made available to address the needs of the current workforce. Training programmes, such as through the Digital Media Forum, should also continue. Sales training programmes, such as those being run by the Irish Software Association, Enterprise Ireland and FÁS, should be made available for those in the digital content industry. A recent study by the Expert Group on Future Skills Needs has addressed the needs for management development in SMEs. The recommendations from that report should be implemented, thereby improving management skills within the digital content industry in Ireland.[3]

Academic and industry partnerships are essential for the success of the industry so as to ensure that students are covering the latest developments and relevant areas and also have some knowledge of the industry on graduation. This can be attained through collaboration between industry and third-level institutions on course development, work experience, guest lectures and also critiquing of projects where possible.

Further research is required to get a better understanding of the views and needs of potential multi-national investors so as to ensure Ireland has the skills to remain competitive and attractive. Forfás have agreed to conduct this second phase of research, focusing particularly on the international dimension.

Responsibility	**Recommendations**
Universities, Institutes of Technology	Re-formulate and re-brand a number of existing computing and computer-related courses in universities and Institutes of Technology to include skills relevant to the digital content industry. It is suggested that approximately one tenth of existing courses be modified within the medium-term.
	Third-level technical courses related to the digital content industry should ensure that students develop skills and knowledge in project management, general business and communication skills. This is likely to require close inter-departmental collaboration.
	A Postgraduate Diploma in 'Digital Media Management' should be established in a Dublin third-level institution.
	Optional sales/marketing modules should be made available in technical third-level courses to meet the need for technical sales jobs.
	Third-level institutions should involve the industry in curricula development, work experience, guest lectures and critiquing student projects wherever possible.
	Some existing third-level marketing/sales programmes should have a particular focus on the broad digital media industry.
Expert Group on Future Skills Needs	Implement the recommendations of the EGFSN report on SME management development to meet the skills needs of managers in the digital content industry.
Enterprise Ireland, FÁS	Sales training oriented to the specific needs of the digital content industry should be made available as necessary.
FÁS, Irish Film Board	The remit of FÁS/Screen Training Ireland should be extended to

[3] It is expected that the study will be completed by December 2004.

	cover the digital content industry. FÁS/STI should then provide a wide range of training courses to meet the training needs of the industry.
EGFSN/ Forfás	Phase 2 of this study should be undertaken by Forfás in 2005, focussing on the skills needs of the international industry, including the views and needs of potential FDI companies.

4.1 Games

Globally, games represent the biggest sector with an estimated worldwide value of €50 billion in 2001 (28% of the industry as a whole). This sector is considered a key growth area for Ireland. It is currently estimated that there are 14 games companies in Ireland, employing approximately 300 people. There have already been a number of activities to promote the industry in Ireland. These include the establishment of the games industry forum, gamedevelopers.ie, to promote the sharing of knowledge and resources among developers. An Irish chapter of the International Games Development Association (IGDA) was also launched earlier this year, again encouraging networking and sharing of resources both locally and globally. The Digital Hub, in collaboration with EI, IDA and Diageo Ireland, ran an Irish selection for the Dare to Be Digital competition for the first time this year, with the winning team having the opportunity to go to the University of Abertay to develop its game concept into a working prototype. All of these initiatives are encouraging for the future growth of the games sector in Ireland.

Project management skills was one of the most obvious areas found to be lacking in Ireland, most recently reiterated at the Irish game developers conference 'Awakenings' in October 2004. This is particularly important for games companies as they are most likely to be working with large teams, a significant budget and a strict deadline. This year's E3 Conference in the USA reported particular challenges in recruiting skilled programmers and games designers. Our research indicates that there is a need to ensure that there are sufficient programmers with the specific skills to work on particular platforms e.g XBox, Playstation etc. Up until recently there were no Degree programmes for the games industry in Ireland. Thus, at present, companies often have to source specific skills from overseas. A new Degree programme has now commenced in IT Carlow with a further games programme in Dundalk IT due to begin in the next academic year. Skills for games artists also need to be addressed, with the lack of skills in Maya a concern when attempting to attract FDIs to Ireland and, indeed, when developing products for the international market.

Along with the recommendations listed above in the main section, the following additional recommendations are considered necessary to ensure the progress of the games sector in Ireland. A fuller explanation of the rationale for these recommendations is given in the main report (Chapter 5).

Responsibility	**Recommendations**
IT Carlow/ Dundalk IT	Any new Degree course in games programming should include elements of console and online programming, C++ programming,

	AI, networking skills, team working skills, project management, communication skills, work experience and a market-oriented, final year project.
Ballyfermot College FE, Dundalk IT, Universities, Institutes of Technology	Any course for games designers should include elements of soft skills, such as communication and team working, business skills, project management, scheduling and a general technical understanding of all elements of games development.
IT Carlow, Letterkenny IT, DLIAT, HEA, Dept of Education and Science	The Masters programmes in the games area, currently under development, should be supported to commence in the short-term.
FÁS/ Screen Training Ireland	Short courses in MAYA need to be made available to update the skills of games artists.
	FÁS/STI should make available suitable short business-related (including project management) training courses for games producers.
Digital Hub, IGDA Ireland	The Digital Hub and IGDA Ireland should act as intermediaries between companies and training establishments to ensure that training needs are met.
	The Digital Hub should facilitate the development of a cluster of games developers in Ireland.

4.2 E-learning

The e-learning sector in Ireland is reasonably established with a number of relatively large companies currently based here. It has been Ireland's most successful sector to date with a turnover of €400 million in 2002. Of the 39 companies located in Ireland, five are international, with total employment for the sector estimated at approximately 700-800. This sector was affected by the downturn in the world economy, resulting in a number of closures and redundancies, although business has begun to pick up again. E-learning is divided into corporate and education – both considered lucrative markets. An increase in the uptake of blended solutions (i.e. the combination of e-learning packages with conventional teaching), has led to a further need for skills in client management. The eLearning CEO Forum have also highlighted the need for improved R&D in Universities which has been deemed lacking to date, primarily due to a lack of established links between academic institutions and the industry.

There have been a number of new third-level courses developed in Ireland in recent years to meet the needs of the e-learning sector. Due to this, along with the number of redundancies of late, no new e-learning courses are required at the present time. Skills conversion courses may be required, however, should demand increase for specific e-learning occupations. General non-elearning specific skills, such as sales and marketing, project management and client management skills are considered weak at present and, therefore, the sector will benefit from the implementation of the main recommendations listed previously.

Further interventions, listed below, are also required to ensure the success of the e-learning sector in Ireland. These recommendations are explored in more detail in Chapter 6.

Responsibility	Recommendations
Universities, Institutes of Technology	The third-level providers of the new instructional design courses should maintain close liaison with industry personnel and representatives, including the Digital Hub, so as to ensure that their courses are meeting the needs of the industry both in terms of content and quantity.
FÁS	Ensure training is available for graphic/multimedia designers to update their skills in new software packages as the occasion arises.
	FÁS should be prepared to run short training courses for e-Learning package testers if a large international company establishes in Ireland.
	Skills conversion courses should be made available in the event of demand exceeding supply in specific e-learning occupations.
Dept of Education & Science, HEA, Enterprise Ireland	Improved Research & Development in e-learning should be encouraged.

4.3 Wireless

The mobile and wireless sector in Ireland is considered by Forfás to have considerable attractiveness as a growth sector for Ireland both in corporate and consumer markets. The future growth of the industry, however, is very much dependent on the success of 2.5G and 3G. This sector employs approximately 4,000 persons in the 60 companies located in Ireland, the largest employer of the sectors examined in this report[4]. The majority of employment is in wireless infrastructure (35% of total employment), with a further twenty-five percent involved in applications. There is currently only one third-level course dedicated to mobile technology. Although a number of computer engineering courses cover similar ground, the addition of modules on mobile and wireless technology would be beneficial both to the wireless sector and the broader ICT industry, through attracting more students to these courses.

Other areas requiring attention include radio frequency engineering and software testing – additional modules in any new wireless/mobile courses would be sufficient at present to meet skills needs. The use of wireless and mobile devices for marketing purposes should be integrated into marketing courses so as to highlight their advantages and to encourage the promotion of the industry. Further training will be required for content developers as technologies become more advanced and more specialist knowledge is required. As content becomes more sophisticated, skills in areas such as video and audio will be required. FÁS should provide training courses to meet any needs in this area.

[4] These employment figures, quoted in the recent Forfás report on wireless communications, include sub-sectors that were not included in the 2002 Forfás report on the digital content industry.

The implementation of the main recommendations, along with those listed below, are essential for the continued growth of this sector. The justification for these recommendations is examined in further detail in Chapter 7.

Responsibility	Recommendations
Universities, Institutes of Technology	Modules in radio frequency engineering and software testing should be included in wireless/mobile courses.
	Marketing courses should incorporate the use of mobile and wireless devices as a marketing tool.
FÁS, Screen Training Ireland	FÁS/Screen Training Ireland should ensure there is sufficient provision of courses in audio and video to up-skill content developers as required.

The digital content industry presents many opportunities for Ireland. It is a relatively new industry which changes regularly with advancements in technology. For this reason, there is a need for flexible third-level courses which keep up to date on industry developments along with a structured training plan to ensure that those working in the industry can update their skills as necessary. It is hoped that the implementation of the recommendations of this report will go some way in ensuring the necessary education and training provision is achieved. It would be useful to explore the needs of international companies with a view to understanding the needs of companies hoping to locate in Ireland. Further study should be undertaken to examine this area.

Chapter 1: Introduction & Methodology

1.1 Background

The digital content industry is widely recognised to be one of the growth sectors for the future. This reflects the application of new digital processes to create new products and services for both consumer and industrial use. It also reflects the replacement of traditional processes by ones using digital means. The digital content sector contains elements of computing, communications and design and requires a wide range and mix of skills.

In 2002 Forfás published a report on the industry entitled 'A Strategy for the Digital Content Industry in Ireland' based on a detailed report by Price Waterhouse Coopers (PwC). The report recommended, inter alia, that a detailed audit of skills requirements for the industry be conducted by the Expert Group on Future Skills Needs (EGFSN). This was agreed by the EGFSN, and FÁS agreed to take the lead in undertaking the research in 2003. The aim of this study is to examine the employment and skill needs of the digital content sector in Ireland and to make recommendations where necessary to meet those needs. (The specific objectives and methodology are presented in more detail below.) However, this study did not attempt to revisit the market and business strategy analysis contained in the Forfás/PwC report. Rather, its focus is on the employment/skills aspects only. A brief summary of that report is therefore presented in Chapter 2.

1.2 Research Authors and Steering Committee

The research for this report was undertaken by the Planning and Research Department of FÁS with the assistance of the STeM Research Centre of Dublin City University. The latter Centre has considerable experience in the area of digital media and was contracted by FÁS to undertake parts of the research in co-operation with FÁS. The Centre was represented by its director, Professor Paschal Preston, IRCHSS post-doctoral fellow, Dr Aphra Kerr and Anthony Cawley. The FÁS staff directly involved were Ms Joan McNaboe and Mr Roger Fox.

The research was overseen by a Steering Committee containing representatives of the industry, education/training institutions and the development agencies (see Appendix A for list of members).

1.3 Methodology

The methodology for the study was based on a recognition that the digital industry is very fragmented, with a poorly defined occupational/skill structure, and with little precise data on numbers and skills of employees. While this might have suggested the need for a comprehensive survey of the sector, the scale of change expected in the industry over the next five years would indicate that data on the existing situation might be of limited value. Thus, the focus of the study was on a more qualitative approach, drawing upon

and analysing information from key informants and existing documents, both at home and internationally.

Although this study endeavoured to examine the digital content industry as a whole, the methodology did not allow for extensive international research. Therefore, the findings are mainly based on the indigenous industry and available international information. Hence, the study does not identify the views and needs of large multinational companies that might invest in Ireland in the medium and long-term.

The Forfás study identified five sectors with the best growth potential for Ireland. It was decided to examine three of these in detail for this study; games, e-learning and wireless. In the case of the games and wireless sectors, this work complements further policy studies by Forfás[5]. The e-learning sector was chosen due its significance in both the Irish and international market[6].

Specifically, the methodology comprised the following steps:

- *Literature Review*

This involved an analysis of existing studies and research about employment and skill trends and needs in Ireland, the EU and USA. It also covered analyses of information on education/training provision overseas.

- *Company Interview*

Personal, face-to-face interviews were held with 36 companies, 33 in Ireland and 3 in the UK. Companies were selected to provide a mix across the different parts of the value chain and product/service areas.[7] Companies ranged in size from 5-10 employees to over 150. The generally small size of companies in the industry can be gauged from the fact that over half of the companies interviewed employed less than 20. The number of companies interviewed that were involved in different areas is presented in Table 1.1.

Table l .1 Number of Companies Interviewed by Type

Sector/Type	Content Enablers	Authoring, Design Conversion, Packaging	Publishing, Marketing, Management, Distribution
Entertainment/ Cultural	8	16	11
Business/ Specialised Information	11	9	7
Education	1	8	2

Note: Many companies operate in more than one area and are included in each in Table 1.
These figures are based on the 36 companies interviewed in both Ireland and the UK

[5] Forfás (2004), '*Electronic Games* Study', Forfás (2004), *'Wireless Communications: An Area of Opportunity for Ireland'*
[6] The two sectors that were not studied in detail were digital libraries and non- media applications.
[7] No attempt was made to select companies through a random or representative sampling process.

The main areas covered in the interviews were company profile and functions, employment structure and numbers, skill trends, recruitment difficulties, education provision, training activities and skills/training issues.

The researchers received excellent co-operation from the companies and would like to thank them for their help in providing information and views for this study.

- *Development Agencies' Views*

Interviews were held with the principal state development agencies to obtain a rounded view of the likely future development of the industry, the activities being undertaken to facilitate such development and issues in relation to skills.

Six interviews in both Ireland and the UK with industry representatives to obtain an overall perspective on issues including recruitment, e-learning, games and digital TV.

- *Profile of Current Education/Training Provision*

Enrolment and graduation data was gathered for Universities, Institutes of Technology and post leaving cert courses. Discussions were also held with a number of education and training providers in Ireland and the UK.

These four steps were then assessed and used to develop the information base and analysis presented in this report.

1.4 Structure of Report

The report contains eight chapters, including this first introductory one. Chapter 2 explores the developments in the digital content industry in Ireland while Chapter 3 presents the occupation profiles of the digital content industry. In Chapter 4, the current education/training system is documented in both quantitative and qualitative terms. Chapters 5, 6 and 7 deal with specific sectors, namely games, e-learning and wireless respectively. The conclusions and recommendations of this report are detailed in Chapter 8.

Chapter 2: Developments in the Digital Content Industry in Ireland

The aim of this chapter is to provide information about the current and future status of the digital content industry in Ireland. To do this it primarily draws on published literature, Irish and international. Given that it draws on existing publications, the chapter may contain little new information for the 'industry insider'. However, it was felt that it was important to present the basic information on the industry as a backdrop to the more detailed analyses in subsequent chapters. There are three sections to this chapter. The first provides basic information about the sector, including the main sub-sectors and activities involved. The second sub-sector reports on some of the literature describing employment and skill characteristics and needs. The final sub-section makes tentative forecasts of future employment growth in the sector.

2.1 The Digital Content Industry – a growth industry for Ireland

A major study of the digital content industry was published by Forfás in 2002[8]. This was based on research carried out for Forfás by Price Waterhouse Coopers. The study identified the digital content industry as a potentially important sector for Ireland's future economic development. Some of the main features identified in the Forfás report are presented in this section.

The digital content industry was defined in the report as encompassing the creation, design, management and distribution of digital products and services and the technologies that underpin these activities. It comprises companies from traditional content, media and entertainment, software and multimedia, and electronic hardware and telecommunications sectors. Convergence among these sectors is being led in large part by the rapid growth in information and communications technologies, the Internet and broadband fixed and wireless access and associated devices, which are driving demand for the electronic distribution of content.

The report states that the industry has emerged as a high-growth, high-value, market. Worldwide, its worth was estimated at over $178 billion in 2001, and this figure was forecast to grow strongly at an annual rate of 29%, reaching $434 billion per annum by 2006.

In Ireland, the consultants estimated, over 280 companies were involved in 2001/2002 in the development of digital products and services. These companies employed in the region of 4,000 to 4,500 people. These firms were supported by a range of other service and support companies. The Irish industry primarily comprised indigenous companies, with a total of 238 companies at that time. Similar to international trends, the industry has developed in clusters, namely in the digital film and television, business publishing (including web design) and e-learning areas. The primary cluster is located in Dublin,

[8] Forfás, (2002), '*A Strategy for the Digital Content Industry in Ireland*'.

where it was estimated that, in 2000, 87% of companies were based. Other clusters exist in Limerick, primarily in the e-learning area, and in Galway and Cork.

Activity is spread across a range of entertainment, education, consumer and business publishing sectors. In general, companies are fragmented and small in scale, with only limited export markets. Skills and competencies vary across the value chain with sectors such as e-learning having a high level and range of competency, while other areas such as digital film and TV are more focused on one aspect of the value chain (content conversion and management).

A number of government and agency initiatives are underway to promote digital content companies in Ireland. These include the development of the Digital Media Hub and MIT Media Lab in the Guinness Hop Store area and the promotional activities of Enterprise Ireland and IDA Ireland to develop a number of sectors.

The Forfás report contained a useful matrix by which the industry could be classified along two dimensions; type of product/service and place on the value chain. In respect of products/services the sector was seen to include:

- Games
- eMusic
- Digital Film/TV
- Digital Radio
- Digital Libraries
- E-learning
- Digital Publishing
- Wireless Services
- Non-Media Applications
- Animation/Special Effects

The report described a value chain that moves from the technical enablers, to content development, to management/storage and marketing/distribution. It is a key feature of the industry that there is very considerable overlap between companies across different sectors, as well as varying Degrees of vertical integration across the value chain. As we shall see later, this makes it impossible to clearly relate particular skill sets (i.e. jobs and education/training courses) to particular sectors or parts of the value chain.

The report analysed Ireland's strengths and weaknesses, threats and opportunities in these areas and on that basis identified five areas of high growth potential and particular attractiveness for Ireland; e-learning, non-media applications, digital libraries, wireless applications and games. Three of these are covered in Chapters 5-7 of this present report.

Globally, the biggest sector is games with an estimated value of $50 billion in 2001 (28% of the industry as a whole). This sector is seen as an area of high growth and opportunity. Returns on investment are very high for successful games developers, despite the high risk involved in producing games. Moreover, the sector has emerged over the last few years as being largely recession proof, with sales continuing to rise, while those in the remainder of the entertainment industry declined. While the sector is not new, there are still many technical developments driving improved performance. The sector is also benefiting from the emergence of new platforms such as mobile phones and interactive TV.

Ireland's existing strengths lie in the development, design and conversion/packaging of games, together with research strengths in both games design and enablers. The enabling technology strengths lie in games middleware. Building on these strengths, there are significant market opportunities for Ireland right across the 'value chain' from games design to games distribution. Ireland's potential is enhanced because in the games sector small development companies can be highly successful, with the majority of games development companies worldwide tending to be relatively small. In addition, by its nature, the products of the sector are internationally-tradable and jobs are highly skilled. (Indeed, one of the distinctive features of the media content sector is the relatively small number of truly global corporations. In 2001, only 23 of the top 500 global corporations had their primary base in the media content sector, as compared with 104 of the top 500 companies who were based in the ICT (hardware, software and telecomms) sectors.)

The global e-learning market covers a wide set of applications and processes, including computer-based learning, web-based learning and virtual classrooms. The market can be divided into two main segments; corporate and educational. Both are attractive growth markets. Forecasts of very rapid growth made some years ago have turned out to be too optimistic. For example, one forecast projected that the global corporate e-learning market would increase from US$2 billion at the end of 1999 to greater than US$23 billion by 2004. In the US, the e-learning market, which represented about 3% of the total US education and training market in 2000, was forecast to grow to approximately 15% of the total market by 2003. Although hard figures are difficult to find, it is generally agreed that these rates of growth have not been achieved. However, there is widespread belief that this remains a growth area in the medium-term.

Ireland's early entry into e-learning market has meant that it has developed a strong international reputation across the e-learning value chain, which can continue to be exploited to ensure the future growth of the sector. With approximately 37 companies in 2002, this is Ireland's most successful digital content sector.

Telematics/wireless services include both mobile Internet and applications, including games, directories, and messaging facilities. The use of telematics/wireless communications technologies to access network-based information and applications from mobile devices is still in its infancy. Yet, this area has significant potential due to the rapid growth of mobile devices, primarily mobile phones, but also personal digital assistants (PDAs) and other such systems. Total European mobile content and service revenues were projected to grow from $5.6 billion in 2002 to $44.23 billion in 2005.

There are few mobile digital content service providers targeting the consumer market in Ireland. The recent downturn in the telecommunication sector, and the relative failure of wireless application protocol (WAP), has resulted in a number of start-ups in this area failing to attract sufficient consumer sales to sustain operations. Ireland has a high level of strength in the business wireless market, however, and the skills developed in this area could be readily transferred to the consumer market.

An analysis of the sector shows that Ireland currently has research and market strengths in technological enablers (principally mobile/access devices) and the design of digital content, together with market strengths in content authoring. Going forward, there will also be opportunities to engage in content management, storage and publishing in this sector.

Non-media applications typically incorporate high-end imaging, design and virtual reality technology tools and applications, developed for scientific and industrial use. Aside from entertainment, digital content enabling technologies are aiding the development of a range of industrial and scientific applications across the medical, automotive, aerospace, and petrochemical sectors. Indeed, the production of digital content-based applications for the scientific and industrial sectors is expected to have high-growth potential globally in both the development of technology enablers and content creation itself.

Currently, there are a number of Irish companies engaged in this type of work. This is an area of high attractiveness to Ireland, based on the high-growth potential of the sector globally and the high-skilled, high value-added, nature of the work involved. It is also a key area which could be stimulated through the encouragement of R & D initiatives in the third-level education system. At present, Ireland has market and research strengths in enablers, content development and design, together with market strengths in the authoring, packaging and management of digital content. Building on current capabilities, Ireland can access significant opportunities in these areas over the next few years.

Finally, in relation to digital libraries, the Forfás report defines the sector broadly as encompassing the software and services associated with the digital asset management[9] of libraries and content located in educational or public establishments. This sector is evolving and represents a high-growth, albeit largely domestic, market with opportunities across all public services. The digital library niche is an area in which Irish enterprise could potentially develop a strong capability, with high growth opportunities in content design through to content storage (including design, authoring, packaging and management) and medium growth opportunities for technology enablers.

More recently, the Enterprise Strategy Group analysed Ireland's potential in a wide range of industries[10]. They quote figures for the digital content industry: in 2002 this industry comprised 120 companies and employing 3020 full-time employees. Of the jobs 40% were in indigenous companies and 60% in foreign owned companies. The Enterprise Strategy Group reported the following:

> 'Despite the downturn in the digital content sub-sector, Ireland has performed relatively well and has exhibited sustained growth. There are a large number of small Irish companies in this sub-sector, but foreign-owned companies account for the majority of employment. The level of R&D expenditure grew strongly in the

[9] This uses a database management system to control functions such as content importing, previewing, editing, and searching.

[10] Enterprise Strategy Group (2004), '*Ahead of the Curve'*, Forfás

> 1999-2001 period standing at over €75m in 2001, with virtually all of it coming from the indigenous sector. The biggest opportunities within the sector are in games, non-media applications and e-Learning. It is a relatively young industry, with an existing base of competencies in terms of creative, software and localisation skills. However, the lack of local sophisticated demand in Ireland is causing significant issues for the sub-sector (e.g. telecommunications, hardware) to provide bundled solutions for customers and industries.' *(Appendix 2, Pg 8)*

Forfás has also published two comprehensive studies of two sub-sectors of the digital content industry – electronic games and wireless communications[11]. These studies include an overview of the global industry, including global market and technological trends, an assessment of the Irish industry and opportunities for development and recommendations for future policy. More detail is provided in Chapters 5 and 7 of this report.

It is important to note that the evolving knowledge economy is marked by the growing role of media-related skills and occupations outside the established and digital media sectors. Many media-related functions are located in the secondary information sector. Thus, we find that, to an increasing extent, companies in other sectors such as banking and manufacturing have established their own in-house competencies in new media in order to maintain and update the communication functions and services essential for competitive performance.

Thus:

- Both ICT and media-related occupations have become generic or pervasive skill clusters within the contemporary knowledge-based economy.
- Only one-third of all media-related occupations and job functions are located in the media industries themselves.
- These trends must be borne in mind when seeking to address both ICT and media skills needs over the next 5 to 10 years.
- National innovation strategies for digital media must ensure the development of both high-level ('leading-edge') skills as well as more operational levels of the relevant skills and knowledge clusters.

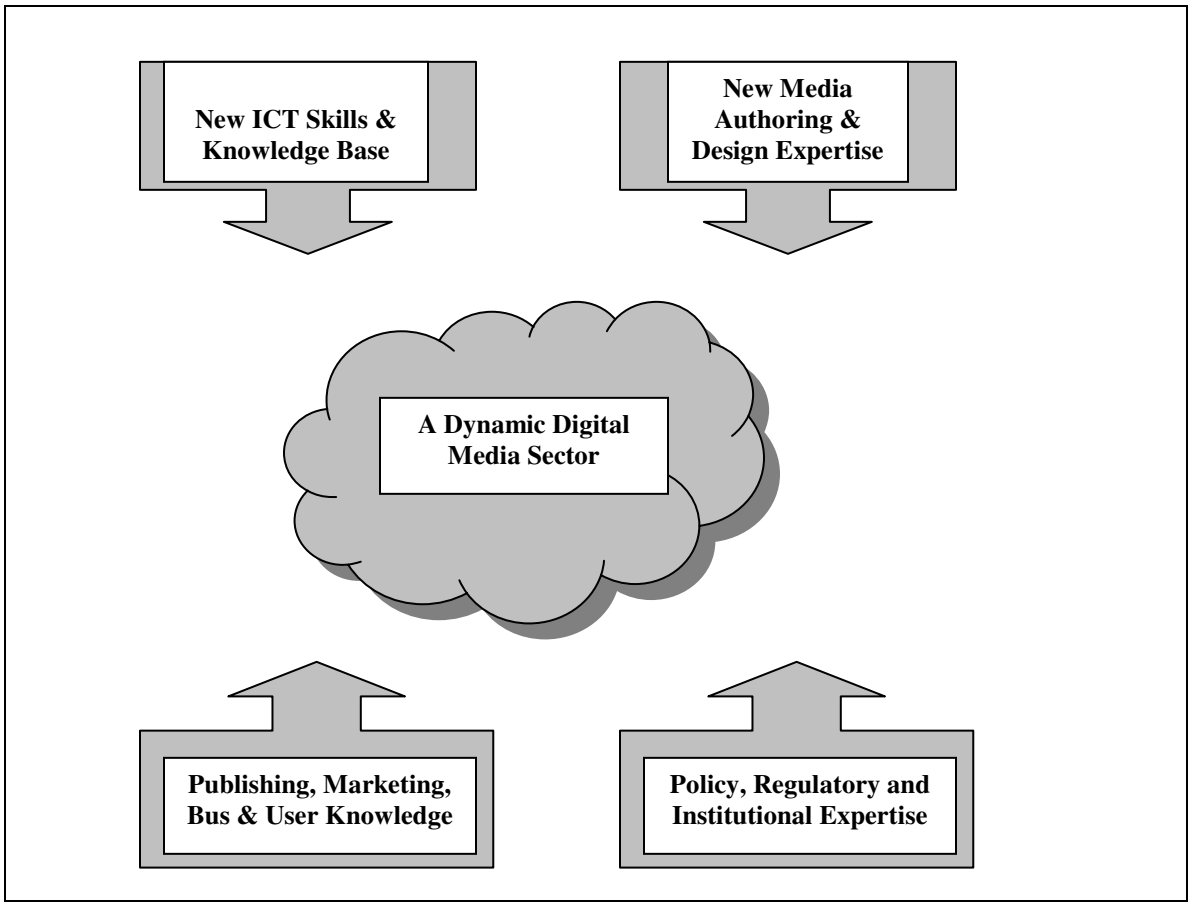
In the media industries, as elsewhere, research plays an important role in product and industrial innovation processes. But it is important to define precisely what kinds of research functions are involved. In the media industries, the relevant R&D functions largely comprise the script, concept, authoring, design and distribution of the media/cultural object (i.e. equivalent to the product R&D and design functions in other industries). In this sector, there are also application innovations in the use of the technical tools (whether language, pen, camera, lighting, colour, computer, telecoms network, etc). Such application innovations, however, tend to involve creative rather than purely technical R&D skills/knowledge (apart from the very early years of a new technical system/platform where 'novelty' technical tricks may play a role in distinguishing one product from another). Thus, in conclusion, technical (ICT) skills,

[11] Forfás (2004), '*Electronic Games* Study', Forfás (2004), '*Wireless Communications: An Area of Opportunity for Ireland*'

competencies and expertise are 'necessary but not sufficient' for successful innovation strategies in the digital media sector.

Figure 2.1 serves to summarise the four key clusters of knowledge and skills relevant to successful industrial innovation in the digital media sector as indicated by the international research in this field.

Figure 2.1 Key Knowledge 'Pillars' (Clusters) in the Digital Media Innovation System



Source: P. Preston (2002c)

There are a number of EU programmes and initiatives which aim to support innovation and the development of new clusters of knowledge and capabilities directly related to the digital content sector. These programmes have funded much of the research and advanced-level training related to digital content in the Irish third-level sector and many now encourage the participation of firms as well. These initiatives may be considered as complementary to (rather than substitutes for) national level initiatives.

The particular field of research concerned with the development of ICTs has been accorded a major role within the overall budgets of the EU's framework programmes since the 1980s. Within the Fifth Framework programme (FP5) covering the period 1998-2002, the 'User-friendly Information Society' was the main research stream concerned

with the development of new ICT and this was allocated some €3,600 million. A key action within this stream was 'multimedia content and tools' with a budget of some €564 million. The successor, 'Information Society Technologies' research stream within the Sixth Framework programme (spanning the period 2002-2006), has been allocated some €3,625 million.

The *e*Content programme (2001-2005), which has been allocated €100 million, is one of the two actions proposed in the '*eEurope Action Plan'*. Its main focus is on stimulating the digital content market through the following action lines:

1) Improving access to and expanding use of *public sector information;*
2). Enhancing *content production* in a multilingual and multicultural environment;
3). Increasing dynamism of the *digital content market.*

Finally, reference should be made to two major EU programmes that are directly and explicitly engaged in supporting culture-specific activities: the *Culture 2000* and the *MEDIA* programmes.

The European Commission's 'Culture 2000' programme helps to finance EU cooperation in all areas of the arts, such as the performing arts, visual and fine arts, literature, music, history and cultural heritage. The programme has been allocated €167 million for the period 2000-2004. The MEDIA programme provides financial and policy support for the audiovisual and related industries. The latest phase of this programme has been allocated a budget of €400 million for the period 2001-2005 and supports the development, distribution and promotion of European audiovisual works (including animation and multimedia.) The MEDIA programme also earmarks €50 million for business and legal training (marketing, intellectual property law), training in technology (computer graphics, multimedia) and courses in how to write screenplays for foreign audiences.

2.2 Employment and Skills in the Digital Content Industry

This section draws on a variety of international sources to highlight some of the features, especially relating to employment and skills, of the digital content industry.

An important feature of the industry is the new combinations of skill sets required. A number of organisations have attempted to define the different jobs and skills sets required in the industry. The aim of doing this is to assist education and training providers to develop suitable programmes. The next few pages of this report describe some of these attempts.

Many digital content companies require IT/programming skills combined with media authoring/design skills and business skills. Indeed a 1999 report by Regan and Associates for the Bay Area Multimedia Partnership and Skillsnet in the US suggested that the convergence of the technically-innovative Silicon Valley and the artistic and creative culture of the Bay Area was the basis for the strong multimedia industry there. The report recommended that education institutions should concentrate on teaching core

knowledge and theories, rather than specific (soon-to-be-outdated) software tools. It also emphasized the value of practical projects, which teach students important problem-solving skills, creativity and teamwork skills.

The same report noted that three trends were impinging on the skill requirements of the digital content industry:

1) the growing importance of usability in design was feeding the demand for graphic design skills,
2) the increasing importance of content was leading to a demand for technical and specialist writers,
3) the increasing complexity and functionality of websites was leading to a demand for more programming and IT skills as well as more QA and testing skills.

An OECD report (2002) noted that IT-related work requires both formal knowledge and skills, and tacit (informal) knowledge. Individuals need a combination of technical skills and abstract concepts. The authors drew upon a number of major reports to note that IT industries require a combination of technical, management and personal skills, while content industries require new 'hybrid' skills combining creative, technical and business skills. One useful list of IT-related occupations presented in the OECD report is taken from the Northwest Center for Emerging Technologies (NWCET) based in Washington, USA. This list divides IT occupations into eight clusters, and each cluster has a range of jobs at various levels. The report goes on to detail the technical skills, employability skills and foundation knowledge required for each cluster.

In the United Kingdom a Skills Framework for the Information Age (SFIA) has been developed by a consortium of public and private bodies[12]. The framework is designed to be compatible with detailed competence descriptions and other schemes, such as the IT National Occupational Standards, the British Computer Society's Industry Structure Model 3 (ISM3.2) and the NWCET system. The UK frameworks and standards were developed in consultation with the NAME Jobs Reference Guide[13], an EU-funded project which conducted a European-wide survey of 525 multimedia companies in order to establish standard European occupation categories and skill requirements for this sector. The final report outlines 26 different job categories grouped into seven job families: project management, authoring, graphic realisation and design, software development, website administration, web marketing and miscellaneous. In each family 96 tasks, including technical, conceptual, human and personal skills are rated as primary, secondary or not relevant. Also in the UK, Skillset, the sector skills council for the audio visual industries, has recently produced a set of job profiles covering areas such as animation, art and design, interactive media, computer games and sound[14].

[12] UK (1999), '*Skills for the Information Age: Final Report of the IT, Communications & Electronics Skills Strategy Group'*
[13] See www.namemultimedia.com
[14] Skillset (2004), '*Job Profiles for the Audio Visual Industries'*

Enterprise Ireland (EI) has published two commissioned reports on the digital media sector; Farrell Grant Sparks (FGS, 1999)[15] and Price Waterhouse Coopers (PwC) (2000)[16].

An important barrier to growth for Irish media companies according to the FGS report was the "lack of breadth of management expertise" and the difficulties faced in building up contacts internationally. The PWC report highlighted the need for skills to integrate both traditional and new media content and broad business skills.

The 2002 Forfás report noted that "educational institutions …lag behind the level of convergence that exists within the sector itself" and that "at an enterprise level… there is a dearth of skills in the high growth areas". In particular, the report noted that business skills needed to be integrated into creative courses, and more creative elements needed to be incorporated into computer science programmes. A new area for possible course development was in 'Media Management' which would focus on developing project management, finance and sales/marketing skills.

While the Forfás report refrains from forecasting future employment trends, the McIver Consulting report on '*Software Skills Requirements for the Software, Digital Media and e-Business Sector*s' (2001) takes a rather different approach. It is important to remember that this report was written at the height of the Irish Celtic Tiger boom and both the findings and forecasts must be read with this in mind. In addition, the report is focussed on the demand for software graduates across all industrial sectors, and not just the digital media sector.

The McIver report divides the digital media sector into three subsectors: (a) entertainment digital media and electronic publishing, (b) e-learning and (c) commercial/corporate digital media. With regard to the entertainment digital media and electronic publishing sub-sector the McIver report notes that Ireland "does not have a strong position in the industries from which a significant digital media sector could grow". Despite this, the report estimates that employment in this sub-sector will grow by 25 percent per annum. E-learning is projected to grow by between 16-20 percent per annum and commercial/corporate digital media by 10 percent per annum. These forecasts are presented in more detail in Section 2.3 below.

The report goes on to discuss the increasing need for higher research Degrees and the need to pay attention to the quality as well as the quantity of graduates. It concludes that there is a need for new types of courses including joint computing/business studies and computing/creative disciplines. In the entertainment digital media sector the report notes that education and training institutions have an important role to play in developing the existing industry, especially through research Degrees, business training for the entertainment sector and conversion programmes aimed at updating skills in the traditional media sector to deal with new media.

[15] Update of Farrell Grant Sparks (1997) 'Multimedia - Realising Our Potential',
[16] Enterprise Ireland (2000), *'Opportunities for Ireland's High-Technology Internationally Traded Services (ITS) Sector to 2007'*.

The recent Enterprise Strategy Group report indicates that a gap exists in terms of the integration of creative and business skills education. The report also states that 'Ireland also needs to encourage creative thinking and skills throughout the educational system (at primary, secondary and higher level) to ensure that it engages people from an early age in the creative industries. This will also minimise the need for 'catch-up' strategies to develop these critical skills at later stages'. *(Appendix 8, Pg 34)*

ICT Ireland produced a report in 2003[17] which repeats the call for more business-related training on ICT courses at tertiary and post-secondary levels. The ICT Ireland report compares Ireland's skills base along a number of dimensions with a number of other ICT clusters abroad. The following table summarises the report's main findings.

Table 2.1 Comparison of ICT students in Ireland, US and Israel

ICT Cluster / Location	Students taking ICT-related subjects at all levels	No. of PhDs in ICT-related areas	Marketing-related skills	Informal Networks / Networking
Ireland	Strong	Average	Weak	Average
US ICT clusters	Weak	Weak	Strong	Strong
Israel	Strong	Strong	Strong	Strong

Source: ICT Ireland, 2003

The report states **"**As already outlined, the 3rd level institutions play a key role in feeding this labour pool. The successful ICT clusters have a good supply of engineering and scientific personnel. The growth of entrepreneurs in the ICT cluster can be choked if the requisite numbers and types of graduates are not produced by the education system. In addressing these needs, sales and marketing capabilities should not be ignored."

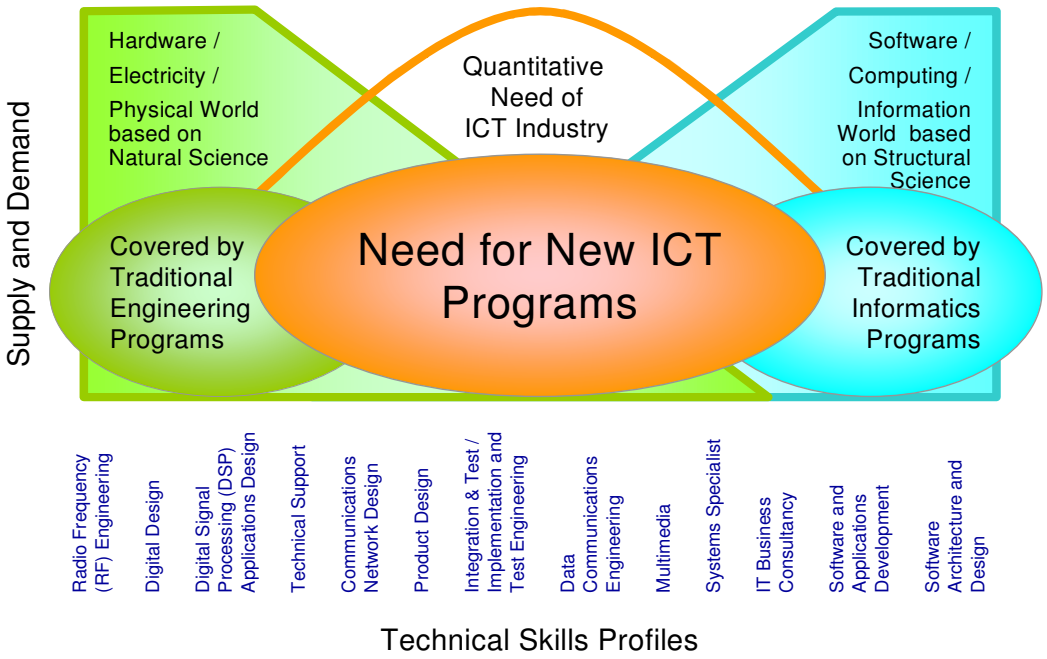
In terms of the share of tertiary-level graduates in computing as a percentage of all fields of study, Ireland has the highest shares amongst OECD countries. However, Ireland's supply of technical graduates is dwarfed by some large, developing, countries who have invested heavily in increasing their supply of technical human capital (e.g. China had about 320,000 students graduating in science/engineering in 1999/2000 while India had 251,000). The 4th report of the Expert Group on Future Skill Needs indicated the need to increase the supply of ICT graduates in Ireland to meet future needs. At a European level some reports conclude that Europe does not have enough skilled ICT people and the gap is widening, with a potential shortfall of 1.6 million jobs expected by 2004 (IDC report (2001). Other reports note that Europe is not facing a skills shortage but rather a skills mismatch between supply and the skills required by industry (OECD 2002).

[17] ICT Ireland (2003), '*Creating a World Class Environment for ICT Entrepreneurs'*

Nevertheless recruitment and retention difficulties experienced by a number of employers prompted the Commission to partner with 11 major ICT companies to develop the Career-Space initiative. This project involved developing 13 generic job profiles for the ICT sector and their circulation via a website and associated publications.[18] Subsequently, the consortium worked on preparing general ICT curricula guidelines, with the participation of the European Standardisation Body for the Information Society (CEN/ISS) and 24 Universities and education institutions. Interestingly they call for a balance between the breadth and depth of knowledge, for 15 percent of time to be spend on personal and business skills, and for a minimum of 3 months industry placement in addition to a minimum 3 month major practical project.

The Career-Space Consortium also addressed the importance of the diversity of skills, which have arisen in the ICT industry. The majority of graduates increasingly need a combined qualification from both the engineering and informatics cultures as well as from other related disciplines such as business and behavioural skills (see Figure 2.2). The Career-Space consortium recommends that Universities create and develop new curricula with elements from electrical engineering, informatics, and a significant focus on the teaching, training and practising of behavioural and business skills.

Figure 2.2 Career-Space's profile of ICT industry's needs for Degree Qualifications



Source: Career-Space Consortium (2001), ''New ICT Curricula for the 21st Century Designing Tomorrow's Education : Curriculum Development Guidelines'. See www.career-space.com

[18] See www.career-space.com

2.3 Future Growth Prospects in Ireland

The Forfás report, which this study complements, estimated that there were about 280 companies in the digital media area in Ireland in 2002 employing between 4,000 and 4,500 persons. However, the report made no projection of how this number might increase. The aim of this sub-section is to review any other information on likely future trends and attempt to make some broad predictions for employment in the digital sector in Ireland over the coming years.

It must be recognised that making forecasts for this industry is very difficult;

- There is no accepted, standard, definition of the industry.
- Many employees are employed in 'non digital media' companies.
- Given that the sector worldwide is expected to grow very rapidly, and part of that growth will be through overseas investment in Ireland, one or two large projects attracted by IDA-Ireland could affect total employment in Ireland greatly.

Nevertheless, it was felt important to attempt some forecast of growth. We first start by reviewing previous forecasts, either for Ireland or internationally.

Enterprise Ireland commissioned a major study of internationally-traded services in Ireland including the digital media sector[19]. The report estimated a likely doubling of the value of the sector in Ireland from 1998 to 2007 on the basis of current policies. However, it also projected that if a new strategy was successfully implemented, a further doubling could be achieved by 2007 (to about £600 million). At that stage employment could number about 7,000.

Another report in 2002 estimated a rise in the value of the sector from €320m in 2002 to €760m in 2007, i.e. an annual growth rate of 20%[20]. It also suggested that, with proper support, employment was likely to increase by at least 50% over the next five years.

McIver Consulting conducted a study in 2001 for the Expert Group on Future Skills Needs in relation to the software, digital media and e-business sectors[21]. This study used, as a base, employment figures for 1999 and projected forward to 2005 in respect of three sub-sectors; commercial digital media, education/training and entertainment/digital publishing. From a total employment level of 3,000 in 1999 McIver predicted employment to rise to 4,500 in 2001 and to 8,400 in 2005. Table 2.2 presents the figures.

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[19] Enterprise Ireland (2000), *'Opportunities for Ireland's High-Technology Internationally Traded Services (ITS) Sector to 2007'*.
[20] O'Hea (2002), '*Digital Media Overview: A report on the current status and characteristics of the Digital Media Sector in Ireland'*.
[21] McIver (2001), '*Software Skills for the Software, Digital Media and eBusiness Sector'*

Table 2.2 Digital Media Sector Employment Projections

Year	Commercial Digital Media	Education & Training Digital Media	Entertainment Digital Media & Electronic Publications	Total Digital Media
1999	1,350	800	800	2,950
2000	2,025	880	1,000	3,905
2001	2,228	1,056	1,250	4,534
2002	2,450	1,267	1,563	5,280
2003	2,695	1,521	1,953	6,169
2004	2,965	1,764	2,441	7,170
2005	3,261	2,046	3,052	8,359

Source: McIver Consulting report 2001

McIver's report separately identified the e-business sector, with two main sub-sectors; internet data centres and 'Born-on-the-Web' companies. The latter classification referred only to companies that had been established specifically to trade over the internet. McIver acknowledge that many of these will broaden their scope to be no longer solely web-focused. McIver's projections of these two sub-sectors are presented in Table 2.3.

Table 2.3 E-Business Sector Employment Projections

Year	Internet Data Centres	"Born-on-the Web"	Total e-Business
2000	300	650	950
2001	1,000	1,040	2,040
2002	1,150	1,430	2,580
2003	1,323	1,820	3,143
2004	1,521	2,210	3,731
2005	1,749	2,600	4,349

Source: McIver Consulting report 2001

International forecasts of the sectors are also bullish. The Forfás report projects an annual average growth rate of the sector of 29% over the period 2001 to 2006. Drawing upon a variety of different studies, the report summarises average annual growth rates by main sector as follows (Table 2.4):

Table 2.4 Projected Growth in Digital Content Sectors

Sector*	Market Size 2005-2006 (Billion Dollars)	Average Annual Growth
Computer Games Animation, Special Effects	60	28%
Games	86	14%
E-Music (USA)	2.3	300%
Digital Film (USA)	8.2	39%
Interactive TV	62	N.A.

Digital Radio (USA)	3.4	286%
E-Learning	23	69%
Wireless Services (Europe)	46	228%
Business Publishing	88	5%
On-line Advertising	14	7%
Technology Enablers	40	58%

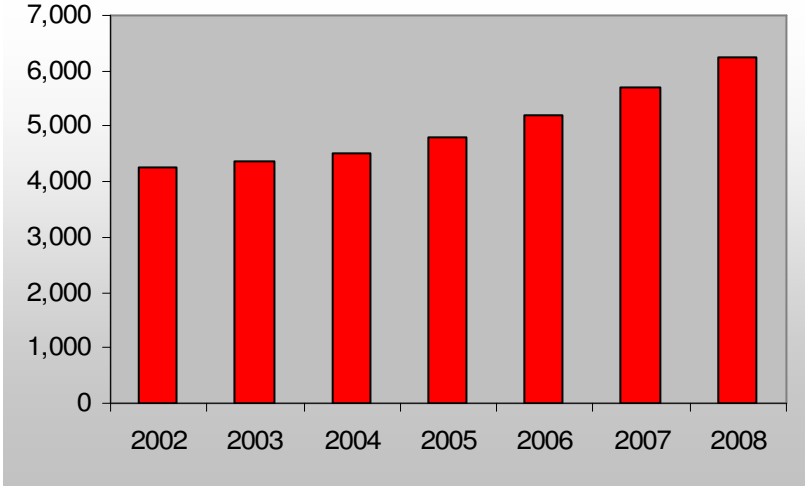
Source: PwC Digital Content Industry report to Forfás 2002
**Global estimates unless specified.*

As the data in Table 2.4 shows, most sectors of the digital content industry are forecast to show very rapid growth. While many of these forecasts were made at the height of the ICT boom, and may now be considered over-optimistic, there seems little doubt that significant growth is likely. Another take on the figures would be that though it may take longer to reach the kinds of levels predicted for 2005/2006 in Table 2.3, in the medium-term a number of very large sectors will be in existence. These are primarily in the entertainment side of the industry, but also important are business, e-learning and the technology enablers. (No growth forecasts were presented by PwC for some sectors such as digital publishing and non-media application.) In summary, as noted earlier, PwC forecasts an overall growth rate of 29% p.a. between 2001 and 2006, "a very attractive market".

The results of the interviews conducted for this study with (primarily) existing Irish companies (see Chapter 3) found that at present there is very little growth (in some cases a decline) in the Irish digital media industry. However, there was a general feeling of optimism about the medium-term future. Such optimism, however, did not extend to large-scale employment growth. Overall, companies felt great uncertainty about the future. In terms of indigenous industry, growth rates of 20% p.a. in terms of employment would be seen as possible but optimistic over a five-year period. In relation to overseas investment, IDA-Ireland has not made any forecasts of growth. However, it sees opportunities for both green-field foreign investment, as well as diversification within existing overseas companies in a range of sub-sectors. However, IDA-Ireland notes that new projects in the sector will typically provide high-level jobs, but with relatively fewer employees per company than in some other sectors. However, good prospects exist across a range of areas including digital asset management, e-learning, games, technology enablers and localisation. (As noted in the introduction, the study did not involve a survey of major digital media companies in other countries. Perhaps a more optimistic picture for investment in Ireland, and hence employment growth, would have been forthcoming if it had done so.)

On the basis of the various forecasts and views summarised above, it would seem that the Irish digital media industry is likely to grow relatively slowly for the next year or two but then possibly show stronger growth. An optimistic view would suggest growth in employment of 2,000 jobs over a five-year period to 6,250 by 2008. Figure 2.2 shows such a growth path, with marginal growth in 2003 and 2004 but then accelerating in 2005-2008. (Base is assumed to be 4,250 in 2002).

Figure 2.2 Total Employment Projections 2002 - 2008



It is important to emphasise that the potential growth of the Irish digital media industry is, in one sense, even greater. Within the context of an industry valued at over €500 billion world-wide, a target of under €1 billion for Ireland does not seem unrealistic. Much of the industry is internationally-mobile, and would invest in Ireland if Ireland can offer a profitable location for business. Against this, as noted previously in Section 2.1, this industry is less dominated by global companies than (say) the ICT software, hardware or telecommunications sectors. Equally, as noted earlier, FDI companies are likely to be smaller than those in, say, the ICT sector. These latter factors might point to a lower reliance on foreign, compared to indigenous companies, for the growth of this sector. In conclusion, there is much uncertainty about the future growth of the sector, but a forecast of 2,000 extra jobs over a period of five years is possible. Further growth in employment could be expected in subsequent years.

Chapter 3: Occupation Profiles and Employment in the Digital Content Industry

This chapter provides profiles of the occupations in the digital content industry based on company interviews and a literature review.

3.1 Overview of Occupations

In order to define the key occupations each person interviewed was asked to list the key occupations in their company and outline the key tasks involved in each. (Where job titles differed the key tasks were used to group similar occupations together.) Interviewees were also asked to outline the number of full time employees in each area and the extent to which they used contract or freelance employees.

Table 3.1 presents the main occupations mentioned by each interviewee and where possible these occupations were grouped into families with similar functions. The development of these families drew upon the literature review including NAME, Skillset, Career Space and SFIA[22].

Table 3.1 Occupations in the Digital Content Industry in Ireland.

Family	Occupation
Management	Company Directors Project Managers Producers/directors (creative and technical) Vendor Management Operations Research Analyst
Content Authoring	Author Journalist Content Quality Assurance
Media Authoring & Design	Web Page development & graphic design (incl. Flash) Sound design/engineering Video 2 & 3D animation Instructional design
Software Development	Programming Technical R&D Technical Customer Support Multimedia Programmer
IT and System Support	Internal and external network administration Database administration Technical Support Webmaster
Sales and Marketing	Sales Marketing Public Relations

[22]Name, '*Multimedia Job Reference Guide*'; Skillset (2004), '*Job Profiles for the Audio Visual Industries*'; Career Space (2001), '*Generic ICT Skills Profile*'; SFIA, '*Framework Reference*'

QA and Testing	Software Quality Assurance Hardware compliance testing
Other specific	Logistics/Operations Warehousing
Other generic	Legal Accounts Administration Human Resources

Table 3.2 shows the percentage employed by each occupational family and by employment type for the companies interviewed, ranging from full time to permanent fixed contractors to freelancers or temporary contractors. It should be noted that no attempt was made in this survey to randomly choose companies from the entire population of companies, rather companies were chosen on the basis of the particular sector i.e. entertainment, education, business services, and the stage of the value chain they occupied. The aim was to achieve maximum coverage and interview companies in all nine sectors of the value-chain matrix (see Chapter 1).

Table 3.2 Employment by Occupation in Irish Digital Content Companies*

	Full time	Permanent contract	Temporary contract	Part time	Total
Management	13%	1%	1%	-	15%
Content Authoring	7%	0.1%	0.5%	-	7.6%
Media Authoring	20%	3%	3%	-	26%
Software Development	12%	0.5%	-	-	12.5%
IT& Sys Support	2%	0.1%	-	-	2.1%
QA & Testing	9%	10%	1%	-	20%
Sales & Marketing	5%	-	-	-	5%
Other specific	0.5%	0.1%	-	-	0.6%
Other generic	11%	-	-	0.2%	11.2%
TOTAL	**79.5%**	**14.8%**	**5.5%**	**0.2%**	**100%**

*From 23 companies

Some interesting findings emerge from Table 3.2. Firstly, the vast majority of employees are full time employees. This result may be influenced by the fact that two multinationals account for 76 percent of the full time/fixed term contract employment. Secondly, media authors and QA/ testers account for the majority of contract staff. Indeed, these two occupations had the highest staffing levels at 26% for media authors and 20% for QA & testing. Within media authoring the greatest number are employed in graphic design/web page development followed closely by instructional design. Interestingly, quality assurance (QA) and testing is a significant employer reflecting the strength of both localisation (of entertainment content) and e-learning in Ireland.

The third most significant family of occupations, representing 15 percent of employment in the companies interviewed, is management, which includes company managers, project managers and creative/technical managers (also called producers in some

companies) who develop new business. The software developers group, which includes programmers and engineers, are the next most significant group at 12.5 percent.

3.2 Overview of Skills by Occupation

When it comes to skills, not surprisingly, the smaller companies require people to multi-skill while larger organisations allow people to specialise in particular areas. In smaller companies everyone has to be 'client-facing' with good communication skills. These 'human' skills, as one interviewee put it, are important in dealing with both clients and the production team.

It is clear from the interviews conducted that in media authoring, software development and QA/testing a commitment and ability to continuously update transient skills like new software tools was a prerequisite and employees needed to commit to life long learning. In many companies employees were expected to learn these new tools on the job, either on a project or using e-learning tools.

Across all occupational groups a small number of core competencies emerged. These included communication skills, team working skills, project management skills, creativity and problem solving skills. In each occupational group some occupationally-specific core skills were also identified, for example, drawing skills for animators.

The need for project management skills in particular was discussed at length in some interviews and is returned to in the next chapter on education and training (see Chapter 4). For many interviewees, the immaturity and informality of the industry was a key attraction, but many also recognised that management in particular, but all employees too, would benefit from improved project management skills and a more formal approach to project development and execution.

Table 3.3 lists the key skills as identified by interviewees for each occupation in the digital content industry in Ireland. Generic occupations such as administration and finance are not included.

Table 3.3 Key Skills by Occupation

Family	Occupation	Key Skills
Management	Company Directors	Manage company and develop business strategy Manage business relationships Business development
	Project Managers	Project management skills Communication skills Team working skills Some technical and creative skills
	Producers/directors (creative and technical)	Concept and business development Presentation & communication skills Knowledge of entire production process from start to finish Varying levels of involvement in production

		depending on size of firm Multi-skilled
	Vendor Management	Communications skills Project management skills
	Operations Research Analyst	Market research Ability to make deals with clients and manage the production process in-house
Content Authoring	Author Journalist Content Quality Assurance	Literacy skills Knowledge of subject matter important, particularly in e-learning companies Attention to detail Basic computer skills Basic HTML Database skills
Media Authoring	Web Page development & graphic design (incl. Flash)	Graphic Design Skills Creativity Good authoring skills in HTML, Flash, Fireworks, PhotoShop, Illustrator, Director, Dreamweaver Communication skills Team skills
	Sound design/engineering	Origination, mixing and engineering Team skills
	Video	Video production and camera skills Offline and online editing skills
	2 & 3D animation	Good basic drawing skills Maya, 3D Studio Max, Flash Team skills
	Instructional design	Good writing skills Planning and team skills Specialist subject knowledge Human Computer Interaction design skills Instructional/teaching skills
Software Development	Programmer/Engineer	Problem solving skills Communication skills, C++, Java, Visual Basic, Linux, Windows, ASP, SQL
	Technical R&D	Advanced programming skills Creativity
	Technical Customer Support	Programming languages as above Communication skills
	Multimedia Programmer	Problem solving skills Communication skills XHTML, DHTML, JavaScript, PHP

IT and System Support	Internal and external network administration	Computer programming and network skills
	Database administration	Database skills
	Technical Support	Software, hardware and networking skills Telecommunications, broadcast network skills Communication skills Problem resolution and causal analysis Team skills
	Webmaster	Good administration and management skills Communication and team skills HTML, JavaScript, Photoshop, Flash, PHP
Sales and Marketing	Sales Marketing Public Relations	Interpersonal and communication skills Planning and management skills
QA and Testing	Software Quality Assurance Hardware compliance testing	Good writing skills Attention to detail Knowledge of some programming languages Database skills Team skills
Other specific	Logistics/Operations Warehousing	Communication skills Planning and management skills

- *Managers*

Occupations within the management family include company directors, project managers, producers/directors, vendor management and operations research analysts. The skills required to be a manager in the digital content industry are equivalent to those in other industries. Skills in client management, leadership, communications, project management and business development are universal for mangers. Quality management, corporate communication, production control and project administration were found to be the primary tasks of the producer and project manager in the NAME project. In the digital content industry, however, there are a significant number of small start-up companies with company directors and managers lacking in the essential skills to succeed in the industry. The Digital Media Forum (discussed in detail in Chapter 4) identified business skills of managers as in need of the most urgent attention.

- *Content Authoring*

Occupations within content authoring include author, journalist and content quality assurance. Excellent written and oral communication and presentation skills along with research skills and an inquisitive nature are required for all journalism occupations, according to Skillset.

Content authors and content quality assurance testers are primarily employed in e-learning companies and a detailed examination of these occupations is provided in Chapter 6.

Journalism skills are required in various sectors within the digital content industry to provide editorial skills in e-learning companies, or writing content for web pages, games or mobile devices. Writing content for these mediums can present difficulties for the journalist as they may need to adapt their skills for writing short and concise pieces (sometimes as little as 10 words).

- *Media Authoring*

Media authoring, accounting for over a quarter of employment in the companies interviewed, includes web page development and graphic design, sound design/ engineering, 2D and 3D animation, instructional design and video.

Web page developers and graphic designers are responsible for the design, layout and production of graphics across a number of mediums. They must be artistic and constantly generating ideas, according to Skillset. As mentioned previously, this occupation had the highest numbers employed in the media authoring group.

According to Skillset, sound designers require good communication skills '*along with imagination and creative flair to produce original sound elements and effects'* and being '*computer literate with a good knowledge of sound recording, playback and editing equipment, along with a knowledge of lighting techniques*'[23]. Sound designers can be found throughout the digital content industry from film to producing sound for games or e-learning. In some audio-visual companies multi-skilled individuals are sought – usually with both sound and video skills. The use of sound and video in e-learning packages is increasing which will lead to further demand for this occupation.

Animators work in numerous sectors, including film, TV, internet and games. There are approximately 2,000 people working in animation in the UK, with 30% working in traditional animation and 70% working in computer generated animation, according to Skillset's 2003 Census of the audio-visual industry. This increase in demand for computer generated animation has lead to the need for more technical skills along with the traditional drawing skills. Skills in advanced packages, such as Maya, are becoming increasingly sought, particularly in the US.

Instructional designers are employed within the e-learning sector and are discussed in more detail in Chapter 6.

- *Software Development*

Software developers are required across the breath of the digital content industry and their role provides an essential component in the production of a digital package or service. For all occupations within this family of skills, knowledge of programming languages, tools and operating systems are essential and the ability to keep up to date

[23] Skillset (2004), '*Job Profiles for the Audio Visual Industries*', Pg 66

with advances in technology is required. Communication skills are becoming increasingly important as the developers often have direct contact with the client or work in teams with content and media authors to meet the needs of the client. Those involved in research and development are also expected to have a high level of creativity due to the nature of the job but this attribute is also an asset for the other occupations in this family.

The skills required for this occupational group, including the specific technical skills, are discussed in further detail in the chapters relating to the games and wireless sectors (Chapters 5 and 7 respectively).

- *IT and System Support*

The occupations involved in IT and systems support include internal and external network administration, database administration, technical support and webmaster. Collectively, they are responsible for maintaining and updating computer systems along with dealing with any problems that may affect the systems. Excellent technical skills are required and there is a need to keep up to date on any new products on the market. Those responsible for technical support for either customers or co-workers require communication skills along with problem solving skills.

These occupations are found in many industries in Ireland but most employment can be found in the digital content and ICT industries. With companies such as Google and eBay locating in Ireland, the need for these occupations will significantly increase in coming years.

- *Sales and Marketing*

According to Skillset, those involved in sales and marketing are responsible for '*planning, organising and implementing an organisation's marketing and sales policies to increase financial gain' (Pg 123).* They liase with new, potential and existing customers to promote and sell the company's products. Due to the nature of the job, excellent communication skills are essential.

Many companies in the digital content industry seek sales/marketing staff with technical knowledge so as to better understand the product they are selling. In other cases, however, the ability to sell is the only determining factor. There is now a greater demand for technical staff to also provide a sales service with the number of sales engineers required on the increase.

A lack of talented sales staff is a definite concern for employers in Ireland at present, with the balance of sales and technical skills difficult to find.

- *QA and Testing*

The quality assurance tester is responsible for ensuring the quality of the software product through rigorous testing. Testers are most often responsible for both designing

and conducting detailed testing procedures and produce reports to detail any faults that may occur.

Excellent technical skills are required for this occupation along with up-to-date knowledge of any new software. Problem solving and report writing skills are also generally required.

Testers can be found in most companies that produce or distribute new software. In Ireland companies such as Microsoft employ a large number of testers most often on a contract basis. Games companies are also significant employers with an interest in playing games the most important requirement. QA technicians and testers are discussed further in Chapters 5 and 7 on games and e-learning respectively.

3.3 Current Vacancies and Future Employment Needs

The following discussion on current vacancies and future employment needs is based on the interviews in both Ireland and the UK. Very few of the companies interviewed reported any vacancies and most were having no difficulties finding people to fill any vacancies that had arisen. With the downturn in the global economy there would appear to be sufficient, if not oversupply, of people in all the major content, media and software development areas, particularly at entry level. Indeed, given the global economic downturn, most of the companies interviewed had experienced restructuring, redundancies or employment freezes in the past three years.

With the higher than average number of contractors and freelancers in the media authoring family of occupations 'timing' was an important issue. Interviewees noted that while there seemed to be a sufficient pool of talent available at the moment, sometimes the talent wasn't available when one won a significant contract. In this case companies had to hire people from abroad.

Difficult to fill vacancies were predominantly in the sales, marketing, and management areas. In these areas in particular it would appear that there is a lack of experienced staff available in Ireland who have a knowledge of the digital content industry. Companies also noted that selling digital media products was made more difficult by the largely negative experiences of the dot.com era and the absence in Ireland of a subscription culture, even for off line products.

For sales and marketing staff companies preferred to recruit people with a knowledge of the media and retail channels in Ireland. These occupations were often filled with people recruited from other industries in Ireland. For project managers, particularly executive producers working in new areas like interactive television, employers tended to recruit abroad in order to up-skill their internal teams.

One sub-sector which was experiencing particular difficulties recruiting staff was the games industry. While there is an adequate supply of software developers and 3D animators for most sectors of the digital content industry, the development of games for

consoles and the PC requires specialist knowledge of the underlying hardware. Both start-up companies and well established multinationals reported that they had to recruit game developers from abroad. This issue is discussed in further detail in Chapter 4 on the games sector.

Looking to the future most companies were quietly optimistic about the prospects for growth over the coming three to five years. While many found it difficult to articulate where the growth would come, many anticipated they would increase numbers of employees in existing occupational areas. In particular 26 percent of the Irish companies interviewed felt they would need more media authors, 22 percent felt they would need more software developers and 17 percent felt they would need more content producers/managers and sales people.

In addition to this increase in staff, some companies anticipated hiring staff in areas not already in existence in the company including:

- Online creative producers and executive producers
- high end 3D animators
- designers for new platforms
- sound engineers
- online editors
- website administrators
- business development managers
- sales people with a knowledge of the digital content industry
- game play testers
- customer support staff
- administrators

The large multinationals indicated that they were likely to hire more contractors in the following areas:

- Project managers
- QA and testing
- Customer support

Interviewees also noted that changes in technologies and the market meant that there was a need for new types of occupations with a new mixture of skills: “the big gap at the minute is the ‘creative entrepreneur’ who has a business head, a sense of finance but can see the synergies between different media”, according to one interviewee. Another new combination was that of the technical sales person. As mentioned earlier, these people have traditional engineering or computer science skills but are also good communicators and help sell to clients. Increasingly, web designers also needed some back-end programming skills.

When asked about the growth in employment many interviewees pointed to potential opportunities generated by developments in technology hardware, software and networks.

In particular companies were hopeful about the development of digital television (d-TV) or interactive television (i-TV) and the development of enhanced television programmes with accompanying websites, merchandising and phone-ins. Other areas included games for the Internet, mobiles and consoles, video for online and offline e-learning services, WAP and SMS services on mobiles. The development of consumer broadband in Ireland was also seen as offering potential opportunities both in the domestic market and in terms of servicing overseas clients.

New software tools were also helping to redefine the skills needed for certain jobs. For example, the development of content management systems means that for content-heavy websites journalists and writers need less HTML skills. Tools like Flash have allowed animation companies to reduce their costs considerably and produce content for multiple platforms.

3.4 Lessons from the UK Interviews

Three companies were interviewed in the UK and they were chosen because they operated in segments of the digital content industry where Irish companies had very little, if any, presence. They were also all significant employers operating on a global scale. They were asked the same questions as their Irish counterparts.

Table 3.5 Overview of Companies interviewed in the UK

Company	Nationality of ownership	Size in employees	Function
A	British	177 employees in UK, 576 worldwide	Develops and publishes digital games on all platforms
B	German	60 in the UK, 500 in Europe.	Develops online communication tools and e-commerce solutions
C	Australian	450 in the UK, 1500 worldwide	Develops digital tools and content for interactive television

In these companies by far the most important occupational categories were QA/testing, sales/technical sales support and R&D. As such, they offer a useful comparison to the Irish findings already outlined.

Company A's occupational structure bore some similarity to large multinationals who were localising entertainment content in Ireland. They employed a team of 20 producers who worked alongside external game development teams. These producers had a mix of project management skills and knowledge of the game development process but their role was primarily to keep development projects on time and within budget. They also employed a large number of QA/testing staff (55 full time and 60 part-time). Where they diverged from Irish companies was in their employment of three full time R&D staff, which reflects the dynamic nature of technology in the digital games field.

Company B employed 13 graphic design and content authoring staff, seven technical staff and 18 staff in sales and marketing. As a supplier of content enabling tools this company had a clear focus on sales.

Company C divided most of their technical staff into two groups: a multimedia technology group and a broadcast technology group. Most of these staff had engineering and computer science backgrounds, but as the following description outlines, they combined their technical occupation with sales and customer support.

The multimedia technology team employed core software developers but also a team focussed on 'customer development' and on 'integration support'. The latter were focussed on pre-and post-sales support. Within the broadcast technology team there was a 'new products group', which focussed on developing new products and supporting pre-sales. The broadcast team also had a group of 'architects' who developed customer specification documents and turned them into formal technical design documents. Both groups had a core R&D team (of 10 and 7 respectively).

Company C had far fewer sales staff, only 20, but clearly their technical staff offered a partial sales function as well.

All three companies reported that they had experienced no major difficulties recruiting staff in the past year, although one company reported that it was difficult to find senior managers in marketing with the necessary management skills.

With regard to skills, Company B noted that there was a need for sales people with good technical understanding and an understanding of the specificities of new media and the new media user.

Looking to the future, Company A could not say what new occupations and skills would be needed, as much depended on the next generation of games platforms. They did see a need for a more formal corporate culture and management skills.

Company B envisaged that websites will become more 3D and video-game-like and graphic designer roles will expand as a result. They also saw a need for usability experts.

Company C felt that the occupational and skill set was likely to stay the same in the medium term with slow growth in employment, although they would probably take on a few graphic designers.

On conclusion it is interesting to note the existence of formal R&D departments in these three UK companies, particularly in Company A which was a content developer and publisher. This group is concerned not just with developing new tools but also with generating knowledge about forthcoming platforms which can then be communicated to producers and other staff working within the company, often through internal briefings. In this way producers are kept informed as to what technologies third party game developers will be using in the future and sales and management are kept informed as to developments in their field.

3.5 Conclusions

Although few companies interviewed reported significant vacancies, there were areas where a lack of relevant skills occurred. These include sales, marketing, project management and specific skills such as console games programmers. In the medium-term, approximately a quarter of the companies interviewed expected to be recruiting in the areas of media authoring and software development, with a further 17% expecting to increase their sales staff and content producers/managers. It was thought that potential growth areas such as digital and interactive television could create many opportunities with the development of enhanced television programmes and their accompanying websites, merchandise etc.

Similar to the Irish situation, the need for sales staff with technical knowledge, or vice versa, occurred in the UK companies interviewed. Also, future growth of the industry was considered to be dependent on uptake of new technologies.

Chapter 4: Education and Training Provision

There are over 200 courses, relevant to the digital content industry, currently available in the third-level education system in Ireland at present along with a variety of training courses, ranging from one day courses to traineeships. The educational background required for employment in the digital content industry varies depending on the occupation with jobs such as animators or instructional designers requiring more specific qualifications as compared to occupations such as software developers or testers where a general computer science qualification is often sufficient. These issues will be discussed further in this chapter with more specific occupational information in the chapters on games, wireless and e-learning. The availability of training for those currently working in the industry, or indeed, interested in working in the industry is also detailed in this chapter.

4.1 Education Provision

There are a total of 227 courses in the Universities and Institutes of Technology (IoTs) in Ireland that were found to be related to the digital content industry. An examination of all University and IoT courses was conducted with courses selected on the basis of being related either directly, such as courses in animation, film and TV and games, and indirectly, such as computing courses which produce graduates that are suitable for employment in a number of industries, one being the digital content industry. These courses are detailed in Table 4.1 below.

Table 4.1 Digital content courses by award level, 2001-2003

	Cert	Diploma	Degree	Graduate Diploma	Masters	Total
Universities	-	-	38	15	28	**81**
ITs	31	47	54	5	9	**146**
Total	**31**	**47**	**92**	**20**	**37**	**227**

Source: HEA, Dept of Education & Science

The majority of courses are to Degree level (92 of the courses) with IoTs providing nearly two-thirds of all courses in this area. The IoTs provide the majority of courses to Degree level whereas the universities provide more courses at postgraduate level. Twenty of the courses included in Table 4.1 were offered for the first time in the previous academic year or are due to commence this year.

The courses are categorised into seven groups in Table 4.2 – details of the courses included in each group can be found in Appendix C[24]. The Computing/IT courses account for over a quarter of the courses available for the digital content industry followed by Multimedia courses which total 44, fourteen of which are to Masters level.

Table 4.2 Classification of courses by type and award level

Classification	Cert	Diploma	Degree	Grad Diploma/ Masters	Masters	Total
Computing/IT	14	9	26	6	6	61
Computing - Business	2	8	7	-	5	22
Networks & Electronic Systems	3	4	5	3	4	19
Information Systems Management	1	4	10	-	2	17
Engineering - Electronic/Computing/Software	6	6	19	5	6	42
Multimedia Applications/Technologies	4	6	15	5	14	44
Art & Design	1	10	10	1	-	22
Total	**31**	**47**	**92**	**20**	**37**	**227**

Source: HEA, Dept of Education & Science

4.1.1 Enrolments

Table 4.3 provides information on enrolment figures for the 2001/2002 and 2002/2003 academic years. These figures include both University and IoT enrolments. Nearly 30,000 students enrolled in digital content-related courses in the two academic years examined.

Table 4.3 Enrolments by type and year

Classification	2001/ 2002	2002/ 2003	Overall Total
Computing/IT	6,417	5,266	11,683
Computing - Business	1,649	1,553	3,202
Networks & Electronic Systems	784	744	1,528
Information Systems Management	705	777	1,482
Engineering - Electronic/Computing/Software	2,890	2,482	5,372
Multimedia Applications/Technologies	1,305	1,537	2,842
Art & Design	1,607	1,600	3,207
Total	**15,357**	**13,959**	**29,316**

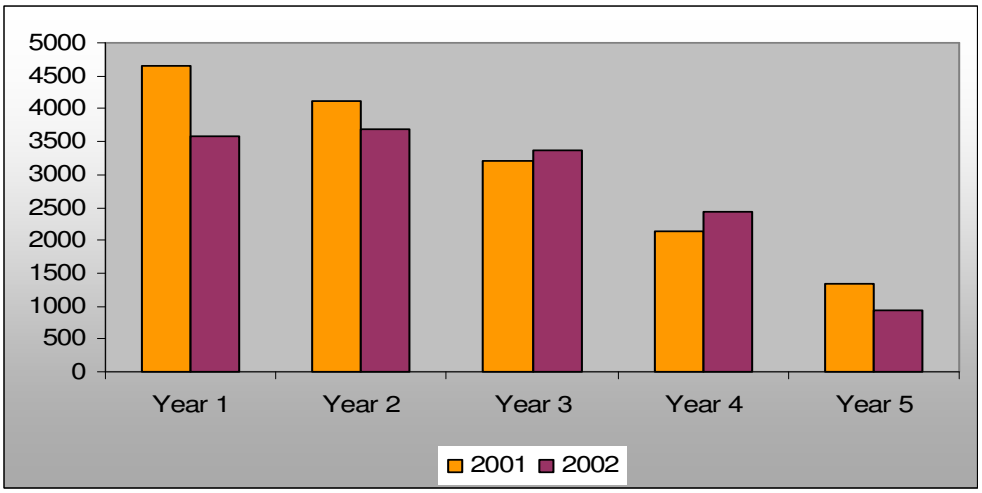
Source: HEA, Dept of Education & Science

Computing/IT courses have had the most significant enrolments in the two academic years, followed by engineering courses with over 5,000 students enrolled. Both of these categories have experienced a drop in students enrolling as have the majority of the IT-related groups. Multimedia courses, however, have witnessed a growth in numbers in this time from 1,305 to 1,537. This reflects the fact that a number of new courses have been introduced in recent years.

[24] A number of courses in these groups provide graduates for a variety of industries and are therefore not serving the digital content industry solely.

When enrolment figures are examined by year for the academic years 2001/2002 and 2002/2003, a notable drop in 1st year enrolments is observed, as seen in Figure 4.1. This indicates a significant reduction in over 1,000 students registering in 1st year between 2001/02 and 2002/03 and a small fall in 2nd year enrolments between those two years. The position is reversed in the 3rd and 4th years with enrolments greater in 2002/03 (reflecting growth in enrolments in the late 1990s).

Figure 4.1 Enrolments by year (Universities and IoTs)



Source: HEA, Dept of Education & Science

An average of 3,000 students undertake digital content-related Post Leaving Cert (PLCs) courses each year with the majority participating in courses in Information Technology and Media Production. E-business, multimedia studies and TV & Film Production courses have been introduced in recent years. Similar to the universities and IoTs, PLCs have also experienced a decrease in numbers registering in digital content-related courses in the previous three years (see Table 4.4). Again, this is particularly the case for computing courses such as eTechnology, Engineering Technology and Information Technology courses. However, multimedia-related courses increased in the period between 2001 and 2003. These courses include design, media production and multimedia studies.

Table 4.4 Registration in Post Leaving Cert Institutions by type and year

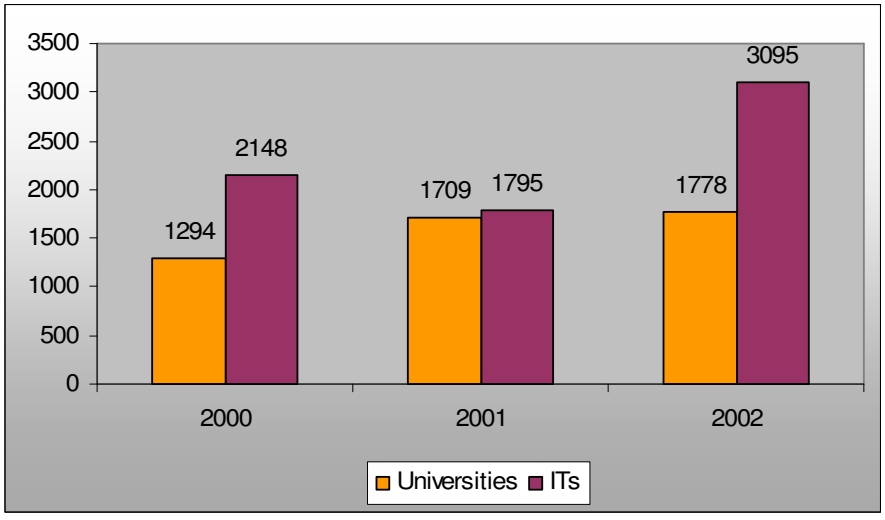
	2001	2002	2003	Total
Design	80	134	110	324
E-Business	147	159	144	450
Electronic Technology	202	130	122	454
Engineering Technology	141	131	91	363
Graphic Design	268	167	144	579
Information Technology	1623	1095	725	3443
Media Engineering	125	128	79	332
Media Production	847	890	881	2618
Multimedia Studies		190	204	394
Network & Software Systems	301	192	209	702
TV & Film Production		43	35	78
Total	**3734**	**3259**	**2744**	**9737**

Source: Dept of Education & Science

4.1.2 Graduations

A total of 14,820 students graduated from digital content-related courses in the period between 2000 and 2002. There has been a significant increase in numbers graduating in this period from 3,442 in 2000 to nearly 5,000 in 2002 (an increase of 42%), with over 3,000 graduates coming from IT courses in 2002 alone (see Figure 4.2).

Figure 4.2 Graduation data for third-level institutes, 2000-2002



Source: HEA, Dept of Education & Science

The numbers of students graduating from each type of course increased in the period from 2000 to 2002 (see Table 4.5). The increase in numbers graduating in computing-related courses reflects the tail-end of the surge of take-up (and provision within the education system) of computing courses which occurred during the initial boom in the IT industry. The increase in multimedia graduates is due to the introduction of a number of new courses in recent years.

Table 4.5 Graduation by type and year

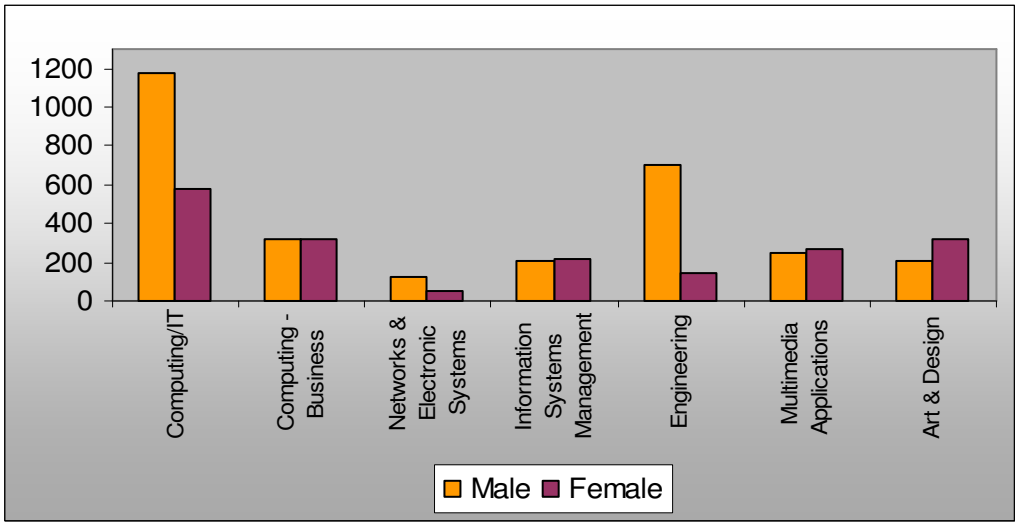
Classification	2000	2001	2002	2003*	Total
Computing/IT	1337	1293	1753	942	5325
Computing - Business	234	305	641	303	1483
Networks & Electronic Systems	87	167	176	136	566
Information Systems Management	355	299	415	438	1507
Engineering - Electronic/Computing/Software	784	721	847	328	2680
Multimedia Applications/Technologies	330	405	513	341	1589
Art & Design	315	314	528	513	1670
Total	**3442**	**3504**	**4873**	**3001**	**14820**

Source: HEA, Dept of Education & Science

* 2003 figures include only IoTs as University data was not available

There was a significant majority of males graduating from both computing/IT and engineering courses, as per Figure 4.3. For the remaining types of courses the numbers of females and males graduating were reasonably equal with the exception of art and design, where there was a majority of females graduating.

Figure 4.3 Graduation by gender in 2002



Source: HEA, Dept of Education & Science

4.2 Ideal Educational background by occupation

The ideal educational background for each occupation was ascertained through a combination of interviews and analysing job advertisements. The companies interviewed were asked to describe the ideal educational background for each of the occupations within the company and also which courses they considered as good models or where they got good graduates. For many of the occupations the interviewees did not specify the necessity for Degree-level qualifications and of those that did a general Degree often sufficed. Experience, talent, enthusiasm and industry knowledge were more valuable in areas such as sound engineering and film and TV production. However, it must be noted that given the previous small-scale of the industry, in many cases there were no specific

courses available in areas such as programming for games platforms etc. As games courses are only now commencing in Ireland there is no indication of the quality and demand for these potential graduates. There were some occupations where specific qualifications were required – these include Animation, Graphic and Instructional design – while others such as software developers and testers require general Degrees in Computer Science or equivalent.

Table 4.5 provides a breakdown of ideal educational background by occupation and also the related courses available. It should be noted that these courses are not an exhaustive list in most cases, but instead an example of courses which are currently available and relevant for the particular occupations. Further details on the education background by each family of occupation follows Table 4.5.

Table 4.5 Qualifications required by occupation[25]

Family	Occupations	Ideal Educational Background	Related Courses
Management	Company Directors	N/A	
	Project Managers	N/A	
	Producers/directors (creative and technical)	Degree – marketing, computers, business 5 years experience preferable	Diploma in Multimedia - Colaiste Dhulaigh, BCFE Degree in Film & TV Production - IADT
	Vendor Management	N/A	
	Operations Research Analyst	N/A	
Content Authoring	Author	Journalism skills, subject matter expertise Degree and/or Masters Computer literacy	Diploma in Journalism – BCFE, GC Degree in Journalism – DCU, DIT
	Journalist		
	Content Quality Assurance		
Media Authoring	Web page development & graphic design (incl. Flash)	Degree in art, industrial design, graphic design Portfolio	Diploma in Design Communications – AL, CIT, WIT BSc in Multimedia - DCU MSc in Multimedia – DCU, UCC, TCD BA in Graphic, Product & Interactive Design – UU
	Sound design/engineering	Minimum of Leaving cert	Diploma in Music Technology - BCFE Grad Diploma/Masters in Music & Multimedia Technologies - TCD Grad Diploma/Masters in Music Technologies – UL, NUIM, DIT
	Video	Practical Film & TV courses Interest in Film & TV most important	Diploma in Television & Film Production - IADT Cert in Media Production - Liberties College Diploma in Film Operations & TV Productions – BCFE Diploma in Film & TV- GMIT

[25] See Appendix C for titles of abbreviated third-level institutions

	2 & 3D animation	Animation Degree plus 1-4 years experience in classical animation and flash	BA in Animation - IADT Diploma in Classical Animation – BCFE Diploma in Computer Animation & 3D Modelling - BCFE
	Instructional design	Teaching qualification – TEFL, H Dip Degree in area of subject matter expertise Masters an advantage Journalism	Technical Communications – UL E-Learning Design & Development - UL BSc in Multimedia -DCU MSc in Multimedia – TCD Graduate Diploma in e-Learning - NCI
Software Development	Programmer/Engineer Technical R&D Technical Customer Support Multimedia Programmer	Degree – computer science Projects very important 2-4 years experience recommended	Degree in Computer Science – TCD, UCD, DCU Diploma IN Computing in Multimedia Programming - IADT BSc in Computing (Software Development) – Tipperary Institute BSc in Software Development – LIT, GMIT Graduate Diploma/Masters in Software Design & Development- NUIG
IT and System Support	Internal and external network administrator Database administration Technical Support Webmaster	Computing Diploma or Degree Practical projects	Cert in IT Support – AL, BN, CW
Sales and Marketing	Sales Marketing Public Relations	Sales experience most important Marketing qualification although Degree not always necessary	Degree in Marketing – DBS, WIT
QA and Testing	Software Quality Assurance Hardware compliance testing	Degree – computer science Some experience preferable	Degree in Computer Science – WIT, LIT, UL, Tipperary IT. Degree in Software Engineering – AL, IT Carlow, DCU, NUIM Masters in Software Engineering – UL,UCD, NUIM Grad Diploma/Masters in Software Localisation – UL
Other specific	Logistics/Operations Warehousing	Level of training depends on company and level	Diploma in Operations, UL

- *Managers*

The lack of qualification requirements specified for managers has a number of possible explanations. Firstly, to get to management level, experience is often of more value than specific qualifications. Secondly, the majority of the companies interviewed (78%) were Irish owned and the manager was, in many cases, the individual who set up the company. For this reason ideal educational background is irrelevant.

It is generally felt in the industry that there is a lack of project management skills in the digital industry. One factor that may cause this is a pattern of technically qualified people setting up companies while lacking the business skills to develop the business. One solution, as suggested by one of the interviewees, would be to source project managers from either the TV or software industry where there is an availability of experienced project managers.

On closer examination of the educational courses recommended by the interviewees, many include modules on project management. These include two of Colaiste Dhulaigh's Diploma courses, Animation and Multimedia, Limerick Institute of Technology's BSc in Multimedia Computing with Design and the MSc in Multimedia Systems in Trinity College Dublin. With project management skills in demand, inclusion of these modules in multimedia courses is recommended.

- *Media Authoring*

Occupations involved in media authoring include web page development and graphic design, sound engineering, video, animation and instructional design. There are currently a number of courses available for graphic designers and web page developers as demonstrated in Table 4.5 and the interviewees did not express any concern with current provision. Requirements for positions in this occupation tend to focus on computing knowledge in certain areas, such as HTML or Flash, rather than on education achievements.

In the smaller companies that provide audio-visual services, an employee providing one specific media service, such as video, sound or editing, is rare – rather they are expected to be skilled in a variety of media services. For this reason a more general qualification with more rounded experience may be the most beneficial. This seems to be a factor influencing the development of the new BA in Film and Television Production in IADT which commenced in September 2004 – students will cover all areas of Film & TV in their first two years before specialising in the final two years. Often qualifications are not essential for occupations such as video and sound design as experience and interest are of more value. In these cases short specific courses can often address skill needs.

Skill requirements are more specific in animation companies, with relevant Degrees required. There was a feeling amongst animation companies that skills in classical animation are still vital despite advances in software in this area. It may, therefore, be worth ensuring that elements of classical animation are contained in the emerging courses

on computer animation. Currently BCFE run Diploma programmes in classical animation, computer animation and 3D modelling. Also, IADT have developed a new animation Degree course which commenced last September. This course includes both traditional and computer animation (Photoshop, 3D Studio Max and Macromedia Flash).

IDA-Ireland has expressed concern in relation to the software packages taught in Ireland – while in Europe the main software package is 3D Studio Max, in the US it is MAYA. Indeed, a number of development companies in the UK, such as EA, Climax and Sony, have recently moved from 3D Studio Max to MAYA[26]. The lack of graduates with working knowledge of this product is creating difficulties in attracting large animation companies to Ireland. IADT considered introducing MAYA into their new Animation course but cost had to be considered. IADT also felt that an intensive course of 2 to 3 weeks would suffice for a qualified animator to upskill in MAYA.

Specific Instructional Designer courses are needed, according to IDA-Ireland and e-learning companies, so as to assist in meshing both subject matter and technical expertise in e-learning. Currently those working as instructional designers tend to have a teaching qualification although the Technical Communications Graduate Diploma in the University of Limerick was recommended by a number of practitioners for entry into this occupation. As Table 4.5 indicates a number of courses are currently available for instructional designers and this occupation is discussed in further detail in Chapter 6 on e-Learning.

- *Software Development*

As mentioned in Chapter 2, recent OECD figures point to Ireland having the highest number of graduates in computing as a percentage of all fields of study amongst OECD countries. The majority of employees in software development tend to have a computer science qualification and tend to work in programming/development. Third-level projects were stressed as being an important determinant of future employment. The need to be client-facing in this occupation was also stressed in the interviews, particularly for the smaller companies. Indeed, a number of employees in this occupation have taken on a sales function as part of their job function. As a result, a communications module in these courses may be an advantage for gaining employment.

The role and skills needs of software developers are explored in further detail in the chapters relating to games, e-learning and wireless (see Chapters 5, 6 and 7 respectively).

- *QA and Testers*

Most QA and testers come from a computer science background and it is one of the few occupations where employment of graduates occurs, although experience is required in some situations. Two companies employing QA & Testers take on co-op students from a number of IoTs and universities on a regular basis and often recruit these students on completion of their course. It also seems to be the case in the companies interviewed that

[26] http://www.mayaassociation.fsbusiness.co.uk/mov-escapestudios.htm

QA & testing staff tend to progress to product/project management. As noted in Chapter 2, QA & testing is one of three areas where multinationals indicated they are intending to recruit in the future.

The games sector employ a significant number of testers and further details on this occupation are included in Chapter 5.

- *Sales & Marketing*

A large majority of interviewees noted that they have had difficulty recruiting sales staff with knowledge of the industry. Many sales people are also reluctant to join a small digital media company as it may not have sufficient growth potential to attract them. Potential customers for this industry are also often hard to sell to due to negative experiences in the IT industry downturn. One interviewee noted that there are no Degree programmes in Ireland in sales – an area which the interviewee felt needs rectifying. As mentioned previously, it is the case in some companies that technical engineers are providing a sales service without any specific sales training. Modules on communications and sales techniques may be of benefit for such persons, either included in the technical courses or as stand-alone options.

4.3 Links between industry and third-level education bodies

Many of the companies interviewed stressed the importance of industry participation in the educational system – the level of participation could vary from assisting in designing the courses or part-time lecturing, to providing guest lectures to students. A number of third-level institutes currently consult with industry personnel when developing new courses. Examples include the new BA in Film and Television in IADT and the BSC in Games Development being developed in Dundalk IT. It is a HETAC (the Higher Education and Training Awards Council) requirement for all ITs to conduct extensive industry research before setting up any new course.

Many interviewees stressed the importance of third-level projects for future employment of graduates and many of the courses recommended by the interviewees include projects as a large part of their programme. Employers felt that this provided an excellent guide to a student's abilities and also worked as a good opportunity to prepare students for work in the industry and to introduce them to business practices. It was thought that projects should be more commercially-based than at present and also supervised or critiqued by industry personnel. This would both advance the student's business skills and awareness and bring their work to the attention of possible future employers. Higher education institutions are aware of these suggestions and IADT, for example, aims to provide interdisciplinary projects to encourage teamwork and create more of a 'real-work' environment. The O2 Student Media Awards is another method of achieving these objectives. Similarly, Dare to be Digital Ireland, a competition for games enthusiasts in Irish third-level education, was launched this year. Originating in Scotland, this competition involves interdisciplinary teams developing their own games. The competition has also extended to Korea and Malaysia with the winners in each country

travelling to Scotland to compete in the international final. All of these initiatives assist in enabling students to gain project experience before graduating and should continue to be encouraged and funded.

Work experience during education was also discussed with the interviewees. Although this was deemed useful, it is an area that requires improved management according to companies. As much of the workload of smaller companies is project-based, it is not always satisfactory for them to have students working there when there is little for them to do. Being able to take on students for the length of a project would be far more beneficial for both employer and student. Unfortunately, this is not always possible in a structured educational programme. As mentioned in Chapter 5, the use of co-op students working in the larger companies as testers appears to be a very successful model and has led to employment for a number of students on graduating. Educational bodies have, however, pointed to the difficulty in finding placements for students on work programmes, particularly in small sectors such as games and animation. With the increase in industry participation in the education system, communication between both should assist in alleviating some of these issues.

The system of having guest lectures incorporated into courses is also recommended be industry with a number of the interviewees stating their willingness to provide this service, considering it to be an excellent learning tool. A number of education providers have adopted this approach including IADT, who state that they have no difficulty in getting industry personnel to participate. Guest lectures are advertised by New Media Technology College as being a significant part of the Diploma offered.

The MSC in Digital TV Management and Production in the University of Brighton is an excellent example of all of these initiatives. An industry board was set up to assist in advising on developing the course and students also give presentations to the board, giving them the opportunity to showcase their work to industry personnel. Guest lectures and a three-month company placement are also incorporated into this course. Cross-disciplinary co-operation is also undertaken in this course – a very important development for courses as technical, business and creative elements continue to merge.

4.4 Initiatives in second-level education

There are a number of initiatives currently running in second-level education which are encouraging the use of digital media. The Digital Hub oversee the Liberties Learning Initiative which is an education programme in the Liberties area delivering a range of learning and showcasing projects focused on the creative use of digital media. The FÍS programme, run by IADT and funded by the Department of Education and Science, is an initiative to promote film in primary education, with schools receiving digital camcorders and access to editing suites. This programme is currently running on a pilot basis with 28 schools in Dublin and Cork.

The National Centre for Technology in Education (NCTE) also have a number of programmes, such as the Technology Integration Initiative, Teaching Skills, Schools

Integration Project and Scoilnet, which assist in encouraging students to learn about and use digital technology. It is hoped that these initiatives will encourage the uptake of digital media in Ireland along with increasing interest and innovation in the area.

4.5 Key issues emerging in education

A decrease in enrolments in computing and engineering courses related to digital content has occurred in recent years. Multimedia courses, however, have experienced an increase in numbers in this period. Graduation figures increased in all groups in the period between 2000 and 2002. However, with the significant decrease in enrolments in the computing and engineering fields, the number of students graduating in these fields will decrease accordingly. To ensure that there is a sufficient supply of graduates to meet the future needs of the digital content industry, measures need to be put in place to combat this decline in numbers. The EGFSN has already made recommendations in this area and a number of initiatives have been taken. However, the latest CAO application trends suggest a continuation of the downward trend. The significant majority of males over females in computing and engineering courses may be of interest along with the increase in uptake of multimedia courses. Re-developing and re-branding a number of computing/engineering courses to include elements of the digital content industry, such as games and wireless, may assist in attracting students to these courses and hence provide a supply of graduates both for the digital content industry and the IT industry as a whole. This suggestion is discussed further in Chapters 4 and 6. The second-level education initiatives described above will also help to assist in attracting more students to these areas of study.

Gaps exist in the third level education provision in emerging markets such as games and wireless as described in Chapter 3. At present there are no Degree programmes for games development, and many games companies are forced to recruit from abroad to attain someone with the necessary skills and experience. The lack of courses is also a hindrance in attracting large games companies to Ireland according to IDA Ireland. However, a number of games courses have recently been developed with a Masters in games development in Carlow IT due to commence in this academic year and a BSC in Games Development in Dundalk due the following year. These are discussed in more detail in Chapter 5.

The interviews also suggested the need for improvements in the courses currently available for the digital content industry. New/improved modules in project management, producer skills, business skills, innovation, entrepreneurial skills and communication techniques are necessary in the relevant technical and creative courses.

4.6 Training Provision

The provision of training is essential for the continued advancement of the existing workforce in the digital content industry along with any potential employees who require a conversion course so as to work in the industry.

From the interviews it was ascertained that a majority of those companies that carry out training do so in-house, through a variety of methods such as master classes from more senior staff, weekly staff presentations to exchange knowledge, induction and mentoring programmes and in some of the larger companies access to online learning specific to the company. Larger companies and/or branches of multi-nationals were found to have a more structured training plan and budget for staff, many with structured induction programmes for new recruits. Two of the larger companies had access to a vast array of online learning for staff. These companies also tended to have large training budgets for accessing external training. This is not the case for many of the smaller companies, many of whom do not have specific training plans or budgets for their employees.

Numerous private colleges in Ireland provide training in relevant areas such as project management, specific computer packages and languages and sales training. Accessing funds to send staff on these courses can often be difficult for SMEs and should be considered by Enterprise Ireland so as to ensure that Irish companies can compete in the global market.

4.6.1 FÁS/Screen Training Ireland

FÁS/Screen Training Ireland (STI) is a section within FÁS which is specifically dedicated to providing training both for professionals in the film and independent TV sector in Ireland. It receives special funding for this purpose. Courses vary from one day master classes to traineeships. Courses contain elements of technical, business and creative skills with the amount of each depending on the course type. Examples of courses include budgeting, health and safety, 3D animation, script analysis and film scoring. Many of the courses cover areas such as finance and business skills and also elements of media authoring, which would be of value to the digital content industry. FÁS/STI also oversees a bursary scheme that funds industry professionals to receive training and/or work experience abroad when it is not available in Ireland. Overseas training accessed in recent years includes screenwriting, camera directing and the European Masters in the Management of Digital Interactive Services (EMMDIS). An expansion of the remit of FÁS/STI would be of great benefit the digital content industry in accessing relevant training.

4.6.2 Digital Media Forum

The Digital Media Forum, funded largely by Skillnets, was set up in Dublin in April 2004 and consists of 22 companies located around the Digital Hub. Their focus is to provide networking opportunities and training and development for these companies with a particular initial focus on business skills for owner-managers. This training will cover areas such as strategic planning, sales and marketing, delegation and client management. Support and funding should continue for this training and it should be extended to cover digital media companies throughout Ireland.

4.6.3 Training by occupation group

- *Managers*

There is a general feeling that there is a lack of entrepreneurial, business strategy and project management skills in the digital content industry. The extent of management training is notably different between large/multinational companies and small/medium companies. The IMI runs a number of management training courses and, indeed, a number of managers from the larger companies interviewed were found to have attended these management training on a reasonably regular basis – covering management skills, budgeting, HR development courses etc. FÁS/Screen Training Ireland also runs a number of courses to advance business skills in the film and television industry in Ireland. Indeed, one of the recommendations in a report on training needs for FÁS/STI[27] was to continue to provide extended business-orientated development programmes for producers and management teams and to increase business-oriented short courses.

FÁS/STI also runs a Screen Leaders programme which has been devised for experienced owner/managers to enhance business expertise in the key areas of management, strategic planning, marketing and distribution. This programme involves a number of workshops and mentoring sessions over a 3-4 month period. The Digital Media Forum is also focusing its attention at present on providing business skills training to owner-managers as described in the previous section.

- *Media Authoring*

FÁS/STI run a number of courses for those working in media authoring, including character animation, video and an assistant sound editor traineeship.

The importance of classical animation skills was stressed by the traditional animation companies interviewed and a lack of character animation skills has been identified by the industry. FÁS/STI runs a number of courses in animation and has recently run a series of courses relating to character animation.

Training in MAYA is also an area in need of focus at present for media authors. Many developers, including EA, Climax and Sony, who had previously worked on 3D Studio Max have now changed to MAYA. For Ireland to compete at an international level, the need for skills in the relevant disciplines is essential. FÁS/STI has begun to use MAYA in their animation courses but specific courses in MAYA will also be needed.

If demand for instructional designers increases significantly in future years and the number of graduates from the relevant third-level e-learning courses is not sufficient, short-term courses may be required to train subject matter experts in the technical e-learning methods.

[27] Training Needs Report: Film and Television Sector 2002-2007. McIver Consulting, March 2002

- *Software Development*

As technologies are constantly changing there is a need for software developers to keep their skills up to date. Conferences on emerging technologies are seen as valuable training events for a number of companies and employees travel on a regular basis to the USA, which is considered at the cutting edge of new technologies. Employees also attend developers conferences such as on Xbox, PS2 and mobile operators have also become involved in these conferences for their new platforms. There are a number of training providers available both off and online for a variety of software packages. Training for some of the more specialised technologies, such as J2E, can currently only be accessed in the UK. If these types of courses are not in high demand it is often cheaper for companies to send individuals abroad to gain these skills rather than approach a training provider in Ireland to supply this training. However, if it is determined that there is demand for specific technical courses, these should be provided in Ireland, possibly in the Digital Hub.

- *QA and Testers*

Similar to software developers, there is a need for QA and Testers to keep up to date on new developments, including network support such as Novell and Unix. There are a number of private colleges running these courses.

- *Sales & Marketing*

FÁS/STI runs a number of courses, which include developing skills to successfully pitch ideas. As mentioned previously, it is also the case that in some of the companies the technical staff are providing a sales service without any sales training. It is difficult to get the balance of technical knowledge and sales techniques for either technical or sales staff. If this need is not met in the third-level system, short-term courses will be required to upskill staff in these areas.

4.6.4 Key issues emerging

The training requirements differ between large/FDI and small/medium companies. The former tend to have structured training plans and budgets and can offer extensive training for their staff in-house. This is not the case in many of the small companies – a majority of whom would benefit from business, communication and sales skills training. Often, they do not have the budget to allow staff to attend training sessions abroad to keep up to date on emerging technologies.

Training is available from a variety of sources including IMI, Digital Media Forum, and FÁS/Screen Training Ireland with many private colleges providing training on new technology. Each of these focuses on a small area of the digital content industry with no-one having overall responsibility for providing training for the industry as a whole. The remit of FÁS/ Screen Training Ireland was established in the particular circumstances of Ireland's developing film/TV industry a decade ago. Changes in technology, and the

economic development, need to simulate equally the digital content industry, suggest that this constrained remit of FÁS/STI is no longer appropriate. It is recommended, therefore, that FÁS/STI's remit be extended to the broad digital content industry, and funds be made available to allow it to play a similar role for the digital content industry to that it plays for film/TV.

To attract FDI companies to Ireland, there may also be a necessity to train staff in Ireland in any particular skills required to meet the needs of prospective FDI companies. FÁS should continue to maintain its flexible approach to training of the unemployed and job-seekers whereby special, customised, training courses can be provided in the case of new FDI employment-generating projects.

4.7 Summary of Recommendations

The inclusion of project management modules in current and future digital content-related courses is required to alleviate the current difficulty in sourcing these skills in Ireland. It is also recommended that modules in communications and sales techniques be included in technical courses as the technical role in companies becomes more client-focused. Training in MAYA is also required both to assist in attracting FDI to Ireland and for Irish companies to compete in the global market.

Industry participation in the education system should continue to be encouraged in the form of establishing courses, third-level projects, work placements and guest lectures. Support of second-level initiatives in digital content areas will also assist in encouraging more students to pursue a career in this industry.

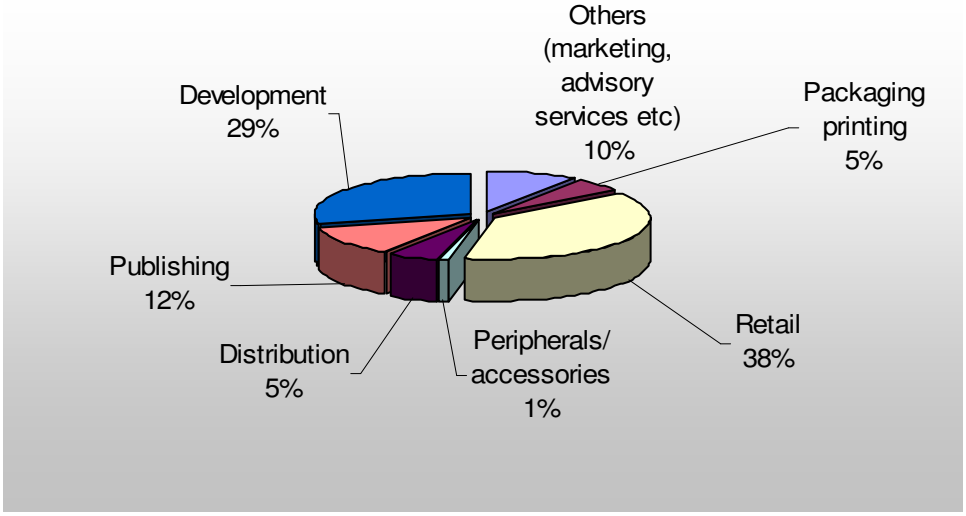
For the continued advancement of those currently working in the industry, or intending on moving into this industry, the expansion of FÁS/STI will be required. Funding for participation on technical courses may also be required.

Chapter 5: Focus on Games

5.1 Description of the games sector

The games sector is identified in the Forfás report as being a potential key growth area in Ireland across the breadth of the value chain. This sector includes games for PCs and consoles, along with mobile, interactive TV (iTV) and online games. Worldwide the games industry is expected to grow from €42 billion (in 2001) to €71 billion by 2005/2006 with average annual growth of 14%[28]. Globally, it represents the biggest sector in the digital content industry with sales accounting for over a quarter of the industry's worth. U.S. sales of console games totalled €4.6 billion while computer games accounted for €1.2 billion in sales[29]. The UK leisure software industry (including games), the third largest market after the US and Japan, has been estimated to be worth €1.6 million in 2002, according to ELSPA (the Entertainment & Leisure Software Publishers Association) while the Irish leisure software market is valued at €120 million.[30]

Figure 5.1 Employment in the UK Games Industry in 1999 Total: 20,750



Source: Human Capital[31]

It is estimated that about 20,000 persons are employed directly or indirectly in the UK games industry. As Figure 5.1 demonstrates employment in the UK games industry is predominately in retail. Development is next with approximately 6,000 employees. Although publishing employs considerably less, it is a very significant area which ultimately drives games development. The games industry typically works with an advance and royalty payment system. Developers must win publishing deals to bring their games to the market. Publishers are the 'king-pins' of the industry and they drive

[28] Forfás (2002), '*A Strategy for the Digital Content Industry in Ireland*'.
[29] Entertainment Software Association, 2003
[30] Forfás (2004), '*Electronic Games Study*'.
[31] Human Capital (2001), '*The UK Games Industry and Higher Education*'. DTI

the industry in financial terms. There has been considerable global consolidation at this stage of the value chain with a few large companies dominating the market. For this reason, Ireland is unlikely to develop one from scratch. However, it would be very beneficial if Ireland could attract a publisher to establish a presence in Ireland.

This could provide key knowledge and financial support for Irish developers. In addition, many publishers have their own internal first party development teams. This would potentially lead to a number of international games developing companies locating in Ireland so as to be in close proximity of the publishers. For these reasons, attracting a large publisher to Ireland would create an excellent opportunity for Ireland and its games industry.

The games sector in Ireland at present is small and underdeveloped. It currently includes 14 games companies (11 Irish and 3 international) represented in Table 5.1 by their main function although most of these companies provide a variety of services across the value chain. There is an estimated 300 people working in the industry in Ireland, the majority being involved in localisation with only 118 working in original content, software and middleware development.[32] Microsoft and Vivendi are both large employers in the area of localisation of games and other entertainment products. The sector has also experienced success through Havok with its innovative middleware. Havok is now recognised as an international player. There are some games development start-up companies such as Kapooki and Eirplay, the latter having won the 'Game Developer of the Year' award at this year's O2 Digital Media Awards. Upstart Games, a games publishing company on the N-gage platform from Nokia, recently ran a competition in collaboration with Nokia to encourage innovative mobile games ideas for the N-Gage platform.

Table 5.1: Companies in Ireland by their main function

Development	Middleware	Localisation	Publishing
- Kapooki Games - Torc Interactive - Bugaboo Studio - Eirplay Games - Meedja - TKO Software - Purplenose Games	- demonWare - Havok	- Microsoft Games Studio - Vivendi Universal Games	- Upstart - Selatra - Trust 5

The games industry in Ireland has progressed in a number of areas in the last year. The games industry forum, gamedevelopers.ie, was launched last year to allow small games developers to share knowledge and resources. In January 2004 IGDA (International Games Development Association) launched an Irish Chapter to advance games development as a craft and to assist networking and access to resources for games developers both locally and globally. There has also been a considerable amount of attention focused on the games industry in Ireland recently through the Dare to be Digital competition which was run in Ireland for the first time this year. The event is sponsored by the Digital Hub, IDA, EI and Diageo Ireland and attracts undergraduate and

[32] IEI (2004), '*The Games Software Industry in Ireland*'.

postgraduate students along with recent graduates. The purpose is for the team to submit a game idea, outlining the creative, technical and business management of it. One winning team are given the opportunity to develop their project into a working prototype, in the University of Abertay in Scotland, with training, mentoring programmes and supports provided. The promotion of competitions such as Dare to be Digital it is hoped that a number of interdisciplinary groups will form to create teams for games development and thus drive the growth of the games industry in Ireland.

5.2 Future directions of the games sector

It is predicted that the majority of global growth will be driven by console games, delivering annual growth of 15%, whilst PC games will grow more slowly in value[33]. Internet, mobile and interactive television are also expected to develop as compelling new platforms for games, attracting new gamers and greater revenues. Games are amongst the most popular interactive services delivered through digital TV. Networked multi-player gaming – whether online, mobile or iTV – is also becoming increasingly popular.

The costs involved in developing a console game are considerable, between €2-5 million, it takes between 18 to 24 months and requires a team of about 20 although numbers involved can increase significantly depending on the game. In order to increase Ireland's ability to compete in the console and PC games area IGDA Ireland are recommending that the government adopt a number of policies. The first is to review current R&D practices with the possibility of introducing tax credits to allow companies to write off some of the development costs. This is an initiative which TIGA (The Independent Games Developers Association) has been involved in implementing successfully in the UK. TIGA is currently conducting R&D Tax Credit 'road shows' in the UK to help games companies utilise this new initiative. Another option is to extend Section 481 – this is a tax incentive currently utilised in the film industry to attract investment. If these two tax incentives were introduced it would also enhance Ireland's prospects of attracting a large games publisher to Ireland and produce many jobs in the industry as a result. To ensure Ireland is prepared for this we need to ensure the availability of sufficient skills in console and PC games development.

As the development of a PC/console game is such a costly undertaking, many smaller games companies are developing their skills and experience through the development of mobile games. The development costs and time to produce a mobile game are significantly less than for console or PC games. Global forecasts for the mobile games industry show it to be the biggest growth area with an expected market value of €3.1 billion by 2007 and reaching €5.7 billion by 2010[34]. Mobile games are an opportunity for Ireland not only due to the low barriers to entry but also to the fact that Ireland has such a high rate of mobile phone penetration. However, a high rate of mobile phone penetration is not sufficient to sustain a mobile business as the low barriers to entry foster intense

[33] DTI (2002), '*From exuberant youth to sustainable maturity: Competitiveness analysis of the UK games software sector'*.
[34] Informa Media Group (2003), '*The Dynamics of Games'*.

competition. At present, a large majority of the games companies in Ireland are producing or distributing mobile games. For some this is an opportunity to gain skills and recognition in the games industry with a view to moving to console games development when the company is more established. It would be expected, therefore, that in the short term at least we will see an increase in mobile games production in Ireland.

The Forfás report indicates that the initiatives required to advance the games industry in Ireland include:

- Attraction of an international development or publishing company
- Possible attraction of online games hosting servers
- Focus on the creation of games-related education and training in Irish economy

The attraction of an international development or publishing company to Ireland would assist in creating the image of Ireland as a global player in the games industry. It would also bring a strong skill set into Ireland along with creating a number of high skilled jobs. An online games hosting server would not provide a particularly high value-added service but it would give the Irish industry an opportunity to establish its name in the global games industry. The current lack of education and training courses for the games industry may, however, act as a deterrent when attempting to attract games companies to locate in Ireland.

5.3 Occupation and skills profile

Information on the key occupations in games has been gathered from interviews, games company websites, reports on the industry and through a search of international job advertisements for each occupation. Skillset in the UK are also working on defining the key skills areas in the computer games industry[35]. They have identified seven key areas including design, creative, audio, technical, project and production management and managing the organisation and quality assurance. These key areas have yet to be finalised but elements of their analysis are included below.

Of the 23 Irish companies interviewed for this report, five were identified as having games as their main function with a further two having games as a secondary function. The five specialist companies interviewed consisted of one enabler company, two focusing on the localisation of games and two content developers. In addition, two interviews took place in the UK; one with a leading games publishing company and the other with a representative of TIGA. The information supplied by these interviewees will be incorporated into the chapter. Current and future skills needs for the international games industry was also discussed at this year's E3 conference in the US and the findings of this workshop are discussed by occupation.

The games development process has five key occupations. These are:

[35] http://www.elspa.com/about/education/keyareas.pdf

- Games programmer
- Artist
- Games designer
- Tester
- Games producer

Of the games companies interviewed in Ireland, the largest percentages of full-time game specific staff were programmers with only a small percentage employed as designers or artists. However, it should be noted that this concentration of programmers over artists reflects the dominance of mobile and middleware companies in our sample. Producers and testers also represented a significant percentage of the game specific occupations particularly when account is taken for contract workers. The large proportion of testers, as opposed to the other game specific occupations, is due to the inclusion of two large localisation companies in the survey. Sales and marketing was also a significant area of employment (the demand for these other occupations is discussed in the previous chapter on general skills needs). The background of the companies interviewed should be kept in mind, along with the fact that this survey does not claim to be representative. The survey is undoubtedly skewed by the inclusion of two large localisation companies. These firms require a much larger number of testers and sales people than a standard development firm.

5.3.1 Games Programmers

The role of the games programmer is to develop the software and related tools used in the game development process along with participating in the design and testing of games. Programmers make up a large proportion of the games development team with one games company suggesting that the development process involves 5-10% design with the remainder involved in programming. The skills required for a games programmer differ depending on the platform on which the game is being developed. These range from consoles (Xbox, Playstation), PC, online and mobiles. The programming languages differ even among the platforms – for example a number of established companies are moving into the mobile market with Sony's PSP and Nintendo releasing mobile handsets using C++ and PC-based programming languages and Nokia's N-Gage which is based on Java and C++ languages. With the roll-out of broadband and increased usage of mobile games, networked games will become increasingly popular leading to the need for games programmers with networking skills.

The recent E3 conference in the US highlighted the need for people with skills particularly in C++ and artificial intelligence (AI), but also assembly language, graphic and audio techniques. Increasingly it was found that programmers are breaking in specialities such as AI, graphics or audio.

The strong demand for programmers with C++ and AI skills was reflected in the international job advertisements examined for this occupation, with these the predominant skills sought. 3-D programming techniques are also often required. Many

job ads also specified platform experience such as PS2 and XBOX, and knowledge of software packages such as Direct 3D, Direct X, OO, OpenGL, J2ME and Java. Team working and problem solving skills are also key as are good communication skills which were stressed in the majority of the job advertisements.

5.3.2 Games Artist

There are a variety of different artist roles involved in the development of a game. Specific job titles in this category include Concept Artist, Texture Artist, 3D Modeller and Animator. The Concept Artist creates the original artwork for game design concept documents; the Texture Artist adds all texture elements to the surroundings, characters and 3D models; the Modeller provides working 3D models for use in a game and the Animator is involved in animating individual characters and scenic elements within a game.

Artistic talent is the most obvious basic requirement for the position of Artist in a games development team with traditional drawing skills a must. 3D computer animation techniques (such as Maya, 3D Studio Max and Photoshop) and 2D packages (e.g. Photoshop, Delux Paint and Paintshop Pro) are necessary as was reflected in their predominance in the job advertisements examined for these occupations. Nintendo, represented at the E3 conference, stated that while they have always used 3D Studio Max they are now changing to Maya, as is the trend for many games companies. Having skills in both techniques was considered advantageous making a candidate very marketable. Animation skills required included 2D sequencing, 3D modelling, texturing and lighting with experience in high-end compositing and video editing. More emphasis has been placed lately on light and colour and how they interact, according to comments made at the E3 conference. These skills and knowledge are very similar to those required in the animation sector and there is the possibility that if necessary these artists could be sourced from animation companies/courses should demand require it.

5.3.3 Games Designers

The games designer is responsible for developing storylines, characters and settings to implement concepts for computer games. A combination of skills in design, project management, scheduling, communication and research are central to working as a designer in the games industry as is also an understanding of all aspects of a game including music, code, art etc and extensive knowledge of existing games. Therefore, basic knowledge of C/ C++ and art packages such as 3D Studio Max and Deluxe Paint are required. Prior experience is also often required for this occupation. Soft skills such as communications, creative and analytical skills were the most frequently mentioned requirements in the job advertisements. Some games designers may start out in scripting and progress to games design.

There is a huge need for level designers at present, according to reports from the E3 conference, with particular reference to those with technical skills (i.e. knowing how to script). The ability to communicate with both artists and programmers is considered a

key skill and good project management skills are essential along with a real interest in games.

5.3.4 Games Tester

The role of the games tester is to test software for ease of use, reliability, consistency and compatibility. A minimum of Junior Cert Maths and English along with a strong interest in games, good organisational and communication skills are important. Technical understanding of computer hardware and its products are also a requirement. A games tester requires skills in problem solving, the ability to play games well and good powers of observations along with database, spreadsheet and project planning.

As there is a significant amount of localisation currently taking place in Ireland, this is an occupation which is in high demand mainly on a contract basis. Indeed, localisation makes up two thirds of games activity in Ireland. However, it is a position with high turnover and often depends on the cyclical pattern of games development. Games Tester positions, though, are an excellent way of getting experience of the industry with the possibility of moving up the ranks.

5.3.5 Games Producer

The duties of the games producer include co-ordinating resources, monitoring the development teams, agreeing milestones, presenting the product, and accounting for resources and expenditure. Progression from associate producer is the usual method - this requires either a Degree or experience, with many producers coming from backgrounds in programming, design or testing. Experience in working through the lifecycle of at least two games products was required for a number of advertised jobs.

Skills in project management along with experience are the most significant requirements to work as a games producer. One interviewee expressed major concern about the lack of people with the necessary experience and skills for this occupation in Ireland. As producers are often promoted from another occupation they may lack the project management skills necessary to ensure that games are produced on time and to budget. With the considerable costs involved in producing a console game these skills are essential for the success of game development in Ireland. For this reason it is important to consider the current provision of project management skills in games-related courses.

5.4 Skills gaps and future skills demand

The existing companies in Ireland interviewed did not express any current recruitment difficulties except in two cases where sales and marketing staff were in demand. Difficulty has arisen, however, on occasions when companies have sought specific skills, such as PS2 programming, which often results in recruiting from abroad due to the lack of these specific skills in Ireland. With regard to the future outlook, sales staff were again dominant along with programmers and designers but to a lesser extent. There was also a general uncertainty about the future with technology changes being the major influence on skills needs.

In the short to medium term mobile games programming skills will be required. This will include knowledge of Java, and J2ME in particular, C and C++ (refer to Chapter 5 on Mobile & Wireless Sector for more information on these specific skills needs). Console and PC programming skills will be required in the medium to long-term if Ireland is to capitalise on this growth market. Specific console programming skills along with knowledge of C, C++, Java, OpenGL or Direct X will also be essential. As skills in Maya are considered one of the key requirements for employment as a games artist internationally, there is a need to ensure there are sufficient suitably trained individuals available in this area. Project management, communication and team working skills need to be incorporated into all games courses as they are needed across all occupations working in games development.

Although interviewees did not express concern over recruitment difficulties, it should be noted that any expansion has been gradual and difficulties may arise if there is a sudden increase in demand e.g. if a number of foreign owned companies set up in Ireland. A core aim for the IDA is to attract game companies to Ireland and there is a need to ensure that there are sufficient suitably trained personnel available.

5.5 Education and training provision

With regard to third level education there are three games courses currently running in Ireland but none to Masters level. However, one Degree programmed commenced in this academic year with the possibility of a further three courses due to start in the following year.

Table 5.2 Third Level Games Courses in Ireland

Course	Institute	Award	Student Intake	Duration	Status
Training in Computer Games & Interactive Entertainment Development	Ballyfermot CFE	Fetac Level 2	20	1 year	Running
Computer Games Design	Ballyfermot CFE	Higher National Diploma	24	2 years	Running
Computer Games Engineering	IT Carlow	Degree	30	4 years	Commenced Sept 2004
Games Development	Dundalk IT	Degree	20	4 years	Proposed start date: Sept 2005
Games Design & Technology	Dundalk IT	Degree	-	3 years	Proposed start date: Sept 2005
Games	Letterkenny IT	Masters	18	9 mths F/T + 1 year P/T	Proposed start date: Sept 2005
Games Design	DLIAT	Masters	-		In discussion

Until last year there was only one course available in Ireland in relation to games. The one-year *Training in Computer Games and Interactive Entertainment Development* in Ballyfermot College of Further Education takes in 20 students a year who have in recent years been very much in demand on graduation, particularly in the UK. Entry requirements are low and include good computer literacy, experience of playing computer games and a knowledge of computer games styles. Subjects include:

- History and development of the Multimedia Industry
- 3D Computer Animation and Modelling (3DStudiomax)
- Games Analysis and Design
- Digital Audio Production (Soundscape and Soundforge)
- Multimedia and Web Authoring
- Computer Graphics and Computer Programming
- Computer Architecture Systems and Storyboarding

This one year course provides graduates with an overall grounding of all elements involved in games development although further study is required to move into the industry. Indeed, this course has become a feeder course for the new Higher National Diploma.

(The other courses being established are described further in the following sections.)
In respect of training of existing employees, findings from the report by Surrey Institute of Art & Design[36] indicated that spending by companies in South-East England on training was negligible and that in fact 40% of respondents had not received any training in the previous year. The TIGA representative suggested that the games industry is similar to the film industry where new entrants come in as runners and work their way up through on-site training. This would be in concurrence with the Surrey report findings where almost every respondent had undertaken self-directed and peer-to-peer training in-house and gained experience on the job. Our interviews had similar findings with the majority of training being on-site. This included staff giving seminars and weekly tech talk. Online learning is also used for updating skills in new software packages. Conferences were also of significance in keeping staff informed of new advances in the sector with companies travelling to the US to attend conferences as the US is considered to be at the cutting edge of technical developments. Multinational console manufacturers also hold developers' conferences for emerging products e.g. for PS2 and XBOX, which Irish companies attend.

There is currently no specific training facility for the games industry to ensure that personnel are kept up to date on technology developments in the industry. FÁS/Screen Training Ireland (STI) or a similar body would seem an ideal solution to this - they operate a number of short courses such as animation, scheduling, budgeting, sales and marketing which would be beneficial for those working in games development. The games industry in Ireland would most likely benefit from the subsidised training available

[36] M. Blythe, J. Ibbotson & S. Roworth-Stokes (2002), *'The Future Skills Needs of Interactive Leisure Software professionals in the South East'*.

if STI were to broaden their remit to include the games industry (alongside their current remit of film, TV and animation).

5.5.1 Games Programmers

From the job advertisements examined and the interviews undertaken it was determined that a Degree in computing, software engineering, mathematics, physics or engineering is the usual route for games programmers. Knowledge of C and C++ were the predominant core skills required, along with AI and 3D programming techniques. Specific console programming abilities and experience in software packages such as Direct 3D, OpenGL, J2ME and Java were mentioned frequently.

There is currently only one third-level educational course specifically for games programmers – the Degree programme in IT Carlow that commenced this year. This is a concern when considering the high percentage of games programmers required as compared to the other occupations involved in a games development team. It is also an occupation in which interviewees and international games companies expected demand to increase. Although most enter this area through computing, maths or physics Degrees, platform specific programming skills are not included in these programmes, something which would be an advantage according to those interviewed. Considering the expected demand globally for console games, this is an area which requires attention. Programming skills for networks on a variety of platforms will also be of benefit as games move more towards multi-players whether it is via PC, console, mobiles, internet or iTV. Java programming will also become increasingly important if mobile games production increases in Ireland as anticipated.

Two new games programming courses have been developed recently. The Computer Games Engineering four year Degree programme in IT Carlow commenced in September of this year and is designed to provide students with the programming and supporting skills to develop a broad range of computer games on different platforms. Modules include Applied Mathematics and Physics, 3D Graphics and Audio, Human Computer Interfaces, Games Engineering, Algorithms, Network Programming, Animation, AI, Programming for Games Devices and On-Line Gaming Technologies. The course also includes industrial placements and project work. The Games Development Degree programme in Dundalk IT, also four years and expected to commence in September 2005, includes modules on OO Design, Algorithms, Mathematics & Physics, Animation, AI, Software Engineering, Advanced Networking Technology, Computer Games Platforms, Games Design and 3D Modelling. Project work is also included. IT Carlow offer 30 places on their Degree programme while Dundalk IT plan to offer 20 places. Both of these courses seem to be suitable for a career in games programming with both covering AI, a skill currently in demand according to the E3 conference this year.

Table 5.3 below sets out examples of established courses for games programmers in both the UK and USA. These Universities and courses were mentioned by interviewees as being of high reputation and producing quality graduates.

Table 5.3: Sample of game programming courses available in the UK and USA

Courses		Modules
UK	University of Abertay – *BSc and MSc in Computer Games Technology*	Mathematics, C++, Java, 3D programming, Communication skills, work experience, Japanese Studies option.
	John Moore's University – *BSc in Computer Games Technology*	Mathematics for games, Human-Computer Interaction; Principles of interactive graphics, Object-Orientated Design for Games Development; Computer Games Design; User Interface Design, Virtual Reality, Multimedia networking, Work experience
	Teeside University - *Degree in Computer Games Programming*	C and C++; Mathematics, Functional Programming; Virtual Reality, Communications; Business Organisation, Games Production; Games Design; AI, Project, work experience
USA	Fullsail, Florida – *Degree in Game Design & Development*	3D content creation, 3D programming, AI, C++, Console Development, Open GL, Physics & Maths, Structure of game design, Business communications, Gaming project

These courses have a number of modules in common including an emphasis on maths, C++ programming and communication skills and are similar to the two new courses in Ireland. All of the UK courses include a work experience element and many include significant projects. One company interviewed stressed the importance of final year projects for future recruitment.

Both the above courses and the new Irish games courses share a number of similarities with software development/computing courses with modules such as networking, algorithms, maths, physics, AI etc. Indeed, the 2 new games courses indicate that graduates of these courses will be suited to work as software developers in other sectors of the computer industry. This generates two possibilities.

Firstly, a selection of current software development/computing courses could be altered to encompass some games elements, with the possibility of the name being changed to Computer Games Development. Many courses currently running have modules relating to games (mainly games programmers) such as the BSc Computer Science in UCC, BSc in Computing in University of Ulster and the Diploma/ Degree course in Computing (Multimedia) in DLIAT. Modules vary between courses but include some of the following: Java, C++, algorithms, networking, animation, multimedia authoring and multimedia communications. The BSc in Computing in University of Ulster also runs modules specific to the games industry such as Computer Games Design and Development and 3D Modelling and Rendering. Such a change in emphasis (and name) could have the advantage of attracting more students to software development/computing courses to alleviate the current drop-off in demand by students. In addition, in anticipation of demand increases in the short-term, conversion courses (possibly Masters) for software development/computing graduates could equip them with the skills required for the games industry.

A number of Masters courses are currently in the development stage in Letterkenny IT, DLIAT and Dundalk IT for example. The MSc in Letterkenny IT is due to commence in September 2005 which is expected to involve a 9 month fulltime taught element leading to a Graduate Diploma and those students who are eligible can continue on to Masters level on a part-time basis. There will be 18 places available for participation on this course. The majority of the programme is expected to focus on software development but games related subjects such as game design, mathematical methods and 3D modelling will also be studied along with a business element. The focus of the remaining two courses has yet to be determined.

The University of Abertay currently runs a Masters programme in Computer Games Technology. This course is open to students with an Honours Degree that includes a substantial element of computer programming and a reasonable background in Mathematics. Modules include 2D and 3D Games Programming, Console Games Programming, Art and Sound in Games and Designing Games. At present a significant number of Irish students are participating in this course which would suggest that there would be a demand in Ireland for a similar course.

Recommendations:

- Any new Degree course in games programming should include elements of console and online programming, C++ programming, AI, networking skills, team working skills, communication skills, work experience and a market oriented, commercial final year project. *(IT Carlow, Dundalk IT)*
- The Masters programmes in the games area, currently under development, should be supported to commence in the short-term. *(IT Carlow, Letterkenny IT, DLIAT, HEA, Dept of Education & Science)*
- A number of current software development/computing courses should be adjusted and re-branded to explicitly include elements of games development so as both to enhance Ireland's skills in games and to reverse the reducing trend in take-up of computing courses. *(Universities, Institutes of Technology)*

5.5.2 Games Artists

Some artists' jobs recommend a qualification in art or design for a career as a games artist but this is considered a bonus rather than a requirement. More significant are computer animation techniques such as Maya, 3D Studio Max, and Photoshop. 2D sequencing, 3D modelling, texturing and lighting are also essential animation skills. As can be derived from the skills required, games artist shares many skills with an Animator. There are currently 3 courses in animation in Ireland – 2 Diploma courses in Ballyfermot (Classical Animation and Computer Animation & 3D Modelling) and one Degree programme in Animation in DLIAT. The Degree programme takes in 22 students per year. However, all of the international advertisements for artists examined commonly require experience working with MAYA, although this is not currently being taught in the third-level system in Ireland. This is an important consideration for IDA Ireland who will have difficulty in attracting FDI to Ireland without a suitably skilled workforce. When developing their Diploma course in Animation into a Degree programme, DLIAT

considered the use of MAYA. It was determined to be too expensive and it was felt that a 2-3 week intensive course would be sufficient for a qualified animator to become proficient in MAYA. 3D Studio Max is used in the course instead. Short, add-on courses may, therefore, be an effective method of providing skills in Maya.

FÁS/Screen Training Ireland (STI) has recently run a number of short courses on animation including 3D animation skills and creating character animation in 3D which would be beneficial for games artists. Indeed, they have indicated that due to increased demand the next animation training may likely take place using MAYA. If the games industry could be included in the remit of STI then games artists would be able to access these relevant courses. Collaboration with IGDA to identify future skills needs would be of benefit to FÁS/STI as IGDA represents games companies directly.

Due to the expansion of animation courses a decade ago to serve the animation sector, the current outflow from the third-level courses appears sufficient to meet demand in the short-term. Indeed, the companies interviewed did not express any current or future concerns in recruiting games artists. However, as the industry expands, as is anticipated, the number of courses available for games artists may require attention. Also of need of attention is to ensure that future graduates and those currently working in the industry have the opportunity to update their skills to be proficient in new software packages.

Recommendation:
- Short courses in MAYA need to be made available to update the skills of games artists. *(FÁS/STI)*

5.5.3 Games Designers

Skills required to become a games designer include design, project management, scheduling, communication and an overall understanding of all aspects of the game development process. Ballyfermot College of Further Education has introduced a new Diploma course with higher entry requirements which commenced in September of last year. The *Higher National Diploma in Computer Games Design* is a 2-year programme, with student intake of 24 per year and modules including:

- Games Production
- Games design theory
- C++ programming
- 2D Image Processing and Animation, 3D Modelling
- Story-boarding for Games Design
- Desktop Audio
- Web Support and Small Business Development

This Diploma programme contains many of the elements considered important for working as a games designer – subjects such as games production, games design theory and desktop audio – although is seen to lack an emphasis on business and soft skills. Basic programming skills would also be an advantage. As prior experience is a principal

requirement for employment in this occupation, work experience and significant projects would also be of benefit.

The proposed Degree course in Games Design and Technology in Dundalk IT, mentioned in Table 5.2, is expecting to commence in September 2005. This will be a three year course and aims to develop the creative skills required to design computer games in areas such as games structure, graphics, modelling, animation and interface design. Business skills are an important component of the syllabus which, as mentioned above, is of great importance for games designers.

With one course currently available for games designers and a proposed Degree course due to commence next year, the short-term demand for games designers in Ireland should be met as only a relatively small number of designers are required in the game development process. Indeed a number of games designers currently find employment in the UK as there have been difficulties finding available jobs in Ireland. As the industry expands, demand for games designers will increase. They may then be sourced through attracting Irish games designers back to Ireland or increasing numbers on available courses. More importantly, however, is to ensure that graduates of the courses in Ireland are suitably qualified, with the necessary soft skills and business knowledge, to advance the games industry in Ireland.

Recommendation:

- Any course for games designers should include elements of soft skills, such as communication and team working, business skills, project management and scheduling, and a general technical understanding of all elements of games development. *(BCFE, Dundalk IT, Universities, Institutes of Technology)*

5.5.4 Games Testers

Third-level qualifications are not generally a prerequisite for employment as a games tester. Skills in problem solving, good communication abilities and an interest in games are the main priorities. However, in some instances, knowledge and experience in working in specific platforms, such as consoles, is required. A number of companies interviewed employ co-op students from third-level institutes such as Waterford IT and University of Limerick and these students are often offered positions in the company on completion of their studies. Testers, on gaining experience, can progress to areas such as games producers. Testing is therefore a good opportunity to gain experience in the games industry as it is currently the biggest employer. FÁS currently run a short course on Software Testing which includes modules on localisation, networking and multimedia. Should the need arise this course could be adapted to suit the needs of games localisation companies.

Recommendation:

- Companies should be encouraged to continue to take on co-op students to assist them in gaining experience in the games sector. *(Universities, Institutes of Technology)*

5.5.4 Games Producers

As games producers progress from the other occupations, there is no particular education route for this job. However, to work successfully in this position the skills that were identified earlier such as project management skills, budgeting, scheduling and presentation skills should be incorporated in all games-related educational courses. Experience in working through the lifecycle of a number of games products is also essential for this career and therefore practical real-life project work would be an obvious advantage along with industrial placements. Short-term training courses may also benefit the individual in certain business skills. For example, being able to access business-related courses that FÁS/Screen Training Ireland conduct, such as scheduling and budgeting, would be relevant to games producers.

Recommendations:

- Project management skills should be incorporated into all games courses so as to equip students with the skills to progress to the level of games producers. Work experience and projects in courses would also be an advantage. *(Universities, Institutes of Technology)*
- FÁS/STI should make available suitable short business-related (including project management) training courses for games producers. *(FÁS/STI)*

5.6 Gaps and future needs in education and training provision

One area of training requiring attention is that of project management. This is alluded to in a number of studies and was regularly mentioned in the interview process. It was generally felt that there was a lack of suitably qualified people in this area i.e. those that had successfully managed the lifecycle of at least two games. This has been discussed in relation to games producers above and is also dealt with in the previous chapter.

Extending FÁS/Screen Training Ireland's remit to include games, or establishing a similar body with responsibility for the games sector, would benefit the industry due to being able to access current courses such as specific animation courses and business-related training. FÁS/STI could also provide short courses in new software packages related to games to update the skills of those seeking employment in the games industry. The availability of such training could be used to meet the short term training needs of FDI and indigenous companies. An intermediary between companies and training bodies should be set up to ensure that skills needs are sufficiently met. The Digital Hub may be in a position to make the connections, which should also include new and existing games companies. This has already commenced with the setting up of the Digital Media Forum, consisting of 22 companies from the Digital Hub area, which intend to provide enterprise resources such as training. Funding is being provided by Skillnets with the main training focus being on advancing the business skills of owner-managers of digital media companies. IGDA Ireland should also be involved in consultation with the Digital Hub to identify future skills needs, so as to ensure the total sector is included and not just companies located in the Digital Hub. Indeed, IGDA Ireland and gamedeveloper.ie have

already collaborated with the Digital Hub and Enterprise Ireland to run a number of games workshops. The continued support for such projects should be encouraged.

Furthermore a games cluster such as Game Republic in the UK would also be an advantage in relation to training needs in the future. Game Republic, a cluster of game developers, has set up in Yorkshire and its mission statement is to support, encourage and promote games development in the Yorkshire and Humberside region. Seven of the region's leading developers have signed up along with the majority of local games companies. One of their goals is to support training and development across all areas of video games development and build relationships with local Universities and colleges. This method of companies sharing resources effectively and efficiently may be an excellent model for the Irish industry to consider so as to assist in developing the industry here. At present, we do not have a significant number of companies or sufficient funding to emulate the Games Republic, however it is a desirable goal for the future. The Digital Hub sees this as a key role and is keen to act as a catalyst for developing clusters within the industry. It is important, however, that this does not exclude companies outside the Digital Hub area.

Recommendations:

- FÁS/STI or a similar body should be responsible for providing on the job training programmes for existing workers in the games industry. *(FÁS, STI, Enterprise Ireland)*
- The Digital Hub and IGDA Ireland should act as intermediaries between companies and training establishments to ensure that short-term training needs are met. *(Digital Hub)*
- The Digital Hub should facilitate the development of a cluster of games developers in Ireland. *(Digital Hub)*

5.7 Conclusions and recommendations

Overall, the skills needs of the games industry in Ireland are benefiting from the significant expansion in third-level games courses over the next 2-5 years. The most immediate need is for games programmers with console programming skills. This need is being met by two new games programming courses, in IT Carlow which commenced in September 2004 and Dundalk IT, due to commence in the next academic year. The proposed BA in Games Design & Technology in Dundalk IT will expect to meet the needs of the industry for games designers to possess significant business skills to advance the development of games in Ireland. Furthermore, there are three proposed courses at Masters level in both design and development. The graduates of all of these new courses are expected to meet the short-term demands of the industry. However, processes should be put in place to ensure that new skills needs will be addressed within an appropriate time frame. Assigning responsibility to the Digital Hub to monitor the needs of new and existing games companies is necessary to ensure the success of the games industry in Ireland.

In summary, the recommendations given throughout the chapter are listed below:

1. Any new Degree course in games programming should include elements of console and online programming, C++ programming, AI, networking skills, team working skills, communication skills, work experience and a market-oriented, final year project. *(IT Carlow, Dundalk IT)*

2. The Masters programmes in the games area, currently under development, should be supported to commence in the short-term. *(IT Carlow, Letterkenny IT, DLIAT, HEA, Dept of Education & Science)*

3. A number of current software development/computing courses should be adjusted and re-branded to explicitly include elements of games development so as both to enhance Ireland's skills in games and to reverse the reducing trend in take-up of computing courses. *(Universities, Institutes of Technology)*

4. Short courses in MAYA need to be made available to update the skills of games artists. *(FÁS/ STI)*

5. FÁS/STI or a similar body should be responsible for providing a range of training courses for existing workers in the games industry. *(FÁS/ STI)*

6. Any course for games designers should include elements of soft skills, such as communication and team working, business skills, project management and scheduling, and a general technical understanding of all elements of games development. *(Universities, Institutes of Technology)*

7. Companies should be encouraged to continue to take on co-op students to assist them in gaining experience in the games sector. *(Dept of Education & Science, HEA)*

8. Project management skills should be incorporated into all games courses so as to equip students with the skills to progress to the level of games producers. Work experience and projects in courses would also be an advantage. *(Universities, Institutes of Technology)*

9. FÁS/STI should make available suitable short business-related (including project management) training courses for games producers. *(FÁS/STI)*

10. The Digital Hub and IGDA Ireland should act as intermediaries between companies and training establishments to ensure that training needs are met. *(Digital Hub, IGDA Ireland)*

11. The Digital Hub should facilitate the development of a cluster of game developers in Ireland. *(Digital Hub)*

Chapter 6: Focus on e-Learning

6.1 Description of the e-Learning sector

E-learning has been defined as the delivery of educational–related content via all electronic media, including on-line platforms (the internet, intranets, extranets LAN/WAN), broadcast (digital analogue and interactive TV), and packaged based media (audio/video, CD-ROM and DVD-ROM etc)[37]. It covers a wide set of applications and processes, including computer based learning, web-based learning, virtual classrooms and digital collaboration.

The leading country for the creation and use of e-learning is the United States. In terms of the scope of educational e-learning, a study by the Sloane Consortium[38] shows that in the United States, an overall growth rate of 20% is expected in the number of students in third level education studying online from 2002 to 2003. Over 1.6 million students in third level education took at least one online course in Fall 2002 and over one third of these students took all of their courses online. Complete online Degree programmes are offered by 34% of all institutions of higher education. Among public institutions, the numbers are even higher, with 49% offering an online Degree programme and 97% offering at least one online or blended (i.e. part e-learning, part conventional teaching) course.

EU policy has stressed the role of e-learning in improving innovation in the education and training of its citizens. In a report on the European e-learning Summit, Viviane Reading, the European Commissioner for Education and Culture, described e-learning and innovation in education and training structures as the "key to delivering a new European Information Society"[39]. The e-learning Industry Group was established in 2001 to promote the implementation of e-learning in Europe.

E-learning has been Ireland's most successful digital content sector to date, with a total estimated turnover of €400 million for 2002[40]. There are 39 companies currently located in the country, employing approximately 700-800 people. Of these companies, 34 are Irish while five are internationally owned. Many of the Irish owned e-learning companies also have international offices in locations such as UK, US, Singapore and Hong Kong. The e-learning companies tend to be better established than most of the other areas in the digital media industry in Ireland with many companies over 8 years old. The industry in Ireland has witnessed many changes in recent years due to the economic slowdown with a number of companies forced to close including some of the more established e-learning companies. These include Educational Multimedia Group and Unlimited along with a large employer in the south west, NETg, closing their Irish offices

[37] From *The Digital Content Industry*, PricewaterhouseCoopers Report to Forfás, Sept 2002, p.47-8
[38] I. Elaine Allen & Seaman, J. (2003) '*Sizing the Opportunity: The Quality and Extent of Online Education in the United States, 2002 and 2003'*. Needham, MA: Sloane Consortium.
[39] Report on the European e-Learning Summit 2001, 10-11 May, IBM International Education Centre
[40] Enterprise Ireland data

in 2003. There are also, however, five new start-up companies and an overall optimism among the companies that the outlook for the industry is positive.

6.2 Future directions of the e-learning sector

The Forfás report identifies e-learning as a digital content sector with a high opportunity for growth in Ireland. The market can be divided into two main segments, namely corporate and educational. Both are attractive growth markets. Although forecast figures had to be reduced last year after poor sales in 2002, the global corporate e-learning market is still forecast to grow from €5.5 billion in 2002 to €19.6 billion in 2006[41]. America will remain the largest regional market with growth expected to increase from €4.3 billion in 2002 to €15.6 in 2006, although Europe is forecast to experience the greatest growth rates from €0.5 billion to €2.7 billion in the 4 year period. Ireland's early entry into this market has meant that it has developed a strong international reputation and it is believed that this can continue to be exploited to ensure the future growth of the sector and a significant share of the European market.

As mentioned above, the market is still sizeable and demand is still growing, despite not performing as strongly as some of the predictions made a few years ago at the height of optimism about the potential of e-learning[42]. What has happened is that there is an increased demand for blended solutions, which incorporate elements of traditional face-to-face classroom teaching or training with interactive e-learning methods. There is also an increased demand for tailor-made or custom-designed e-learning packages, rather than off-the-shelf products. One area which requires attention is that of research and development. Recently, an e-Learning CEO Forum in Ireland highlighted the need for improved R&D provision in Universities and a stronger link between academia and the industry to be established and encouraged so as to further enhance Ireland's progress in the e-learning sector.

6.3 Occupation and skills profile

The structure and occupations constituting e-learning companies was researched through a combination of interviews and desk and Internet research. Eight companies interviewed stated that e-learning was one of their primary functions.

E-learning companies in Ireland differ from other digital content companies in that there are some medium to large-sized companies, rather than just small companies. They also tend to be established longer with the majority being at least 8 years in existence. Consequently, it is possible to have more clearly defined occupational roles within e-learning companies.

From the research, it emerged that the structure of a typical medium to large e-learning company can be divided conceptually into six different groups. There can, of course, be overlap between the different functions. This overlap occurs more often in smaller

[41] IDC (2003), '*A Bird's Eye View of the Worldwide e-Learning Opportunity, 2002-2006'*.
[42] '*Hard lessons from the big e-learning experiment'*. The Guardian, Nic Paton, 30 August 2003.

companies where employees are required to provide a multitude of functions. The groups and their corresponding occupations are summarized in the table below.

Table 6.1: Structure of typical e-learning company

Groups	Occupations
Editorial group	Content authors
Instructive & interactive design group	Instructional designers
Media group	Multimedia specialists Graphic designers
Technology Group	Programmers
Quality Assurance Group	Content quality assurance Software quality testers
Services Group	Technical support

It should be noted that this table excludes the general categories of management, sales, finance, human resources and administration. It focuses only on roles specific to the core activities of e-learning companies. The other occupations have been discussed previously in Chapter 3.

Within e-learning companies there is generally an editorial group with subject matter expertise and an instructive/interactive design group that provides pedagogical expertise. This latter group provides the interactive structure necessary to engage the learner. A media group then creates the interactive structure using graphics, animation and video, while a technology group carry out any back-end programming necessary. In addition, there are quality assurance and software testing groups who check the products and programmes for errors. Finally, there may be a services group that provides learning and technical support. There were no employees in this final category in the companies interviewed, however.

Each of the companies interviewed was asked to detail the occupations of all of its employees. Table 6.2 below outlines the distribution of employment in the 8 companies interviewed by broad occupation. Two-thirds of employees were in the core e-learning occupations. Instructional designers constituted the largest proportion (20%) of the numbers employed, followed by multimedia/graphics artists (18%), programmers (13%), quality assurance testers (11%) and content authors (4%). The columns on the right display the distribution of employment in other occupations. Managers comprised the highest number, followed by administration, sales, finance and human resources. These other occupations made up one-third of total employment.

It must be emphasised that the Irish data was not from a random sample survey and thus the figures can not claim to be representative statistically. However, the occupational distribution found in the interviewed companies is similar to the distribution found in the E-Learning Guild 2004 Salary Survey[43], in that instructional designers constitute the largest overall group (20.4%), followed by managers and designers.

[43] www.eLearningGuild.com

Table 6.2: Distribution of persons employed in interviewed companies by occupational group

Occupations	Percent employed	Occupations	Percent employed
Core		**Other**	
Instructional Designer	20.0	Management	15.4
Multimedia/Graphics	17.8	Admin	13.6
Programmer	13.0	Sales	3.7
Quality Assurance Tester	10.6	Finance	1.4
Content Authoring	3.9	HR	0.5
Total	**65.3**	**Total**	**34.6**

The majority of persons employed in the companies interviewed were employed on a permanent basis. Employment in e-learning has undergone many changes in recent years. At the start of the decade, companies were expanding at a rapid rate. In 2002, with demand not sustained at expected levels, some companies were forced to make redundancies or even close down. Demand has subsequently improved in some cases and in the past year, companies have started recruiting again, mainly on a contract basis.

Each of the core occupations will be examined, in terms of the specific skills and qualifications required by the companies interviewed and from an examination of vacancies notified both domestically and internationally.

6.3.1 Content Authors

The role content authors play in e-learning companies varies depending on whether the company is product oriented (where the company develops its own product) or focuses on custom development (where the company works to a particular client specification). If the company focus is on the former, the content author provides subject matter expertise for the e-learning product being created. The companies interviewed sought persons with writing skills and subject matter knowledge, either through formal qualifications or industry experience. A journalism background, along with editorial skills, was viewed as beneficial. Due to the nature of the job, subject matter experts tend to be employed on a contract basis.

If the company is working to a client specification, it tends to specify the ability to learn quickly and disseminate information as crucial skills. Client management skills are also important. With the increase in demand for blended e-learning solutions there will be, in the future, a greater demand for content authors to have client management skills along with excellent communication skills.

6.3.2 Instructional Designer

Instructional designers represent the largest overall group working in e-learning – approximately twenty percent. They are responsible for designing the pedagogical structure of the e-learning package. In order to be employed in this position, it is generally necessary to have a background in education or training. Teaching experience is valued, as is a background in learning theory and human-computer interaction (HCI). Oral, written and interpersonal communication skills are also essential components of this occupation. Familiarity with graphic tools such as Dreamweaver, Photoshop, HTML and Flash, along with knowledge of JavaScript, Visual Basic or Director, is considered necessary for instructional designer positions. The ability to create graphics, visual and audio content and knowledge of programming/coding of web-based training are also required in a number of job advertisements. This is particularly the case in smaller companies where multi-tasking is the norm. As e-learning methods advance, knowledge and experience in blended learning solutions are becoming more significant.

Vacancies for instructional designers in the United States tend to specify, in addition to the above mentioned skills, the need for persons to have a knowledge of a variety of e-learning development guidelines, such as World Wide Web Consortium, the Americans with Disabilities Act and SCORM[44].

6.3.3 Graphic/Multimedia Designer

Graphic and multimedia designers provide the media to support the interactive design using graphics, animation and video. A graphic/multimedia designer working in the e-learning sector requires the same skills as in any other sector. The occupation remains the same across sectors; it is simply the nature of the content that changes.

For employment within the e-learning sector much emphasis is placed on a person's portfolio. Experience in software packages such as Adobe Photoshop, Illustrator, Quark Express and Macromedia Flash is often sought. Knowledge of Pre-Press, Macromedia Freehand, Dreamweaver, 3D Studio Max, HTML and Java can be desirable also. Many vacancies stress that the ability to learn new software packages is crucial.

6.3.4 Programmers/Developers

The skills required for developers working in e-learning are no different to those required in other digital content sectors. Companies tend to require some form of post-secondary qualification in a relevant multimedia area in order to be employed as a programmer. The skills required for programmers vary depending on what type of programmer is being sought, which in turn is dependent on the type of e-learning product being produced. Vacancies for 3D Developers, for instance, tend to specify the need for persons with skills in 3D Studio Max and Adobe Photoshop, while vacancies for Authorware Developers seek persons with experience in Macromedia Flash and Director.

[44] SCORM is the acronym for Shareable Content Object Reference Model. It is a collection of specifications adapted from multiple sources to provide a comprehensive suite of e-learning capabilities that enable interoperability, durability, accessibility and reusability of Web-based learning content.

General multimedia programmers need a background in Java and HTML (and/or DHTML /XML).

6.3.5 Quality Assurance Testers

E-Learning companies require both content quality and software quality assurance testers. Content quality assurance testers check the content of e-learning products for errors while software quality assurance testers check the programmes for bugs. For content quality assurance, the companies sought individuals with good language skills and an eye for detail. The educational background specifically mentioned was either journalism or TEFL. For software quality assurance testers, companies sought people with a computing/IT background. The skills required for this role are of a low level. Companies have successfully employed co-op students from neighbouring Universities for this occupation.

Should a large international company locate in Ireland this is an occupation which may be in high demand, particularly if the company's focus is on localisation of their product for the European market.

6.4 Skills gaps and future skills demand

Due to the slowdown in the economy during the last few years a number of companies in Ireland downsized, with some having to close down. As a result of this there is currently an excess supply of e-learning personal. However, the industry in Ireland is optimistic that the market will pick up this year so that demand may soon match supply.

As stated previously, there is increased importance attached to the ability of companies to adapt to the current e-learning climate and to provide blended solutions, which combine on-line elements with traditional face-to-face or alternative teaching methodologies. As a result, those working in the industry would be expected to have excellent communication and client management skills.

A number of companies interviewed also stressed the importance of international sales and marketing skills and were expecting to be recruiting in this area in the near future. The sales and marketing environment for e-learning differs from other digital content sectors in that companies are generally selling to business customers rather than private consumers. This has implications for product/market development within the companies.

In terms of future demand for skills, many companies stated that there will be an increased demand for incorporation of video in e-learning with skills such as sound engineering and sound editing becoming increasingly important. This is the trend in the US but it has yet to reach Ireland due to the slow roll-out in broadband. If this is the case, then it will soon be necessary to have people with skills in video which can be integrated into e-learning packages. Also, if Digital TV advances in Ireland as predicted many new skills will be required.

Other skills felt to be currently lacking in the e-learning industry in Ireland include project and account management skills, business development skills and creative design skills.

There is an increasing need for content authors to have client management skills along with journalist and editorial skills. While a number of companies seek instructional designers with skills in graphics and programming, it is important to focus on the interactive methods of teaching depending on the different platforms i.e. via CD-Rom, internet, digital TV or through a mobile device (M-learning). In the future, graphics/multimedia designers with audio and video skills will become increasingly in demand in the e-learning sector. Also, the establishment of a large international e-learning company to Ireland would increase significantly the demand for both content and quality assurance testers.

6.5 Education and training provision

The e-Learning Guild's 2004 US Salary Survey found that 90% of respondents had completed at least a bachelor Degree with 54% reaching a minimum of Masters level education. The level of education attained varies among occupations with subject matter experts and project managers having a very high level of third-level qualifications. This would suggest that the e-learning industry requires high levels of education achievement and, therefore, offers high-level occupations.

Eleven courses have been identified in Ireland as relating specifically to e-learning (see Table 6.3). These are made up of six courses to Degree level, one Graduate Diploma, three Graduate Diploma/Masters and one Masters programme. Many of these courses are very new. Five courses have so far produced graduates yielding 116 graduates in both 2001 and 2002 respectively. Total registration in e-learning courses increased from 356 students in the 2001/2002 academic year to 491 students in 2002/2003 - due mainly to the introduction of the new courses. Annual student intake is estimated at approximately 215.

Table 6.3 Current Education Provision relating specifically to e-Learning

Course	Institute	Award	Student Intake	Duration
Audio Visual Communication	IT Tallaght	Cert/ Diploma/ Degree	~28	2-4 years fulltime
Interactive Multimedia	IT Tralee	Degree	25	4 years fulltime
Multimedia	DCU	Degree	~45	4 years fulltime
Multimedia Computing & Design	University of Ulster	Degree		4 years fulltime
Applied Languages & Computing	University of Limerick	Degree	~15	4 years fulltime
Interactive Media	IADT	Degree	20	1 year add-on
e-Learning	NCI	Graduate Diploma	~15	1 year part-time
Education & Training Management	DCU	Graduate Diploma/ Masters	~36	2 years part-time

e-Learning (Interactive Teaching Technologies)	University of Ulster	Graduate Diploma/ Masters		1-3 years
Technical Communications	University of Limerick	Graduate Diploma/ Masters	15	1 year full-/part-time
e-Learning Design & Development	University of Limerick	Masters	15	1 year fulltime

The undergraduate programmes tend to provide general skills for working in multimedia along with elective modules specific to e-learning such as Instructional Design. The Audio Visual Communication courses available in IT Tallaght combine audio and video production modules with business skills along with an option to study interactive design. The Interactive Multimedia course in IT Tralee, new in the 2003/2004 academic year, covers modules such as graphic design, video/audio production, multimedia design and development along with an elective in instructional design. The more specific postgraduate e-learning courses focus primarily on instructional design although most also include elements of graphic and multimedia design along with some programming skills. This is beneficial as some jobs for instructional designers require skills and knowledge of these areas.

There is a need to monitor the outflow from the newly established e-learning courses. At present it is too early to establish whether they are meeting the needs of the sector, although the course content indicates that they are in principle appropriate. It is also necessary to ensure that the courses modernise as time goes by, using the most appropriate technology and teaching the most up-to-date pedagogical techniques.

From the interviews it was established that most training is provided in-house and up-skilling occurs mainly through on-the-job training.

6.5.1 Content Authors

As mentioned previously, the skills required for content authors depends on the company focus, be it product or custom oriented. For product oriented companies subject matter expertise is most often required. Therefore, qualifications in specific niche areas are required. The e-Learning Guild, in their 2004 US Salary Survey, found that 50% of Subject Matter Experts studied to a minimum of Masters level. People with journalism qualifications are also sought for positions as content authors in both product and custom oriented e-learning companies. There are 10 journalism courses currently available in the third-level education system in Ireland –one Diploma, three Degrees, 1 Graduate Diploma and 5 Masters – and no shortage of persons trained in journalism.

In terms of educational provision specific to the e-learning industry, the University of Limerick runs a Graduate Diploma course in Technical Communications, which can be carried on to a Masters level. This course enables graduates with subject matter expertise to communicate effectively to various audiences through a number of media.

The course includes modules on technical communication theory (such as learning theory and reading theory); the context of technical communication theory (for example, legal issues concerning intellectual property and copyright laws); documentation management; localisation processing and human-computer interaction. The course is offered in two streams, depending on the individual's experience with computers. There is also the option of taking this course by distance learning. Of the first graduates off the course last year (12 in total), five are working in e-learning related jobs, one is teaching, two working on their theses with the remainder either travelling or not working. Considering the closure of the biggest employer in the area, NETg, this information is quite optimistic for the future with the course director confident that the industry is picking up again.

The MA in e-Learning Design & Development in UL, along with the BA in Applied Languages & Computing, both contain modules on technical communications. A number of courses also contain authoring modules, including the BSc in Multimedia in DCU.

An M.Sc. in Science Communication (not included in Table 6.3) is offered in Dublin City University (DCU), which, although not aimed at preparing students for e-learning, nonetheless trains students in technical communication. In 2000 and 2001, when recruitment demand was high, a significant minority of graduates from this course were employed in e-learning companies. The course is offered on both a full time and part time basis. It can and has provided e-learning companies with (mainly) science graduates who have a solid grounding in communications theory.

As discussed earlier, with changes in e-learning, such as the increased popularity of blended solutions, there is a need for content authors to have communication, project management and client management skills. In the short-term these could be provided through 2-3 day stand-alone training courses but should also be considered as part of the curriculum in third-level courses. If demand increases in the short-term for content authors, training courses should also be made available to up-skill those with journalist and editorial skills in e-learning methods.

Recommendation:

- Client management skills training should be made available for content authors in the e-learning sector through short stand-alone courses and also integrated into the curriculum for third-level courses. (*FÁS/STI, Digital Media Forum)*

6.5.2 Instructional Designers

In terms of educational qualifications, the companies interviewed stated a preference for a Degree, higher Diploma or Masters in education when recruiting instructional designers. The majority of current vacancies in Ireland seek experienced instructional designers with 3 years or more industry exposure. Most companies and vacancies do not require knowledge of particular software packages or programming languages, although familiarity with Macromedia Flash, Java script, Adobe Photoshop, Visual Basic and

HTML is desirable. The focus is very much on qualifications in education and experience in instructional design and teaching.

All of the ten courses listed in Table 6.3 contain some element of instructional design techniques such as learning theory and human-computer interaction. For example, Dublin City University has included the option of taking a module on Instructional Design and e-Learning in the final year of its BSc in Multimedia. Of the 48 students enrolled on this Degree programme this academic year, 37 opted for this module in its first year in operation. This course covers learning theory, project management and courseware evaluation.

The four postgraduate courses available in Ireland provide more specific instructional design learning. Many of the companies interviewed stressed the need for instructional design courses in Ireland, thus the introduction of these courses is very welcome. Along with the Technical Communications Graduate Diploma/ Masters programme, the University of Limerick runs a Masters programme in e-Learning Design and Development. The University of Ulster has also developed a postgraduate qualification in e-Learning (Interactive Technologies) while the National College of Ireland has a Graduate Diploma course in e-Learning. The main benefit in having these qualifications, as opposed to a traditional qualification in education, is that they contain modules not only on learning theory but also on interactive design and human computer interaction, which are particular to an e-learning environment.

The instructional design modules in the University of Limerick are theoretical modules that cover*, inter alia*, learning theory, cognitive psychology, models of instructional design (mainly from the US where there has been much research in this area), how to build motivation into a course, designing on-line courses and how to incorporate feedback. The National College of Ireland e-learning course also includes a theoretical module on instructional design, as well as a module specifically on human computer interaction.

As many of these courses have only commenced in recent academic years there is a need to monitor them to ensure they are meeting the needs of the e-learning sector. As instructional designers represent the most significant number of employees in an e-learning company, it is essential that we ensure there are sufficient numbers to meet any future need so as to enable Ireland to successfully compete in the e-learning market.

There is also a need to ensure that the relevant graphic tools such as Dreamweaver, Photoshop and Flash are being taught on the relevant courses along with skills in JavaScript, Visual Basic or Director. Knowledge of e-learning development guidelines such as World Wide Web Consortium and SCORM should also be included to ensure that graduates from Irish e-learning programmes have the skills and knowledge to work in the international e-learning market (either in companies linked to overseas operations or, indeed, based overseas).

Recommendation:

- The third-level providers of the new instructional design courses, along with the Digital Hub, should maintain close liaisons with industry personnel and representatives so as to ensure their courses are meeting the needs of the industry both in terms of content and quantity. (*Universities, Institutes of Technology, Digital Hub*)

6.5.3 Graphic/Multimedia Designer

The e-Learning Guild's 2004 Salary Survey indicated that 71% of those working in Graphic Design/Art/Creative held a Bachelor Degree with a further 14% with a Master's Degree. A Degree or Diploma in multimedia, graphic design or fine arts is generally sought for these positions. The University of Ulster, Magee College runs a four year Degree programme in Multimedia Computing & Design which is highly regarded among e-learning professionals due to its ability to integrate challenging projects into the course. Modules include multimedia authoring, human-computer interaction, imaging and design application. The course also includes work placement abroad and a significant project. (A detailed examination of the third-level educational provision for graphic and multimedia designers has been addressed in Chapter 3).

As the skills requirements for graphic designers in e-learning are similar to the requirements for similar positions in other areas in the digital content industry, these people can be sourced from other sectors should demand increase. One difficulty, noted by an interviewee, was that it was harder to attract creative designers to e-learning companies as they tended to go into (more popular) areas such as games or film. As a significant number of graphic/multimedia designers are required for the development of e-learning products, employers will need to find ways of attracting these designers from other digital content sectors. Employers also state the importance of designers keeping up to date on new software packages as they emerge. This can be achieved through on the job training, on-line courses or short training courses.

Recommendations:

- Ensure there are sufficient graphic/multimedia designers in the digital content industry to meet the needs of the e-learning companies in Ireland. (*See relevant recommendation in Chapter 3*)
- Ensure training is available for graphic/multimedia designers to update their skills in new software packages as the occasion arises. (*FÁS*)

6.5.4 Programmers/Developers

A number of the e-learning courses listed in Table 6.3 provide modules in programming including the BA in Applied Languages & Computing and the Graduate Diploma in Technical Communications, both in UL. Knowledge of multimedia technologies are also specified in job advertisements and similar to graphic/ multimedia designers there is a need to keep up to date on new software packages. The skills requirements and third-

level education provision for programmers/developers in e-learning are parallel with the requirements for this profession in other areas of the digital content industry and thus the education provision is the same as that found in Chapter 3.

Recommendation:
- Ensure there are sufficient programmers/developers in the digital content industry to meet the needs of the e-learning companies in Ireland. (*See relevant recommendation in Chapter 3*)

6.5.5 Quality Assurance Testers

The e-Learning Guild's 2004 Salary Survey indicated that 43% of those working in Quality Assurance held a Bachelor Degree with a further 43% with a Masters Degree. For content quality assurance, journalistic and editorial qualifications are required. As mentioned previously with regard to content authors, there are 10 third-level courses currently available in this area. The educational provision for software quality assurance testers can be found in Chapter 3 but generally they are sourced from computing/IT courses. A number of e-learning companies source their software quality assurance testers through co-op students from the local Universities and ITs. This gives the student an excellent opportunity to gain experience and industry knowledge and should be encouraged to continue.

As mentioned previously, demand for quality assurance testers is likely to increase significantly if an international e-learning company locates in Ireland. FÁS provides a short-duration course on Software Testing (as mentioned in the chapter on games) which could be adapted to meet any short-term needs.

Recommendation:
- FÁS should be prepared to run short training courses for e-Learning package testers if a large international company establishes in Ireland. (*FÁS*)

6.6 Gaps and future needs in education and training provision

Interviews with the companies involved in e-learning in Ireland found an overall satisfaction with the third-level education system at present. However, there were some issues relating to the lack of available sales Degree programmes and the lack of business/marketing courses with digital media related modules. Some employers stated the need for courses with instructional design/pedagogical methods along with human-computer interaction. The newly established courses will be expected to meet this need. One company also suggested the possibility of adding an e-learning element to the HDip.

Graduates tend to be lacking in industry knowledge according to employers. The industry is prepared to support industry/academic partnerships through internships, in-company placements, or graduate sponsorships but this would require rules to govern the process. Other methods of ensuring that students have industry knowledge on

completion of their courses would be through challenging projects, possibly with an industry critique, and through guest lectures. UL invites guest speakers on a weekly basis for their Technical Communications course – these are mainly from industry but also academics from overseas Universities. The response from industry has been very positive, to the extent that extra seminars had to be held to fit in all the people that agreed to conduct seminars.

With regard to the specific occupations discussed, while at present there appears to be no difficulty in sourcing these occupations, future expansions in existing companies or the attraction of a large e-learning company to Ireland would result in demand exceeding supply. At present, sources within the industry state that there is a surplus of instructional designers in Ireland. If there is an increase in the demand for instructional designers with the establishment of new companies in Ireland or by an expansion of existing companies, then this surplus is a possible source of supply. Should there be a need to quickly produce persons with basic instructional design skills at a more rapid rate than through NCI or UL, it may be necessary to create a skills conversion programme to train people with a background in education or teaching via an intensive short-duration course. There is also the possibility of increasing supply through the inclusion of modules in existing Degree courses, as is the case in the DCU BSc in Multimedia. Similar interventions could be applied to content authors should the need arise. A short training course should be made available for those with effective writing and editorial skills to be trained up in e-learning methods. FÁS, or a similar body, should be responsible for such training.

In relation to training, a number of companies have availed of FÁS/Screen Training Ireland courses such as Health and Safety, Video Production, Producers. As mentioned previously, uptake of video production courses will most likely increase with the increased use of video in e-learning packages. Owner managers will also be able to avail of training by the Digital Media Forum in areas such as business management skills, entrepreneurship and project management. These are areas which were deemed to be lacking at present.

Industry employers have also identified the need for improvements in research and development in e-learning and the need for improved links and partnerships between academia and industry.

Recommendations:

- Academic/industry partnerships, through internships, work placements and guest lectures, should be encouraged to assist students in gaining industry knowledge and experience. (*Universities, Institutes of Technology*)
- Skills conversion courses should be made available in the event of demand exceeding supply in specific e-learning occupations. (*FÁS*)
- Improved Research & Development in e-learning should be encouraged. (*Dept of Education & Science, HEA, Enterprise Ireland*)

6.7 Conclusions and recommendations

The e-learning industry in Ireland is relatively well-developed with a number of companies having established an international presence. However, the slow-down in the industry world-wide since 2001 has also hit the industry in Ireland and some companies have re-trenched or closed down. Some of the very bullish predictions of the industry's growth worldwide are now seen as too optimistic. The use of stand-alone e-learning packages is now seen to be of limited value – rather, their use in conjunction with conventional teaching methods is seen as providing the best outcome for most learners. This means that a greater focus in developing e-learning is being placed on learning and pedagogy rather than technical ICT aspects. The prospects are for steady employment growth in the industry in Ireland with the possibility of a 'step change' if a major international e-learning company decided to establish a company here.

There has been a significant growth in educational provision at third-level over the last few years and this should meet the likely need for recruits in the industry over the next years. We do not recommend a further increase in provision at this stage. Where the industry is currently lacking is in the non-digital media occupations such as sales and marketing and also in business skills such as project management and client management skills. There is sufficient supply of personnel in e-learning occupations at present due to the recent redundancies. However, demand may increase rapidly due to expansion of existing companies, new start-up companies or the introduction of a new international e-learning company to Ireland. To prevent demand exceeding supply, short-term courses need to be made available to train relevant staff in e-learning skills.

The summary of recommendations from the chapter are summarised below:

Recommendations:

1. Client management skills training should be made available for content authors in the e-learning sector through short stand-alone courses and also integrated into the curriculum for third-level courses. (*FÁS/STI, Digital Media Forum)*

2. The third-level providers of the new instructional design courses, along with the Digital Hub, should maintain close liaisons with industry personnel and representatives so as to ensure their courses are meeting the needs of the industry both in terms of content and quantity. (*Universities, Institutes of Technology, Digital Hub*)

3. Ensure there are sufficient graphic/multimedia designers in the digital content industry to meet the needs of the e-learning companies in Ireland. (*See relevant recommendation in Chapter 3*)

4. Ensure training is available for graphic/multimedia designers to update their skills in new software packages as the occasion arises. (*FÁS*)

5. Ensure there are sufficient programmers/developers in the digital content industry to meet the needs of the e-learning companies in Ireland. (*See relevant recommendation in Chapter 3*)

6. FÁS should be prepared to run short training courses for e-Learning package testers if a large international company establishes in Ireland. (*FÁS*)

7. Academic/industry partnerships through internships, work placements and guest lectures should be encouraged to assist students in gaining industry knowledge and experience. (*Dept of Education & Science, HEA*)

8. Skills conversion courses should be made available in the event of demand exceeding supply in specific e-learning occupations. (*FÁS*)

9. Improved Research & Development in e-learning should be encouraged. (*Dept of Education & Science, HEA, Enterprise Ireland*)

Chapter 7: Focus on Wireless & Mobile Communications

7.1 Description of the wireless/mobile sector

The Forfás report identified mobile and wireless as having "particular attractiveness" as a potential growth sector in Ireland, in both consumer and corporate-based markets[1]. Use of mobile and wireless devices to access information and services is still in its infancy, but the widespread ownership of mobile phones (81% penetration in Ireland), the growing use of devices such as PDAs, and the imminent rollout of 3G suggest a strong basis for future market development. Globally, the wireless market for data services is valued at $55 billion, and is expected to rise to $235 billion by 2010[2]. Data services include messaging, data networking, e-entertainment, m-commerce and video telephony. Ireland's consumer spending is approximately €560 per user, with data services accounting for near to twenty percent of this total revenue in 2002 – almost double the Western European average, according to Forfás.

Sixty companies are estimated to be located in the mobile and wireless industry in Ireland, which between them employ approximately 4,000 people (excluding network operators such as Vodafone, O_2)[45]. The spread of employees is divided reasonably equally between indigenous and foreign-owned companies. Employment in indigenous companies averages 40, with 18 of the 49 companies employing less than 15. Average employment in foreign-owned companies is much higher, approximately 160; however, three of the largest FDIs account for over 75% of employment, with average employment dropping to 39 when these companies were excluded. The breakdown of employment by function in indigenous companies is described in Table 7.1 with wireless infrastructure accounting for 27% of employment. Messaging applications and security account for 15.6% and 12.4% respectively.

Table 7.1: Employment in indigenous companies in the wireless industry in 2002[46]

Wireless Framework	Employment	% of Total Employed
Billing & Mediation	179	9%
Software development tools	25	1.2%
Infrastructure	542	27.1%
Location Based Services	47	2.3%
Messaging Applications	312	15.6%
Mobile Commerce	371	18.6%
Mobile Middleware	91	4.6%
Network Management	183	9.2%
Security	247	12.4%
Total	**1997**	**100%**

Source: Forfás

[1] Forfás (2002) *A Strategy for the Digital Content Industry in Ireland: PricewaterhouseCoopers Report to Forfás*
[2] Forfás (2003) *Wireless Communications: An Area of Opportunity for Ireland*
[45] These employment figures, quoted in the recent Forfás report on wireless communications, include sub-sectors that were not included in the 2002 Forfás report on the digital content industry.
[46] Enterprise Ireland data

Of the FDIs it is estimated that three quarters of employees are involved in wireless infrastructure and applications with the remainder in design and development of middleware and end-user devices (see Table 7.2 below). There is an overall predominance of companies (both indigenous and foreign-owned) involved in the development of enabling technologies, which usually consists of developing software applications to enable communications, data services, content delivery and bill paying across mobile and wireless devices. (This is reflected in the sample of companies for this study, the majority of which have as their primary function the development of enabling applications.) The Forfás report identified enabling technologies as a high potential growth area, as new applications will need to be developed for next generation mobile and wireless devices.

Table 7.2: Employment in foreign-owned companies in wireless-related occupations in 2002

Wireless Framework	Employment	% of Total Employed
Wireless Infrastructure	900	43%
Applications	690	33%
Middleware & end-user device development	490	24%
Total	**2080**	**100%**

Source: Forfás

Mobile and wireless services are delivered to both corporate clients and consumers. The consumer and corporate markets combined account for approximately 1,100 employees, or 28% of total employment. The Forfás report identified services to corporate clients as a 'high' opportunity for the sector in Ireland. The services identified included messaging, email, mobile sales applications, and the transfer of data across corporate networks and databases. Consumers were identified as presenting a 'high to medium' opportunity, with services including mobile Internet, games, directories, and messaging. The content development for these two markets are considered distinct with corporate clients seeking information on financial markets, up to date business news and more of a need to access email etc. while out of the office. The focus of the consumer market, on the other hand, is directed more towards ringtones, entertainment news and access to music via mobile devices.

Ten companies were interviewed for this section of the report. The purpose of these interviews was to ascertain the views of employers in this sector in relation to skills needs, future growth, the education system and training needs. Six of the companies had as their primary function the development of software applications to enable the delivery of content, data and communications services across mobile and wireless. Three of the companies were involved in mobile marketing and the provision of content. The final company constructed the equipment for wireless networks and installed them for clients.

The companies were chosen to try to encompass – in so far as it is possible in a small sample – the breath of the industry in Ireland, across the value chain. The companies range from those producing enabling software applications to others that use such applications to deliver content and services to end-users – both corporate and consumer – to, finally, a company that installs wireless networks for end-users. Employees in the companies interviewed totalled 136 in Ireland with a number of companies also having representation abroad.

7.2 Future directions of the wireless sector

Forfás considers that the key growth areas for the wireless sector will be centred around the provision of wireless services and content (where Ireland's strengths are based). Established players in Ireland, according to Forfás, include those involved in OSS, billing systems, transaction management and security. Emerging players include middleware, messaging, location-based services, vertical applications and interface management.

The industry has reached a stage where much depends on the roll out of 2.5G and 3G and the extent to which clients – consumer and corporate – take up services. The Forfás report cautions that, after the relative failure of WAP, market demand for consumer wireless services has experienced limited growth. Many of the projected services will need 2.5G and 3G to be functional. High speed wireless data connections are enabled through 3G, allowing users to download files, access the internet, play advanced games and make video calls. The downturn in the telecommunications sector, coupled with a high spend on 3G licences, has depleted the capital of many international telecommunications operators for building wireless infrastructures and networks.

According to the Forfás report, the successful development of the sector in Ireland will depend on a number of factors: government funding and policy initiatives, the roll out of infrastructures and networks, and the take-up by consumers and corporate clients of devices and services, particularly across 2.5G and 3G. Vodafone have recently launched their 3G network in Ireland, with two datacards (3G/GPRS and GPRS-only) which allow the user to connect to the 3G network. Hutchison Whampoa (who operate as 3 in Ireland) and O_2 have both applied for their 3G licence. The success of the take-up of 3G will have a significant effect on the success of the mobile and wireless sector in Ireland. Fostering a relevant and up-to-date skills base within Ireland is also important to the sector's development.

Some of the companies interviewed reported that there was less innovative activity in the industry than a couple of years ago. This was partly because some of the companies had developed their core products and were now putting their emphasis on sales and marketing. Another reason was that, because of the economic downturn, the spend of clients has fallen over the last few years. Clients were more likely to want only the core applications without any extras. The smaller companies, especially, operated within strict financial parameters, so they focused their development efforts on servicing these core products because they couldn't afford to devote resources to products and services that clients weren't in a position to purchase. The companies broadly believed that, although

the market remained tight, there were signs that it was recovering and that clients' budgets were increasing.

Also, as a consequence of this, many companies had a sharper sense of what their core business was. They had a focus to their business that might have been lacking in earlier years. For example, one of the companies interviewed initially deployed its personalisation applications to digital television, but on finding that the market wasn't large enough to sustain the business it moved into mobile and wireless.

Ireland shows strong growth potential in this sector, with a high mobile penetration rate and a large share in the data services market. However to capitalise on the expected global growth of the sector, Ireland needs to ensure that it has sufficient relevant skills and processes in place to adapt to any new skills needs that may arise.

7.3 Occupation and skills profile

Information on the occupations and skills required for the wireless sector was attained through the company interviews, an extensive internet search of the careers in both Irish and international companies and job sites for the wireless sector.

Company structures, particularly among the software companies, tended to be divided into two main functional areas: R&D and sales and marketing[47]. There were also administration and finance areas within the companies (and human resources in the bigger companies), but the main emphasis was on R&D and sales and marketing.

In general the main occupations broke down as follows:

- Management
- Technical/ R&D
  - Software engineers/ developers
  - Software testers/ QA engineers
  - Technical services/ customer support
  - Sales engineers
- Content developers
- Sales and marketing

In addition, some companies had business development officers and business analysts, who had responsibility for developing business strategies or identifying new and pre-competitive market opportunities.

Ten companies in Ireland were interviewed with a total of 136 employees. Although the companies interviewed were broadly structured along these functional areas, organisational structures within them were relatively weak because of their small size.

[47] In this context, marketing means a company promoting its own products and services. This is distinct from companies that offer a service in 'mobile marketing', which entails promoting a client's products or services across mobile phones (typically, via SMS).

For example, a software developer could also have responsibility for software testing and customer support. The smaller the company, the wider the range of roles an employee might have to undertake. In one of the mobile marketing and content companies, the co-founder was also in charge of finance and held responsibility for sourcing, generating, editing and structuring content.

7.3.1 Software Engineers/ Developers

As the development of software for mobile devices is the main focus of the indigenous wireless companies in Ireland, software engineers and developers would be considered the core occupations in this sector. The criteria for entry into a career in software engineering varied from company to company. However, a number of key strands emerged. Employers were looking for engineers to be involved in all aspects of the software development lifecycle but in particular, within design, coding and testing. Coding experience with Unix and Windows, skills in Visual Basic, C++, Oracle and Java and also knowledge of scripting languages, such as Perl, were considered essential skills. Knowledge of internet technologies such as JSP, HTML and at least 2 years experience in the design and development of software solutions were also listed for a number of vacancies.

The programming skills identified by the companies were reasonably standard for software development: an ability to understand the technical requirements of an application, define functional specifications and work within a development team, strong programming skills, mathematical skills, and technical writing. Although most of the companies had certain programming languages or development environments that they preferred to work in, they considered it a bonus if developers were comfortable with a variety of programming methodologies. This was because, depending on a customer's requirements, products could be deployed across a range of platforms: Microsoft, Sun Solaris, UNIX and Open-source.

For those specific to Java development, Java skills were obviously essential including knowledge of J2EE. Java was the principal programming language among the companies for developing mobile applications. Rococco, a Middleware wireless company, consider Java to be easier than any other programming language for the development of wireless applications and also stated that there are over 2.5 million Java programmers worldwide[48]. Indeed, Java was considered a requirement for developers across the spectrum of wireless functions with messaging companies specifically seeking Java developers. As messaging is one of the emerging areas identified by the Forfás report, it will be essential to ensure there are sufficient Java developers to meet the advancing needs of the industry.

Experience was widely regarded as being key to developing applications specifically for mobile and wireless devices. Graduate entry positions were available, but for more senior positions at least 3 years experience in developing telecommunications software solutions, preferably wireless technologies, i.e. SMS, WAP, OTA, were necessary.

[48] www.rococcosoft.com/services/java.html

Common for all vacancies, though, was the need for communication, interpersonal and organisational skills.

In summary, knowledge of the following programming languages, development environments, and servers were required in at least some of the jobs examined:

Table 7.2: Technical skills required for software engineering/developing roles

Languages	Environments	Servers
Java XML XHTML HPUX MMSQL Wireless specific scripting languages Visual Basic VB.net ASP.net JSP XML, HTML C, C++	J2EE Sun Solaris Windows Oracle Apache/Tomcat Unix Microsoft Suite	SQL Servers Linux Open-source technologies

In addition, some companies wanted programmers with skills in data mining, databases, and object-oriented design.

The smaller companies interviewed, especially, appreciated programmers who could complement strong programming skills with an understanding of business processes and how business worked. This was partly because programmers in smaller companies often had to deal directly with customers. Also, the companies believed that an understanding of business processes would help programmers generate applications that would be viable in the marketplace. They believed that many programmers were inclined towards a technologist's view – developing technology for technology's sake. They stated that a programmer with strong business awareness would be better able to demonstrate how a technology or application could give a benefit to a client's business. Many of the companies called for an improvement in the business awareness of graduates coming from programming and development backgrounds.

7.3.2 Software Testers/ QA Engineers

Software testers are responsible for the planning, developing and execution of tests and documenting any product defects. Good computer and communication skills are required for this position with employers seeking individuals with a strong interest in telecommunications. Technical knowledge in Oracle and Java are also desirable. QA engineers work in teams with testers. Senior QA engineers have more involvement in the design process with input on testability, for example. Job advertisements for QA engineers tend to have more specific technical requirements including programming

languages, especially Java, JavaScript, Visual Basic and C/C++; knowledge of HTML, XML and WML, and experience with HP, Solaris, Linux or Windows 2000 operating systems. Knowledge of Oracle and MySQL is also considered an advantage along with being a Sun-Certified system administrator. For senior positions at least 4 years experience in software verification was required whereas other positions generally required at least 2 years experience. Again, communication and project management skills were essential with knowledge of telecom systems an advantage.

7.3.3 Technical Services/Customer Support

Technical services and customer support positions entail providing daily technical and operational support through maintenance, administration and trouble-shooting. Performing software upgrades and new software installations is also required. Working knowledge of a number of languages, servers and environments mentioned in Table 7.2 were required with particular emphasis on Java programming and experience working with the UNIX operating system. Due to the nature of the position, excellent communication, organisational and interpersonal skills are considered necessary attributes. Experience in telecommunication software development, preferably in wireless technology such as SMS, WAP or OTA, is also desirable.

7.3.4 Sales Engineers

Sales engineers provide pre-sales assistance to the sales team through analysing customer requirements and advising on product suitability. Sales engineers are also responsible for delivering product demonstrations to both current and prospective customers. Excellent organisational and communication skills are necessary as is experience in a customer-facing role and strong technical skills. Good working knowledge of HTML, Dreamweaver and Java was quoted as desirable in a number of job advertisements for this position.

7.3.5 Content developers

Mobile marketing and content skills are still firmly grounded in traditional marketing and content skills. Experience, again, is regarded as the key to better appreciate the idiosyncrasies of marketing across or creating content for mobiles and being comfortable working in a digital environment.

For example, one of the valued skills was the ability to source and generate content that would be suitable for delivery across mobile (in this case, principally as SMS content). Two of the smaller marketing and content companies interviewed claimed that, at this stage of development, the technologies of SMS were relatively easy to work with, but experience was necessary to frame content within the parameters of the medium.

SMS content is restricted to 160 characters, so strong writing and editing skills are needed to communicate a message with brevity and coherency. In addition, content creators need an ability to judge what types of content would be suitable for delivery

within such tight parameters. It was regarded as important to generate a series of content that was open-ended. One company's most popular content strands were daily gardening tips – these were not restricted in terms of timeline and, also, people usually found the daily pieces of information interesting enough not to 'opt-out', even if they weren't gardening on a daily basis (or at all).

7.3.6 Sales and marketing

All of the companies interviewed – applications, marketing/content, and infrastructure - placed a strong emphasis on sales and marketing of their products and services. Whereas they could precisely define the technical skills-sets they required, for sales and marketing they put a greater stress on the tacit qualities of the persons themselves. Of utmost importance were communications skills, presentability, presence, and the ability to create trust with clients. The companies believed that most traditional sales and marketing principles still applied in the area of mobile and wireless. Because the industry is new, however, specific knowledge and experience of selling and marketing mobile and wireless could come only through working in the industry itself. They wanted their sales and marketing staff to have an understanding of mobile and wireless technologies (e.g. MMS, SMS, WAP), be able to articulate clearly how the products or services would benefit a client's business, and have sufficient knowledge to answer technical questions related to a client's specific requirements, if necessary.

In some companies the sales component was incorporated into a technical role with software engineers providing both technical pre-sales and continuous sales support to the customer.

7.4 Skills gaps and future skills demand

Although the companies interviewed were optimistic about the growth of the wireless/mobile industry in Ireland, some were reluctant to predict the direction of the industry over the next five years. Much depends on the take-up of devices over the next five years or so – the move to next generation hand-sets, growth in MMS, and increasing use of wireless networks and devices. Some of the smaller companies admitted that they were satisfied to allow bigger and better-funded competitors to break into a market first – and carry the associated development and financial risks. They would then follow-in (perhaps into a niche area within that market) once the application or service had proved viable.

To counter the uncertainty of the future direction of the market, the companies interviewed believed it would be best to keep pace with emerging languages and technologies, such as enhanced Java applications, Sun Solaris, and J2ME. This would give employees a wide array of relevant skills-sets that could provide the basis for specialisation if a particular area in 3G proved to be a success in the market. For example, if MMS services were popular, employees would have a general programming and applications skills-set to be able to adjust to working specifically in this area.

Building greater business awareness into all occupations was seen as necessary for the success of the industry in Ireland. For example, the software companies wanted to stress to programmers that businesses were not just about developing technologies but also about selling, managing a business, running an office, being attentive to a client's needs and being receptive to client feedback.

The companies interviewed anticipated recruitment in the areas of business development managers, business analysts and project managers – people who could identify potential in emerging or pre-competitive technologies and markets. They also anticipated growth in sales staff, because as technologies advanced the costs of developing new products would rise, and this would necessitate a greater volume of income.

Lack of experience was a major concern for employers and the difficulty in finding experience cut across programming (developing applications), content (structuring content so it was suitable for the parameters of mobile devices), and sales and marketing (being able to illustrate precisely to clients how an application or service could benefit their business).

7.4.1 Technical

The software companies interviewed did not report difficulties finding programmers or developers, beyond people with experience and acceptable salary expectations. However, because developing applications for mobile and wireless was relatively new, they were prepared to hire programmers who didn't have experience as long as they had the core software development skills-set to be trained in-house as mobile and wireless applications developers.

The companies interviewed emphasised that software programmers, particularly in a new industry such as mobile and wireless, had to be willing to commit to on-going learning. This would require an amount of self-sufficiency, that given time, resources, books and applications they would, to a certain level, be able to self-train. In terms of future skills requirements, the companies believed that this would depend largely on emerging technologies, languages and development environments, and the need to keep up-to-date. It would also depend on the mobile and wireless devices and services that were being taken up by customers and corporate clients in the coming years.

As the provision of software for wireless devices is the main focus of companies in Ireland it will be necessary to ensure there are sufficient technical skills in the workforce to meet the needs of the industry. At present, employers are prepared to hire programmers without mobile technology skills, with the intention of in-house training. However, in the future the availability of these skills will become increasingly important as applications become more advanced.

7.4.2 Content developers

The companies did not identify a difficulty in recruiting people with content skills. Mobile and wireless devices remain at a relatively primitive stage of development for content – in particular SMS – and traditional skills in writing and editing are easily applied to them. However, advances such as MMS and 3G are expected to put greater demands on content skills. With more sophisticated content – colour, larger displays, less restriction on the volume/size of content that could be transmitted across wireless, MMS – companies may have to adopt a more formalised approach to content creation, perhaps employing people who would have skills in audio and video. The companies expected the range and sophistication of their content skills to increase in the coming five years, depending on the success of new services and new generations of technologies. In general, they believed that the fundamentals of writing, editing and content generation would remain broadly the same.

7.4.3 Sales & Marketing

Similarly, at this stage of the industry's development, the companies believed that employees who had a good grounding in traditional marketing and sales could apply those skills to mobile and wireless. But, as the industry matures, they anticipate that more specialised knowledge will be required.

7.5 Education and training provision

Because the mobile and wireless sector is relatively new, there is little formal education and training provision in Ireland. At present there is only one course in Ireland specifically related to this sector compared to other countries such as the UK which has introduced a number of new courses in recent years. Modules in mobile technology have been introduced into the curriculum of third-level education in a number of countries such as the US (Berkeley), Denmark, Australia, Germany and Israel. Although these courses contain similar elements to courses available in Ireland, their main focus is on providing graduates with specific skills for the wireless/mobile market.

As new mobile courses emerge in the global market, Irish graduates may find it increasingly difficult to compete for jobs internationally without the necessary skill-set. In the meantime, employers in Ireland are using valuable time and resources in up-skilling employees to meet the needs of the advancing industry.

7.5.1 Technical

The software companies interviewed were looking for the following educational backgrounds of graduates: a computer science, computer applications or computer engineering Degree, usually of 3-4 years, with a preference for the bigger, established Universities. Maths and engineering Degrees of similar duration were also sought. Within these Degrees, the companies expected a firm grounding in various programming

languages and protocols. This trend was similar to that of the larger international companies with computer science Degrees the most prominent qualification sought.

A sample of courses currently available in Ireland is listed in Table 7.3 below. These courses cover a variety of subjects relevant to the wireless industry such as digital communications, computer and communication networks, and wireless communications systems.

Table 7.3: A sample of current education provision relating to wireless

Course Title	Institute	Award	Student Intake	Duration
Mobile Communications & Electronics	Athlone IT	Diploma	40	3 years
Engineering – Electronic & Computer Engineering	Galway – Mayo IT	Diploma	20	1 year add-on
Electronic & Computer Engineering	NUI Galway	Degree	~35	4 years
Computer Engineering	University of Limerick	Degree	25	4 years
Computer Engineering	DIT	Degree	40	4 years
Digital Media Engineering	DCU	Degree	16	4 years
Computer & Software Engineering	Athlone IT	Degree	40	4 years

Although these courses contain elements related to the wireless/mobile industry and indicate this industry as a possible career prospect, Ireland is lacking in specific courses for this industry. The Mobile Communications & Electronics Diploma in Athlone IT is currently the only mobile communications course available in Ireland and this course commenced in the last academic year. In the UK a number of courses have been introduced in recent years in relation to mobile technology. These courses include the following:

- BSc in Mobile Computing – Brunel University
- BSc in Mobile Communications Technology – Northumbria University
- BSc in Mobile Communications Systems – University of Salford
- BEng/ MEng in Mobile Communications - University of Bradford
- MSc in Mobile Applications – University of Bradford

Information on the modules included in these courses is listed in Table 7.4 below.

Table 7.4 Sample of mobile-related courses available in the UK

Course Title	Institute	Modules include:
BSc in Mobile Computing	Brunel University	Computer engineering, mobile systems, data networks, software engineering methods, wireless systems, mobile information device programming
BSc in Mobile Communications Technology	Northumbria University	Mathematics, circuit theory, analogue & digital electronics, radio frequency circuit design for mobile communication, mobile network design, mobile systems hardware technology, optional work placement
BSc in Mobile Communications Systems	University of Salford	Data communications, Java programming, systems analysis, object-oriented design, mobile networking, communication systems, programming for mobile platforms
BEng/MEng in Mobile Communications	University of Bradford	Digital electronics, telecommunications fundamentals, radio frequency engineering, mobile systems, work placement
MSc in Mobile Applications	University of Bradford	Software systems & developments, networking, mobile application design

These courses share common threads with the computer engineering courses currently available in Ireland. For example, if comparing the BSc in Computer Engineering in University of Limerick with the BSc in Mobile Communication Technology in Northumbria University, a number of similarities occur. Both cover a number of common modules including mathematics, digital systems, networking and circuit analysis. The main difference occurs in the final year where the BSc in Mobile Communications Technology concentrates on mobile technology, including radio frequency design for mobile communication, mobile systems hardware technology and mobile network design.

The computer engineering courses in Ireland listed in Table 7.3 have all experienced a drop in required entry points, often a sign of decreased interest in the area. Points dropped as much as 110 points in some of these courses in the period between 2002 and 2004. The Degree in Digital Media Engineering in DCU, however, experienced a slight increase in points level in this same period. According to a BBC report[49] one of the UK courses listed in Table 7.4, the BSc in Mobile Computing in Brunel University, was introduced in recent years to attract more students to software engineering. Similar to Ireland, the UK is experiencing a shortage in computing and engineering graduates and these new courses are considered one method to attract them back into the industry. With much of Ireland's focus in this sector on providing software for mobile devices, and employment over 4,000, the establishment of a new course for this sector is justified. A modification and re-branding of a number of computer engineering courses in Ireland may suffice, similar to Recommendation 3 in Chapter 4 on the games industry, and also benefit the ICT industry as a whole through attracting students to software engineering-related courses along with providing graduates with specific skills in the area of mobile communications.

[49] BBC online, '*University offers mobile phone studies'*, 15th June, 2002

A lack of external training for radio frequency engineers in Ireland was a concern for a wireless infrastructure company interviewed. The company anticipated that, as the use of wireless networks and devices grew, there would be a greater need for radio frequency engineers. As there are no courses in Ireland training people specifically as radio frequency engineers, the company sought people who had a basic grounding in radio frequencies, radio technology, antenna construction and design, and radio systems design, and the use of radio frequencies for data and voice transmission. The Commission for Communications Regulation (ComReg) have recently identified radio frequency identification (RFID) as a potential provider of significant opportunities in the Irish telecommunications industry[50]. These systems "will create large volumes of data which will need to be transported, managed and integrated with existing IT systems", according to John Doherty, Chairperson of ComReg. Radio frequency engineering modules are listed in two of the courses listed from the UK, Mobile Communications Technology in Northumbria and Mobile Communications in University of Bradford. Only the Diploma in Mobile Communications & Electronics in Athlone IT contains a module on radio communications.

Experience in software testing was identified as important and as being under-represented in educational courses. For positions as software testers qualifications in electronic engineering, computer science or equivalent are required to at least Degree level. Only a few graduates came to companies with experience in software testing, however, and generally the graduates had gained the experience while on a work-placement. Software testing was regarded as important not only for detecting and solving problems before applications and products were deployed to customers, but the experience of identifying what went wrong, and why, could help programmers to avoid repeating errors when they came to writing code.

All of the companies stressed the importance of work-placements to Degrees, with a number of them taking on students for work-placements. One company, for example, felt it could give work-placement students a better hands-on grounding in software testing and Java development than they would receive in a classroom environment. In general, however, they believed that work-placements in mobile and wireless companies were in short supply, and they were receptive to closer links between the educational sector and industry in this regard. Only two of the seven courses listed in Table 7.3 indicate that work placement is part of the curricula for the course. In contrast, three of the four Degree courses available in the UK (as per Table 7.4) encourage industrial placement.

As mentioned with regard to the games industry, Java programming will become increasingly important if mobile games development increases in Ireland as anticipated. Java programming is used extensively in the wireless industry and, therefore, it is necessary to ensure that this area is covered both in third-level education courses and short-term courses as required. According to Table 7.1 there are over 300 people employed in indigenous companies in messaging applications, where Java developers are one of the main occupations. The University of Salford specify a module on Java

[50] www.comreg.ie '*ComReg says wireless identification technology could increase business efficiency',* July 22nd, 2004

programming in their Mobile Communications Systems Degree programme. The Irish courses examined do not identify if Java programming is included on their curricula. FÁS provides training in Java programming through both their Software Engineering course and FÁS eCollege.

Recommendations:

- A number of current computer engineering courses should be adjusted and re-branded to explicitly include elements of mobile communications so as both to enhance Ireland's skills in the mobile industry and to increase the take-up of software engineering courses. *(HEA, Dept of Education & Science)*
- Modules in radio frequency engineering, software testing and Java programming should be included in any new wireless/mobile course. *(Universities, Institutes of Technology*)
- Work placements should be encouraged in computer engineering Degree programmes and in any new mobile course. *(HEA, Dept of Education & Science)*

7.5.2 Content Development

Mobile marketing and content companies wanted graduates who could understand, communicate and disseminate information. This could include producing reports and feedback for clients (e.g. the benefits the application or technology was providing to their business, or provide revenue analysis of an SMS service to clients). They stressed that for content – e.g., writing, editing, structuring content – and marketing (direct selling) that many of the traditional principles still applied to mobile and wireless.

Similar to the e-learning industry, content development requires journalistic/ editorial skills. There are a number of journalism courses currently available in Ireland. As mentioned previously, as content becomes more sophisticated further skills in audio and video will be required to meet the needs of mobile content development. It may be necessary for current employees in content development to up-skill in these areas. Courses available in FÁS/Screen Training Ireland may be suitable for this. FÁS also runs a course on Multimedia Production for Web Site Design which includes a module on video production and sound editing.

Recommendation:

- FÁS/Screen Training Ireland should ensure there is sufficient provision of courses in audio and video to up-skill content developers as required. (*FÁS/Screen Training Ireland*)

7.5.3 Sales and Marketing

For marketing roles, the companies were looking for people with marketing Degrees and experience of marketing. There are numerous courses available in Ireland in the area of marketing. The companies, in general, noted a lack of focus in marketing courses on either how to market mobile or wireless products or services, or on the opportunities to

market across mobile and wireless platforms. They felt that marketing and communications courses did not make students aware of the possibilities of wireless and mobile as a medium or as an additional distribution channel for marketing and advertising.

Sales and marketing skills generally tend to be more tacit according to employers. The companies wanted a marketing Degree, but much of their assessment of marketing graduates depended on the person themselves. In effect, how they sold themselves during interviews, on the assumption that if they could not present themselves well they would not be able to present the company's products well.

Recommendation:
- Marketing courses should incorporate the use of mobile and wireless devices as a marketing tool. (*Universities, Institutes of Technology*)

7.5.4 Company Training

All of the companies interviewed conducted in-house training. For the software companies, this could involve training graduates in Java development. Many of the companies stated that, because the wireless and mobile industry was so new, relevant courses weren't available for leading-edge technologies or processes (e.g. Bluetooth or 3G). However, they would consider sending staff on such external training if relevant courses became available.

However, the cost of these courses was an important consideration. For the smaller companies, in particular, training budgets were quite small and so a course would have to justify itself by offering an immediate practical or commercial benefit to the company. In the case of the bigger companies, most training was based on keeping up with new technologies and languages. But some also considered that their in-house experience was ahead of what was available in the educational and training sector, and therefore employees had sufficient experience and knowledge to be able to self-train in newer technologies and languages.

External training tended to be organised on an ad hoc basis – depending on the availability of relevant courses or the need to acquire a specific skill – rather than being continuous and structured. The small size of the companies didn't lend itself to the structured and defined training and advancement paths that could be evident in larger companies. Generally, when the companies did seek external training the person who had been trained would be expected to pass on the knowledge to others in the company. One company would hire in a contractor with specialised skills and learn from him/her.

Much of the external training was based on keeping up-to-date and adding to existing skills-sets rather than learning significant new skills-sets. In this respect, much of the impetus for external training came from the companies that produced programming languages and development environments. For example, if Sun released a new version of

its environment applications, companies might seek training specifically in the features of the new version.

7.6 Gaps and future needs in education and training provision

The companies highlighted a number of deficiencies in new graduates. They identified a lack of communication skills (written and oral), particularly in graduates from computer and engineering backgrounds. This could be at the relatively simple level of misspellings on application letters or CVs. But, more fundamentally to the company, it could also be an inability to communicate with other functional areas (e.g., technical and sales) or, if necessary, with clients. A lack of business awareness was the other main weaknesses of graduates from programming and development backgrounds.

There was also a strong feeling among the software companies that Degrees in computing, engineering and science did not adequately prepare graduates for the corporate world. This was an important issue for smaller companies, where programmers might have to perform a number of roles, many of which would involve interactions with customers or would affect business processes or performances. Some computing, engineering, and science Degrees did contain business modules, but often these were peripheral to the Degree and students did not regard them as important. One company suggested that it would be useful if programmers active in the industry could talk to students, to emphasise the importance of business skills even if the students' primary education was in computer programming.

Closer links between the mobile and wireless industry and the educational sector were seen as important. Work-placements were regarded as a way of giving students experiences in the skills and processes most relevant to the industry, and also to allow them to experience work in a corporate environment. Some companies believed that the educational sector sometimes lagged behind a fast-moving industry such as mobile and wireless, and it would be useful if people active in the industry could have inputs into courses, either by teaching modules or giving talks.

It was argued that marketing Degrees under-represented mobile and wireless as an emerging marketing and advertising channel, and greater awareness should be created of current trends and potential in the industry.

Graduates from a technical background were felt to be lacking in hands-on experience of the newer technologies associated with mobile and wireless and also tended to lack a general understanding of the differences of working over wireless networks and wireline IP networks. The updating of a number of current computing/ engineering courses to include modules on mobile technologies would help to alleviate this skills deficit.

Recommendations:

- Computing, engineering and science courses at third-level should incorporate business and communications modules. (*Universities, Institutes of Technology*)

- Industry participation in education courses, via guest lectures, work placements, and developing curricula should be encouraged and supported. (*Universities, Institutes of Technology*)

7.7 Conclusions and recommendations

Future skills-sets and the direction of products and services depends a great deal on the success of 2.5G and 3G and how consumer and corporate clients begin to take up services across these. As the technologies become more advanced, it is anticipated that more specialised functional areas and specialised knowledge will be required, with larger technical teams to allow them to operate.

Developing software for wireless devices is the primary focus of indigenous wireless companies in Ireland. For this reason we need to ensure that there are sufficient graduates to meet the needs of the wireless/mobile sector. One method of combating this is to re-brand and adapt a number of current computing/ software courses to include elements of mobile technologies. This would also provide graduates with specific mobile technology skills – an area currently lacking in the education system.

In summary, the recommendations given throughout the chapter are listed below:

1. A number of current computer engineering courses should be adjusted and re-branded to explicitly include elements of mobile communications so as both to enhance Ireland's skills in the mobile industry and to increase the take-up of software engineering courses. *(Universities, Institutes of Technology)*

2. Modules in radio frequency engineering and software testing should be included in any new wireless/mobile course. *(Universities, Institutes of Technology)*

3. Work placements should be encouraged in computer engineering Degree programmes and in any new mobile course. *(Universities, Institutes of Technology)*

4. FÁS/Screen Training Ireland should ensure there is sufficient provision of courses in audio and video to up-skill content developers as required. (*FÁS, Screen Training Ireland*)

5. Marketing courses should incorporate the use of mobile and wireless devices as a marketing tool. (*Universities, Institutes of Technology*)

6. Computing, engineering and science courses at third-level should incorporate business and communications modules. (*Universities, Institutes of Technology*)

7. Industry participation in education courses, via guest lectures, work placements, and developing curricula should be encouraged and supported. (*Universities, Institutes of Technology*)

Chapter 8: Conclusions and Recommendations

This final chapter draws on the findings of the study to identify the main developments and issues in respect of employment and skills in the digital content area. Recommendations to address these issues are also presented.

8.1 Current situation

The digital media sector is important for Ireland and this has been recognised by the Government's development agencies and the public education/training system. The key strategic challenge for Ireland Inc. is to build not merely on its traditional media authoring and design skills, but to capture as much as possible of the high value-added stages and functions in digital media sectors.

One challenge is to ensure that Irish firms design, create and publish new media products, based on either 'original' stories and content or on adding value to existing information and content products. Another challenge is to creatively harness the new opportunities for publishing and distribution. These new opportunities to by-pass traditional distribution bottlenecks and gatekeepers (and tolling systems) are especially important for on-line digital media products. A related challenge is to develop suitable new business and/or publishing models which ensure and maximise ownership and control over intellectual property rights.

Clearly, Ireland needs to develop skills, competencies and knowledge if these challenges are to be met, and the new opportunities for national employment and economic development are to be realised in practice.

We need to ensure an appropriate supply of the diverse kinds of skills and knowledge directly related to digital media services, ranging from high-level authoring, design and business competencies for innovative products, to operational level and more routine media-related skills sets.

At the time of interviewing (2003), companies had few vacancies or problems recruiting persons. There appeared to be a plentiful supply of entry-level IT and design graduates. Nevertheless, some demand existed for more experienced and senior-level staff who were not always available locally. Thus, there was a certain amount of overseas recruitment for producers and experienced programmers occurring. In addition, there was found to be a lack of experienced games developers and companies seeking such employees usually had to recruit overseas (including Irish emigrants).

Companies often look outside the digital media area for sales staff and project managers (e.g. from traditional media sectors or publishing). There is also the need to have suitably qualified staff available so as to attract foreign companies to Ireland. Although there appears to be a sufficient supply of staff to work in the indigenous industry at present, labour shortages may occur in the event of even one large digital company locating in Ireland.

While general recruitment difficulties are not a problem at the moment, the research suggests that there are specific skill weaknesses in the industry which need to be addressed. Management skills are lacking in indigenous SMEs, as it is usually the case that people from a technical or creative background, rather than a business background, set up such companies. Skills in project management, finance, negotiation, communication and sales are often inadequate in the SMEs in the digital content industry. This is an area that requires attention so as to ensure the success of the industry in Ireland.

In relation to technical skills, in general the industry seemed to be satisfied with the particular knowledge sets available. However, some concern was expressed that games artists and animators are skilled in packages commonly used in Europe, but less knowledgeable about Maya - the US industry standard. Maya is increasingly being adopted in companies in the UK, but is currently unavailable in Ireland's third level education system. Hence training courses in Maya need to be made available to ensure that Ireland's animators remain up-to-date with industry standards.

Finally, knowledge of the legal and copy-righting aspects of the business was reported to be weak. Intellectual property is the key source of value for many digital media businesses so it is important that Irish companies successfully protect their investments in this area.

8.2 Future Prospects

Overall, and in the long-term, the digital media industry is seen as being one of high growth on a global basis. Reports on the Irish industry over the last 2-3 years have all been optimistic; this is a very desirable industry for Ireland and one where, based on a realistic view of Ireland's strengths, significant growth is possible. However, there is considerable uncertainty at present and the interviews with companies for this study indicated no great level of optimism about a resumption of growth in the short-term. On balance, the report suggests an increase of 2,000 jobs over the next five years from the 4,000-4,500 estimate of the Forfas/PwC report in 2002. The majority of this growth is likely to occur in the latter part of the period. Further growth would be expected in subsequent years.

In very broad terms, the types of occupations and skills for the future are seen as a continuation of existing skills mixes. However, building on the concerns indicated in Section 8.1, there is an increased need for 'hybrid' skills and multi-skilled employees, especially at higher levels and in small companies. Two that were specifically mentioned in the company interviews were creative entrepreneurs and technical sales. Thus, in the former case, there needs to be a mixture of innovation, in terms of products and services, and business skills to market and finance a new project. In the latter case, technical knowledge and selling ability need to be combined.

One of the features of the UK companies interviewed was their formal R&D functions. In only one of the Irish companies interviewed was this the case. For the successful

development of the Irish industry, there is likely to be a need for a greater effort in the R&D area and this will require employees with suitable education and skills. Media Lab Europe is already established in this area and company-based R&D efforts will also often link into activities within the higher education sector.

8.3 Generic and Specific Skills

The industry accords dual importance to generic, core competencies, allied to specific skills. The nature of many of the sub-sectors puts a premium on core abilities such as teamwork, communication skills, project management, creativity and problem solving. While such skills are needed in many businesses, they are particularly important in this sector because of the importance of innovation, the fact that an integral part of most products is communication, the flexible, task-based, organisational staff structure often used, the mix of IT and 'arts' type of employees on many projects, the need for small companies to try to win business in a range of different sub-sectors, and the generally small size of companies. Thus, employers want to recruit staff with these core competencies and expect the education/ training system to produce graduates with such skills.

Naturally, most of the jobs in the industry also require specific skills, e.g. software programming, animation, sound, instructional design. These technical skills are essential for employment in the industry. As new technologies or processes are developed, there will be a recurrent need for employees to acquire new technical skills. Thus, a willingness to engage in life-long learning, and provision to facilitate it, are essential.

8.4 Third-Level Education

There are over two hundred third-level courses which produce graduates (at certificate, Diploma, Degree, Graduate Diploma and Masters level) in the broad digital media area. These include computing, networks, engineering, multimedia applications and art and design. Over 4,800 students graduated from these disciplines in 2002, with over 1,000 from multimedia and art/design courses combined. A number of new courses have started in recent years, specifically related to the digital content industry, with others scheduled to start next year, resulting in the number of graduates over the next couple of years expected to continue to increase.

In terms of quality and suitability, there was a generally positive feedback from companies about existing third-level provision. However, there was a belief that courses should provide students with a better understanding and capability in relation to 'real-life' project working. It was felt that many students fail to appreciate the commercial realities of project work. One approach to addressing this was suggested – to have industry practitioners assess student's work. A number of companies also commented favourably on programmes that involved a work placement module, although the difficulty of having placements at 'slack times' was recognised.

These concerns are part of the overall need to provide students with the core competencies and hybrid skills outlined above. Specifically, the need is to integrate:

- Business and creative modules into technical courses, and
- Technical and business elements into media courses.

In general, industry strongly supported the idea of having a strong voice in advising on the content of courses. Equally, the use of industry experts as outside lecturers or guest speakers on courses was recommended.

An area where there is currently a deficiency in provision is games. To address this, IT Carlow have commenced a four year Degree programme this year in Computer Games Engineering. Dundalk IT is also due to start a Degree programme next year in Games Development. A number of colleges are also considering Masters programmes in this area. This should meet the need for specialist games developers (e.g. for console/PC games). Adding games modules onto existing multimedia/computing courses should be sufficient at present to meet the needs of simpler game development (e.g. mobile phones).

Finally, in response to the need for senior, experienced, employees (including owner/managers) to have good business and management skills, it is suggested that a Postgraduate Diploma in 'Digital Media Management' be established. This would include modules on project management, finance and sales/marketing (which modules could be taken alternatively on a stand-alone basis).

8.5 Training

In considering the need for training of existing employees and possible actions to address deficiencies, an important distinction must be drawn between large and small companies. The former, typically, have formal HRD functions, develop HRD plans based on an identification of training needs and either provide training in-house or have the funds to buy training on the open market. The State should play a limited role in assisting such companies through promotion, advice and collective actions. Small companies, on the other hand, often possess none of the above characteristics and need more support and assistance from State agencies. The approach adopted in other sectors can be usefully applied to this sector. Thus developing companies can be supported to improve their HRD capability in a number of ways. Groups of companies can be encouraged to work together to cost-effectively identify and meet their training needs. This is considered a key role of the Digital Hub who could provide a very valuable focus in this regard. The Digital Media Forum, located in the Digital Hub, is currently providing training in this manner with the initial focus on improving the business skills of owner managers. Where specialist training courses are not available in Ireland, FÁS should assess the possible demand for their delivery in Ireland, and organise local delivery as needed. FÁS should also consider supporting particular experienced staff to acquire training overseas through a bursary-scheme approach (similar to that used by FÁS/Screen Training Ireland for the film and TV sector).

In general, there would seem to be a need for FÁS, probably through an extension of FÁS/Screen Training Ireland's remit, to provide a range of training interventions in the sector. This would involve specialist up-skilling courses for the industry (e.g. iTV and games development). FÁS might also, from time to time, need to develop and run specific new training courses for potential industry recruits to meet the needs of newly establishing businesses.

The decision of the Digital Hub to provide facilities and space for training activities may be particularly useful in enhancing informal learning. A number of sources in the industry pointed to the importance of developing clusters or 'critical mass' to create a momentum for industry development. Such clusters might develop around a particular sub-sector or large company. They might also develop on a geographical basis such as in the Digital Hub. In the USA, commentators point to the importance of informal networks to exchange experiences, ideas and approaches. Already, semi-formal, networks or associations exist in Ireland in some areas (e.g. gamedevelopers.ie). Further development of such networks would be desirable and the Digital Hub should be a major locus in this regard.

Funding for the types of training initiatives set out above does not necessarily need to be confined to Irish Government and private sector sources. As indicated in Chapter 2, the EU MEDIA programme earmarked €50 million over the 2001-2005 period for training. To date, Ireland's take-up of this funding has been relatively low. The European Social Fund also provides part-funding to support national initiatives for in-company training.

8.6 Entry into the industry

One of the issues for both persons completing initial education and training courses, and for digital media companies, is how to bridge the gap between college and employment. This, of course, is not a problem only for this sector and experience has shown that perceptions of its severity vary greatly with the economic cycle. For individuals, however, it is hard to build-up a portfolio of experience when so much employment is in small companies and on short-term contracts. For companies, they have not the spare resources to be able to manage inexperienced persons. In the film and TV sector these issues have been solved by an extensive system of recognised trainee grades with people starting at the bottom and working their way up. FÁS/Screen Training Ireland has also developed a more formalised system of traineeships for some occupations in film/TV involving a mixture of off-the-job training and on-the-job work experience. It is suggested that this model may be appropriate for some occupations in the digital content industry.

In addition, as discussed in Section 8.4, third-level courses should contain a greater amount of work-related projects and work experience placements within their curricula.

8.7 Summary of main recommendations

- ***Re-formulation and re-branding of existing computing courses***

Enrolments in computing courses have declined significantly in recent years with points dropping in many courses. CAO points have reduced by on average 100 points on computer science Degrees at Universities in the period from 2000 to 2004. While enrolments in computing courses have decreased, interest in digital content-related courses has increased. The numbers of students enrolling in computing/IT and engineering courses witnessed a decrease of 22% and 16% respectively in the 2002/2003 academic year whereas enrolments in multimedia courses increased by 15% from the previous year. As mentioned in Chapter 7 on wireless and mobile communication, while points have dropped in a number of computer engineering courses, the points level has increased for digital courses. Despite this, the demand for computing graduates is increasing and by 2007 the demand for graduates with computing Degrees is expected to exceed supply by over 1,000[51]. Changing courses to include elements of the digital content industry, such as wireless/mobile communication or games, could prove advantageous in countering this shortage.

Re-formulation and re-branding of courses would involve retaining the main components required to work as a software developer, for example, while introducing new modules specifically related to digital content areas such as games or mobile communication. The course could then be marketed as a digital content course (e.g. Mobile Computing, Computing for the Digital Industry) so as to increase interest and uptake of the course.

Such modifications of courses have a number of potential benefits. Due to the higher demand for digital courses such as games, more students would be attracted to these courses and thus, in the long term, increase the overall availability of graduates who would not only be skilled to work in the digital content industry but also the wider ICT industry. Indeed, the two new games courses in Ireland – the Computer Games Engineering Degree in IT Carlow and the Games Development Degree programme in Dundalk IT – indicate that graduates of these courses can be further employed as software developers in other areas of the computing industry. The UK has already adopted the approach of updating courses to include elements of the digital content industry in the hope of attracting more students to the ICT industry.

Recommendation:

- Re-formulate and re-brand a number of existing computing and computer-related courses in Universities and Institutes of Technology to include skills relevant to the digital content industry. It is suggested that approximately one tenth of such courses be modified within the medium term. (*Universities, Institutes of Technology*)

[51] The Fourth Report of the Expert Group on Future Skills Needs (2003) 'The Demand and Supply of Skills in the ICT Sector', Pg 28

- ***The need for business and communication skills***

Most of the companies in the industry in Ireland are very small and have been set-up and staffed by creative or technical rather than 'business' people. Management skills in a general sense, and more specifically marketing and financial skills, are often very weak in such companies. This is a significant constraint on the development of many Irish SMEs. The Digital Media Forum is currently addressing this skills gap through providing business skills for owner-managers. This service is only available to companies in the Digital Hub at present, however, although this training would be beneficial to the industry throughout Ireland. A study on SME management development needs in Ireland has recently been conducted for the Expert Group on Future Skills Needs[52]. The recommendations contained in the report should meet the skills needs of the owner-managers in the digital content industry. As mentioned in Section 8.4, there is a need for management education programmes for persons working in the digital content industry.

Much of the industry is (increasingly) based on a project model (e.g. the development of a new game) and involves management and organisation of a variety of inputs and components. Project management skills are, therefore, a very important driver of efficiency and time-scales. There are reported to be weaknesses in this area across much of the industry. This should be addressed at an early stage by introducing project management skills into technical and creative courses.

Similarly, the ability to deal with clients, both existing and prospective, is essential for the success of any company yet has been found to be lacking in the digital content industry. For this reason, the inclusion of communication skills training at undergraduate level would be beneficial for graduates so as to be more proficient in their jobs.

Recommendations:

- Third-level technical courses related to the digital content industry should ensure that students develop skills and knowledge in project management, general business and communication skills. This is likely to require close inter-departmental collaboration. (*Universities, Institutes of Technology*)
- A Postgraduate Diploma in 'Digital Media Management' should be established in a Dublin third-level institution. (*Universities, Institutes of Technology*)
- Implement the recommendations of the EGFSN report on SME management development to meet the skills needs of managers in the digital content industry. (*EGFSN*)

- ***Sales and marketing skills***

The lack of sales skills in the digital content industry was the biggest concern for a number of interviewees. Companies often have to choose between turning their technical (creative) persons into salespersons or trying to give their salespeople technical

[52] Expert Group on Future Skills Needs (2004), *'SME Management Development in Ireland'*

knowledge. Either option requires careful selection of suitable persons and further training. It is also difficult to attract sales staff to small companies due to a perceived lack of growth potential.

As mentioned previously, technical staff are increasingly taking on a sales role. In some cases, they do not have the skills to match the job requirement due to the lack of sales skills incorporated into undergraduate programmes or indeed the availability of sales training courses. Modules in sales techniques would be beneficial to the industry and should be included in technical courses or as stand-alone options. Enterprise Ireland, in conjunction with the Irish Software Association and FÁS, runs 'Sales Star', a sales and marketing training programme for Chief Executives in the ICT sector, which includes elements of the digital content industry.

Recommendations:

- Optional sales/marketing modules should be made available in technical third-level courses to meet the need for technical sales jobs. (*Universities, Institutes of Technology*)
- Some existing third-level marketing/sales programmes should have a particular focus on the broad digital media industry. (*Universities, Institutes of Technology*)
- Sales training oriented to the specific needs of the digital content industry should be made available as necessary. (*Enterprise Ireland, FÁS)*

- ***Academic/industry partnership***

The digital content industry will benefit through an increased partnership between academic and industry personnel. At present, Institutes of Technology seek industry participation for the designing and updating of courses so as to ensure the relevance of their courses and the future employment of their graduates. This should be encouraged to continue. Partnership through work experience, internships and guest lectures will benefit the student in being more familiar with the industry before entering the job market. Therefore, the inclusion of work experience should be encouraged, where possible, in digital courses, along with the participation of industry in providing guest lectures and possibly critiquing student projects.

Recommendation:

- Third-level institutions should involve the industry in curricula development, work experience, guest lectures and critiquing student projects wherever possible. (*Universities, Institutes of Technology*)

- ***Availability of training services***

Due to the nature of the industry and its dependence on emerging technologies it is essential for members of the digital content industry to update their skills on a regular basis. FÁS/Screen Training Ireland (STI) currently provides a range of training for people in the film, TV and animation sectors in Ireland along with managing a bursary system for participants to receive training or work experience abroad. This service would prove invaluable if extended to include all elements of the digital content industry. The Irish Film Board, who provide funding for STI, in a recent report established its interest in extending its current remit to deliver digital content skills training and education to the industry as a whole[53].

Recommendation:

- The remit of FÁS/Screen Training Ireland should be extended to cover the digital content industry. FÁS/STI should then provide a wide range of training courses to meet the training needs of the industry. (*FÁS, Irish Film Board*)

- ***Further research***

Although this study gives an indication of both the current skills available and required in the indigenous digital content industry in Ireland, further study is required to examine the requirements to attract foreign-direct investment to Ireland. Forfás have agreed to conduct such a study in 2005 which will examine the views and needs of overseas companies so as to ensure Ireland remains attractive as a potential location for investment.

Recommendation:

- Phase 2 of this study should be undertaken by Forfás in 2005, focussing on the skills needs of the international industry, including the views and needs of potential FDI companies. (*EGFSN/Forfás*)

[53] The Irish Film Board (2003), '*Irish Film: The Digital Future'*

Appendix A Members of the Steering Committee

Paul Duggan, Chairman	Intermedia Partners
Denis Molumby	IDA-Ireland
Maeve McConnon	IDA-Ireland
Liam Fitzgerald	Consultant
John Guest	Microsoft
Adrian Devitt	Forfás
Áine McDonagh	Forfás
Seamus Gallen	Enterprise Ireland
Mary Lyons	FÁS
Joseph Kehoe	IT Carlow
Michael Hallissy	The Digital Hub
Jerome Morrissey	NCTE
Eleanor Clarke	Havok
Roger Fox	FÁS

Appendix B Guide Questions for Interviews

1) Company Size, Markets and Background:
   a) Year Established
   b) Nationality of Ownership
   c) Size in terms of employees
   d) Main geographical markets sold to

2) Industrial Sector:
   1. Primary - Entertainment, Business/Specialised Information, Education. Secondary -

   2. In what sectors are your company's customers?

   3. Where would you position your company in the following value chain –
      a) content enabler;
      b) authoring/ design/ conversion,
      c) publishing/ marketing/ management or distribution?

3) Company Functions & Occupations:

   1. Please explain the main functions of your company?

   2. Can you list the key occupations/ functional areas in your company and give details about what each occupation entails.

   3. Is this structure the norm for this sector at this stage of a company's development?

   4. For each occupation do you anticipate that you will require more or less staff over the next 5 years?

   5. Do you think the skills requirements for these occupations will change within the next five years?

   6. Do you see any new occupations being introduced into the company or having a more significant role in the sector in general in the next 5 years?

   7. Are there any occupations that you are currently finding difficulty in recruiting for?

   8. Do you know of any other occupations within the industry that are currently in high demand?

4) Education & Skills Training issues re. Company Functions/Occupations

   1. For each of the occupations mentioned what would be the ideal educational background?

   2. In your opinion are current educational courses adequately preparing graduates for work in your sector?'

3. Training:

- What training courses do staff and managers currently attend?
- Are you planning any significant changes to these courses over the next 5 years?
- Who currently provides training for your employees?
- Are any of your training requirements particularly difficult to address at present? If so, give reasons:
- Would you consider that the current education and training provision for the digital content industry is adequate?
- What could be improved?

Appendix C Classification of courses

Classification	Courses
Computing/IT	Computing Computing (Information Technology Support) Computing with Internet Development Computing in Web Development Computing - Computer Programming Computer Applications Computing in Internet Technologies Computing & Information Technology Management Computer Science Applied Computing Software Development Psychology Applied to IT Internet Systems Development
Computing - Business	Commercial Computing Business Studies in eBusiness Business Information Technology Business Computing Business Studies in Computer Applications Business Studies - E-Commerce Business Studies in Information Systems
Networks & Electronic Systems	Electronic Systems Electronics & Communications Systems Computing with Data Communications Network, Satellite & Mobile Communication Software Development & Computer Networking Mobile Communications & Electronics Computer Networking Electronics & Digital Communications Computing - Networking & Optical Communications Systems Analysis Ubiquitous and Multimedia systems Telecommunication Eng/ Electronic Systems
Information Systems Management	Information Systems Management Computing in Information Technology Management Information Systems Development Business Information Systems Management Information Systems
Engineering - Electronic/Computing/Software	Computing - Software Engineering Electronic Engineering Electronics & Computer Engineering Electronics & Communication Systems Computer Engineering Digital & Software Systems Computer Engineering Software Design & Development Computer Integrated Design
Multimedia Applications/Technologies	Multimedia Applications Computing with Multimedia Interactive Multimedia Audio Visual Communication

	Multimedia Studies Multimedia Computing & Design Video & Sound Technology Film & Television Production Digital Media Technology Audio Visual Media Technology Music Technology Applied Music Communications with Multimedia Film (Theory & Practice) Music Technology Media Studies Technical Communications E Learning Design & Development
Art & Design	Design in Communications Fine Art Design Visual Communications In Graphic Design Design Digital Media Visual Communications Design Graphics Art and Design Animation Graphic Communications Design Technology

Abbreviations	Institution
AL	Athlone Institute of Technology
BCFE	Ballyfermot College of Further Education
BN	Institute of Technology, Blanchardstown
CIT	Cork Institute of Technology
CW	Institute of Technology, Carlow
DBS	Dublin Business School
DCU	Dublin City University
DIT	Dublin Institute of Technology
GC	Griffith College Dublin
GMIT	Galway-Mayo Institute of Technology
IADT	Dun Laoghaire Institute of Art Design & Technology
LIT	Limerick Institute of Technology
NCI	National College of Ireland
NUIM	National University of Ireland Maynooth
TCD	Trinity College Dublin
UCC	University College Cork
UCD	University College Dublin
UL	University of Limerick
UU	University of Ulster
WIT	Waterford Institute of Technology