# Cluster origination and development: a case study of Scotland's video games industry

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# Table of Contents

## List of Tables



## List of Figures

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This thesis was created during one of the most physically, mentally and personally challenging times of my life – chaos reigned! Now that it is complete, I want to thank those around me that helped me to reach the finish line.

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## Author's Declaration

This Dissertation is wholly and exclusively my own work and following the normal academic conventions, I have made due acknowledgement to the work of others.

Signed ..... Date .....

# Chapter 1 - Introduction

*"Somewhere, something incredible is waiting to be known"*

Dr. Carl Sagan (1934-1996)

## 1.1 Aims of the Study

Clusters can be considered "in terms of spatial agglomerations of enterprises and related supplier and service industries" (Mytelka and Farinelli, 2000, p. 7). The underlying aassumption in both the academic and policy literature is that clusters are beneficial and can contribute to economic development. Cluster focused economic development strategies are used extensively by policy makers, although the impact is not always evident (Atherton and Johnston, 2008). Understanding clusters is therefore important if this phenomenon is to be of value in economic development, particularly when policy is being created around this concept.

Cluster-focused research has been undertaken in a variety of disciplines with debate about definitions, typologies, theoretical approaches, and the cluster process itself. This study is situated within the body of research that addresses ideographic, historical work on the origin and development of clusters (Harrison, Cooper and Mason, 2004). The aim is to contribute to theory about cluster emergence and evolution, a neglected area in the research, and address the question of how a cluster evolves, the barriers to its development and the dynamics therein.

## 1.2 Approach and rationale

An empirical study is undertaken that adopts a cluster as the unit of analysis to provide insight into the cluster development process. The conceptual framework adopted is Mason's (2008) four phase model of high technology cluster development, together with the proposition that entrepreneurs are a critical part of the cluster process. The aim

is to interrogate and enhance this model by examining cluster development in 'new economy clusters' (Mason, 2008, p.48) such as the creative industries.

Recent literature acknowledges that multi-level analysis and new models are required to research the complexities of the clustering process. However to date, the majority of cluster studies have involved a static, 'top-down' examination of the cluster. This study takes a dynamic, 'bottom up' approach with the aim of generating a rich, narrative response to address the lack of existing data about the cluster development process. The methodological approach reflects a subjective ontology and anti-positivist epistemology, indicative of an interpretative stance.

A case study strategy is adopted with the focus on a single case, namely the video games cluster in Scotland from its emergence in the 1980s to the end of 2010. This cluster is prominent in terms of its profile, attention from policy makers and entrepreneurship activity.

Qualitative data are employed to provide a deeper insight into the historical development of the cluster. This approach recognises the lack of consistent theoretical literature, and existing data about the video games cluster. The data are collected using documentary analysis and forty semi-structured interviews with respondents involved in the cluster from the public, business and academic sectors. The interview participants are identified using a purposeful sampling strategy.

## 1.3 Exposition

This first chapter provides an overview of the study. It details the aims and objectives of the study and the approach adopted. Subsequent chapters of this dissertation address the literature review, methodology, data analysis and findings, and the conclusion.

Chapter 2 contains the literature review which provides the foundation for the study by establishing what is known about clusters and where the opportunities exist for further research. The cluster concept is presented in the initial stage of this chapter addressing definitional issues and the notable debate and inconsistencies that exist. Cluster origination and development is then discussed, examining the various contributory factors including entrepreneurship. The role of clusters in policy making and economic development are outlined including cluster policy in Scotland. The chapter concludes by providing an overview of clusters in the creative indsutries and contextual data about the video games industry. Finally, the key gaps in the literature are highlighted providing the rationale for undertaking the study.

The methodological aspects of the study are addressed in Chapter 3. The philosophical underpinnings of the study are explored including ontological and epistemological assumptions. The research questions and the key objectives are then reiterated before the research design and the research framework are presented. Following this, the research approach is discussed particularly the rationale and the case study selection. Data collection issues are explored and the two research methods employed for data collection (documentary analysis and semi-structured interviews) are presented with the rationale for each. Additionally for interviews, the key ethical issues are highlighted together with the criteria for sample selection. The final stage in the research approach, namely data analysis, is described including the tools and procedures adopted. The

chapter concludes by examining the methodological limitations of the research design before summarising the chapter's key points.

The study findings are provided in chapters 4-7. Chapter 4 presents the findings in relation to the scale of the cluster and the evolution phases which it has evidenced. First the changing profile, scale and geography of the cluster are examined. This is also visually represented using a cluster genealogy tree which was developed during the study. The four phases of the cluster's development are then identified, namely Pioneering (1980s- 1995), Engagement (1996-1999), Consolidation (2000-2005) and New Directions (2006 – 2010). The key characteristics of each are examined together with the important enablers and events relevant to each phase.

Chapter 5 examines the factors that have contributed to the evolution phases presented in Chapter 4. First the cluster's emergence in the 1980s is examined. This was triggered by indigenous entrepreneurs and facilitated by a number of factors at a local, national and international level. The trigger events and contributory factors are explored, as is their impact on the initiation of the cluster. Second, the factors that have supported the cluster's evolution are highlighted namely the changing conditions in the global video games industry, the public and academic institutions that have engaged with the cluster, the behaviour of entrepreneurs and firms, and the role of the city of Dundee. Each factor is identified and discussed.

The barriers to the cluster's development are explored in Chapter 6. This examines why the cluster has not fulfilled its potential. The five key barriers are each discussed. First the effect of industry, market and technology conditions on the cluster are explored,

highlighting how the specific characteristics of the computer games industry (and the role that Scottish companies play) have on the companies and subsequently the cluster. Second, the negative perceptions of the industry are explored. These have arisen from a diverse number of sources that include academia, the investment community, the games industry itself, and the general public. Third, the issue of company start up, growth and sustainability is noted as an important barrier. This was multifaceted and emphasised the important role that the sustainability of companies has on the cluster. A number of weaknesses are identified and discussed. The fourth factor addressed in this section is that of geography. This primarily relates to the perceived disconnect between Dundee and elsewhere in the cluster. Finally, the issue of public policy is addressed, another key factor mentioned in the study particularly in terms of inconsistency and inappropriateness.

Chapter 7 presents a comparison of the empirical findings about cluster evolution to a model of high technology cluster development proposed by Mason (2008). The key differences are identified namely the scale of evolution and the timing of activities; the propositions about new economy clusters relative to high technology clusters; and (iii) factors influencing entrepreneurial spin-off in the cluster. The rationale for the differences are identified as industry-specific factors (such as the level of disruptive innovation, the dominance of buyer driven supply chains, and the negative perception of the industry), the activities of firm in the cluster (particularly the focus on games development in a buyer driven supply chain) and the dominant role that entrepreneurship has played in the cluster.

The study's conclusions are presented in Chapter 8. This commences by reiterating the aims of the study and the approach adopted to address these. A summary of the main findings in relation to the three research questions is then presented. This is followed by an explanation as to where the study has contributed in terms of the literature, theory building and methodological approach. The study's limitations are then presented together with recommendations for future research.

# Chapter 2 - Literature Review

*"The real voyage of discovery consists not in seeking new landscapes,*

*but in having new eyes"*

Marcel Proust (1871-1922)

## 2.1 Introduction

The cluster literature is diverse and has generated a certain amount of debate and "analytical overlapping, confusion and duplication" (McCann, 2008, p.23). A review of this literature was undertaken at the outset of the study in a systematic, explicit and reproducible way (Fink, 1998). The aim was to achieve familiarity with the literature, gain an insight into methodological approaches, and identify areas of potential research (Randolph, 2009). The phases of the review, and data sources accessed, are provided in Appendix 1. The chapter begins by discussing the cluster concept where a high level of debate and inconsistency is evident. The different types of cluster research are discussed before focusing on the clustering process, the focus of this study. The chapter then explores the role that clusters plays in policy making where it has been widely adopted as an economic development tool. This includes the role of cluster-related policy in Scotland and its application to the creative industries. The chapter concludes by highlighting the gaps in the literature that provide the basis for the study's rationale, research questions, and contribution.

## 2.2 The cluster concept

### 2.2.1 An overview of cluster research

Cluster-focused research has been undertaken in a variety of disciplines (for reviews see for example Cumbers and MacKinnon, 2004; Martin and Sunley, 2003; Rocha, 2004). There is evident interest in clusters in the academic literature but a perceived a lack of "critical intellectual engagement with the cluster concept" (Cumbers and MacKinnon, 2004, p.959). Integrated approaches have not been evident (Cheshire and Malecki,

2004) and the result has been "analytical overlapping, confusion and duplication" (McCann, 2008, p. 23).

There is debate about definitions, typologies, theoretical approaches, and the cluster process itself (Martin and Sunley, 2003; Maskell and Kebir, 2005) although Benneworth and Henry (2004, p. 1021) argue that such "inconsistencies and ambiguities of the clusters concept are part of the theoretical work in progress around this immature yet politically powerful concept." As a result of such divergence, there is no common definition although Porter's (1998) description is widely quoted:

> "Geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also co-operate*"* (Porter, 1998, p.197).

Despite the criticisms, debate and lack of consistency in cluster research, the underlying assumption in both the academic and policy literature is that clusters are beneficial, contribute to economic development and can help to "shape the evolution of the regions where they are located, making them more competitive and innovative." (DePropris *et. al*., 2009, p. 7). Understanding clusters is therefore important if this phenomenon is to be of value in economic development, particularly when policy is being created around this concept.

The basis for the cluster literature is in agglomeration theory and economics (Marshall, 1920) from which assortments of approaches and frameworks have been developed. Every cluster is in some way an agglomeration although not all agglomerations are

clusters (for example, cities are economic agglomerations but not necessarily cluster based. At their core, agglomeration economies have location specific benefits (externalities) related to the economies of scale, in the form of increased revenues and lower costs, that are derived in that location. Such externalities can be shared by all firms in a location (urbanisation effects or general economies), or they can be localised to firms involved in similar or linked activities (industrial effects or local economies) (Solvell *et al.,* 2003; NESTA, 2009). A thick labour market provide firms with access to specialist labour, and provide the specialist labour with more opportunities, and attracts skilled labour from elsewhere (Florida, 2002). Additionally, there is access to specialist input suppliers, such as business advisors, investors, marketing specialists, universities, etc., who are attracted to the cluster as they can exploit internal economies of scale. Finally externalities can arise from knowledge spillovers between firms and intangible externalities such as local social, institutional and cultural foundations.

Cluster research can be broadly divided into (i) theoretically focused research which is concerned with the mechanisms that give advantages to firms in the cluster; and (ii) ideographic, historical work on the origin and development of types of clusters (Harrison, Cooper and Mason, 2004). Theoretically focused research, addressing the 'existence, extension and exhaustion' of clusters has been extensively research. However there has been less focus on origination and development (Harrison, Cooper and Mason, 2004; Potter, 2009)

### 2.2.3 Cluster origination and development

Each cluster "has a unique development trajectory, principle of organisation and specific problems" (Mytelka and Farinelli, 2000, p. 11). However, the origination and evolution process remains relatively under researched (Markusen, 1996; Feldman and Francis, 2004; Harrison, Cooper and Mason, 2004; Braunerhjelm, 2005; Potter, 2009). The clustering process is dynamic in nature. It "engages multiple actors, cooperating in many ways, through a growing range of collaborative activities that develop closer and more intensive ties and interactions between firms" (Atherton & Johnston, 2008, p. 111). Increasingly, clustering is being perceived as evolutionary (Menzel and Fornahl, 2010) and adaptive (Martin and Sunley, 2011) and the complexity of this process requires that the wider context of the cluster needs acknowledged. This includes the processes that operate at different geographical scales, within networks of different lengths, and which incorporate concepts like embeddedness and social capital (Johns 2010).

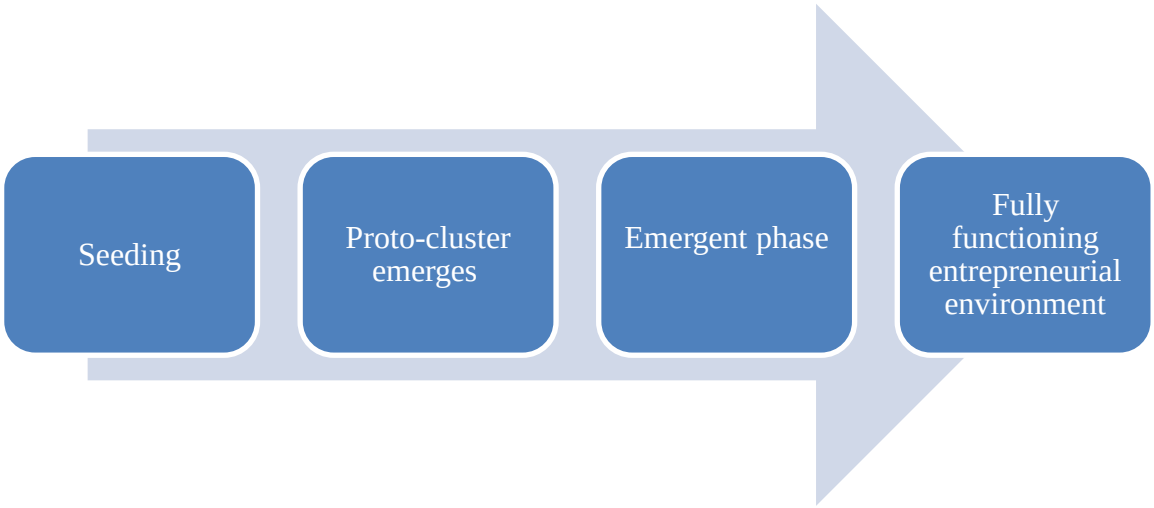
The role of entrepreneurship in the cluster process is crucial but often overlooked (Potter, 2009). Various definitions of entrepreneurship exist but the "creation of new organisations" (Gartner, 1989, p. 62) is a common factor. For the purpose of this study, entrepreneurship is defined as follows:

> "an activity that involves the discovery, evaluation and exploitation of opportunities to introduce new goods and services, ways of organizing, markets, processes, and raw materials through organizing efforts that had not previously existed" (Shane, 2003, p. 4).

Policy makers advocate clusters as an important stimulant for entrepreneurship (Scottish Enterprise Digital Media Advisory Group, 2009; Downes and Botham, 1999; OECD, 2009; ECPG, 2009) as do academics (Delgado, Porter and Stern, 2010; Feldman, 2001; Rocha and Sternberg, 2005). Entrepreneurial agency has been proposed by some researchers as a critical element of cluster genesis, evolution and sustainability (Feldman, 2001; Feldman Francis and Bercovitz, 2005; Mason, 2008). Entrepreneurs are change agents that "spark cluster formation and regional competitive advantage" (Feldman, Francis and Bercovitz, 2005, p. 130). They evolve with the cluster, attract resources, and stimulate the formation of the cluster (Feldman 2001; Menzel and Fornahl, 2010; Karlsson, 2008a), giving the cluster a unique genesis (Harrison, Cooper and Mason, 2004):

Entrepreneurs can also affect the components of the cluster's "entrepreneurial climate" (Karlsson, 2008a, p.9) which is important for new firm formation in clusters (Porter 1998). Such formation is perceived as a "crucial element in the creation of industrial clusters" (May, Mason and Pinch, 2001, p. 374). The emergence of clusters is often triggered by people, often from the same organisations, deciding to form companies in a location (Feldman, 2001; Dahl, Pederson and Dalum, 2005). For example, through spinoff activity by employees of indigenous firms, firms that have relocated to that area and/or de novo firms (Maskell, 2001; van Heur, 2009; Klepper, 2007; Zoltan *et al.*, 2009). Feldman, Francis and Bercovitz (2005) view entrepreneurs as critical to cluster formation and sustainability and Mason (2008) suggests that entrepreneurial activity has been the central mechanism in driving high-tech clusters. He proposes that high-technology clusters can be described in four key phases as summarised in Figure 1.

Figure 1. Cluster development in the high technology industries




Source: Adapted from Mason, (2008)

Cluster development in Mason's model is equated to the maturation and the density of the cluster's actors and activities. The key components in this are as follows:

- company activity (increased volume, diversity of activities, entrepreneurial recycling);
- institutional activity (increased involvement of public, academic and research institutions for example in terms of support, funding, initiatives, research activity, spin-outs etc.);
- customers and suppliers diversity;
- financial organisations, and
- other components, principally the profile of the cluster, the sense of community and the geographic concentration.

The indicator of a change of phases usually relates to a market and/or technology development, an increased volume of companies, or the evolution of a community (in

terms of networks and profile). At the outset of the cluster, the seeding phase describes the foundations that are laid for future development. This involves the embedding of research intensive activity in the region whether within universities, large companies and/or other institutions. It is research focused and not industrialised. The proposition is that high quality research activity will attract in other people to the region, as well as facilitate the generation of knowledge and technology that will provide the basis for spinouts. The second stage in the model, 'proto-cluster', occurs when people create ventures in the region, having left organisations that are based there. This is followed by the 'emergent phase' which displays more notable signs of entrepreneurial activity stimulated by a range of new businesses emerging after their founders leave organisations in the region and start-up companies that focus on a small number of technologies. It is during this phase that the support ecosystem starts to develop for firms, involving both public and private organisations, and engagement between various actors takes place – 'a collective sense of community' (Mason, 2008). At this stage, there are signs of successful company sales or flotations and entrepreneurial recycling. At this point, the cluster is judged as self-sustaining. However it is not deemed to be a 'fully functioning entrepreneurial environment' until at the firm level there is diversity in size, activities, and ownership, as well as a more integrated business support infrastructure, for example, venture capital funds, specialised support agencies, academic involvement in skills development, and Government funding and infrastructure support (Mason, 2008).

## 2.3 Clusters and policy

### 2.3.1 The role of clusters in economic development policy

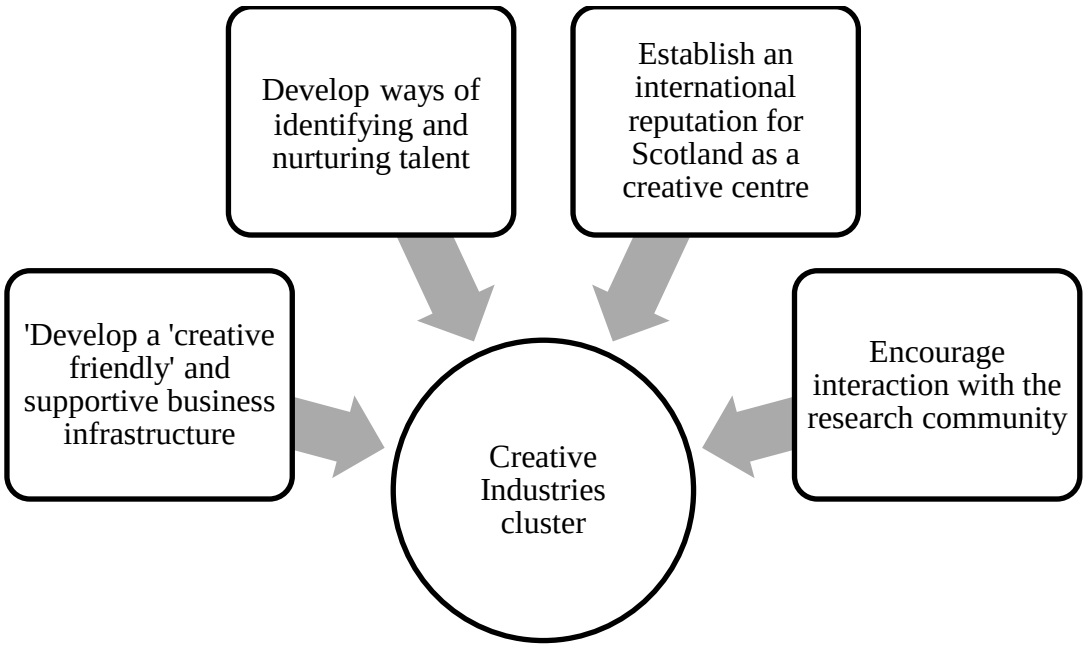
Cluster development strategies are evident in a number of countries and are "an integral part of the political thinking on industrial and regional policies" (Karlsson, 2008a, p. 1). The adoption of clusters within economic development has resembled the "search for the Holy Grail" (Henry and Pinch, 2006, p. 116). However the success of such policy is questionable (Atherton & Johnston, 2008, p. 93). While policy makers are keen to use the cluster concept, their strategies are not always rooted in a theoretical understanding of clusters or the academic literature (Martin and Sunley, 2003). Despite this, cluster development strategies are evident globally with case studies (OECD, 2009) and support initiatives (Solvell, Lindqvist and Ketels, 2003) being identified with the purpose of disseminating 'best practice'. The European Cluster Policy Group was formed in October 2009 to support and improve cluster related policy in the Commission and Members States, believing clustering to be a critical success factor in the economy (European Cluster Policy Group, 2010). The UK has also pursued cluster focused strategies since the Department of Trade and Industry (DTI) identified this as a key economic development objective (DTI, 1998).

### 2.3.2 Cluster policy in Scotland

A cluster focused strategy has been evident in Scotland since the 1990s (Solvell, 2003; Brown, 2000; Downes and Botham, 1999). It was introduced by the economic development agency, the Scottish Development Agency (subsequently renamed Scottish Enterprise), with contribution from Michael Porter's consultancy company. The approach adopted in Scotland combined a 'top down' and 'bottom up' approach, involving policy makers and business practitioners (Brown, 2000). It was based on the

rationale that "successful clusters enhance performance of companies and drive economic development and provide conditions for start-ups/innovation and global cost" (Downes and Botham, 1999). Scotland's initial cluster policy focus was on biotechnology and ICT. By 1997, the focus was on four key clusters and individual sector priorities. One of the individual sectors was filmmaking which was subsequently combined with multimedia and other industries to form a Creative Industries cluster (Solvell, 2003). The aim was to develop four perceived opportunities namely the development of a support infrastructure, supporting talent, raising Scotland's profile and developing closer linkages with research institutions. These are illustrated in Figure 2.

Figure 2. Development opportunities for the Creative Industries cluster in Scotland




Source: Adapted from Solvell, 2003

In this study, the creative industries were found to still be a priority for priority makers in Scotland in 2010 (Scottish Government, 2011; Scottish Enterprise Digital Media Advisory Group, 2009). Debate exists in the literature about how to define the creative industries and identify a 'best fit' taxonomy (O'Connor, 2007; Flew and Cunningham, 2010). However a widely used definition covers thirteen industries[1] that are "based on individual creativity, skill and talent. They are also those that have the potential to create wealth and jobs through developing intellectual property." (Department of Culture Media and Sport, 2009).

### 2.3.3 Clusters and the Creative Industries

The literature relating to clustering within the creative industries has increased in the last decade although is still relatively limited (Cook & Pandit, 2008; Turok, 2003; Cooke and Lazzeretti, 2008; De Propris *et al.,* 2009; van Heur, 2009). There have been concerns in the literature about the lack of evidence based policy particularly where the creative industries are viewed as a panacea for economic development (Oakley, 2004). Cluster focused policies do not often illustrate an understanding of the Creative Industries and are "overly dominated by an inadequate cluster agenda that fails to elaborate fully how the creative industries operate" (Jayne, 2005, p. 553).

Research has been undertaken at an overall sector level in the creative indstries (Chapain *et al.,* 2010; van Heur, 2009; Evans, 2009) as well as specific sub-sectors, for

[1]There are thirteen industries included in the definition namely advertising, architecture, art and antiques, crafts, design, designer fashion, film and video, music, performing arts, publishing, software, television and radio.

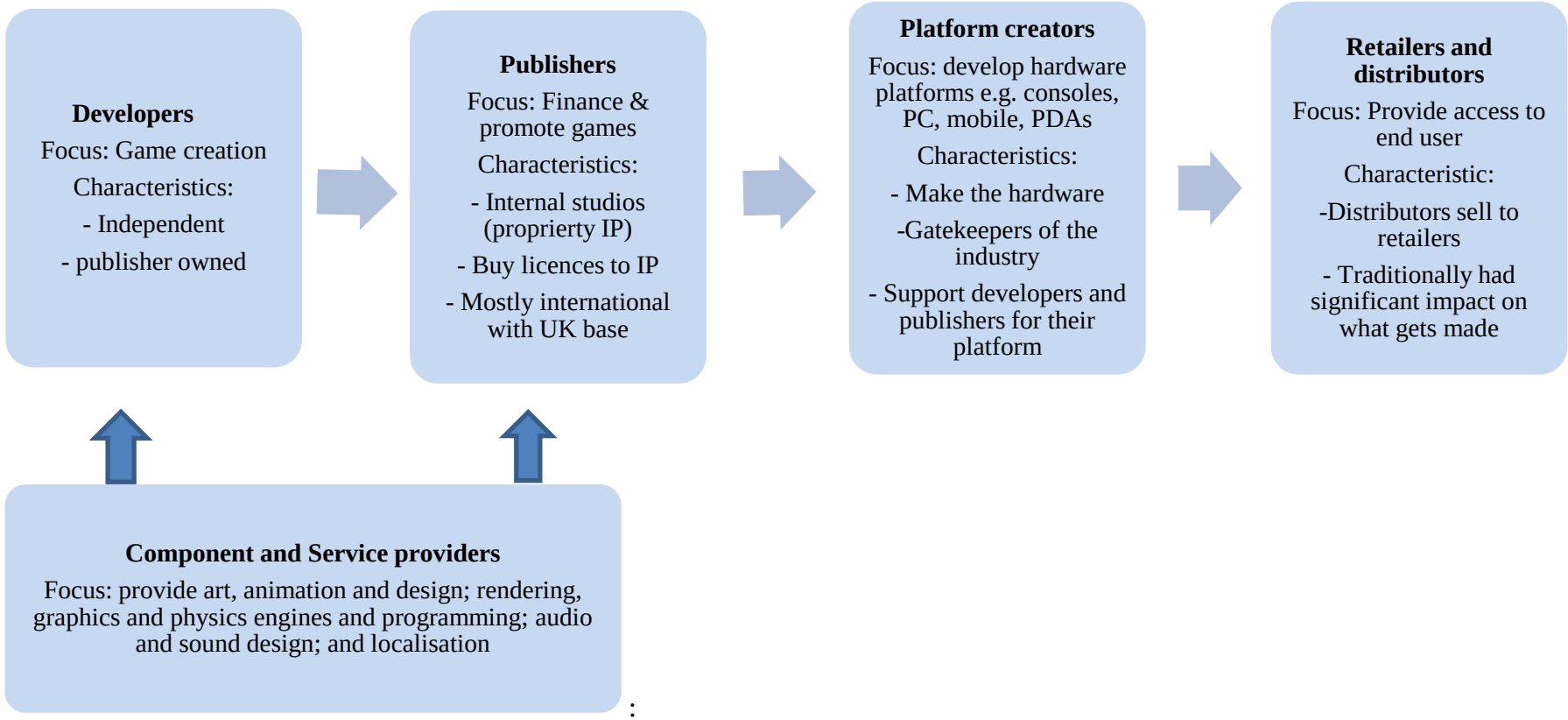
example media (Nachum and Keeble, 2003; Cook and Pandit, 2008; Turok, 2003), design (Reimer, Pinch and Sunley, 2008) and music (Braunerjhelm, 2005). The video games industry has evidenced clustering, although it still remains one of the most dispersed creative industries in the UK, (Chapain *et. al*., 2010; Oxford Economics 2008; Cornford and Naylor, 2001). However it remains a 'black box' (Teipen, 2008, p. 351), has received "relatively little attention from social scientists." (Johns, 2006, p. 351) and has only been considered as relevant for economic development since the 2000s (Kerr, 2003).

The video games industry is characterised by four key features: (i) technological developments; (ii) firm entry, growth and exit; (iii) new and specialist acitivites in the value chain; and (iv) changing power dynamics between publishers, platform owners, and superdevelopers (Readman and Granthan, 2006). It is inherently entrepreneurial, emerging "largely thanks to a group of young, seat-of-the-pants entrepreneurs" (Leadbetter & Oakley, 2001, p. 42). Traditionally, a buyer-driven value chain has dominated with games developers holding less power (see Figure 3). Additionally, the technology platforms in the industry have a 5-6 year cycle in terms of traditional console technology developments (Johns, 2006). This has implications for developers who have to change their tools and processes for each generation of technology (Cadin, Guerin and DeFillippi, 2006) and rely on their dynamic capabilities to remain competitive (Readman and Grantham, 2006).

A global games market has existed since the 1960s. Initial games emerged as a by-product of US Government funding to the military for software and technology development. The first notable private sector game was *Pong*, created by Atari for

arcade machines. Since then, the industry has moved from "small firms, many even individuals programming software in their bedrooms, producing for a highly niche market, to an industry dominated by multinational hardware producers" (Johns, 2006, p. 157). The global market is projected to grow at an annual rate of 10.6% to $86.7 billion in 2012 (PriceWaterhouseCoopers, 2010).

Figure 3. The video games value chain

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Source: Adapted from Cadin and Guerin (2006); Teipen, (2008); Skillset (2009a)

The UK video-game industry originated in 1975 but lacked any major international firms until the 1990s (Izushi and Aoyama, 2006, p. 1853). By 2008, the UK had one of the largest video games development communities in the world (NESTA, 2008), third after the USA and Japan. It generated £2billion in global sales, contributing £1billion to GDP and employing 10,000 people (Games Investor Consulting, 2008; Oxford Economics, 2008) Scotland was ranked 3rd in Europe's top 50 locations for games (Scottish Development International, 2008) while Dundee, Edinburgh and Glasgow have all been identified as games "Hotspots" (HSBC, 2009).

A variety of terms are used to define the computer games industry including interactive software, interactive entertainment, computer games, and video games. In Scotland, the Scottish Government uses "Computer Games". However for statistical purposes it is included within "Computer Games, Software and Electronic Publishing"[2] (Scottish Government, 2009a) and for economic strategy purposes, it is included within the Creative Industries, a priority sector for the Scottish Government (Scottish Government, 2007; 2009b) and digital media, where the aim is to increase the turnover of the entire sector by £2.47bn by 2012 (Scottish Enterprise Digital Media Advisory Group, 2009). Scottish Enterprise aims to "maximise the economic potential of all of the creative industries but in particular those companies operating in the high growth area of digital media" (Scottish Enterprise, 2010a, p. 15).

## 2.4 Proposed contribution and research questions

[2]Prior to 2003 the industry was included in "Software (including leisure) & Computer Services"

This study contributes to the literature that focuses on ideographic, historical examination of clusters in relation to their emergence and evolution. Two key gaps identified in the literature review provide the basis for this study. The first is the lack of empirical research examining cluster emergence and development (Markusen, 1996; Feldman and Francis 2004). The aim is to better understand this process by interrogating and enhancing Mason's (2008) model of high technology cluster development.

The second gap is the role of entrepreneurship in cluster emergence and development. There is a lack of resarch about this and the "motives and constraints of entrepreneurs as they form and grow their innovative small firms" (Feldman and Francis, 2004). An examination of entrepreneurial activity over the evolution of the cluster could provide useful insights into both of these phenomena. Such an approach requires a historical perspective and a 'bottom up' approach which takes into account the perspectives of actors within the cluster.

These two gaps provide the context for exploring the evolution of the video games cluster in Scotland. The research questions, aims and objectives are presented in Table 1.

Table 1. Research questions, aims and objectives

| **Research Question** | **Research Aim** | **Research Objectives** |
|---|---|---|
| RQ1: How does a cluster originate and develop? | To understand how the video games cluster in Scotland emerged and manifested itself. | To identify the trigger events that started the cluster.<br><br>To identify the stages of |

| | | |
|---|---|---|
| | | the cluster's development. |
| RQ2: What are the barriers to cluster development? | To understand the factors that negatively influence cluster evolution. | To identify the barriers to cluster development.<br><br>To identify how barriers hinder the cluster's development. |
| RQ3: How does the evolution of a new economy cluster compare to that of a high technology cluster? | To identify and understand the differences between high technology and new economy clusters. | To identify the differences between the video games cluster's evolution and the model of high technology cluster.<br><br>To identify the factors contributing to such differences. |

## 2.5 Conclusion

This chapter provided details of the literature that forms the basis of this study. It generated three key outputs namely familiarity with the literature and contextual information for the study, gaps and weaknesses in the literature, and an understanding of the methodological approaches of other researchers. This study is situated within the work relating to ideographic, historical work on the origin and development of types of clusters (Harrison, Cooper and Mason, 2004). The aim is to contribute to the under-researched area of cluster emergence and growth, (Markusen, 1996; Feldman and Francis 2004), particularly the dynamics involved in the clustering process from the 'bottom-up'. The conceptual framework that will be used in the study is Mason's (2008) four phase model of high technology cluster development together with the proposition that entrepreneurs are a critical part of the cluster process (Mason, 2008; Feldman, Francis and Bercovitz. 2005) particularly its genesis.

# Chapter 3 - Methodology

*“A man should look for what is, and not for what he thinks should be”.*

Albert Einstein (n.d.)

## 3.1 Introduction

The methodological approach adopted to address the research questions is described in this chapter. Inherent in this approach was the need for, and importance of, consistency in terms of philosophical assumptions, the research design and research methods (Leitch *et al.*, 2010; Knox, 2004). At the outset of the chapter, the philosophical underpinnings of the study are explored including ontological and epistemological assumptions. The research questions are then restated and expanded to highlight the key objectives inherent in each. The research approach is explained and the rationale for adopting a case study research strategy is discussed, as is the focus on collecting qualitative data. The two methods, semi structured interviews with cluster elites and documentary analysis, are discussed in detail to illustrate the rationale for adoption and their limitations. Data analysis follows this including how the analysis was handled recognising the case study strategy and the use of qualitative data.

## 3.2 Ontology and Epistemology

An interpretivist paradigm (Burrell & Morgan, 1979) most closely reflected the underlying philosophical assumptions in this study. The inherent ontological assumptions concerning reality were nominalist, the epistemological assumptions were anti-positivist, human nature was viewed as voluntarism and the methodology focused on an ideographic approach. Ontology "lies prior to and governs subsequent epistemological and methodological assumptions" (Chua, 1986) and in this study, the ontological assumptions are more subjective than objective. The assumption is that the

social world consists of "nothing more than names, concepts and labels which are used to structure reality" (Burrell and Morgan, 1979, p. 4). Epistemologically, it is important to understand how people view the world in their terms. (Morgan and Smircich, 1980, p. 493)

An interpretive approach was appropriate for this study, based on the belief that the phenomena under investigation were human and required a different approach from the natural sciences where a functionalist approach is common (Dilthey 1976; Husserl, 1965). The complex process of cluster origination and development was explored via the perspectives of key participants on the inside, with no focus on rules or causality. Trust and credibility were important in gaining access to the cluster and necessitated the development of industry connections and regular interaction with key individuals to nurture the requisite relationships. This was compatible with an interpretive approach where the researcher can interact with the participants more readily and essentially "gather their stories" (Patton, 2002, p. 340) as they see them. Interpretative approaches have increased in entrepreneurship research (Neergaard and Ulhoi, 2007; Leitch *et al.*, 2010; Pittaway, 2005) with encouragement of more "paradigmatic experimentation, engagement and debate" (Grant and Perren, 2002). However as a field of study, entrepreneurship is still fairly young (Bygrave, 2007, in Neergaard & Ulhoi, 2007) and has traditionally evidenced a functionalist approach which is visible in terms of journal publications (Grant and Perren, 2002).

## 3.3 Research Design

The aim of the study was to contribute to theory in cluster emergence and development. The video games cluster in Scotland was selected as the unit of analysis with the focus on understanding the clustering process. The aim was to undertake a longitudinal exploration to examine the cluster's evolution and gain an understanding of the dynamics involved. This study was essentially inductive in nature and the aim was not to confirm or deny hypotheses nor build generalisations from the population under investigation. This approach allowed the identification of themes and issues after data collection without "presupposing in advance what the important dimensions will be" (Patton, 2002, p. 56). Acknowledging that research "can be confusing, messy, intensely frustrating, and fundamentally nonlinear" (Marshall and Rossman, 1999, p. 21), a research plan and framework was developed to guide this study. The research framework is provided in Table 2 and further explored in Sections 3.4 to 3.8.

Table 2. Research framework for the study

| **Activity** | **Components** | **Rationale** | **Activities** | **Proposed output** |
|---|---|---|---|---|
| 1.Literature review | Source, review, interrogate, apply, revisit. | Familiarity with academic literature. Identify gaps. Understand study context. | Identify key words. Structured search. Identify gaps Revisit as apt. | Overview of subject area. Research questions. Ideas for methodology. |
| 2.Research approach | Case study. | Understand dynamics. Unit of analysis is a process. Address 'how?', 'why?' questions. | Define case study. | Rich data about cluster dynamics over its existence. |
| 3.Data collection | Documentary analysis. | Historical data requirement. Triangulation. Context for case study. Preparation for | Review pre and post interviews. Review post-cluster map creation. | Contextual and historical data. Interview and cluster map validation. Identification of |

| | | | | |
|---|---|---|---|---|
| | | interviews. | Event attendance. | key actors. |
| | Semi-structured interviews. | Understand cluster process.<br>Understand entrepreneurial activity.<br>Address lack of historical data. | Sample identification.<br>Research tools.<br>Access to respondents.<br>Fieldwork. | Key stages and components of cluster origin and development.<br>Entrepreneurial histories. |
| 4.Data analysis | Cluster emergence, development and dynamics. | Identify development path and key enablers/ barriers.<br>Identify entrepreneurial activity and its role. | Review secondary material.<br>Review transcripts.<br>Interpretation. | Comparison to literature.<br>Emerging themes.<br>Entrepreneurial activity.<br>Cluster map. |
| 5.Data presentation and findings | Cluster process Entrepreneurship. | Answer research questions.<br>Identify new themes. | Identify cluster path.<br>Create cluster map. | Contribution.<br>Cluster map. |

## 3.4 Research approach

The complex nature of clusters can present issues of "theoretical and empirical definition, as well as methodological investigation" (DTI, 2004, p. 4). Within the cluster literature, both theoretical and empirical studies are evident although the underlying philosophies and methodological approaches are not always clear or consistent (Maskell & Kebir, 2005; Wolfe and Gertler, 2004). However a review of previous approaches identified that a case study research strategy was appropriate. In cluster research, the case study approach can generate "important insights into the nature and dynamics of regional industry clusters and the sources of their success" (Wolfe and Gertler, 2004, p. 1083) The cluster related literature has many examples of its usage (Karlsson, 2008b) including a range of sector focused studies that include media (Nachum & Keeble, 2003), music (Braunhjemmer, 2005;van Heur, 2009), high technology (Harrrison, Cooper and Mason, 2004; Feldman, Francis and Bercovitz, 2005)), motorsport (Henry and Pinch, 2001), computer games (Readman and Granthan, 2006; Cadin, Guerin and DeFillipi, 2006) and design (Reimer, Pinch and Sunley, 2008). In Scotland, this has included the oil and gas sector (Cumbers, MacKinnon and Chapman, 2003), biotechnology (Leibovitz, 2004), electronics (Turok, 1993) and film/TV (Turok, 2003).

### 3.4.1 Case study

The study adopted a single unit case study, namely the video games cluster in Scotland. The case study is "an empirical enquiry that investigates a contemporary phenomenon in-depth and within its real-life context, especially when the boundaries

between phenomenon and context are not clearly evident" (Yin, 2009, p.19). This approach is useful to explore *how* and *why* questions and the rationale for adoption is usually a "desire to understand complex social phenomena" (Yin 2009, p.4). This was very appropriate for the study where the questions were predominantly of this nature and recognised the level of debate and inconsistency in the cluster literature (Martin and Sunley, 2003). It is a method neutral approach therefore methods can be mixed (Yin 1981; Stake 2005) and can be used to test or develop theory (Eisenhardt, 1989).

A case study approach is also appropriate for process orientated research, such as the cluster origination and development process in this study, and allows recognition of the different growth routes between clusters (Harrison, Cooper and Mason, 2004). In this study, it provided a way of dealing with multiple causation and complexities that arose including relevant historical factors that impacted the origination and development of the cluster over a long time.

The case study approach has been criticised for not being generalisable to a wider population as the data are not collected from a representative population. However findings can be generalisable to theories rather than populations and can therefore be used to develop theory, as well as test it (Eisenhardt, 1989). As Yin (2003, p. 10) states, "The case study does not represent a sample and, in doing a case study, your goal will be to expand and generalize theories and not to enumerate frequencies". In this study, the emphasis was on building theory relating to the origination and development of clusters and a case study approach was relevant for this.

### 3.4.2 Case study selection

The case study selected was the video games cluster in Scotland. The definition of a cluster's boundary "is often a matter of degree, and involves a creative process" (Porter, 1998, p. 202). This study considered the unit of analysis to be the 'Scottish cluster' as a whole. This choice was based on a number of factors. First, Scotland has evidenced a cluster focused economic development policy since the 1990s (Solvell, 2003; Brown, 2000; Downes and Botham, 1999) which was still evident in 2010 (Scottish Enterprise, 2010). Such policy included the video games industry which itself is recognised as important to Scotland (Scottish Development International, 2008; HSBC, 2009; Krugman, 2009; Digital Media Advisory Group, 2009; Scottish Government, 2009b; Chaplain *et al.*, 2010; Willets, 2010).

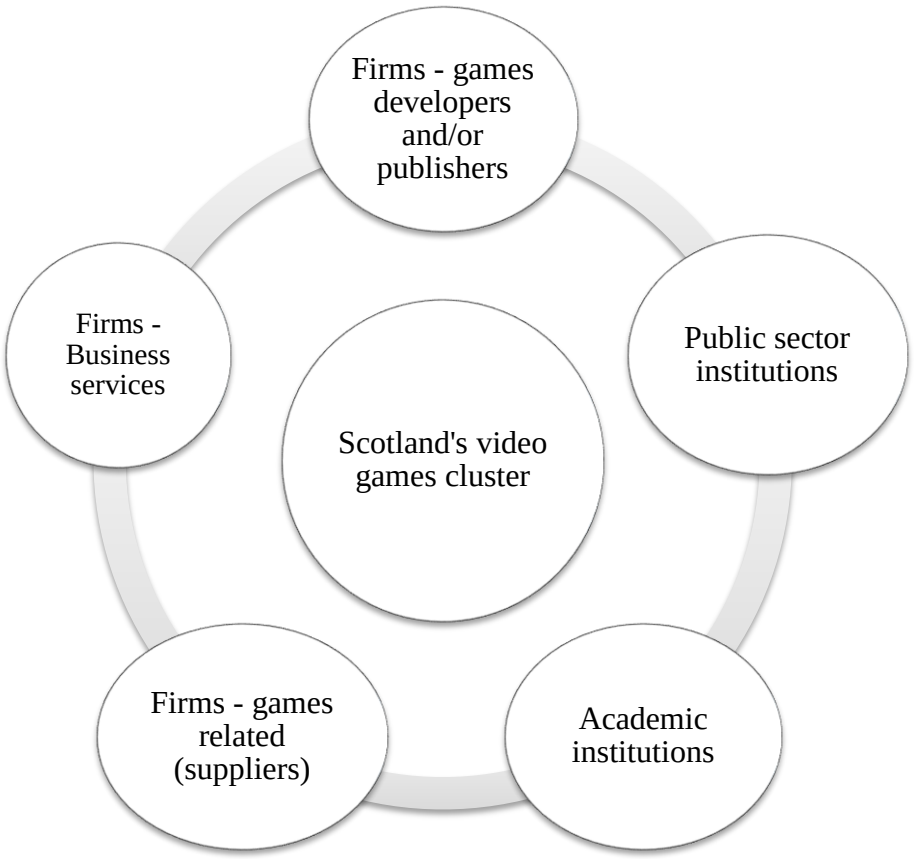
Second, the term cluster is regularly used to refer to Scotland's entire video games industry despite its dispersion. Scotland's games industry has been referred to as a cluster since 1990s: "Our home-grown talent is fast earning Scotland a reputation as a cluster of gaming excellence" (McCallum, 1998). The games industry was badged as 'Scotland's game industry' by policy makers and their initiatives supported this. From around 2000, the term cluster became more synonymous with Dundee rather than Scotland as activity became more concentrated there and it was used as a brand. However, towards the end of this study, geographic concentrations had further evolved with additional hubs emerging in other cities (DePropris, 2009).

There is no clear definition of the video games cluster in Scotland and no definitive list of its participants over its evolution. A database was therefore created as part of the study to identify and describe cluster participants. First data were gathered from 'official' lists of industry participants in 2010 such as those produced by publicly

funded organisations such as Scottish Enterprise[3] in the Talent Scotland[4] website, Scottish Development International[5], the Scottish Government[6] and Interactive Tayside[7]. Second, data about cluster participants pre 2010 were obtained from a range of secondary sources (see Section 3.7.2.2) and primary interviews. This combination of data sources provided the core database for the study and indicated that three main types of cluster participant existed namely public organisations, academic organisations and firms. The latter was further divided into video games developers and/or publishers, video games related firms (i.e. suppliers of services and components to, although not exclusively, the video games industry such as music, animation, software, 3D modelling, hardware, technology etc.), and business services (including marketing, recruitment, legal and finance). Figure 4 depicts these key participants.

[3]http://scottish-enterprise.com/
[4]http://www.talentscotland.com/
[5] http://www.sdi.co.uk
[6] http://www.scotland.gov.uk
[7]http://www.interactivetayside.com

Figure 4 Classification of participants in Scotland's video games cluster




### 3.4.3 Qualitative data

In this study, a qualitative approach was appropriate as the aim was to gain a deep level of understanding about the cluster. The adoption of a qualitative or quantitative approach is not exclusive to any specific philosophy or paradigm as "their use is defined by the researcher's philosophical assumptions" (Klein and Myers, 1999, p. 69). Qualitative research is undertaken in "real-world settings and the researcher does not attempt to manipulate the phenomenon of interest" (Patton, 2002, p. 39). The key principle is to allow respondents to "express *their own* understandings in their own terms" (Patton, 2002, p. 348). An approach that collects qualitative data is appropriate

for cluster research as it facilitates deeper explanations about the how and why of the cluster process:

> "the growth and innovation dynamics of clusters can only be properly captured by using qualitative research techniques, especially in-depth interviews with a broad cross-section of cluster participants or ethnographic accounts of the cluster's evolution from leading members." Wolfe and Gertler (2004, p. 1081).

The data required for this study is summarised in Table 3.

Table 3. Data requirements for the study

| **Research Question** | **Research Aim** | **Research Objectives** | **Data Requirement** |
|---|---|---|---|
| RQ1: How does a cluster originate and develop? | To understand how the video games cluster in Scotland emerged and manifested itself. | To identify the trigger events that started the cluster.<br><br>To identify the stages of the cluster's development. | Historical data about the period prior to the cluster's inception<br><br>Primary and secondary data about its inception, e.g. who, what, why, where, when?<br><br>Company start-up data from inception to 2010 |
| RQ2: What are the barriers to cluster development? | To understand the factors that negatively influence cluster evolution. | To identify the barriers to cluster development.<br><br>To identify how barriers hinder the cluster's development. | Historical secondary and primary data about events, people and organisations involved in different stages of the cluster, and their influence on |

| | | | |
|---|---|---|---|
| | | | the cluster's development. |
| RQ3: How does the evolution of a new economy cluster compare to that of a high technology cluster? | To identify and understand the differences between high technology and new economy clusters. | To identify the differences between the video games cluster and the model of high technology clustering.<br><br>To identify the factors contributing to such differences. | Secondary and primary data about the key components in the cluster evolution. |

The credibility of qualitative methods "hinges to a great extent on the skill, competence, and rigor of the person doing fieldwork – as well as things going on in a person's life that might prove a distraction" (Patton, 2002, p. 14). Recognising this, and wishing to ensure accuracy in the case study, data were triangulated, rich descriptions provided, negative data and outliers acknowledged, time spent in the field and all data were accurately recorded and stored (Collis and Hussey, 2003).

## 3.5 Data Collection

The two methods used to collect the data were semi-structured interviews and documentary analysis, both of which have been used to collect qualitative data sets in the cluster literature (Nachum and Keeble, 2003; Henry and Pinch, 2001; Braunerhjelm, 2005). This combination of methods allowed the collection of independent data sets that complemented each other and facilitated triangulation.

### 3.5.1 Documentary analysis

Documentary analysis involves the examination and interrogation of documentary data (written and non-written material) from a secondary data source. It is an unobtrusive research method and the emphasis is decided after data collection (Saunders, Lewis and Thornhill, 2009). In this study, documentary analysis was selected as it contributed in three key areas namely background information and preparation, the creation of the cluster genealogy map, and triangulation.

First, historical analysis was used to provide contextual details about the cluster. This included the structure of the cluster and the organisations therein. It also provided data about respondents prior to the primary research (Marshall and Rossman, 1999). This reduced the data collection time at the interview and recognised the potential for respondents' inaccuracy of recall given the historical time period. Additionally, this background knowledge was important for enhancing credibility when connecting with respondents and gaining access (Marshall and Rossman, 1999).

Second, documentary analysis was used to create the cluster genealogy map illustrating entrepreneurial activity over the cluster's lifespan. This included details relating to the respondents' employment history and education plus the business' establishment date, founder details, merger/takeover details, and closure dates. Third, documentary data was referred to on completion of the interviews and cluster map to triangulate the data and identify similarities and discrepancies. Where discrepancies existed, respondents were contacted for clarification and/or further secondary research was undertaken.

A range of online and offline sources of data were accessed. This included written and audio material regarding the cluster such as company information, publicity material, interviews, newspapers and media, reports and policy documentation. Some of this was 'grey' literature, produced by organisations whose main business is not publishing therefore it is not usually widely disseminated. A range of online blogs and videos were also accessed, some of which provided data from participants in the cluster's early stages. Table 4 contains an overview of the sources used, examples and the rationale.

Table 4. Documentation sources and rationale

| **Source** | **Who** | **What** | **Examples** | **Rationale** |
|---|---|---|---|---|
| Industry | Company founders, employees, analysts, investors, professional advisors, trade associations, event organisers | Media, interviews (radio, video and print), blogs, magazines, websites, | Bert Wednesday, http://www.stevehammond.org/), http://www.dmadesign.org, ScottishGames.net, MCV, Develop, Gamesutra, GamesIndustry.biz, Edge, gamesBrief, Creative Dundee, TIGA, UKIE (previously ELSPA), radio/TV, Twitter, LinkedIn, Dare to be Digital, Game in Scotland | Company information, Industry elite profiles and interviews, industry trends and issues, notice of events and publications, triangulation |
| Public sector | European, UK, Scotland, sector specific support organisations, geographic specific organisations | Directories, databases, policy documents, consultancy reports, Government enquiry, research, statistical data, conference material | NESTA, Scottish Enterprise, Scottish Government, European Commission, UK Government, Skillset, Interactive Tayside, Cultural Enterprise Office | Policy documents, strategy, statistical data, triangulation |
| Private sector | Consultancies, | Research reports, | Ekos, New Media Partners, Games Consulting, Young | Access to non-video |

| | | | | |
|---|---|---|---|---|
| (non games specific) | professional services, investors, analysts, media | publications, media articles and broadcast, websites, blogs, conference material | Company Finance | games focused sources |
| Education | Universities, Colleges, Educational focused organisations | Websites, publications, projects, prospectuses | Abertay University, Glasgow Caledonian University, Edinburgh University, Dundee University, University of the West of Scotland, Education Scotland. | Identification of FE/HE courses, insight into spin-off activity, profiles of alumni |

In addition, sector data were collected by attending four industry related seminars (see Table 5). This provided contextual data, highlighted current issues, and presented networking opportunities. The seminars were attended over the period March to August 2010, addressed different aspects of the computer games industry and were hosted by universities, economic development agencies and industry bodies. The topics included innovation, self-publishing, market applications and business start-ups.

Table 5. Events attended during fieldwork

| **Event** | **Date** | **Location** | **Organiser** | **Rationale** |
|---|---|---|---|---|
| Inspiring Innovation | 24th March 2010 | Bonar Hall, Dundee University, Dundee | University of Dundee | Insight into the start-up and development experience of video games companies |
| "Guide to Self-PublishingEvent" | 15th April 2010 | Enterprise House, 3 Greenmarket, Dundee, DD1 4QB | TIGA (The Independent Games developer association), | Understanding one of the key trends taking place within the industry |

| | | | | |
|---|---|---|---|---|
| | | | Trade organisation | |
| "Play for your Life: How Gaming can transform Health | 24th June 2010 | Centre for Excellence in Computer Games Education, University of Abertay, Dundee, DD1 1HG | Wellness Health Innovation | Understanding new application areas for games. |
| "Independent Games Workshop" | 31st August 2010 | Enterprise House, 3 Greenmarket, Dundee, DD1 4QB | Revolver PR & Scottish Enterprise | Insight into post-closure activities (for ex-staff and Dundee) regarding Real Time World |

Secondary data were interrogated on an on-going basis to provide contextual information to support and/or question the data collected from the interviews. Care was taken when inferring meaning from the data and "a modest scepticism" was retained (Marshall and Rossman, 1999, p. 124). This recognised issues with data sources, definitional problems (including the absence of SIC codes), and measurement tools.

### 3.5.2 Interviews

#### *(i) Rationale*

Semi-structured interviews were chosen for this study. The interview allows the respondent's perspective to be expressed, based on the assumption that "the perspective of others is meaningful, knowable, and able to be made explicit" (Patton,

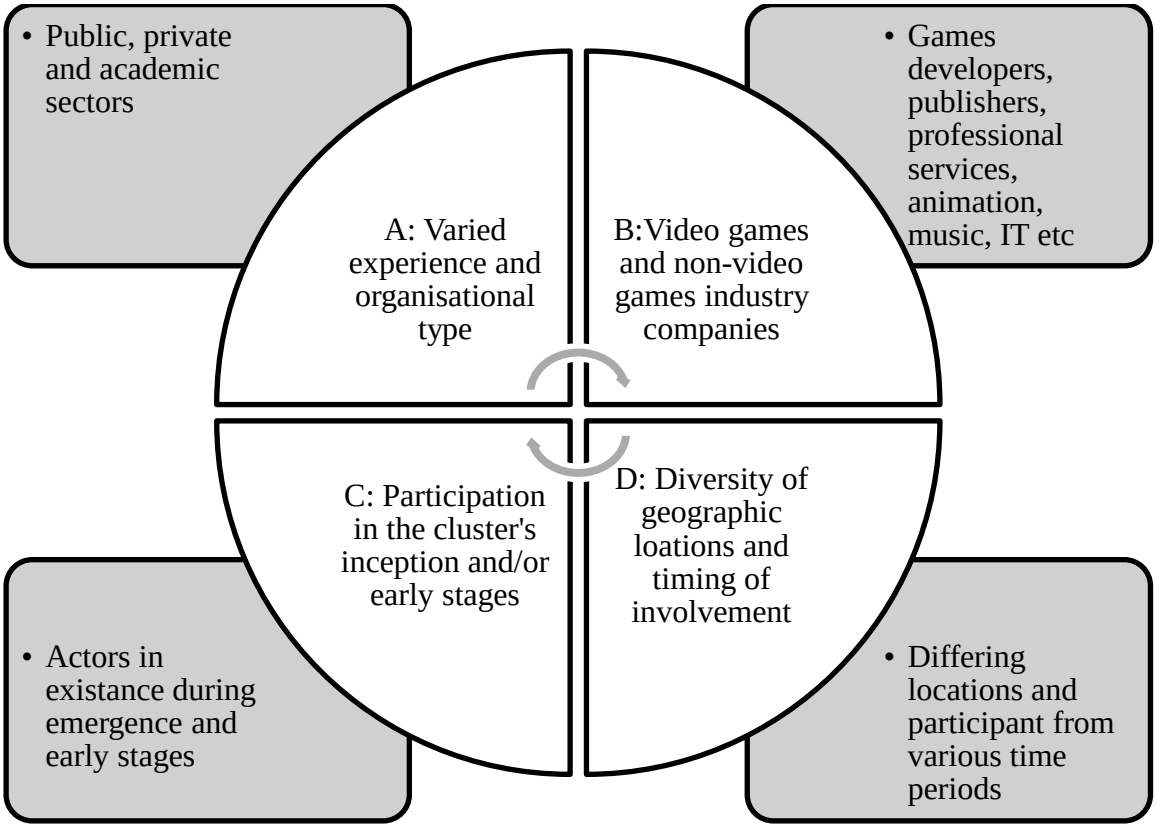
2002, p. 340). They can be qualitative or quantitative in nature. The former tends to be more open than the latter which requires "respondents to fit their knowledge, experiences, and feelings into the researcher's categories" (Patton, 2002, p. 348). In this study, qualitative interviews were employed to "capture the richness of detail and nuances of the phenomena being studied" (Collis and Hussey, 2003 p.57). This acknowledged the need to uncover things that could not be directly observed. The semi-structured nature was appropriate as there was a need to understand the respondent's view of the world (Easterby-Smith, Thorpe and Lowe, 1991). This format allowed the issues discussed at the interviews to change as new data were revealed. Collis and Hussy (2003, p. 168) consider this "process of open discovery" to be the "strength of such interviews". The interviews provided the opportunity to "observe, talk to and interact with real-life entrepreneurs" (Neergaard and Ulhoi, 2007, p. 478) and to "capture the richness of detail and nuances of the phenomena being studied" (Collis and Hussey, 2003, p. 57). The interview respondents were the 'elites' of the cluster (key informants who had specific expertise and were viewed as informed and influential). They provided an actor perspective about the cluster recognizing that heterogeneous nature of firms in the cluster. Interview respondents were identified using secondary research, exploratory discussions with industry observers and interviews.

### *(ii) Respondent Selection*

A non-random sampling technique with a sequential sampling approach (Saunders, Lewis and Thornhill, 2009) was employed in this study. This recognised the time constraints and ensured that the respondents could be selected to ensure that four key

elements were addressed namely. These are indicated in Figure 5 and explained in more detail subsequently.

Figure 5. Criteria for respondent selection




(i) varied experience and organisational type – to recognise the diversity of actors in the cluster (quadrant A);

(ii) video games and non video games industry companies – to represent the diversity of activities in the cluster (quadrant B);

(iii) participation in the clusters inception and or early stages – to ensure a wide ranging historical coverage that covers the timespan of the study (quadrant C);

(iv) diversity of geographic location and timing of involvement – to represent the various geographic bases of actors in the cluster over the timeframe (quadrant D).

The respondents were selected from the cluster database compiled during the study (see section 3.4.2). As the fieldwork progressed, this database was augmented via snowballing.

### *(iii) Data collection tools*

Interviews were conducted using two interview guides. The first (Appendix 2) was used with non founders/senior management of firms while the other (Appendix 3) was employed with founders/senior management of firms from the cluster. Both interview guides followed a similar thematic structure consisting of five parts to facilitate comparisons between the data. However, the content of section three "Entrepreneurial activity" varied depending on whether or not the respondent had been a company founder/ senior manager in a firm. This acknowledged the different perspectives that each respondent could provide in relation to understanding ther cluster and the role of entrepreneurial activity therein.. Each of the five thematic areas were discussed with the respondent using a combination of questions and prompts which acknowledged that questions should stimulate and encourage use of the respondent's own creativity and knowledge (Marshall and Rossman, 1999). Table 6 provides an overview of the areas covered by the guides.

Table 6. Interview guides - thematic areas and rationale

| **Thematic areas – Founders/senior management team** | **Thematic areas – non-founders** | **Rationale** |
|---|---|---|
| 1.Introduction | Introduction | Provide an overview of the study aims, confidentiality and the rights of the respondent. |
| 2.Personal background | Personal background | Obtain an overview of the respondents and their role in the cluster (verified against secondary data). |
| 3.The Entrepreneurs | Entrepreneurial activity<br>-Company start-up<br>-Company development | To understand the perception of entrepreneurial activity in the cluster particularly to what extent it existed, the drivers and the key activities.<br><br>To identify the experiences of company founders in establishing and growing a company in the cluster including an insight into the ecosystem in which they operated. |
| 4.The Cluster | The Cluster | Gain an insight into how it emerged, how it developed, and the factors that influenced this. |
| 5.Other | Other | Ensure study has credibility, identify other respondents and triangulate data to ensure that the majority of key players are identified. |

### *(iv) Ethical considerations*

In recognition of the importance of commercial and personal confidentiality issues in this study, data were collected and held in lines with the requirements for data protection, confidentiality and ethical behaviour as guided by the University of Strathclyde and the ESRC's 'Framework for Research Ethics' (ESRC, n.d.). All respondents were supplied with an Information Sheet that (i) stated the project title; (ii) provided an overview of the project including course and supervisor details; (iii) detailed data collection and usage details including confidentiality issues; (iv)

emphasised that the respondent's participation was voluntary and they could withdraw at any time, and (v) provided contact details for the researcher and supervisors. A copy of this is provided in Appendix 4. Data were stored securely and in confidence and backed up on a separate hard drive. Respondents were not identifiable from the text and were anonomysed throughout the research. This was particularly important as the cluster is relatively small and therefore the risk of identification of people and companies was high. The coding system used in presenting the findings, remained separate from the respondent details, avoiding identification of them by name.

### *(v) Access to Respondents*

Prior to recruiting the sample, it was recognised that access to the cluster elites may be difficult due to their availability (time constraints and other priorities) and their interest (relevance and credibility). To address the issue of availability, a planned and timely approach was taken that involved consistent, but sensitive, follow-up with potential respondents. To encourage their interest in participating, credibility was important (Marshall and Rossman, 1999). The knowledge gained during the literature review and documentation analysis satisfied this requirement. Finally, to address both the availability and the interest issues, unstructured discussions were undertaken with four representatives from the public, private and academic sectors. These elites had extensive involvement in the cluster and were able to provide data, help identify other elites, and facilitate access for the future interviews.

The initial approach to potential respondents was made by email to ascertain their interest in participating in the study. The rationale for contacting them was given,

together with a summary of the study. The request to interview them was made with an explanation of what would be involved in terms of interview duration, format and confidentiality. Recipients were also offered the opportunity to receive further information and/or references, prior to agreeing to participate. Follow-up contact was initiated with non-respondents. Interviews were arranged with those respondents that agreed to participate and, on completion, an email was issued to them to thank them for their participation. This reiterated how the data would be used, confidentiality issues and the participants' right to withdraw at any time. All access activity was recorded in a spreadsheet which contained data about the potential respondent, their organisation, data source and the level/type of contact made with the person.

### *(vi) Fieldwork*

Forty semi-structured interviews with respondents from the public, private and academic sectors were undertaken from January to September 2010. The preference was to undertake the interview face-to-face as well as observing the workplace. However due to respondent time constraints, non UK geographical locations, and/or the preferences of the respondent, alternative formats such as email and telephone were also used. In summary, twenty five face-to-face interviews took place along with fourteen telephone interviews and one interview via email. Face-to-face and telephone interviews lasted an average of sixty minutes although some exceeded this. Written notes were taken and the dialogue was recorded where the respondent's permission had been obtained beforehand. Two respondents (one company founder and one expert) requested not to be recorded. After each interview, the recording was reviewed together with notes taken during the interview. Of the thirty eight recorded

interviews, thirty seven were then transcribed verbatim (one was unusable due to the quality of the recording, therefore the interview notes were used instead). The profile of all respondents is provided in Table 7 and the breakdown of respondents, relative to the sampling plan requirements, is provided in Figure 6.

Table 7. Profile of respondents

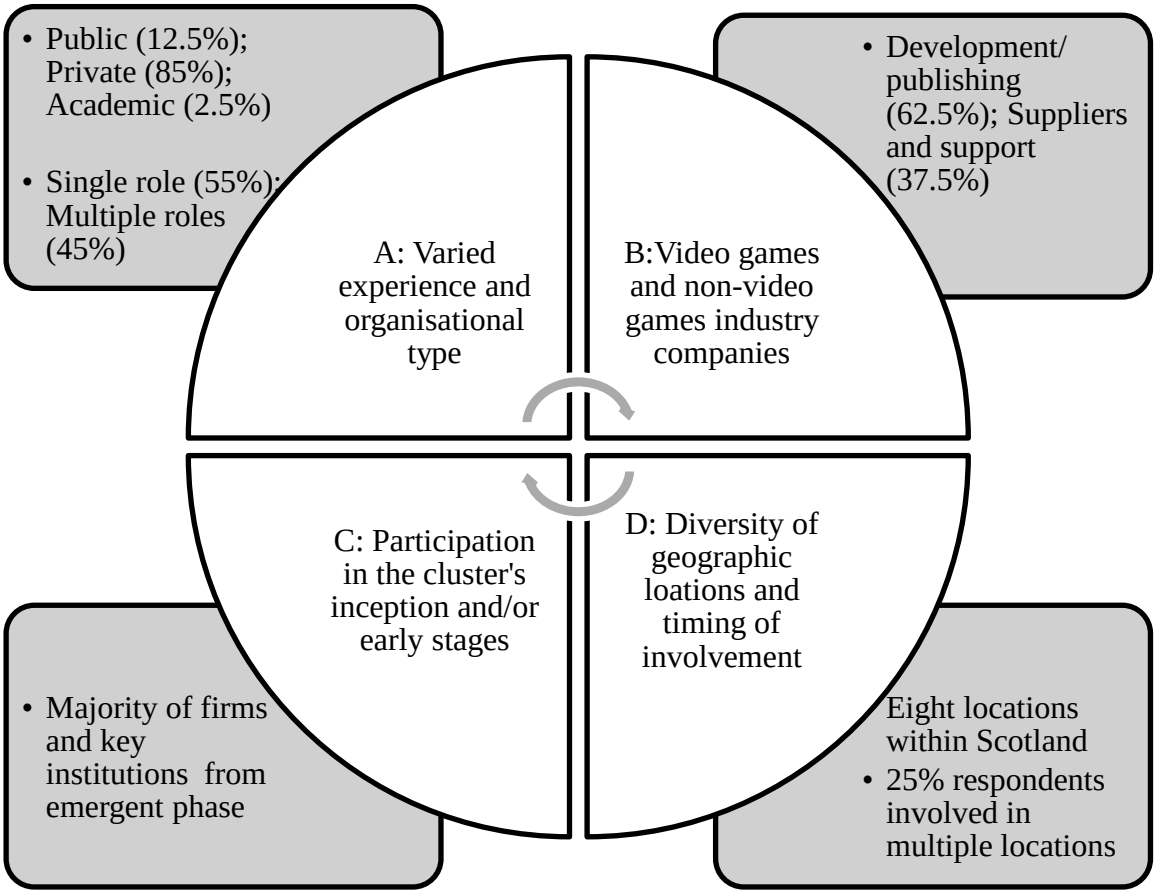
| **Roles in the cluster*** | **Organisation type** | **Organisation's activities** | **Geographic locations** |
|---|---|---|---|
| Founder/ Employee | Private | Developer Publisher | Dundee |
| Founder/ Employee | Private | Developer, Publisher | Dundee, Dunfermline, Glasgow |
| Founder/ Employee | Private | Developer | Dundee |
| Founder/ Employee | Private | Developer Publisher | Dundee Dunfermline |
| Founder/ Employee | Private | Developer | Dundee |
| Founder/ Employee | Private | Developer | Dundee Livingston Glasgow |
| Founder/ Employee | Private | Developer Publisher | Dunfermline Edinburgh |
| Founder/ Employee | Private | Developer Publisher | Dundee |
| Founder/ Employee | Private | Developer | Glasgow Dundee |
| Founder/ Employee | Private | Developer | Glasgow Dundee |
| Founder/ Employee | Private | Developer | Glasgow |
| Founder/ Employee | Private | Developer | Dundee |
| Founder/ Employee | Private | Developer | Dundee |
| Founder/ Employee | Private | Developer Publisher | Glasgow |
| Founder/ Employee | Private | Developer Support | Stirling Dundee |
| Advisor | Private | Finance | Edinburgh |
| Advisor | Public | Support | Dundee |
| Advisor | Public | Support | Scotland |
| Advisor | Private | Developer | Dundee |
| Advisor | Public | Support | Scotland |
| Advisor | Public | Support | Glasgow |
| Advisor | Public | Support | Scotland |
| Investor | Private | Support | Edinburgh |
| Investor/ Director | Private | Developer Support | Edinburgh Dundee |
| Director | Education | Support | Dundee |
| Director | Private | Developer | Dundee |
| Director | Private | Games related | Glasgow |
| Director/Employee | Private | Games related | Edinburgh |
| Employee | Private | Related | Scotland |
| Director/Employee | Private | Games related | Edinburgh |
| Founder | Private | Developer, Publisher | Dunfermline |

| | | | |
|---|---|---|---|
| Founder | Private | Developer, Publisher | Dunfermline, Dundee, Glasgow, Edinburgh |
| Founder | Private | Developer | Dundee |
| Founder | Private | Games related | Glasgow |
| Founder | Private | Developer | Dundee |
| Founder | Private | Developer | Dundee |
| Founder | Private | Games related- | Edinburgh |
| Founder | Private | Games related | Dundee |
| Founder | Private | Developer | Edinburgh |
| Founder | Private | Developer | Edinburgh |

*Key:

- Founder – respondent has been involved in starting up a firm in the cluster.
- Employee – respondent has been employed by an firm or organisation in the cluster.
- Advisor – respondent has been involved in providing private or public sector support to firms in the cluster.
- Investor – respondent has been involved in a firm that has invested in firms in the cluster.
- Director – respondent has held the post of Director in the organisation but was not the firm founder.

Figure 6. Profile of respondents compared to sample requirement



First, in quadrant A, thirty four (85%) respondents were based in private sector organisations, five (12.5%) in public sector and one (2.5%) in an academic organisation. Of these, 22 (55%) had experience of one role within the cluster namely advisor, investor, director, employee or founder. The remaining 18 (45%) had undertaken multiple roles namely founder/employee, investor/director, and director/employee. Second, to address the requirement for quadrant B, respondents were sourced from games development/publishing, games related firms, business support firms, public institutions, and academic institutions. Third, to satisfy quadrant C requirements, the sample included respondents that had been involved during the mid-1980s to mid-1990s. This included those people and organisations referred to by study participants as 'critical' to the cluster's formative years and the 'must talk to' people referred to in the interviews. Finally, the quadrant D specification was addressed by securing respondents who had been involved in eight different geographic locations and in different points of the cluster's timeline.

## 3.6. Data Analysis

The main data analysis activities were undertaken after data collection had been completed. Data analysis in a case study should involve "examining, categorising, tabulating, testing, or otherwise recombining evidence" (Yin, 2009, p. 126) and diverse ways exist of analysing qualitative data (Miles and Huberman, 2002). The study adopted a predominantly inductive approach to allow the identification of themes and issues after data collection without prescribing the key elements beforehand (Patton, 2002). Rich descriptions were provided, negative data and outliers acknowledged, time spent in the field and all data were accurately recorded and

stored. The stages undertaken during the data analysis process are summarised in Table 8 .

Table 8. Data analysis process

| **Stage** | **Activity** | **Rationale** |
|---|---|---|
| 1.Data Preparation | 1.Review and collation of documentary data<br>2.Interviews are taped and transcribed | Accurate and transparent record of data content and sources. |
| 2.Familiarisation | Multiple reviews of each transcript and review of documentary data | Gain a holistic view of each participant and familiarity with the contextual cluster data. |
| 3.Classification | 1.Review of all transcripts to cross reference subject areas and identify key thematic areas<br>2. Creation of a master transcript combining participant responses under interview subject areas. The original content and reference was preserved.<br>3. Coding of documentary and transcript data using research questions and objectives as a framework. | Identify key themes across participants plus commonalities and outliers therein<br><br>Facilitate the review of (i) individual participant feedback in context and (ii) combined participant responses regarding each subject area.<br><br>Identify data associated with questions and other emerging themes. |
| 4.Identification of connections across thematic areas | 1. Review of the thematic data relating to cluster origin and development, and influences on its evolution.<br>2. Creation of a timeline of the cluster's development<br>3. Creation of a draft cluster genealogy map of firm activity and circulation to respondents. | Identify linkages, patterns, similarities and differences.<br><br>Triangulate data and identification of key issues. |
| 5.Analysis and interpretation | 1. Analysis of data relating to research questions and connections therein.<br>2. Identify influences on the cluster's evolution particularly barriers hindering its growth.<br>3. Identify differences between the empirical data and Mason's (2008) model. | Address the study's objectives and outputs.<br><br>Identify areas for further exploration. |
| 6.Explanation | 1. Revisit literature and write up findings. | Provide context for the findings and identify areas of |

| | | |
|---|---|---|
| | | contribution. |

Stages one and two of the data analysis process focused on the preparation of, and familiarisation with, the data. The primary and secondary data were collected, recorded and stored in preparation for analysis. Familiarity with the data had been maintained throughout the study through regular immersion. However on completion of the data collection, all of the data was reviewed multiple times to gain deeper insight into the cluster and the dynamics therein.

The third phase involved classification of the data where key thematic areas were identified together with any similarities and anomalies. The research questions were used to guide this classification although emerging issues outside of the questions were not omitted. Connections were subsequently identified in stage four, when patterns, similarities and differences across the thematic areas emerged. During this phase, triangulation of data facilitated the development of a timeline representing the cluster's evolution.

A draft cluster genealogy tree was developed for the cluster. This was based on the database created in the study from a variety of sources[8]. Genealogy trees provide a method of visually illustrating the origination and development paths of various phenomena over a time period, such as cluster evolution. They have been used in the

[8] Compiled from Companies House (http://www.companieshouse.gov.uk), LinkedIn (http://www.linkedin.com), TalentScotland (http://www.talentscotland.com/), Scottish Development International (http://www.sdi.co.uk), Scottish Games (http://www.scottishgames.net), Scottish Games Alliance (http://web.archive.org/web/19981206200701/www.scottigames.org/s02p01.html), company websites, study respondents, newspapers and publications.

literature to track individuals' career histories and/or their tacit knowledge (Henry and Pinch, 2000; Smith, 2002), examine spin-out activities from single organisations (Segal Quince & Partners, 1985; Myint, Vyakarnam and New, 2005) and explore firm genealogy within clusters and regions (Xu and McNaugton, 2006; Neck *et al.*, 2004). In this study, this framework was used to illustrate firm emergence in the video games industry in Scotland.

MindMeister software was employed to create this genealogy tree. This detailed the company's year of establishment, location and known founders. A master copy was generated plus four geographic specific versions representing Glasgow, Dundee, Edinburgh and 'other' locations in Scotland. All maps were circulated to the forty respondents in September 2010 for review to (i) confirm the accuracy of their own information and (ii) verify other details on the map. This resulted in twenty eight responses from the forty respondents and was positive with minimal modifications. A number of supportive comments were received about the cluster map from fifteen of the respondents and are provided in Appendix 5. The remaining thirteen did not include any commentary, but suggested modifications and additional information, all of which were checked for accuracy using sources such as Companies House, LinkedIn, NexIs, Google, Archive.org, among others.

Finally, further analysis and interpretation of the data was undertaken focusing on the emergence and evolution of the cluster, and the influences thereon. The evolution and dynamics were analysed in comparison to Mason's (2008) model and the genealogy tree was finalized. The findings were evaluated against the literature to understand the study's contribution.

## 3.7 Limitations of the study

The first potential limitation of the study is bias. There were a number of instances where bias could have occurred during the study and affected the reliabiltiy and validity of the outcomes. Bias can be generated by both the respondent and the researcher therefore it was important to be aware of it from the outset and try to limit it (Cresswell, 2003). Reflection throughout the study, considering beliefs and assumptions, was critical. This included awareness that the respondent's perception of the interviewer, or the interviewer's perceived bias, may affect how they respond in the interview. Additionally, it was important to consider factors such as gender or positionality (balance of power) that can affect the research process (Schoenburger, 1991; McDowell, 1992). Finally, the views of the respondents may not have been be representative of the cluster and may themselves be inaccurate due to the nature of self-report and recall bias resulting from the time lag between their involvement in the cluster and the interview (Podsakoff and Organ, 1986). Mindful of all of these issues, multiple sources were accessed to inform the study and research questions, including observation, documentation, preliminary discussions with elites and attendance at sector events and ongoing reflection.

The second issue is that of accuracy. Data have to be accurately collected, recorded analysed in a confidential and systematic way. This can cause issues if not undertaken property as the credibility of qualitative methods "hinges to a great extent on the skill, competence, and rigor of the person doing fieldwork – as well as things going on in a person's life that might prove a distraction" (Patton, 2002, p. 14). This study involved a retrospective analysis of a cluster therefore historical data was reviewed and

analysed. Although this was substantial and undertaken thoroughly, there may have been documentary data that were inaccurate, incomplete and/or unavailable. Data triangulation was undertaken using multiple sources as detailed in section 3.7.2.2. to reduce accuracy issues to a minimum. Accuracy may also have been an issue in the interviews given the reliance on self reporting and the substantial time period involved.

The cluster genealogy tree also has limitations in terms of accuracy. First, it is based on data collected but is not exhaustive and is likely to be an underestimate as some firms will have been overlooked in the study due to their size, profile, and activities. For example, freelancers, small companies not registered at Companies House, companies that existed for a short time, etc. However data was drawn from multiple sources and reviewed by the respondents to support the analysis process, therefore it is likely that such companies represent a substantial part of the cluster's population. Second, recognising time and data constraints, the origins of the companies are based on the incubating organisation of one founder, namely the person most closely identified with the company by the documentary and interview sources. This is also a limitation as (i) companies were often founded by teams; (ii) founders had often worked at several companies (games and non-games) beforehand; and (iii) some founders had moved between roles as business owners and employee on several occasions. Third, were some discrepancies in data sources about start up dates and company activities. In these instances, decisions were taken based on the level of authenticity of the data. However this is still subjective.

The third issue related to data analysis. The interview data were qualitative in nature and substantial. Qualitative data can be diverse and are not always known in advance (Miles and Huberman, 2002). There is also a need to provide context plus analysis of the data for themes and issues (Cresswell, 2003). Triangulation of the data from different sources was therefore employed and total familiarity of, and immersion in, the data was ensured.

## 3.8 Conclusion

This chapter has detailed the methodological aspects of the study. It addressed the rationale behind the study's methodology including philosophical assumptions. Initially, the research questions and research objectives were detailed. The research framework that guided the study was then presented. A case study approach was selected to obtain rich, qualitative data and facilitate a deeper level of understanding about the cluster origination and development process. The rationale for adopting this approach was discussed. The two research methods selected to achieve this aim were semi structured interviews with industry elites plus documentary analysis using secondary data sources. The combination of both was crucial to ensure rich, contextual, triangulated data. The rationale and activities associated with these methods was explored as was data analysis, recognising the challenges of working with qualitative data. Finally, the limitations encountered were addressed. The data and findings will now be presented in Chapters 4-7.

# Chapter 4 – Findings : the origins and development of the cluster

*"There is nothing like looking, if you want to find something.*
*You certainly usually find something if you look,*
*But it is not always quite the something you were after"*

J. R. R. Tolkein (1892-1973)

## 4.1 Introduction

This chapter focuses on the origination and development of the cluster from the 1980s to the end of 2010. First, it commences by providing an overview of the scale of the cluster since its inception. This focuses on firm activity is illustrated in the cluster genealogy tree created during this study (Appendix 8). The volume, activities and geography of firms are examined together with the changing characteristics of the cluster in relation to its profile, networks and geography. Second, the chapter presents the four phases of the cluster's evolution that are identified in the study. The characteristics of each phase and determined together with the key events and enablers.

## 4.2 The scale of the cluster

### 4.2.1 The cluster's profile

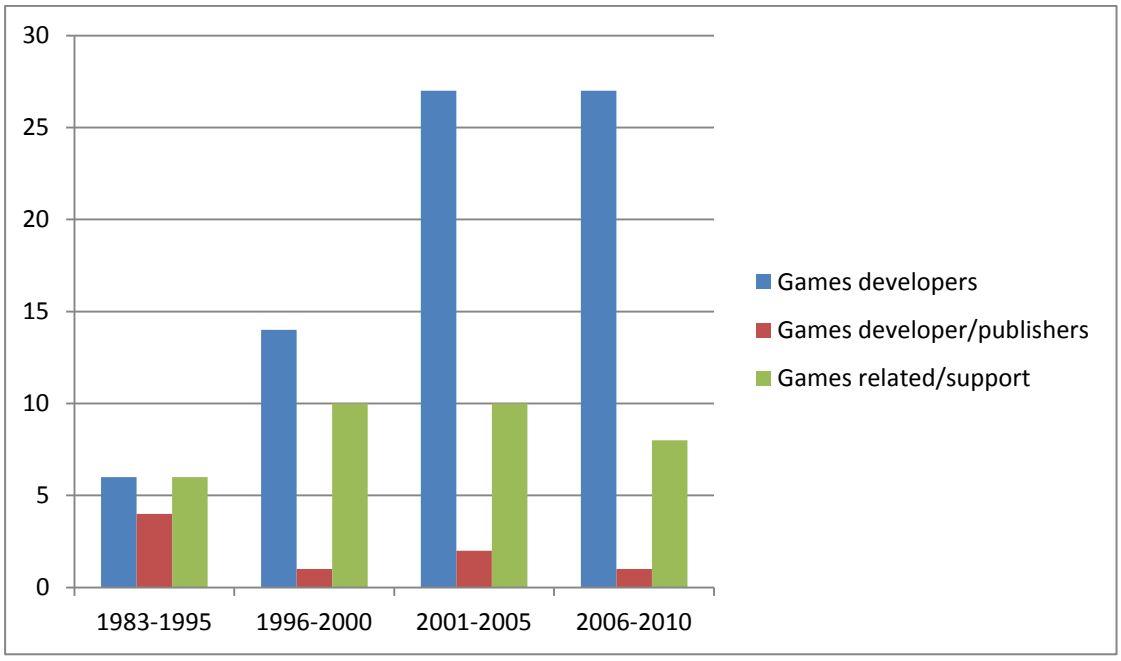
The cluster operated relatively invisibly until the late 1990s, after which time, success stories, cluster champions, market development activities all positively influenced the profile. By 1999, Scotland had a reputation as a video games hub. "*you could say things started to change around 99 in terms of more of an awareness" [17];* However during the early 2000s, it was Dundee that became recognised for games and the cluster tag was assigned to the city due to firm concentration and institutional engagement. A period of closures and redundancies from 2003-2006 attracted negative comments about the sustainability of the cluster. However by 2010, the

cluster had continued to evolve and there was evidence of some growth despite several closures of large companies and an inconsistent policy environment.

### 4.2.2 Firm activity

The cluster genealogy tree in Appendix 8 depicts the activity of 116 companies identified in the cluster during the study. The majority operated in the early stages of the value chain and were mostly small and medium sized enterprises with the majority having fewer than 50 employees. Figure 7 illustrates the key activities with 64% involved in games development, 7% in games development/publishing or publishing only, and 29% involved in games related/support. The latter included providers of games related technologies such as middleware, 3D technology etc.; providers of games components such as music, animation, etc.; and business services such as marketing, recruitment, finance, localisation and testing.

Figure 7. Business activities of firms in the cluster



The scale of company activity over time in terms of volume, employees and turnover is difficult to determine as the definitional boundaries of the sector for data collection have not been consistent. The most recent figures indicate that there are over 50 companies in the cluster with approximately 1,080[9] employees (Scottish Enterprise, 2010). However Table 9 gives an indication of the activity in terms of firms, employees and turnover.

Table 9. Cluster firms – volume, employees and turnover

| | **1985** | **1990** | **1996** | **1999** | **2000** | **2007** | **2009** | **2010** |
|---|---|---|---|---|---|---|---|---|
| **Firms** | 3[10] | 7[11] | 8[12] | 15[13] | 18 [14] | 25[15] | n/a | 51[16] -60[17] |
| **Emp'ees** | n/a | n/a | n/a | 300[18] | 500 [19] | 600[20]- 1075[21] | 700[22] | 1080[23] |
| **Turnover** | n/a | n/a | n/a | £50m[24] | n/a | £90m[25] | £20m[26] | £50m[27] |

Key: n/a = not available

[9]Calculated before the closure of Real Time Worlds in August 2010 which had over 250 staff
[10] Estimates derived from data collected during the study.
[11] Estimates derived from data collected during the study
[12]Scottish Games Alliance (n.d.) – SGA full time members excluding affiliates.
[13] Daily Record (1999).
[14]SGA full time members excluding affiliates (Kennedy, 2000)
[15]NMP (2008) - this uses a wider definition.
[16] Scottish Enterprise (2010b). This does not include approximately 70 companies involved in Mobile Gaming, Creative Media, and Mobile Applications and Content.
[17] ScottishGames.com, http://scottishgames.net/whos-who/
[18] Daily Record (1999).
[19] Kennedy (2000) - based on SGA members excluding affiliates.
[20] Skillset (2009b).
[21]NMP, 2008. This uses a wider definition plus 250 freelancers.
[22] Scotland on Sunday, 2009.
[23] Calculated prior to closure of Real Time Worlds in August 2010 with over 250 staff.
[24] Based on SGA members, Daily Record, 1999.
[25]nmp, 2008. This uses a wider definition.
[26] Scotland on Sunday (2009).
[27] Scottish Development International, 2010.

Some of the leading companies in the cluster by the end of 1999 can be seen in Table 10 which lists members of the industry body, the SGA[28]

Table 10. Scottish Games Alliance members 1998/99

| Ranking (previous year in brackets) | Company | Turnover £m (previous year in brackets | No. of employees (previous year in brackets) | Start-up date^ | Status in 2010^ |
|---|---|---|---|---|---|
| 1(7) | Red Lemon Studios | 1.12 (0.53) | 40 (20) | 1996 | Closed in 2002 |
| 2 (3) | Visual Sciences | 1.0 (1.2) | 49 (33) | 1993 | Closed in 2006 |
| 3 (2) | VIS Interactive | 0.72 (1.24) | 65 | 1994 | Closed in 2004 |
| 4 (8) | Absolute Studios | 0.41(-) | 14 (7) | 1998 | Unknown |
| 5 (5) | I-Design | 0.35 (0.34) | 11 (9) | 1991 | Operational but not games related |
| 6 (6) | Steel Monkeys | - | 18 | 1998 | Closed in 2003 |

Source: Scottish Games Alliance cited in Leadbetter and Oakley, 2001; ^ Data collected in this study

Companies in the cluster in 2010 can be classified as Small and Medium sized Enterprises (SMEs) although most are small businesses with fewer than 50 employees. Larger companies do exist although they are not Scottish owned. These include Rockstar North, a games development studio owned by publisher/developer Take2Interactive (US company), iPlay (previously Digital Bridges), a games development and publishing company owned by Oberon Media (and E4E, a games localisation and support company owned by E4E (Scottish division of US company).

[28] However this excludes (i) DMA Design, as the SGA no longer classified it as a Scottish company due to its US ownership, and (ii) Inner Workings which went into liquidation in 1999.

### 4.2.3 The geography of the cluster

The geographic location of firms in the cluster has changed over time. This is illustrated in Figure 8. The cluster was essentially dispersed until around 2000. At this point, Dundee began to evidence a higher concentration of firms with 10% of computer games producers based there in 2001 (ELSPA and ChartTrack, 2001). However from 2005/06 other geographic hubs started to emerge and by the end of 2010 there were notable firm concentrations in Glasgow (games development activities), and in Edinburgh (games related activity, particularly technology):

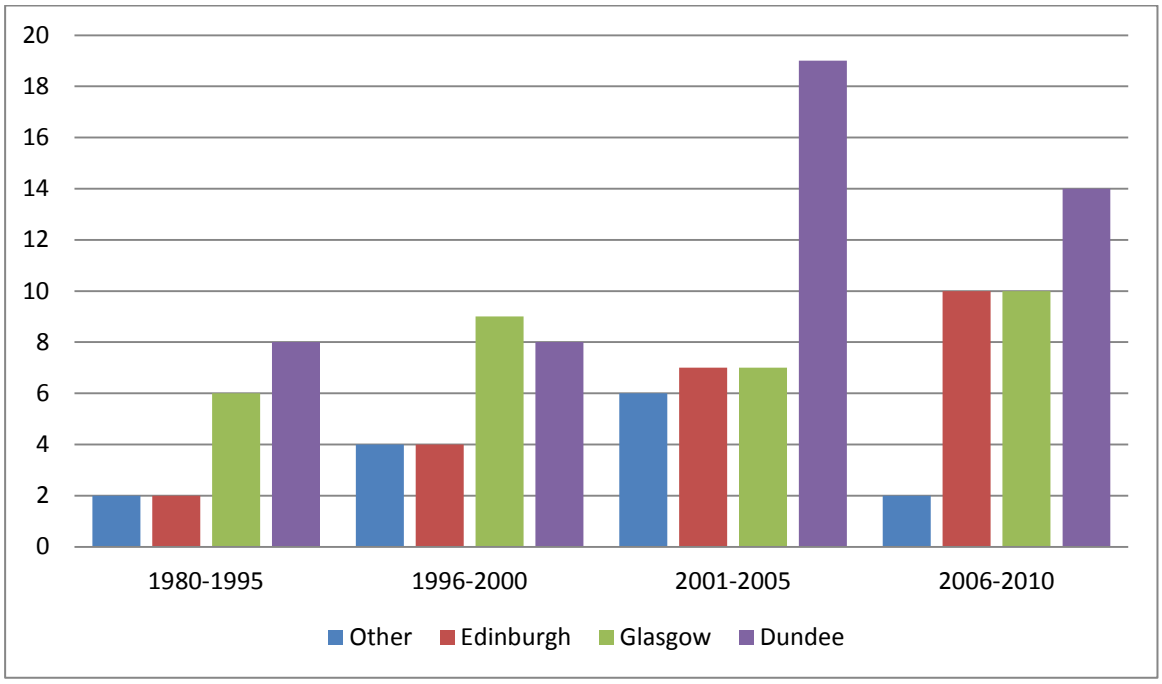
> *"Publicly I don't think it's [Dundee] quite as identifiable as it used to be. It used to be you could say you worked in games, run a games company in Dundee most people would have heard that but now it's much more of a global industry […] the industry is more spread across the world so Dundee doesn't have as much focus possibly as it used to" [14].*

Although institutional involvement has been important in anchoring some of the geographic concentrations, particularly in Dundee, the role of entrepreneurs has evidenced more importance. Study respondents who were founders emerging from Scottish-based organisations faced a 'remain or move' decision and often chose to locate where they had previously lived, studied or worked for the following reasons:

- Personal values and reasons relating to their preference for a particular place: "*it's a great place […] Dundonians really do celebrate success" [31].*

- Family commitments: "*lived there, family there, fellow owners there" [13]; "to be entirely honest, kids get into school you're not just going to move for the hell of it" [39]*.
- Financial savings or risk reduction: "*we'd just left university, still quite young, none of us had mortgages or responsibilities*[…] *it was quite easy, a low risk step to take" [14]*;
- Maintenance of networks within private, public and academic sectors *" we know a lot of people there[…] went to university at Abertay so I think that was one of the big things because obviously they were exposed to a lot of links within the industry"[33]*.

Figure 8. Geographic location of firms in the cluster




## 4.3 Phases in the cluster's evolution

The study identified four stages in the cluster's development. This was based on an analysis of (i) the public, academic and private sector activities relative to the cluster, (ii) the timing of critical events in the cluster, and (iii) the perception of respondents about the characteristics of the cluster over the time period. These four phases will now be discussed.

### 4.3.1 Stage 1: Pioneering, 1980s – 1995

> *"These people were mostly self-taught and had a real entrepreneurial flair that got the industry moving and made Britain a leader in games software design"* (Oakley, 2001).

The UK video-game industry originated in 1975 but lacked any major international firms until the 1990s (Izushi and Aoyama, 2006, p. 1853). This study found evidence of its emergence in Scotland in the 1980s. The cluster's emergence was driven by pioneering entrepreneurs servicing a global industry with relatively low barriers to entry. Participants consisted of 'bedroom coders' (Izushi and Aoyama, 2006) and small, early stage companies servicing a non-Scottish marketplace. There was a predominance of individuals and micro firms focusing on games development and/or games related activities, similar to other video games clusters in the UK (Leadbetter and Oakley, 2001; Izushi and Aoyama, 2006). They were predominantly involved in games development and sought to take advantage of the emerging global opportunity to provide games content.

Pioneers had little visibility or engagement with the public and academic infrastructure and were perceived as "*really small and really hobbyist"* [24]. The founders were often IT/computer literate, opportunistic and proactive: they sought out resources and used their connections to secure clients and take advantage of the opportunity. Leadbetter and Oakley (2001) in their study of creative entrepreneurs identified that business founders in the early stages of the UK games industry were often motivated by their interest in computing ("doing something creative with computers") and a lack of interest in being employed by a large company.

There were no research intensive institutions focusing on video games, although there were various institutions involved in computer science and IT which incubated a few of the early entrepreneurs. Such entrepreneurs and their firms survived by drawing on their resources, networks and the success of their (or other entrepreneurs) firms and products.

### 4.3.2 Phase 2: Engagement, 1996-2000

> *"If you asked people this would be the golden age. This is when they would say "yes, it's when it all started happening" [3].*

This stage represented a period of visibility, growth in the company base and engagement by a few public and academic institutions. The cluster's skills base expanded, company support was evident and Scotland gained a reputation as a games hub. Games development required increased investment and a diversity of skills, driven by the changes in games platform technology and the complexity of games.

Company founders approached the public and academic sectors to encourage their support in helping to address these issues. This triggered a number of policy initiatives and support during the late 90s/early 2000s including the inclusion of video games in policy making, the establishment of the first trade body and the world's first named computer games university degree at the University of Abertay in Dundee. Firm successes attracted investment and closer linkages between companies, academia and the public sector meant that by the end of this stage, the cluster's visibility had increased.

### 4.3.3 Phase 3: Consolidation, 2001-2005

> *"the market took this blip in 2001/2002 and everyone got kind of nervous […] Subsequently it came back really strongly around 2004 but I think a little bit of the momentum might have been lost" [10].*

During this phase the cluster became more integrated into the economic infrastructure. It had visibility and scale. By 2002, five of the world's top selling games were being developed in Scotland (specifically Tayside) namely Lemmings, GTA, Stage of Emergency 1, F1 98 and F2 2000 (Murray-Watson, 2002). The expanded company base evidenced several companies with over 100 employees, accommodating the larger teams required to service the more complex games that were required in the industry. Additionally, there was an increase in graduate start-ups. However there were also various high profile closures, including early pioneers, resulting from unsuccessful business models, failed client relationships and lack of funding.

The key enablers during this time were public sector policy initiatives which focused on the creative industries (including video games) plus the increasing involvement of academic institutions which fuelled the labour market and provided support to start up and existing firms. Additionally, 'cluster champions' from within the business, public and academic sectors were noted as having helped raise the profile of the cluster and provide support to firms. Finally, at the entrepreneur level, networks were developed facilitated by the locational inertial of founders and the fact that many of the entrepreneurs had worked together in prior roles.

### 4.3.4 Phase 4: New directions, 2006-2010

> *"certainly 3 – 5 years ago there was a big phase of a lot of games companies going under […]Now, thankfully, the companies that have largely been left are the ones that do have that sort of business background" [1].*

This stage of the cluster's lifecycle was characterised by change. New generations of companies, new technologies, and new business models emerged as a result of changes in digital technology, gamer demographics, and technology platforms such as smartphones (e.g. iPhone), tablets (e.g. iPad) and social networking sites such as FaceBook. This led to an increasing interest by the games development companies in self-publishing and a move away from the traditional publisher/developer model. Firms were diverse, although games development was still dominant, as were geographic locations. Several geographic hubs were evident in Dundee, Glasgow and Edinburgh with the remaining companies widely dispersed out with these hubs. There were additional high profile closures that involved long-standing companies such as

Visual Science[29]in 2006 and Real Time Worlds[30] in 2010. However the company base continued to expand and by the end of 2010, more games had been released in the last 5 months of 2010 than in the whole of 2009 (Baglow, 2010).

## 4.4 Conclusion

This chapter presented the findings relating to the cluster's scale and evolution phases. Its profile, density and geography varied indicated a pattern of escalation of scale, but stunted and slow growth. Firm activity since the cluster's inception was identified in the study and illustrated using a cluster genealogy tree. The cluster in Scotland was widely dispersed, and had little profile, until the late 1990s when it attracted a 'video games hub' label. This changed in the early 2000s when the city of Dundee became synonymous with the 'video games cluster'. However by 2010, there was further development as geographic hubs emerged in three cities.

Four phases were identified relative to the cluster's existence. The first was 'Pioneering' (1980s-1995), which was characterised by the pioneering activities of the early entrepreneurs who functioned relatively unnoticed until the mid-90s. The second stage was 'Engagement' (1996-1999), demonstrated a period of growth for the company base and more active involvement by the public and academic institutions. The cluster's skills base expanded, company support was evident and Scotland gained a reputation as a games hub. The third phase, 'Consolidation' (2000-2005),

[29]Visual Sciences closed with over 100 staff. It was originally a spin-out from DMA Design in 1993, led by Russell Kay, co-creator of Lemmings.

[30] Scotland's largest independent games developer with over 250 employees

represented a phase where some of the larger, early pioneering companies, closed and a new crop of companies emerged from more diverse origins. A city-related geographic cluster became apparent around Dundee, where certain public and academic institutions were actively engaged. Finally the fourth stage, 'New Directions' reflected the changes in the global games industry where changes in digital technology, gamer demographic, and platforms changed business and industry operating models. Geographic hubs were evident in Dundee, Glasgow and Edinburgh and a nascent ecosystem was apparent in some parts of the cluster. This was facilitated by a thick labour market, locational inertia of entrepreneurs, the depth of historical knowledge and skills, support from institutions, and active personal networks.

# Chapter 5.0 – Findings: Drivers in the cluster's evolution

*"Everyone who has ever taken a shower has had an idea. It's the person who gets out of the shower, dries off, and does something about it that makes a difference."*

Nolan Bushnell, (n.d.)

## 5.1 Introduction

The evolution of the cluster through the four phases detailed in Chapter 4 can be better understood by examining the key events within and out with the cluster that supported its development. Five key components were identified in the study as contributing to this namely the global video games industry, the public sector, academic institutions, entrepreneurs and their firms, and the city of Dundee. Each of these is discussed in this chapter. The chapter begins by providing an overview of the relevant occurrences within the wider global video games industry. This provides contextual information about how the industry developed and how such developments influenced the cluster in Scotland. The activities of the key public sector institutions in Scotland are then examined highlighting the policy related, support initiatives and personnel that were identified in the study as being important factors. The chapter then proceeds to analyse the contribution of academic institutions and those which had a specific influence on the cluster's evolution. Activities at the level of the entrepreneur and the firm are then highlighted to illustrate the notable influence that they have had on how the cluster have evolved. Finally, the role of the city of Dundee has had on the cluster's development is discussed.

## 5.2 Factors influencing the cluster's emergence

### 5.2.1 The origins of the cluster

The video games industry originated in Scotland in the 1980s, driven by a group of pioneering entrepreneurs, predominantly involved in games development, and

attracted by the opportunity provided by a growing global games market: *"They [early entrepreneurs] were dependent on another world* […] *that world was not local or national, it was global" [7].* Key factors within the UK and Scotland facilitated this.

### (i) UK related factors

The key influencers at a UK level were government education policy and the availability of home computers. First, the UK Government introduced computer studies to some schools in the 1970s. This encouraged young people to engage with computing and develop related skills. Some study respondents cited it as a reason for their interest in, and knowledge about, computer programming: "*for the first time ever a generation of kids were studying computers in the classroom [R7].* Supporting this was the substantial interest about computers within the UK population in the late 1970s/early 1980s (Radcliff, 2008) [31]: "*It was this generation that grew up programming BBC Basic that is partially responsible for the tremendous position we have in gaming"* (Hauser, 2008)

Second, the availability of relatively cheap programmable home computers in the 1980s made them more accessible: *"until the Sinclair computer came along there really wasn't any affordable way of making any software" [2].* This facilitated usage and the creation of content. Study respondents mentioned having access to products such as Sinclair's ZX range, the Commodore C64, and the BBC Micro: *"outside school it was the ZX Spectrum. […] everybody could afford them. […] I just kind of*

[31] The BBC's programme series, 'The Computer Literacy Project', was launched in 1980 and achieved an average viewing audience of 500,000-1.2million on late night BBC1– a reach of 16% of the adult population.

*started from there, you know, picked up the manual, kind of started programming it" [1]*. This helped to develop programming skills. Additionally, the limited games content stimulated users to teach themselves games development skills, share ideas, and develop their own products. *"As soon as people, by and large guys, got hold of one of these, they wanted to* […] *make it do something. They might as well make it play games" [3]*. This was evident in Scotland and other parts of the UK were "games developed a do-it-yourself culture which provided the seed bed for full-blown entrepreneurship" (Leadbetter and Oakley, 2001).

**(ii) Scotland related factors**

At a Scottish level, the main influencers were: historical industrial activity, the production of home computers in Dundee, and the networking opportunities provided by computer clubs. First, Scotland's historical involvement in electronics in the 1970s/1980s, and software/IT in the 1980s/1990s was beneficial. *"Scotland had great strengths, actually, a very sort of technologically based sector, Silicon Glen, that kind of stuff coming out of the 70s" [7]*. Some of the early games entrepreneurs emerged from these industries to create their firms. Government support initiatives devised for the software sectors were accessed by some study respondents as no specific games related support existed at that time.

Second, the production of one of the most popular home computers, Sinclair Research's ZX81 was undertaken by US company Timex[32] in Dundee (Inside Sinclair,

[32] The watch manufacturer Timex sought to diversify in response to advent of digital technology. They sought to produce Sinclair's flat-screen tube and Microvision pocket TV. However Sinclair Research

1983). This provided relatively cheap and easy access to home computers and replacement parts. *"We all got them out the back door of the factory for not a lot of money" [11].* This was particularly evident in the responses from the early cluster participants based in and around Dundee: *"if a kid in Dundee wanted a Spectrum they could get one for a packet of 20[cigarettes] […] all the kids in Dundee had half a dozen" [25]*.

Third, at a local level, the existence of computer clubs at schools and colleges facilitated knowledge sharing, product development and learning. Study respondents mentioned 'The Kingsway Computer Club' at Kingsway Technical College (later renamed Dundee College) as an important factor in games development and networking in Dundee. Early cluster entrants had attended such clubs and used networks developed there to support games development in their new ventures: *"kids would go along and that's where a lot of guys like Dave Jones and people like that started out." [11]*

## 5.3 Factors influencing the cluster's evolution

### 5.3.1 The global video games industry

Globally, large hardware firms competed during the late 1970s and early 1980s to dominate the market (Johns 2006). However, the UK industry did not emerge until the mid-1970s and lacked any major international firms until the 1990s (Izushi and

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viewed them as inexperienced and instead subcontracted production of the ZX-81 and the Sinclair printer.

Aoyama, 2006). During the early 1980s, barriers to entry were relatively low for developers. This was due to the uncomplicated nature of games and technology platforms which allowed individuals and small teams to create games: *"When I started, one person could write a game. If you had the idea and the enthusiasm […] then you could do it by yourself"* (Jones, 2001). It was at this time that the 'bedroom coder' generation emerged in the UK: "a whole generation of self-trained programmes, mostly teenagers still at school, who programmed and ran businesses out of their bedrooms." (Izushi and Aoyama, 2006, p. 1853).

After the US market crashed in the mid-1980s, more restrictive technology and commercial conditions emerged for UK developers and publishers (Readman and Granthan, 2006). The dominance of Japanese companies Sega and Nintendo dominated, increased competition and more sophisticated technology impacted on early entrepreneurs throughout the UK as the role of the bedroom coders, and their ability to survive as sole traders in the industry, diminished (Izushi and Aoyama 2006).

By the early 1990s, the US market had consolidated and their need for development skills increased. Demand for UK based developers increased as US firms sought out talented programmers: "drawn by the programming skills of the UK firms supported by a pool of thousands of bedroom coders and crackers" (Izushi and Aoyama, 2006, p. 1853). Additionally, more open commercial and development conditions existed after the entrance of Sony and the PlayStation console to the market in 1995 (Readman and Granthan, 2006). These opportunities were recognised by firms in the Scottish cluster. However the advances in technology, and the need for expensive development

tools, meant that games developers in particularly required substantial finance and a more diverse team of skills (Izushi and Aoyama, 2006). The opportunity and the new challenges led to entrepreneurs in Scotland engaging with the public and academic institutions to facilitate their access to skills and company development support.

During the early 2000s, home entertainment consoles emerged in the video games industry. New consoles such as the Xbox provided a different platform on which to play more complex and internet-enabled games. The requirement for larger, more diverse teams remained. However, although large platform (usually console) developers such as Nintendo, SEGA, Sony and Microsoft dominated during this time, technology advances resulted in an increasing focus on portable/internet connected platforms. This provided games developers with opportunities to produce different types of games for mobile and social platforms such as smartphones (e.g. iPhone), tablets (e.g. iPad), and social networking sites such as Facebook,

> *"the platform ownership of Sony and Microsoft in terms of console ownership are still quite high entry barriers […] The only thing that has begun to subvert that just recently are the games in social networks" [4].*

Allied to this was the changing profile of games consumers particularly in terms of game time (increased), age range (older) and gender (increasing number of woman). Appendix 6 and 7 contains a summary of gamer profiles and games types respectively. This combination of technology and market factors meant that study respondents perceived new opportunities in games that were less labour intensive, quicker to turnaround and that allowed direct sales to consumers:

"*The big games are getting bigger and there are a lot of opportunities at the lower end, your iPhone, iPad etc. […] I think the games industry is going through a huge change. Next five years will basically recreate the games industry" [22]*.

### 5.3.2 Public sector institutions

Public institutions enabled the cluster's evolution by supporting company development, raising the cluster's profile, and facilitating market access. However they were also the source of some of the barriers to the cluster. During the 1980s to mid-1990s, the publicly funded economic development institutions in Scotland were not specifically involved in games: "*There was no differentiation then. Games were software as such." [16]*. *Early* companies accessed policy initiatives created for the software/IT sectors (for example Services to Software[33] in Glasgow), and/or general start-up/company development support. However during the mid-1990s, policymakers' interest in the software sector (Johnston, 1998), and the formation of the software team at Scottish Enterprise, led to the mapping of the software sector and the identification of a group of games companies in Scotland.

This recognition, and approaches from entrepreneurs seeking support, provided the trigger for the establishment of the Scottish Games Alliance (SGA) in 1996. *"When the alliance was set up it used to be a bit like a group of friends who just met" (Ettle, 2000).* The SGA was cited in the study as having positively impacted the sector in a

[33]Services to Software was initiated in Glasgow in 1993, funded by the Glasgow Development Agency and European Commission to provide a range of company development support to small companies in the software sector in Glasgow.

number of ways and generating "*immense benefits" [27]*. The aim was to raise the profile of the industry under a "Developed in Scotland" banner (Scottish Games Alliance, n.d.) and address the issues that the companies were facing. It was the first trade body for the industry: "*There wasn't even a British equivalent of the Games Alliance" [21]*. Respondents emphasised the informal nature of this:

> *"really just a little trade body but not particularly strongly formulated, it was just really getting together for dinner every month or two and then the E3 thing and then it started to grow from there" [11].*

The SGA, with SE support, facilitated attendance for companies at the US trade show, E3 (Electronic Entertainment Exposition). This increased networking opportunities and raised the profile of Scotland's game industry. The initial delegation from Scotland in 1997 consisted of six companies employing 250 people and with a turnover of £10m. Scottish Enterprise provided financial support of £100,000. (Daily Record, 1997). By 1998, 15 companies attended the event and achieved over £10m sales. *"The reputation of the Scottish games industry is already high, but these latest contracts won in the fiercely-competitive international stage have raised the profile even further"* (Downes, 1998). Attendance at this event provided the industry with credibility and raised the profile of the industry in Scotland both nationally and internationally.

> *"Really early on we were the only country that was represented out there… it was incredibly successful and Scotland as a brand and the games industry really started to establish itself fantastically" [11].*

*"very early on, from about 97, 98, we started going out to the big E3 show in the US as part of the Scottish Games alliance […]and because we had government money it meant we had a decent stand in a decent position" [3].*

*"It gathered quite a lot of interest in terms of people coming to see us, and also the fact that […] there were credible companies doing games" [17].*

Some of the study respondents posited that the UK Government's involvement at E3 in 2003 and the creation of Independent Games developers Association (TIGA), the UK trade body, resulted from seeing the impact of SGA : *"E3 was the biggest thing they (SE] did. That was really impressive. The English were desperately envious of that and eventually UKTI decided to put a stand together" [2].*

*"But that then what's quite interesting is the influence of the SGA. They [non Scottish companies] used to make kind of quite amusing comments about "you boys in Scotland get all this free money" and we kind of said "well, look, we've not got any more resource than you've got, we just have talked to our agency and done it. That resulted in TIGA [The Independent Games developers Association" [11].*

During late 1990s, and through the early/mid 2000s onwards, public sector continued their involvement in the cluster and a number of initiatives were supported. For example, the Games Developer UK '98 competition awards dinner (Scottish Games Alliance, n.d); the first International Games Festival in Edinburgh in 2003 (Torney,

2003), and Britain's first dedicated international centre for the virtual environment and computer games industry was established at the University of Abertay (Whittet, 2000a).

The video games industry was formally incorporated within SE economic policy with the launch of a Creative Industries cluster strategy early in 2000s (Solvell, 2003) : *"Eventually the games stuff was taken over by the creative industries as opposed to software" [21].* SE's local economic division for Tayside (SE Tayside) began to focus on digital media and assumed the management of the SGA[34] in 2000: "*clearly they had an interest in digital media in Tayside and that was a big difference from any other region in Scotland at that point" [24].* SE Tayside also collaborated with other institutions to create Interactive Tayside, a public/academic partnership between SE Tayside, Dundee City, Perth and Kinross and Angus councils, university of Abertay, University of Dundee, Dundee College, Perth College and Angus College. The aim was to support the digital media sector in Dundee and Tayside by facilitating networking and providing a link to support services and advice.

Towards the end of the study timeframe, a number of public organisations had evidenced interest in the cluster in Scotland including the UK and Scottish Governments. The increased public sector intervention was, on the whole, supported in the study. However there was also scepticism from some respondents given the relative lack of interest in the cluster previously: *"suddenly games becomes on the radar for Scottish politics […] starting to take that on board in terms of 'oh, actually there is a games industry" [17].* Additionally, respondents questioned the

[34] SGA Membership had risen from 8 full time members plus affiliates and associates in 1999 to 18 companies employing 500 people in 2000 (MacDonald, 2000).

effectiveness of some public sector activities, perceiving them as a barrier rather than an enabler to the cluster (this is addressed in Chapter 5).

### 5.3.3 Academic institutions

Academic institutions were perceived in the study as important contributors to the cluster's evolution in terms of skills provision and development, raising the cluster's profile, and providing support to the firms therein. However, at the outset of the cluster, the study respondents reported a lack of interest from the HE/FE sector in the video games industry.

In the 1980/90s, there were no research intensive institutions focusing on video games, although some were involved in computer science: *"back in 1995,'96, nobody was looking at computer games as far as the skills perspective goes" [16].* Rather a range of respondents referred to how their decision to get involved in games was not taken seriously. Indeed when Dave Jones decided to leave Bell College of Technology after his second year to concentrate on his business, it was not understood: *"Lecturers never understood his decision. Writing games' was a phrase said with scorn […] Games hadn't yet come out of the cottage industry stage and the education system didn't get it"* (Dailly, nod.). Other respondents also mentioned this attitude: *"[university] were pretty clear I was making a mistake, as was my family, as were all my friends. Well, who makes a living making computer games?" [24].*

Despite this, and driven by the need for diverse, high quality skills, various entrepreneurs from Dundee based companies approached local universities to

persuade them to offer courses. Abertay University was interested and collaborated with industry practitioners to create the world's first named computer games degree:

> *"We started talking to Abertay […] with the point of view of introducing it into the curriculum as a part of it but they went in with both feet and said "no it's a course let's do that, let's not shoot low, let's go for the win" and so we started working with them" [17].*

The 'MSc in Software Engineering (Games and Virtual Environments)' was launched in 1997 (The Glasgow Herald, 1997) to sustain the local industry after "pressure from local companies DMA and VIS" (Leadbetter and Oakley, 2001, p. 61). This was viewed as a critical step in sustaining the cluster in terms of skills: *"courses such as the one at Abertay are vital for bringing in new blood"* (McCallum, 1998) and of raising the cluster's profile: "*we started to get this name for Dundee being games, because Abertay were talking about it* [degree course] *a lot. This was their new thing so it started to be in national newspapers as well as on radio and things like that" [17].*

Abertay University also collaborated with public organisation, Scottish Enterprise Tayside (SET), to initiate 'Dare to be Digital' (piloted as the 'Computer Games Challenge') in 1999 specifically to stimulate new ventures and develop the cluster (Dorsey, 2000). The pilot involved two teams from Abertay University and subsequently expanded to include international students in 2002 and a UK-wide launch in 2005 (Aberdeen Press and Journal, 2005).

*"It's essentially about economic development, but it's also about developing a cluster of games developers and other creative industries around Dundee*." (Durrant, 2000)

*"What we are trying to do is give (students) an overview of what it would be like to run their own company, and then give them an opportunity to do that if they want to."* Joyce Matthew, SE Tayside. (Matthew, 2000)

Abertay University was the most frequently referred to academic institution in this study and launched various initiatives to support the cluster and firms therein. [35] However, from the early 2000s through to 2010, academic institutions increased their involvement in the cluster and contributed to its evolution in terms of (i) the provision and development of skills, (ii) promotion of the industry, and (iii) support to companies. This included:

- various games related degrees created by Motherwell College, the University of the West of Scotland (formerly the University of Paisley) and Glasgow Caledonian University, in collaboration with industry partners (Calder, 2001; Miller, 2000)

- support to firms with skills development, consultancy, product development, and spinouts, etc. This included the Digital Design Studio (Glasgow School of Art),

[35] Abertay University was awarded funding to create the "UK Centre for Computer Games Excellence" in 2009 which has strong industrial links with national and international companies. Abertay also secured a £10m project in 2009 to support the games cluster with developing and commercialising intellectual property. This is undertaken in collaboration with Media City in Manchester and aims to create 30 new companies and around 400 jobs in Dundee and Manchester.

Duncan of Jordanstone (University of Dundee), Edinburgh Informatics (Edinburgh University), and Napier University;

- Consolarium was launched by Learning and Teaching Scotland (now Education Scotland) to focus on the use of computer games in schools (Education Scotland, 2010) and games design was introduced into the Scottish schools curriculum in 2010;

- Scotland was recognised as *"one of the leaders when it comes to using computer games in education" (The Times Educational Supplement, 2010);*

- Three degree courses at Abertay University and one at the University of the West of Scotland had Skillset Academy status[36] in relation to video games by the end of 2010.

### 5.3.4 Entrepreneurs and firms

In the initial stages of the cluster, firms in Scotland were described as "*really small and really hobbyist" [24]*. They had little engagement out with the industry. Founders emerged from software, IT, animation among others and had been employed, company founders, and/or graduates. They were often computer literate, entrepreneurial and opportunistic. They mobilised resources to exploit the global opportunity including and used the networks that they developed via game magazines,

[36] There were ten Skillset approved courses in the UK in 2010

trade shows, games events and computer clubs. Two notable examples in the 1980s/early 1990s were Dave Jones and Chris van der Kuyl.

- Dave Jones, an electrical engineering apprentice at Timex, Dundee left with £3,000 redundancy and founded Acme (later renamed DMA Design) in 1983 operating from his parents' home (Dailly, n.d.). He simultaneously attended Bell College of Technology (later renamed Abertay University) but left during second year to focus on his business. Jones became a habitual entrepreneur and was responsible for the globally successful games Lemmings (1991) and Grand Theft Auto (1997). He was the Institute of Directors (Scotland) director of the year in 2010 (Telfer, 2010).

- Chris van der Kuyl, was a computer science graduate who founded Van der Kuyl Interactive Systems after university in the early 1990s to focus on IT. The company was acquired by a marketing agency in 1993 seeking access to the multimedia market. Van der Kuyl subsequently led an MBO from the parent company to enter the video game market (Leadbetter and Oakley, 2001), attracting VC investment and renaming it VIS Interactive Plc. The company was one of the largest developers in Europe in 2003 and Van der Kuyl was involved in various acquisitions, industry associations, and entrepreneurship related activities.

During the 1990s, the firm base expanded due to the increasing scale of the pioneering companies, the emergence of new ventures, and the entrance of subsidiaries of non-Scottish companies. The most notable of the latter was US company Absolute Quality which selected Glasgow as its European testing and support operation in 1999. At that

time it was the world's largest computer games testing and support business. (Daily Record, 1999).

The success of companies and of their products, inspired other entrepreneurs, raised the cluster's profile and strengthened the companies. For example:

- *Lemmings* (1991) was produced by DMA Design and published by Psygnosis. It sold over 2 million copies in 20 different formats by 1995. The game raised the profile of the cluster (Dailly, 2010) and was the trigger for DMA Design's commercial relationship with Nintendo (Jones, 2010)
- *Rollercoaster Tycoon*, developed by Chris Sawyer, reached number one PC game in 1999;
- Grand Theft Auto produced by DMA Design (1997) which did *"for Dundee what Beatles did for Liverpool"* (BBC Radio Scotland, 2010).

Respondents mentioned a range of private and public sector funding sources that had been accessed during their firm's development. During the late 90s and early 2000s, the availability of finance was heightened by the interest in technology companies, facilitated the growth of some firms: "it *was a great sexy area with tons of press […] the investors were really falling over themselves to put their money in" [27].* Two firms listed on the Alternative Investment Market (AIM) in 1995/96 namely Inner Workings a multimedia company established in 1992 in Glasgow, and Digital Animations which started up in Glasgow in 1990. Additionally Digital Bridges in Dunfermline raised £25m over the 5 years to 2004 (Friedli, 2004c); Real Time Worlds in Dundee raised £1.05m in venture capital in 2004 (Friedli, 2004a) and VIS

Entertainment raised £3m from private investors in 2004 taking its total to over £10m (Scotland on Sunday, 2004). However, there was no specific games fund prior to the establishment of games specific fund, Fund4Games[37] in 2004 in Edinburgh:

> *"There are no big real investors in the games industry in Scotland, or even in the UK for that matter. It comes mainly from the US, simply because the big names in publishing are based there. The sector just isn't big enough in Scotland yet. Looked at from a Scottish investor's point of view, the risks are probably still too high. But it's not a peculiarly Scottish problem"* (Van der Kuyl, 2004)

New venture activity was evident throughout the cluster with more diverse incubators as the cluster evolved. In the early 2000s, there was a notable increase in new ventures from academia as graduates emerged from computer games related degrees and university start-up initiatives in Dundee. Additionally new ventures continued to emerge from existing companies including those experiencing corporate restructuring such as DMA Design, VIS Entertainment and Visual Sciences:

- DMA Design experienced various ownership changes in the late 1990s/early 2000s[38] and a move to Edinburgh in 1999.[39] This stimulated new venture activity as employees and founders left. Some other employees, who did not relocate

[37] Fund4Games was founded by the ex Chairman of VIS Entertainment. The company had a £25m fund from Noble Group's investment arm, Noble Fund Managers and was intended for games development projects of £250,000 - £1m (Murray-Watson, 2002)

[38] DMA Design was acquired by Sheffield based developer/publisher Gremlin in 1997 for £4.2m. Gremlin then listed on the LSE but, after performing badly, was acquired by French publisher Infogrammes in 1999 for £24m. Infogrames then sold DMA Design to Take2Interactive for £1 and assumption of $12.3 debt . It was then integrated with their in-house studio Rockstar and later renamed Rockstar North.

[39] DMA Design (as part of Gremlin) opened a new office in Edinburgh with the aim of recruiting 40 games designers and coders. The company had 100 staff in Dundee plus staff in Colorado (Hepburn, 1999)

became part of VIS Entertainment's newly formed Dundee office. After leaving DMA Design in 2000, Dave Jones was recruited by Rage Software to form Rage Scotland and create studios in Edinburgh and Dundee with the aim of creating a team of 30 (Scotland on Sunday, 2000). When Rage Software closed in 2002[40], Jones led an MBO and established Real Time Worlds which became the largest independent developer in the cluster. It closed in 2010 with over 250 employees and triggered the creation of new ventures.[41]

- VIS Entertainment (previously VIS Interactive) was valued at £32m in 2000 and employed over 100 people with offices in Dundee, Dunfermline, Glasgow and Isle of Wight (Whittet, 2000b). The company was involved in various alliances and acquisitions including a £4m joint venture with Telewest Communication (The Mirror, 2000) and the establishment of a subsidiary in animation. (The Scotsman, 2000). The company produced *State of Emergency* which sold over 1m copies worldwide and resulted in profitability for the first time in 2002 generating around $8m in royalities in its first year (Devine, 2004). It was one of the largest games developers in Europe in 2003 but due to rapid expansion, acquisitions, and cash shortage, it was acquired by US games publisher BAM in 2004 (Friedli, 2004b). BAM was subsequently delisted and VIS Entertainment closed in 2005 [42] with 54 employees (Bevens, 2005). However, DC Studios, a games company in Glasgow,

[40] Rage Software reported losses after changing their business model from a games developer to a games publisher. It experienced financial problems and issues with its bank. (The Times, 2002).
[41] Intellectual property relating to 'MyWorld' was sold to Kimble Operations for £1.1m and launched as eeGeo in Dundee (Crossley, 2011) and the intellectual property rights in the game *All Points* Bulletin were acquired by Reloaded Productions (BBC News, 2011).
[42] The company had a cash shortage due to rapid expansion and acquisition. Also, it did not have a publisher for 'State of Emergency 2' (Scotland on Sunday, 2003a) VIS was acquired by US publisher BAM in 2004 but BAM was subsequently delisted from Nasdaq for failing to file accounts on time. (Scotland on Sunday, 2004). Shortly afterwards, VIS Entertainment went into administration.

acquired the rights to *State of Emergence 2* and employed 10-40 ex-employees (Murden & Dixon, 2005). Additionally, Van der Kuyl went on to start another venture, 4J Studios in 2005 in Dundee. (Murden and Dixon, 2005)

- Visual Sciences was established in 1993 as a spinout from DMA Design by Russell Kay, the co-creator of Lemmings. The company closed in 2006 with over 100 employees. This triggered the established of two sizeable new ventures namely Proper Games and Cohort Studios which both started up with around 20-30 ex-employees.

> *"We had Real Time World* […] *Visual Sciences looked like they were strong with 100 people, VIS looked like they were strong with 50 people in Dundee and another 100 people in Dunfermline. Then, all of a sudden two of those companies went within the space of six months and that didn't help. The bubble burst. We're trying to blow that bubble back up again" [12]*.

By 2010, the remaining large companies were not Scottish owned. These included Rockstar North (a games development studio owned by US publisher/developer Take2Interactive), iPlay (a games development and publishing company owned by Oberon Media), and E4E (a games localisation and support company division of a US company). However, the cluster evidenced a range of new (and older) companies that were active in new technologies and business models. This was boosted by a number of new entrants from within and outwith Scotland which focused on mobile and social platforms and an interest in self-publishing.

> *"Scottish companies are already active [in all of the new areas] However, since it was outside the accepted parameters or devices which are part of the mainstream games sector, they've not been recognised"* (Baglow, 2010).

More games were released in the last 5 months of 2010 than in the whole of 2009 (Baglow, 2010) and study respondents perceived the companies existing in 2010 as focused and experienced, albeit not high profile:

> *" I think what we've got now is third generation of companies that are delivering day in, day out, that are growing, that are successful, that are profitable, that aren't sharing quite as widely, maybe that's not such a good thing, maybe we need to share a lot more about the successes and the things that are happening here far more. Maybe that's just a reaction against what's happened in the past" [13].*

### 5.3.5 Dundee

Dundee has been a key part of the cluster during its evolution. It was perceived as an enabler in the study as it had a games community, success stories and engagement from academia and the public sector: *"The impression I get is maybe over the last couple of years things have moved on fairly reasonably impressive, purely because of the Dundee factor"[36].* The city became synonymous with games, despite the activity in other parts of Scotland: *"it's stayed as Dundee partly because of the tie-ins with University and the fact that a lot of people have come to Dundee to work in successful companies like Dave's [Jones]" [2].* The factors cited in the study as having influenced this concentration of activity in the city are now discussed.

The first factor was networks which were recognised as a particular strength and an integral part of the industry: *"the industry is very much about who you know" [12].* Respondents had used personal networks to access advice, make connections, recruit staff, secure contracts and access business support. Historical connections, particularly by the pioneering companies, facilitated this: *"Most of the companies in Scotland know each other because we all worked together at some point" [24].* Several respondents acknowledged the benefit of exchanging knowledge through networks: *"just hearing what they're doing wrong and what they're doing well […] saves us having to go through the same pain" [14].* While some evidenced support to other start-ups by providing office space, funding, mentoring and access to contacts: "*We are very supportive of new companies […] and then you see them do well and you learn from them" [13].* The use of games-focused network connections was more evident in the Dundee respondents than elsewhere: *"the people that are running the companies in Dundee all know each other. So, we tend to speak to one another. I don't really know the guys that are working in Edinburgh and Glasgow that much" [24]*. However, there was evidence that not everyone necessarily engaged in the networks and that networking is necessarily done in the locality in which the firm was based.

The second factor cited was the role of Entrepreneurship. Several of the original pioneering entrepreneurs had achieved scale and chosen to remain in Dundee. Various spin-out and spin-off firms emerged from such pioneers and, due to locational inertia factors and a thick labour market, most of them remained in the area: "*it's a great place […] Dundonians really do celebrate success" [31]; "people come up to*

*interview […] they look around and go "well, if it doesn't work out with Real Time Worlds […] there is another 14 companies I can potentially go and work for" [1].*

Third, the role of public institutions in the area particularly Scottish Enterprise Tayside and the Interactive Tayside initiative, a public/academic partnership [43] launched to support the digital media sector in Dundee and Tayside. The aim was to facilitate networking and provide a link to support services and advice: *"they had an interest in digital media in Tayside and that was a big difference from any other region in Scotland at that point" [24].*

The fourth important factor was the University of Abertay, Dundee. The university was perceived as having provided support to new ventures, helped existing firms, raised the profile, and instigated new initiatives: "*Abertay are very involved in games, very supportive of games and also speak for games at a government level and research council level" [1]*

Finally, study respondents regularly cited two 'cluster champions', key individuals who they perceived as having driven and supported the creation of the Dundee cluster. The first was Joyce Matthew from Scottish Enterprise Tayside "*Joyce Matthew at Scottish Enterprise is almost single handed the person on behalf of the whole Scottish Enterprise group that's championed games for a decade now" [1]*. The second was Dave Jones, founder of DMA Design, Rage Scotland, and Real Time Worlds who supported games related activity in Dundee through employment, new venture

[43] This was a public and academic partnership between Scottish Enterprise Tayside, Dundee City, Perth and Kinross and Angus councils, university of Abertay, University of Dundee, Dundee College, Perth College and Angus College.

creation, acquisition activity, and lobbying. He was the person most regularly mentioned in this study as a role model and cluster influencer particularly until the early 2000s: *"I think by having things like Dave Jones around, he has actually educated a lot of people who have then been able to spin out and get something" [2]*.

## 5.4 Conclusion

This chapter examined the findings relating to those factors that enabled the cluster's origin and development. A range of local, national and international factors were identified as facilitating the emergence of the cluster. However the driver was a diverse group of entrepreneurs from a technology background with (or without) an interest in games. As in other parts of the UK, the video games industry developed from the ground up via a self-taught group of programmers (Izushi and Aoyama, 2006).

The cluster's subsequent evolution was influenced by the activities of firms, public bodies and academic institutions, as well as occurrences in the wider video games industry. Such activities, together with critical events in the cluster, impacted on its evolution path. This was evident in the examination of the cluster's changing characteristics over time.

# Chapter 6 - Findings: Barriers to the cluster's evolution

*"Our goal is to see Scotland become a world centre for games software development"*

Macfarlane, (1998)

## 6.1 Introduction

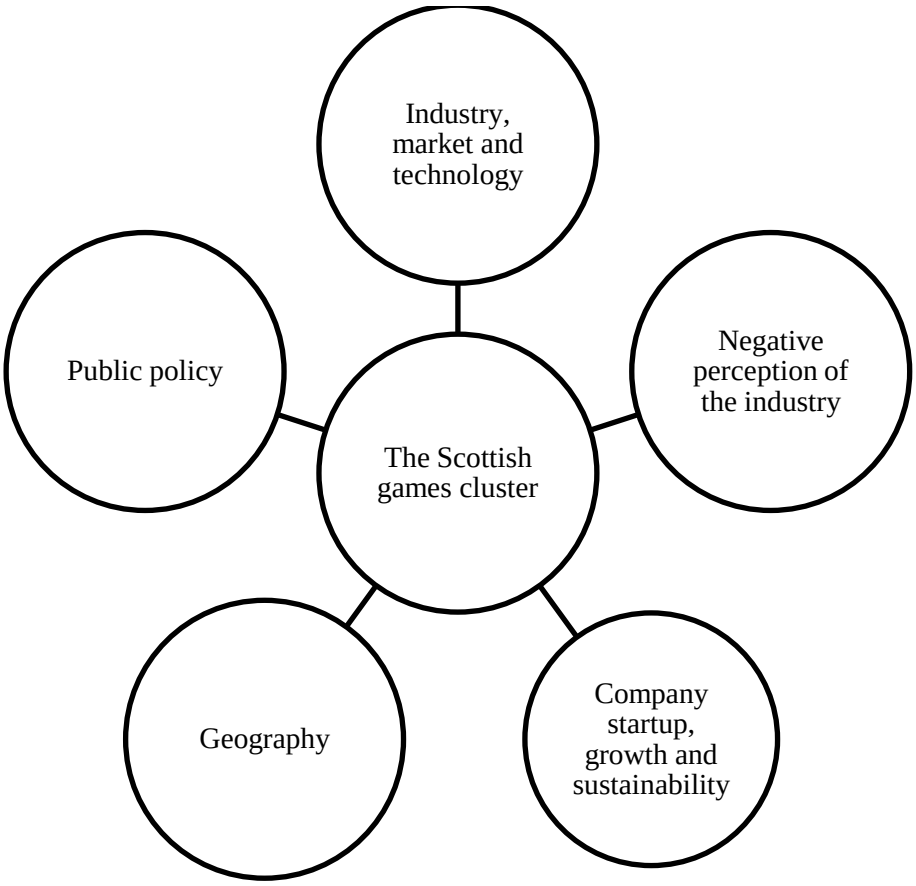
The previous chapter focused on the cluster's origination and development. This chapter examines the difficulties that the cluster has faced in its development. Predictions in the late 1990s envisaged that the games industry would grow fivefold with a workforce of 1,250 by 2002[44] (Daily Record, 1997). However official statistics in 2010 indicated that the cluster had less than this, with around 1,080[45] employees in 50 companies (Scottish Enterprise, 2010). There was also disparity in the perception of the cluster in terms of value and strength. Some study respondents believed it to be strong: *"I think the sector is robust. It's well placed" [13];* while others deemed it to be weak or non-existent: *"To my mind Scotland does not, and never has had, a successful games industry" [18]*. This chapter provides an analysis of why the cluster has developed as it has by focusing on the issues that have negatively impacted on its growth.

## 6.2 Barriers to development

The factors perceived as negatively impacting on the cluster's development are illustrated in Figure 9 and explored in the remainder of this section.

[44]Daily Record, 1997
[45]Calculated before the closure of Real Time Worlds in August 2010 which had over 250 staff

Figure 9. Barriers to the cluster's development




### 6.2.1 Industry, market and technology conditions

> *"there will be more job losses within the sector probably over the short to medium term. But, not because of an inherent weakness in the businesses themselves, but just purely because the market conditions are changing and the way those businesses have been set up is no longer appropriate" [24].*

The games industry environment is one of rapid technological change particularly in terms of technology platforms. Games developers, and those in related activities, have traditionally held less power due to the domination by either the platform owners,

'super developers' or the publishers (Readman and Granthan, 2006). Additionally, a 5-6 year cycle has been evident in terms of console technology developments (Johns, 2006). This has implications for developers who have to respond to such changes and adapt their tools and processes for each generation (Cadin, Guerin and DeFillippi, 2006). Much of this response has been brokered via the publishers. As the publishers have traditionally undertaken the commercialisation activities, it is they who have had the commercial power, skills and networks. This has resulted in companies, whilst innovative in terms of games content, have little opportunity to take ownership of product (whether or not intellectual property is involved) and strategically direct its commercialisation.

The Scottish cluster is dominated by games developers creating content for publishers and games related activities (e.g. technology, components etc.). Both are early stage value chain activities with the power residing elsewhere: *"it's not a good market to be in because, as I say, you are at the bottom of the food chain" [25]*. Opportunities to change this have emerged in recent years in relation to new distribution platforms and many study respondents quoted these as the way forward. However, the current commercial power remains with those involved in platform development and publishing.

### 6.2.3 Company start-up, growth and sustainability

> ***"****There are a whole bunch of start-ups […].The majority of small companies could easily become medium companies. They could easily have a significant workforce and obviously benefit the exchequer but how do you get them to*

*grow just now is part confidence and part support that they do need or could benefit from" [32].*

Company-specific issues were one of the most frequently mentioned issues in the study in terms of barriers to the cluster's developments. There were four recurring themes that were deemed to have affected the start-up activity, growth and sustainability of companies which in turn may have hindered the cluster. These factors were the lack of entrepreneurship, motivational issues, commercial models and skills. They are summarised in Table 11 and discussed in this section.

Table 11. Factors affecting firm start-ups, growth and sustainability

| Factor | Start-up activity | Growth | Sustainability |
|---|---|---|---|
| Lack of entrepreneurship | *"I think the entrepreneurial spirit is pretty lacking generally" [13].* | *"They're happy to be six or seven man, ten man companies [….] I think culturally we are probably lacking a bit of that entrepreneurism" [22].*<br><br>***"****A lot of the new young high growth companies in Scotland should be world beaters […] nobody knows they're there, and nobody is quite sure what the hell they're all about" [3].* | *"We need to weed out the ones that have got the real potential and go and "right, great plans, you're going to make a lot of money, but you're thinking far too small, think big" [1].* |
| Motivation | *" notable difference between Scotland and elsewhere – more reserved, less confidence, less* | *"when they are student businesses they can just about survive[…]the talent around that gets* | *"[reasons for closures] for a number of the companies it probably was a* |

| | | | |
|---|---|---|---|
| | *noticeable knowledge, lack of networking, skills and 'being out there" [34].*<br><br>*"Entrepreneurial events in Scotland are dominated by policy people and the talk is about what help companies can get rather than helping themselves" [2].* | *spotted by some of the larger companies and maybe one or two of the best people would be hired[…] the start-up falters and dies" [14].*<br><br>**"***The games companies […] don't do themselves any favours. It's very, very insular; it's very, very self-contained and incestuous" [3].* | *lack of business acumen and focusing too much on the creative side rather than the business side" [2].*<br><br>*"It was all about the numbers, all about the money, all about making money […] I think that's why it [company] survived [22]***.** |
| Commercial models | **"***There are a whole bunch of start-ups […] They could easily have a significant workforce […] but how you get them to grow just now is part confidence and part support" [32].* | **"** *the historical business model does not work from a developer's point of view. It works for a publisher but does not work for a developer. The key to everything is owning your own IP" [17].* | **"** *the individual businesses are less important[…] the publisher owns so much money to the game developer it's cheaper for them to buy it, or it looks better on the accounts[…]. But then what happens is the staff get fed up of being inside a large publisher […] so they then storm off and form a new company. So, it's unlikely to ever change." [26].* |
| Skills and experience | *"We didn't have a clue. We were games developers! We picked it up as we go along to be honest" [14].*<br><br>*"It was really just a kind of wing it" [12].*<br><br>**"***These companies don't tend to spend* | **"***What we need, particularly in the games, are people that know how to make money" [27].*<br><br>*"I think we do really badly is marketing and sales and exploitation" [13].* | *"A big shortage of people who just understand how the technology industry works." [26].*<br><br>*"I just guess that there aren't that many great global business people in* |

| | | | |
|---|---|---|---|
| | *long enough actually thinking about "where does this fit?"[16].* | "*I think to be honest the managerial experience of these studios [DMA] wasn't in place, even though everything seemed to be going very well" [40].* | *Scotland in this area" [10].*<br><br>***"****It's commercial nous. Scotland's games sector lacks it" [18].* |

First there was a feeling that entrepreneurship was lacking in the cluster. However the use of this terms entrepreneur and entrepreneurship generated a wide variance of responses issues from the respondents and had to be probed further. For some, this was equated positively with commercial sense and business management. Such respondents (including founders) often felt that this is what was lacking in the companies. Other respondents, usually founders, did not like the term. The reasons for this included negative connotations (where they referred to 'dodgy dealing', unscrupulous and unprofessional practices); and/or a perception of being 'not worthy' of the title (using it only to describe successful businessmen/women). Recognising these construct related issues, and having explored this deeper, there remained a perception that one of the issues hindering start up activity was a business/creativity tension combined with a lack of ambition, confidence and willingness to take risk. This was also reflected in comments about the development and sustainability of their businesses.

Second, in terms of start-up and growth, two themes emerged in relation to founder motivation. The first related to the business ownership or employment decision, where the founder's aspirations about their role in the industry as an employee or owner had implications for the company base. The difficulties in sustaining businesses often resulted in owners reverting to employment for financial reasons although still in

games rather than general IT where the salaries were notably higher. Second, there were motivational issues for founders in terms of the 'struggle' between business and creativity, particularly where start up drivers were linked to a love of games or technology rather than business. The negative outcomes of this were reflected in the study in how the companies were perceived, their ability to manage/grow businesses, and their effectiveness in achieving long term sustainability: *" the biggest problem with games companies is that they're run by games enthusiasts[…]games are a labour of love for them but the business is secondary"[1]*. For some founders, there was also a feeling of having sacrificed something: *I had to become far more of a suit. […] and a little bit of you dies" [15]*.

The third issue was that of suitable and sustainable commercial models. This was predominantly mentioned in relation to company growth and sustainability. *"It seems to be the same pattern that quite a few will be there for a couple of years and then pop. And that sort of ecosystem keeps going on" [35].* The dominance of the publisher model has created a reliance on 'work for hire' activities, and a lack of finance, experience and proprietary product that can be commercially exploited. During the cluster's lifetime, there have been examples of indigenous companies that have publicly listed (e.g. Inner Workings and Digital Animations, although both are now closed) and that have evidenced notable growth. For example, during the 1990s to mid-2000s, there were a number of large independent games developers operating in the cluster which were notable even in European terms. However sustainability was an issue and all have now closed. By the end of 2010, after the demise of the largest independent games developer Real Time Worlds in 2010, the largest companies in the cluster are non-Scottish owned. These are Digital Bridges (traded as iPlay) in

Dunfermline[46] a multiplatform publisher, and Rockstar North (formerly DMA Design),[47] a development studio in Edinburgh.

Finally, the issue of skills was evident as a barrier to company growth and sustainability particularly in relation to business management, marketing and commercialisation (creating intellectual property and exploiting it in the market). The two key issues mentioned were the appropriateness of graduate talent[48] and the management skills of founders and senior management.

The availability of graduates was not mentioned as an issue. However graduates were criticised in terms of lack of fit with industry needs, particularly in relation to recent developments such as emerging games and developments. An allied issue was that of matching graduate aspirations to the characteristics of the Scottish games industry. The type of games that were attractive to graduates, and the size of companies they wanted to work for, was not always compatible with the companies and games produced in Scotland. The second theme focused on the lack of appropriate managerial skills within the businesses that would facilitate the operation and growth of a profitable, sustainable business.

### 6.2.4 Negative perception of the industry

[46] Acquired by US based Oberon Media in 2007. The company is a multiplatform publisher and the European HQ for Oberon
[47] Acquired by TakeTwoInteractive in 1999/2000
[48] Skills issues were also highlighted as a key issue for the UK video games sector particularly the lack of fit between industry demand and educational supply (Livingston and Hope, 2011)

*"one of our biggest issues has been the credibility of the industry, the government, media, parents and kids coming through school don't think this is an industry, they don't think jobs in it are a career and hopefully a lot of this awareness is starting to change that" [1].*

The perception of the industry was regularly quoted in the study as having impacted negatively on the cluster's development. It was mentioned by respondents from the public, private and academic sectors who referred to its existence in academia, the investment community, the general public, public sector and the games industry itself. This perception has often affected committed engagement with the sector by the public and academic sectors. Additionally, it has resulted in firms avoiding positioning themselves as 'games' in order to avoid the negative connotations about the industry. The perceptions mentioned, and their impact on the cluster, are summarised in Table 12.

Table 12. Negative perceptions of the cluster and resultant impact

| Source of negative perception | Respondents' comments | Perceived impact on the industry |
|---|---|---|
| Academia | *"in terms of attracting money and recognition from the research council, the funding council, they don't rate it, they don't think it's proper work, they think it's games is a flippant thing that people aren't taking seriously" [1].* | *Research funding*<br><br>*Willingness to get involved* |
| Funding community | *"We started talking to the banks and they just laughed at us, turning up wearing baseball caps and unshaven to speak to the bank manager because we had money, we weren't looking for any borrowing requirements" [27].*<br><br>***"****if I was looking for investment, obviously they're always going to do the research to what other companies in the area have done and that doesn't look good" [14].* | *Affects perceived risk and credibility* |

| | | |
|---|---|---|
| | *"I would say generally a lot of investors are very wary of the sector" [39].* | |
| General public | *"As far as they [parents] were concerned the computer games thing was just a side hobby. They were quite happy as long as I went to university and got a real education so that I could go and do something else" [17].*<br><br>*"[Games] never seemed like a career choice because it was a sort of hobby" [40].* | *Feasibility as a career or start-up*<br><br>*Attracting staff* |
| Games industry | *"We're a software house and games company". I would rather us spread the risk rather than spending, committing all our finances to making games" [35].*<br><br>*"As soon as you say you work in computer games people stop believing you're a real business!" [24].*<br><br>*"We are classified under the games industry, I mean; I don't really see it like that. […] if I'm talking to potential investors, then we are software solutions" [33].* | *Disassociation by companies from the sector and alignment with software or technology where possible* |
| Public sector | *" power tends to lie with older people, more conservative people, they don't play games so they don't understand that market so it won't be seen as socially useful […] Scotland is quite a conservative nation and we're not really into breaking trends with young people and stuff like that so there is no political will"[25].*<br><br>*"At a Scotland wide level I'm less certain that Scottish Enterprise has really understood or got this sector" [4].* | *Inconsistency of support*<br><br>*Inappropriate objectives and support mechanisms* |

### 6.2.5 Geographical issues

> "*The games industry is funny because the games industry is invented in Dundee which is very separated from this whole thing. There is a lot of interesting stuff happening in Edinburgh and in Glasgow" [22].*

Although the positive profile of Dundee, and the strong connections therein, were enablers for the cluster, the disconnect between Dundee and other areas of Scotland

was perceived as a negative influence: *"The story of Dundee helps them all [the Dundee companies] but it's a story that tends to air brush out other companies that are not the Dundee cluster" [7].*

The focus on Dundee related connections and activities, was perceived as a potential limitation to founder/company competitive knowledge. It was felt that this encouraged the recycling of bad habits and an insularity which was not useful. Recognising this, some respondents had tried to broaden their networks as well as recruit from outside of Dundee to avoid the effects of this. However some of the companies were very obviously reliant on Dundee connections: "I d*on't really speak to them [companies outside Dundee] that much, well, there aren't many in Scotland. How many are there outside Dundee? Hardly any" [12].*

Allied to this, was the fact that Dundee respondents regularly commented on their willingness to work together and support other companies. This was accompanied by unwritten rules about business conduct for example avoiding direct competition and not head hunting staff from each other. This may have potential issues in terms of drive and competitive aims.

### 6.2.6 Funding

> *"I don't think it is just that the money doesn't exist. Maybe there's just not particularly great businesses to absorb that level of money. A game developer is a very risky business and way more than 50% of them never survive. It's just not a particularly well structured thing for some VC to go in and invest" [10].*

In terms of impacting on the cluster's development, private investment was not a notable factor but the lack of it was at the root of many of the issues experienced in terms of company growth. The overriding theme was that private sector funding did exist but that games companies were not an attractive proposition because of their characteristics including lack of intellectual property, project based model, and constant change "it's *one that like all media hard to invest in […] It's also a sector that is evolving extraordinarily rapidly and frightens off some, excites others" [39]*. This has resulted in many of the games development companies focusing on subcontract work for publishers: *"a lot of smaller companies end up having to boot strap their finance by working on work for hire projects which means that although there's quite a strong talent base they don't always manage to get their own IP developed" [4]* .

### 6.2.7 Public sector issues

> *"power tends to lie with older people, more conservative people, they don't play games so they don't understand that market so it won't be seen as socially useful and Scotland is quite a conservative nation and we're not really into breaking trends with young people and stuff like that so there is no political will. There's a wee bit of political will with the Scottish Government and Scottish Enterprise" [25]*.

The final factor that negatively impacted on the cluster's development was the public sector. However, it is important to note that public sector activities were also

mentioned as key enablers and it was evident that companies did not think it was the public sector's responsibility to drive the cluster:

> *"It's sort of presumptuous to imagine you need a public agency to make all these things happen. You don't. What you need sometimes is the public agency to provide some sort of appropriate support[…]an environment where people can get together with useful information, they can access information, contacts, make some deliberations" [8].*

The key issues mentioned by study respondents as barriers to the cluster's development were the variability and inappropriateness of support. First, in terms of variability, respondents felt that this existed in delivery, geography and political focus: *"I've given up trying to figure out what the different parts of that is because they change it every year" [28].* A number of non-Dundee based study respondents perceived that Dundee-based companies received a disproportionate amount of support and profile:

> *"as a major support organization I think Scottish Enterprise have only regionally supported the industry. So, for somebody based in Edinburgh, the support available in Edinburgh is rubbish. The support available has been very good in Tayside but everywhere else has been bad. So, I think not having a national program is poor, and a real hindrance" [39].*

> *"Scottish Enterprise decided Dundee was going to be the games centre and so they focused everybody; if you want to be a games company you are pushed to*

*go to Dundee and if you are a games company in Dundee you get tons of support, anywhere else you don't get any […] It's socially engineered so that Dundee would be games. All games companies should be in Dundee. Completely mad" [22].*

*"Scottish Enterprise they do their cluster analysis and work out where are emerging businesses and they discovered there was an emerging cluster of games companies […] they are keen to develop the thing in Dundee […] that's very much as an economic development thing.[…]there is a wee bit of something going on that we should encourage and support but […] it's not major" [25].*

Respondents perceived that the cluster's potential may also have been hindered by the changing policy focus of the public sector which has itself undergone substantial restructuring: *"Lack of attention in recent years [2007/8-2010] due to public sector restructuring"[5].* There was also some evidence from respondents about tension between public sector entities which was perceived as unhelpful and a barrier to an integrated approach:

*"There are a couple of individuals there [Scottish Enterprise Tayside] who have championed games, not just games, digital media. They have seen the potential, they have seen the growth possibilities and have really championed it and really been a big part of why we've got this community in Dundee. But, that's down to a couple of individuals and they've done it almost in spite of what Scottish Enterprise national have been pushing for"[1].*

Additionally, respondents felt that while policymakers expressed willingness to engage, the actual reality was different. There was a high level of scepticism amongst respondents about the interests of policy makers in the cluster, particularly the increased attention in recent years: *"Scottish Enterprise [except Tayside], largely, weren't interested in the sector until about a year ago [2009]. Government, both Scottish and the UK, largely, no in fact were completely uninterested in the sector until about a year" [1]*.

Second, inappropriate support and its associated metrics were viewed as a barrier as they did not take account of the characteristics of the computer games industry. Games development activities are different from technology development. However the support mechanisms were considered to be more suited to technology and or manufacturing:

> ***"****it's one of the little irritations of the world we're in that the rules for industrial support were developed for inward investment, branch factory economy, screw driver plants, and they still haven't really matured beyond that" [25]*.

Allied to this was the feeling that the growth targets set by the public sector were not always appropriate for the types of companies in the cluster and the industry within which they operate:

*"At a Scotland wide level I'm less certain that Scottish Enterprise has really understood or got this sector" [4].*

***"****it's a bit of a shame but Scottish Enterprise want us to grow into this multimillion pound company and employ 400 people and stuff like this and I just don't see that being stable in our sector to do that.[…] I just don't think it's sustainable"[35].*

## 6.3 Conclusion

This chapter has explored the factors that have been barriers to growth in the cluster. It focused on six key areas namely industry market and technology conditions; negative perceptions of the cluster; company start-up, growth and sustainability; geographic location; funding and public sector involvement. First, the Scottish cluster is involved in an industry that is characterised by rapid change. The companies in the cluster are predominantly involved in early stage value chain activities with limited power. This has generated uncertainty for the companies, funders and support providers. Second, there are a number of negative perceptions about the industry from academia, the investment community, the general public, public sector and the games industry itself which are perceived as affecting funding, willingness to engage, perceptions of risk and credibility, and consistency in support. Third, a range of company specific issues have created barriers to start-ups, growth and sustainability, particularly in relation to entrepreneurship, motivational issues, commercial models and skills. The fourth element, geographic location, related in the main to the relationships between Dundee and elsewhere. While the strong connections within Dundee, and its positive profile

have enabled the growth of the cluster, the disconnect between Dundee and other parts of Scotland was perceived as a hinderance. Funding was mentioned as the fifth barrier to the cluster. It was not explicit but rather inherent in many of the company development issues mentioned by respondents. However the overriding theme was that private sector funding did exist but that games companies were not attractive propositions. The final factor was public sector support which was also cited in the study as an enabler to the cluster's growth. In terms of hindering the cluster, it was felt that public sector engagement was inconsistent and sometimes inappropriate vis a vis the characteristics of the companies. Additionally there was perceived tension between different divisions of Scottish Enterprise which was a problem. Chapter 7 will now compare the video games cluster evolution with a model of high technology cluster evolution.

# Chapter 7 - Findings: Comparative analysis of the cluster's evolution

*"Discovery consists of seeing what everybody has seen and thinking what nobody has thought. "*

Albert Szent-Gyorgyi (1893 - 1986)

## 7.1 Introduction

This chapter examines the cluster's origination and evolution by comparing the empirical evidence to a model of high technology cluster development. At the outset of the chapter, the video games cluster's evolution is discussed in the context of Mason (2008) high technology cluster model. The key areas of difference are identified and the rationale for such differences is analysed.

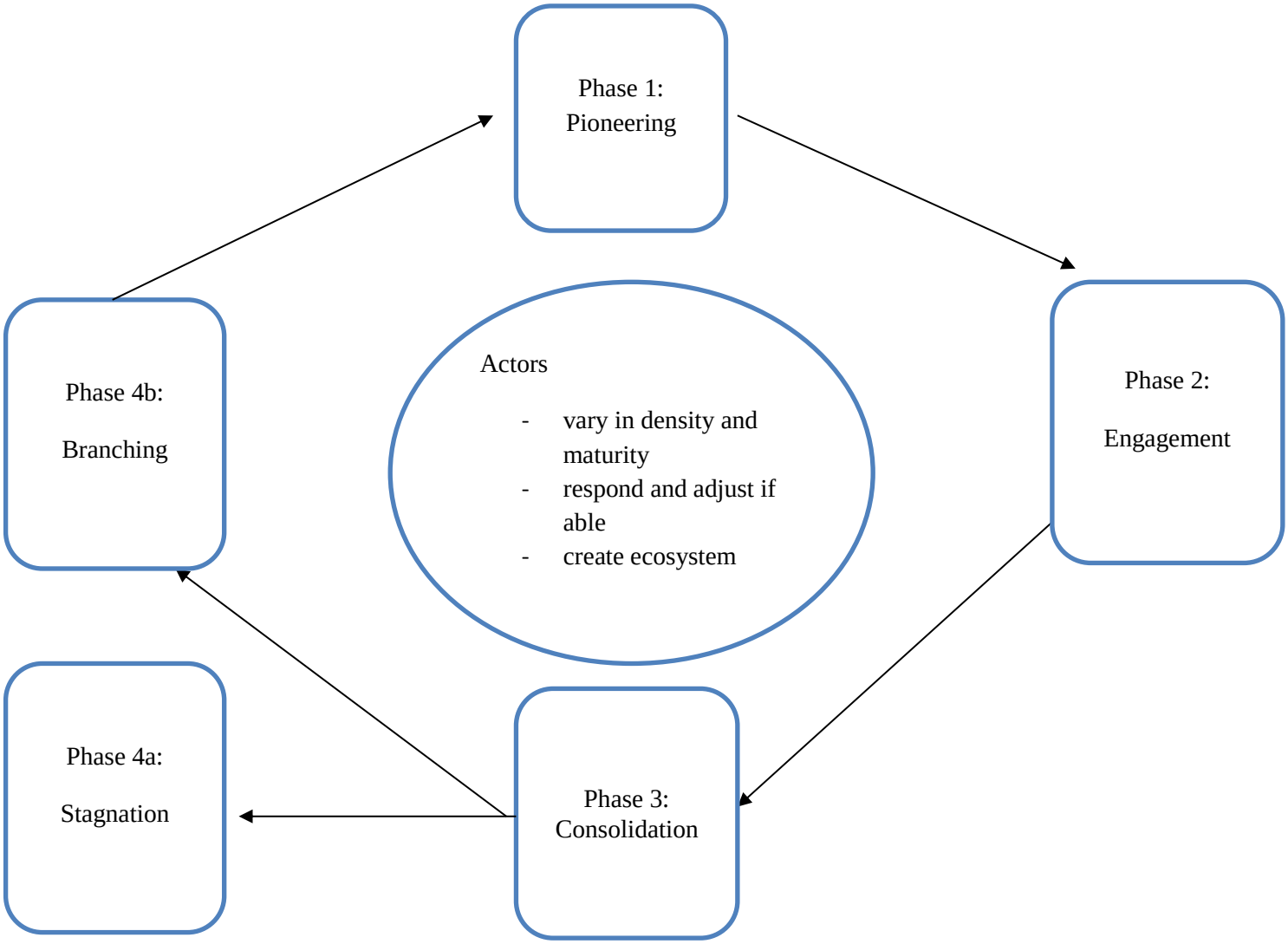
## 7.2 Overview of evolution processes

The video games cluster has evolved over four phases since the 1980s. Although this was an evolutionary process, there was also evidence of more cyclical activity particularly in phase four, as cluster firms started to show similar pioneering behaviour as evidenced at the outset of the cluster (see Figure 10). This was in response to changes in the technology and market environment. However, not all firms were perceived as responding to such changes and risked stagnation or failure, hence this option is included in the illustration.

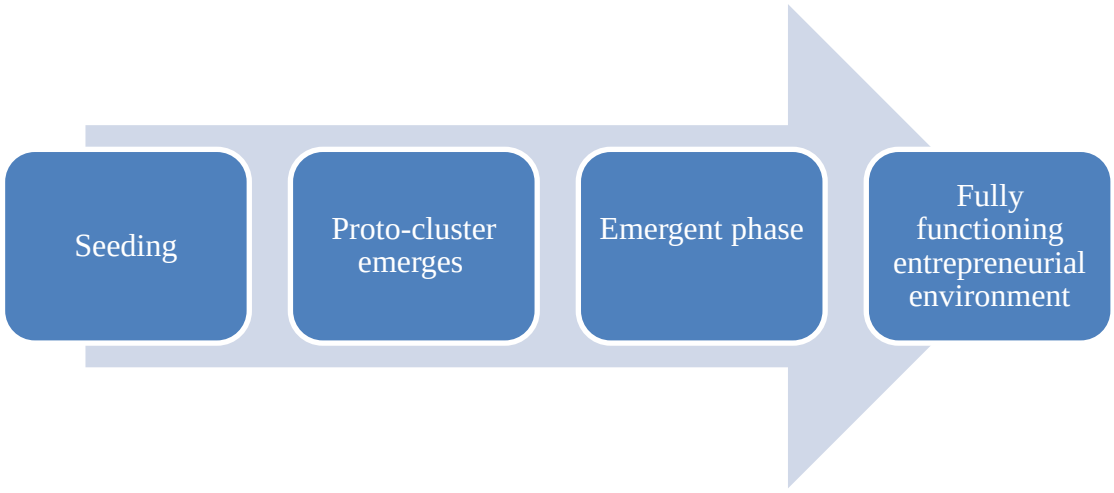
The central part of Figure 10 figure illustrates that at the core of the cluster, there was variety in the density and maturity of actors over time, which when influenced by positive and negative factors, had to respond. This ability and willingness of such actors to adapt, affected the cluster's overall ability to evolve particularly in terms of scale, spatial patterns and profile. Such responses and adaptations seemed to contribute towards the evolution of a supportive ecosystem towards the latter period of the study. One which provides support to cluster actors, particularly firms which are

the critical element: *"people go and work for a company, get fed up with it, spin out, go off and their own things. So, I think some of the companies that have been around have helped the eco-system" [39]*.

Figure 10. Comparison of cluster evolution




Source: Study data




Source: Adapted from Mason, (2008)

## 7.3 Differences between the evolution processes

In comparing the evolution of the video games cluster to the model, there were three notable differences namely (i) the overall evolution and the timing of the activities therein; (ii) the propositions relating to new economy clusters; and (iii) the factors affecting entrepreneurial spinoff in the cluster. These will now be explored.

### 7.3.1 Evolution and timing of activities

Although there was an underlying tendency towards scale in the video games cluster, there was not the same level of linear development, maturation and density of the cluster's actors and components as predicted in the model. The cluster had not achieved the scale and sustainability that had been predicted. Despite evidence of growth, visibility and positive development, there were also periods of little/no growth and retrenchment. The barriers to its development were explored in chapter 6.

Additionally, the timing of activities differed as the overall evolution was more iterative and less deterministic than the high technology model. Using the model's stages as a guide, Table 13 identifies the key differences between predicted phases/activities and the study findings.

Table 13. Comparison of the time-related aspects of cluster evolution

| Phases of Mason's model | Characteristics of model phase | Differences in timescale in video games cluster |
|---|---|---|
| 1.Seeding | | Embedding of research intensive activity in relation to games was not evident. It was industrial firm behaviour that embedded the cluster. |
| | S1- Investments in universities/research | No games related research activity |
| | S2-Anchor firms (not research intensive) | Anchor firms not games related |
| | S3-Research activity high but region not prominent | Start-up founders from variety of origins and not research institution focused |
| 2:Proto-cluster | | Start-up activity was evident throughout the time period. Firms originated from within and outwith Scotland. There was not a noticeable point where pioneers started to leave organisations to start-up. |
| | P1-Exogenous events prompt pioneers to leave and start | Early pioneers prompted by global industry opportunity. Characterised by freelancers and micro companies. |
| 3:Emergent | | There was no noticeable point of density where entrepreneurs left organisations in the region and the focus was on a small number of technologies. Additionally, the sense of community expected in this phase, together with successful company sales or flotations and entrepreneurial recycling, occurred out of sequence. |
| | E1-Spinouts from anchor companies. | Some spinouts from companies established pre 1996; de novo companies evident |
| | E2-Spinouts - narrow technology range | Not apparent in games development firms |
| | E3-Support infrastructure | Emerged in response to firm |

| | | |
|---|---|---|
| | | lobbying. Became a key enabler in Dundee from 2000. |
| | E4-Collective sense of community | Earlier than model driven by the importance of personal networks and locational inertia. |
| | E5-Evidence of company sales or flotations | Investment or flotations occurred earlier |
| | E6-Entrepreneurial recyclying | Evident from earlier and continued throughout |
| 4:Fully functioning entrepreneurial environment | | Diversity existed as well as a relatively integrated business support infrastructure. However elements of this occurred earlier in the process, and the depth of these differed across Scotland. |
| | F1-Spinoffs – range of technologies | Not apparent in games development firms; limited in games related firms |
| | F2-Local VC finance | Not evident to any depth. |
| | F3-Wide range of customers/ suppliers/ services | Necessarily broad from the outset |
| | F4- Early spin-offs are large, publicly listed | Large companies but under foreign ownership |
| | F5–MNEs evident | Limited |
| | F6-University programmes to satisfy skills demand | Evident throughout Scotland from earlier stage due to firm lobbying. |
| | F7-Government involvement and support | Evident from earlier stage due to firm lobbying, public sector champions, and national policy. Consistency varied |
| | F8–Diversity in technology, function, firm size and ownership | Diversity apparent but more depth required |

### 7.3.2 High technology clusters and new economy clusters

There were three key differences in the propositions about high technology clusters relative to new economy clusters (Mason 2008) namely:

(i) *The role of research institutions at the outset:* Rather than have a prominent role at the outset as a source of new ventures and technology, there was limited

involvement until approximately 15 years after the video games industry's emergence in Scotland. Additionally, such institutions have not been prominent nor a consistent source of sustainable new ventures.

*(ii)* *The existence of agglomeration economies which attracted international business:* There was limited evidence of this. A few international businesses have located in Scotland attracted by the skilled talent pool. However, in the main, the international companies located here have done so via acquisition.

*(iii)* *The critical role of Government in mature stage of cluster via financing research:* Government organisations were involved earlier than maturity and their role was wider than financial research. Government funded organsiations, intitiated policy, championed the cluster and established a number of initiatives to support firm and cluster development in areas such as skills, networks, funding, partnering with research institutions and raising the profile of the cluster.

### 7.3.3 Factors affecting entrepreneurial spinoff in the cluster

Factors influencing spinoff activity in high technology clusters were compared with the video games cluster namely institutional environment, technology and industry conditions, incubator organizations and exogenous conditions. These are summarised in Table 14. The interview data was used to explore spinoff triggers and motivations. While the intention was not to infer causal links and impact of such factors, the data

provided some useful insights into similarities and differences between the two types of cluster. These are now discussed in the remainder of this section.

Table 14. Environmental factors shaping the entrepreneurial decsion in high technology clusters

| **A:Technology and industrial conditions** | **B:Institutional environment** |
|---|---|
| • Technological advances that create technological discontinuities and produce new opportunities (Kenney and von Burg, 1999<br>• Technological trajectory where ops are greatest for components that open up new spaces because of their range of applications.<br>• Opportunities based on market emergence<br>• Technology, market and industry conditions, e.g. standards | • Established, highly regarded research base with substantial scientists and engineers<br>• Produce skilled personnel who start-up companies<br>• Research generates new technologies that are the basis of spinouts<br>• Attracts talent and raises region's profile<br>• Attracts funding from government and private sector |
| **C:Incubators** | **D:Exogenous factors** |
| • Job mobility – experience and knowledge gained in employment helps potential founders realise technology potential<br>• Exploit technology<br>• Start up stimulus via positive and negative feelings about employment | • Chance events<br>• Critical moments<br>• Closures |

Source: Adapted from Mason (2008)

### (i) Technology and industrial

Quadrant A represents the technology and industry conditions that can influence entrepreneurship in a high technology cluster by generating or restricting opportunities.

In this study, such conditions did influence the start-up motivations of the respondents, but not just those categorised as spinoffs. Firms that existed at the outset of the cluster were attracted by the opportunities in the industry and/or an interest in games: *"It turns out everyone was so desperate for content people were happy to buy content […]I ended up building up a little company out of that" [1].* Additionally, during the cluster's evolution the changing technology platforms generated opportunities. For example some respondents decided to focus on games in the mid 1990s the new generation of consoles that emerged from Sony and Nintendo: "*they were the first sort of 3D consoles and we looked at those and went 'wow, we could do amazing things with that' so we started to bounce around the idea of actually getting into games" [11].* Finally, during the mid/late 2000s, technology advances have facilitated the start-up of new firms, evidenced new business models (particularly an interest in self-publishing), enabled the production of different types of games, and engaged new audiences.

**(ii) Institutional environment**

Quadrant B indicates those institutional influences identified as crucial in stimulating spin-offs in the high technology model. Institutions with concentrated scientific talent and skills can improve the attractiveness of the area, attract research funding and attract talented personnel. This provides a basis for new venture activity as personnel leave the institution to start-up with or without the parent's support. However, in this study, there was no major games-related institutional activity in the cluster for the initial 10-15 years. In general, institutions were reluctant to get involved due to their

lack of awareness about the industry and, for those that were aware, the negative perceptions that existed. It was individual entrepreneurs making approaches to research institutions that triggered the latter's engagement. This subsequently led to the establishment of degree courses plus initiatives to stimulate and support start-ups in the late 1990s/early 2000s.

**(iii) Incubators**

Quadrant C illustrates the roles that employers play as incubators for new ventures. Employees may identify an opportunity based on their employment experience (including exploiting technology that the employer doesn't want) and/or may be incentivised to start up as a result of a negative or positive work environment. Within this study, this emergence from other companies was recognised: *"It's fostering, […] people go and work for a company, get fed up with it, spin out, go off and do their own things" [39];* with some companies in particular identified as sources of start-ups such as VIS Entertainment, Digital Bridges and DMA Design: "*a lot of the companies are connected to others. So the original game companies that were set up many years ago, I think it started from Dave Jones [DMA Design]" [2]*.

The reasons given by respondents voluntarily leaving employment to start-up a new venture usually related to opportunity and/or personal factors rather than technology driven motivations. Games development firms tended not to exploit employer's technology given the lack of technology development/interest. However, technology based new ventures were evident in games related firms which had emerged from technology based companies and/or universities where games were normally only one

application. Finally, new ventures focused on specialist service provision, started up recognising the opportunity to service the developing cluster.

**(iv) Exogenous factors**

Quadrant D describes those environmental factors known as exogenous, such as chance events, critical moments and closures which result in spin-offs. All of these factors were notable in the games cluster as a source of new venture creation.

First, chance events were evident and included the opportunity to secure a sales contract (sometimes from the client of the founder's current employer), industry-changing developments such as new platforms, and visits to/contact with industry role models: "[after meeting Dave Jones] *I just thought "I'm going to set my own company up. This is easy" [27]*. Second, there were various critical moments mentioned by respondents particularly corporate restructuring as a result of triggers such as changes in senior personnel, dilution of shares/power, investors/management tension and acquisition: *"[after acquisition] I didn't really see eye to eye with them […]they were very much far more corporate and I didn't really fit into their plans" [3]*. Third, closures and company downsizing triggered new ventures: *"some of the failures have lots of companies spinout" [39].* Such closures resulted from unsuccessful business models, failed client relationships, corporate restructuring, lack of funding, and exogenous events that impacted on the firm such as an economic downturn and currency fluctuations due to international events. Some respondents' perception of games development firms was that it was the 'norm' in Scotland for firms to start, grow, close and spawn new companies: *"it seems to be the same pattern that quite a*

*few will be there for a couple of years and then pop. And that sort of ecosystem keeps going on" [35].*

Influences on entrepreneurial activity were similar in both the model and the study. The main exception was the fact that research institutions played less of a role in generating sustainable new ventures. Additionally, there were less technology-based new ventures emerging from employment in the video games cluster given the dominance of games content development in the cluster.

## 7.4 Rationale for the differences between models

As detailed in the previous section, the key differences between the model and empirical data related to the scale and maturation of the video games cluster, the existence and timing of key activities, propositions about new economy clusters, and the influences on entrepreneurship in the cluster. The rationales for such differences are examined in this section.

### 7.4.1 The nature of the industry

The level of disruptive innovation in the video games industry forces developers to relearn every 5-6 years. There is a strong requirement for continuous adaption and innovation. However for much of the evolution of this cluster, the firms were development focused, small, underfunded and without their own intellectual property. This hindered their ability to react to such changes and negatively affected the cluster.

There was also evidence that within the industry, particularly in terms of games development, it is assumed that firms won't necessarily grow to scale. If they do, it is not perceived as sustainable:

> "*If companies go bust the sort of talent in the company pop up again in another company […] the publishers know this so they go "ok, that's fine, we don't care if you go bust, we'll just hire the guy when they form a new company, we'll just hire them and do it" [25].*

### 7.4.2 The focus on video games development

The model is high technology focused whereas video games industry can be considered a hybrid of the technology and creative content industries as production-related firms are normally involved in either technology creation or games content creation. In Scotland, the cluster has been dominated by video games development and this has various implications, not least of which is that some of the model characteristics are not applicable. First there has been a lack of technology based spin-offs focusing on games, from companies or research institutions. Second, traditionally companies have focused on work for hire, project based business models, making it difficult to build in value, growth and sustainability. Additionally, the lack of any companies of scale may have resulted in less 'start-up incubators' and therefore a slower rate of spinoffs.

### 7.4.3 The role of entrepreneurship

Some of the differences between the model and the empirical data can be accounted for by the dominant role that entrepreneurs and entrepreneurial activity have played in the cluster. For much of its evolution, the cluster has been dependent on entrepreneurs' activities, despite the engagement by political, research and financial institutions which supported firms and provided the cluster with more scale and profile. Entrepreneurs have influenced the cluster positively via lobbying, success stories, entrepreneurial recycling, network development, and new venture creation. However they have also created barriers to the cluster's growth in terms of weaknesses in firm start-up, growth and sustainability. The key factor is that their behaviour has impacted on the cluster due to their dominance. However, towards the end of the study period, there was evidence that a cluster ecosystem may have been established which relies less on the dominance of any one entrepreneur, firm, group of firms or geographic hub. For example the largest independent firm in the cluster, Real Time Worlds closed in August 2010 with over 250 employees and despite lots of negative press, the cluster appears to have sustained its position. Indeed there have been a notable number of new ventures emerging from both within and outwith the cluster towards the end of 2010 and throughout 2011

## 7.5 Conclusion

This chapter examined the evolution of the video games cluster in the context of the high technology cluster evolution model proposed by Mason (2008). The video games cluster differed from the model in three key aspects. First, the cluster's evolution was more iterative, slower, and of less maturation than the model. It also involved various different activities and timescales. Second, the propositions about high technology

clusters differed from new economy clusters in relation to the role of research institutions, linkages between agglomeration and inward investment, and the role of Government research funding. Third, the factors affecting entrepreneurship activity in the cluster differed, particularly in relation to the nature of the firms.

Three key factors were identified as contributing to such differences. First, the disruptive nature of the video games industry, the dominance of buyer driven supply chains, and the negative perception of the industry, means that the firms in the video games cluster are often at a disadvantage in terms of building sustainable companies. Additionally, the traditional focus in the cluster on developing non-proprietary video games content meant that the technology-focused characteristics of the model were less relevant. Such characteristics could be identified in the games related companies that focused on technology, although they were in the minority. The difficulties of building scalable, sustainable development companies has implications for the types of spinoffs that are incubated and the pipeline of new ventures

Finally, some of the differences to the model can be attributed to the dominant role of entrepreneurs and entrepreneurial activity in the cluster. Entrepreneurship was found to be closely linked to the cluster's evolution, both as a positive and negative influence, and played a more prominent role than in the high technology model particularly in terms of seeding the cluster and influencing the its scale.

The evolution of Scotland's video games cluster has been compared to a model of high technology in this chapter. This concludes the study findings. Chapter 8 addresses the study's conclusions.

# Chapter 8 - Conclusion

*"But all endings are also beginnings. We just don't know it at the time"*

Mitch Albom

## 8.1 Introduction

This chapter summarises the study as a whole and provides the main conclusion. This study was situated within the literature that focused on historical, ideographic approaches to cluster investigation. The aim was to contribute to this literature by undertaking an exploratory, empirical study to examine the process of cluster origination and development. Allied to this was the aim of understanding the role of entrepreneurial activity in the cluster process. This chapter initially presents a summary of the main findings in relation to the three research questions (see Table 15). The contribution of the study is then discussed before presenting the study's limitations and recommendations for areas of future research.

Table 15. Research questions, aims and objectives

| **Research Question** | **Research Aim** | **Research Objectives** |
|---|---|---|
| RQ1: How does a cluster originate and develop? | To understand how the video games cluster in Scotland emerged and manifested itself. | To identify the trigger events that started the cluster.<br><br>To identify the stages of the cluster's development. |
| RQ2: What are the barriers to cluster development? | To understand the factors that negatively influence cluster evolution. | To identify the barriers to cluster development.<br><br>To identify how barriers hinder the cluster's development. |
| RQ3: How does the evolution of a new economy cluster compare to that of a high technology cluster? | To identify and understand the differences between high technology and new economy clusters. | To identify the differences between the video games cluster and the model of high technology clustering.<br><br>To identify the factors contributing to such differences. |

## 8.2 The evolving cluster – dynamics, barriers and context

### 8.2.1 The multifaceted elements of a cluster's evolution

The process of clustering in the Scottish video games industry was a dynamic one. It was influenced by multiple factors from within and outwith the cluster. The cluster's actors and the enablers and barriers to their activities, were key determinants of how and why the cluster developed as it did. The emergence of the cluster in the 1980s was triggered by entrepreneurs. The entrepreneurial desire of individuals to be involved in the games industry, combined with a preference for locating where they had lived, worked or studied, played an important part in igniting the cluster. Pioneering firms were predominantly involved in games development and sought to take advantage of the emerging global opportunity to provide games content. A number of factors facilitated entrepreneurial engagement namely:

- The existence of a global gaming market which provided the opportunity;
- Policy focus on enhancing computer literacy in the UK which supported engagement and skills development;
- The availability of home computers which encouraged usage and the creation of content including games;
- Historical focus on electronics, software, and IT in Scotland by supportive Government policy;
- The existence of Sinclair/Timex in Dundee which produced one of the most popular home computers and facilitated cheap access to hardware and parts;

- Computer clubs which brought young people together and encouraged networking and product development;

The term ‘cluster’ was used to describe the video games companies in Scotland, irrespective of geographic boundaries. Over time there was some evidence of the cluster characteristics mentioned in the literature, for example, intercompany linkages, buyers and suppliers, networks, and geographic concentrations. However, these were inconsistent although the lack of evidence of such elements on a consistent basis is not new and is not always indicative that a cluster does not exist (Hilliard and Jacobson 2011).

The cluster did not emerge as a cluster. Indeed, in geographic terms, firms were distributed throughout Scotland until the early 2000s. This wider dispersal pattern has been identified as being greater than other creative industries. Entrepreneurs’ personal location decisions affect this, as does the firm’s position in the supply chain. The Dundee-focused firm concentration that emerged in the early 2000s was positively influenced by the engagement of institutions from the public and educational sectors, and the locational inertia of entrepreneurs. The cluster term became more synonymous with the city of Dundee (and the surrounding Tayside region) from this time, particularly in relation to games development. However, towards the end of the study, a more dispersed pattern had re-emerged with city-focused hubs around Dundee, Edinburgh and Glasgow plus firms in peripheral areas. This may reflect findings from other studies that location externalities are of less importance in the early stage of firm development (due to low barriers to entry and games related skills or knowledge). However as firms mature, and capability gaps emerge, access to locations with

relevant skills (often also used by complementary industries) is more important (Cadin, Guerrin and DeFillippi, 2006).

The overall development of the cluster was not linear but rather stunted and 'stop/start' in nature. Engagement by the public and academic sectors in the late 1990s/early 2000s facilitated the cluster's development particularly in terms of stimulating the labour market, supporting company start-up/development activity, and facilitating networking. However the impact of such engagement was difficult to assess and the benefits were expressed in the study as inconsistent.

The cluster's development path has been affected by the personal trajectories of entrepreneurs and their activities including their personal objectives, personal contacts, influence and profile. Their influence was evident in the study in terms of lobbying for university and public sector engagement, raising the profile of the cluster via their own profiles and successes, creating extensive networks which facilitated their personal and company development, and the generation of new ventures. The role of individuals and their networks were important particularly in terms of personal linkages, local ties, and cooperation between people/companies/institutions, all of which had contributed to building the cluster.

The study identified 116 companies of diverse origins, geographic locations and activities. The majority were SMEs (predominantly micro businesses) and were located throughout Scotland with a larger concentration in Dundee particularly in relation to games development. Companies originated from education, employment, serial entrepreneurs and divisions of non Scottish based companies

Four phases were identified namely: Pioneering (1983-1995), a period of relative invisibility despite the international activities and successes of the companies therein; Engagement (1996-2000), representing the formal engagement of the public and academic sectors in the cluster; Consolidation (2001-2006) which involved a period of diversity and growth, alongside closure of many of the original companies, plus concentrated activity in Dundee; and New Directions (2006-2010 inclusive), where the cluster was characterised by the new directions that the wider video games industry has taken in response to changes in digital technology, gamer demographics, and technology platforms.

### 8.2.2 The complexity of cluster evolution – barriers and contradictions

The main barriers to the cluster's growth were industry market and technology conditions; negative perceptions of the cluster; company start-up, growth and sustainability; geographic location; funding and public sector involvement. These existed within and outwith the cluster and were evident at various levels, notably individuals, firm, industry, institution and geographic. Some sources of barriers were also enablers, often interlinked, and affecting some cluster components more than others. Such barriers had an impact on actors within the cluster (particularly firms), and therefore hindered the cluster as a whole. The capabilities and resources of firms within the cluster were important in determining the impact of the influence.

Outwith the cluster, industry and market conditions within the video games industry hindered as well as enabled the cluster. The industry is characterised by rapid change and this requires companies to react and adapt in order to survive. Such survival and

growth is not always possible given the characteristics of firms in the cluster where the majority are involved in the early stage of the value chain and are based on business models that are viewed as temporary and risky. Additionally, the negative perceptions of various actors about the industry inhibited growth by impacting on funding, the willingness of individuals and organisations to engage, perceptions of risk and credibility, and consistency in business support.

Within the cluster, firm specific factors, the geographic location (particularly the role played by Dundee), and public sector engagement were all the key barriers:

- A range of firm specific issues had created barriers to new ventures, firm growth and sustainability, particularly in relation to entrepreneurship, motivational issues, commercial models and skills.

- Geographical disparity in support, profile and focus was a barrier, particularly in relation to Dundee (albeit that Dundee was also an enabler).

- The lack of funding was not mentioned explicitly but was inherent in many of the company development issues mentioned by respondents. Private sector investment was in existence but games firms were not perceived as attractive propositions.

- Public sector support, a key enabler in the cluster, had also prevented its growth due in the main to the inconsistency of engagement (and perceived tension between different divisions of Scottish Enterprise) and the inappropriateness of support relative to firm characteristics.

### 8.2.3 Comparison of new economy and high technology clusters

In relation to Mason's (2008) model for the development of high technology clusters, there were differences relating to the cluster's overall development, the propositions, and the factors influencing entrepreneurial activity. First, in terms of its development, the evolution of the video games cluster was more iterative and showed differences in terms of density and the timescale of activities. Second, although there was some similarity about the propositions relating to new economy clusters, differences remained in relation to (i) the role of research institutions where they lagged behind the seeding of the industry; (ii) the lack of evidence to support positive externalities as an attractor for international business; and (iii) the fact that Government institutions participated earlier than the predicted mature phase, prompted by national policy and lobbying by industry. Finally, there were differences in relation to the role of research institutions as influencers in entrepreneurial spinout. The lack of research institution involvement in the early/mid stages accounts for this. However there has been increasing activity in this area towards the latter end of the study, although the sustainability of such new ventures has yet to be evidenced.

The differences between the high technology cluster model and the video games cluster were due to the following:

- Industry characteristics – the characteristics of the video games industry particularly fast-moving nature of the video games industry;

- The nature of firms in the cluster - the dominance of firms in the early stage of the supply chain and with a content development focus, created differences between the model and the study. Given the technology focused nature of the model, this is not surprising. The activities in the model, particularly the early seeding and proto-cluster phases, have more resonance with those games-related firms in the cluster that were based on proprietary technology with applications in games and other industries;

- The role of entrepreneurship – the dominant role of entrepreneurs in the emergence and development of the video games cluster was a key differentiator. Much of the early cluster activity was initiated by entrepreneurs, rather than developed from a games related research base or large anchor companies as in the high technology model. The origins, and the subsequent positive and negative activities of entrepreneurs/their firms, have therefore been influential in how the cluster originated and evolved.

The differences between the model and the study cannot be generalised to new economy clusters as a whole. However, they reinforce the complex nature of cluster evolution (Atherton and Johnston, 2008) and the associated need to understand the various components therein and consider new ways to do this (Johns, 2010; Ter Wal and Boschma, 2011).

## 8.3 Contribution

This study is based on the research relating to the historical and ideographic approach to examining cluster origination and development. It contributes to the literature on cluster emergence which has lacked attention (Fornahl, Henn and Menzel, 2010) by exploring how the cluster originated and the key actors, events and contextual factors that influenced this. Researching cluster emergence is a complex process and presents methodological challenges given the necessarily historical nature of the data. However it is important to understand this process given the political focus on creating clusters and the public investment in this activity.

Additionally, this study highlights the important role that entrepreneurship had in this cluster's development where it was an enabler and a barrier. This supports earlier studies where entrepreneurship has been proposed as a key element in the clustering process (Feldman, 2001; Feldman Francis and Bercovitz, 2005; Mason, 2008). Entrepreneurs provided the impetus for the cluster's origination and early development, with institutional engagement occurring and co-evolving subsequently, albeit inconsistently. It challenges the assumptions that institutional actors triggered and drove the cluster (Krugman 2009 in Donald, 2009; CIHE, 2010) although acknowledges that certain institutions played an important role in sustaining the Dundee-based hub to develop.

Finally, from a methodological perspective, the research approach acknowledges the need for more longitudinal studies, and case studies (Boschma and Fornahl, 2011; Wolfe and Gertler, 2004) focusing on where clusters emerge and how they evolve (Frenken, Cefis and Stam, 2011). It also applied the cluster genealogy tree approach for the first time to this industry in Scotland.

## 8.4 Future research

### 8.4.1 The geography of production in the Creative Industries

The first area of future research relates to the geography of production within the creative industries and the potential to extend this research, acknowledging the differences within such industries (Tschang and Yang, 2008). This could involve (i) a geographic specific approach (e.g. a city-focused example) recognising the differences that emerged in the study between activity in the city of Dundee and elsewhere or (ii) an examination of the global production networks that such companies inhabit, particularly those operating in the early stage in the supply chain, and the issues encountered in terms of such companies dealing with issues of value, power and embeddedness using a Global Production Network lens (Johns, 2010; Ivarsson and Alvstam, 2010; Parker and Cox, 2011; Sunley *et al.*, 2008).

### 8.4.2 Entrepreneurship in cluster origination and development

The second area of research is an examination of the role of entrepreneurship in cluster formation and growth, and entrepreneurial genealogy as rationale for emergence and spatial dispersion (Feldman and Francis, 2004; Mason, 2008). A more integrated approach that brings together the management, entrepreneurship and economic geography literature could be beneficial (Maskell and Kebir, 2005; Ogbor, 2000; Crone, 2008) to examine clusters via the "entry, growth and exist of firms and how in turn clusters affect entry, growth and exit through agglomeration economies"

(Frenken, Cefis and Stam, 2011). This would consider entrepreneurship in context and recognise that entrepreneurs' actions impact on, and contribute to changing a context (Welter, 2010). The underlying assumptions are that regional path dependence needs entrepreneurs from related industries to engage in branching as a cluster emerges despite a lack of localisation externalities, due to good performing spinoffs from a selected number of parents (Klepper, 2007; Wenting 2008; Heebels and Boschma, 2011). Such a study could involve an examination of (i) the nature of inheritance of routines and conditions under which they are replicated– industry characteristics, start-up motivations, geographic distance between parent and spinout (Boschma and Frenken 2011) and (ii) whether or not this theory applies to services/creative industries in a similar way to manufacturing (Wenting, 2008; Heebles and Boschma, 2011).

### 8.4.3 Dynamics of Creative Industry clusters

The third area of future research relates to creative industry clusters and the need to obtain a better understanding of the components, dynamics and functions of such clusters (Chapain *et al.*, 2010). Cluster research should acknowledge the dynamism and complexity of the process, particularly the multiple levels of analysis therein. In the case of the creative industries, this includes a clearer definition of cluster components, their evolution and impact. This should be aligned with more appropriate measures of 'success' that acknowledge the heterogeneity and characteristics of individual industries, the influences from within and outwith the cluster ((Ter Wal and Boschma, 2011; Shin and Hassink, 2011) and the challenging of stylised facts relating to the creative industries (Reimer, Pinch and Sunley, 2008)

# References

Albom, M. (nd) ‘The Five People You Meet In Heaven’, p. 1. Accessible at http://www.quotationspage.com/quotes/Mitch_Albom/

Aberdeen Press and Journal (2005) ‘Computer challenge makes its UK debut’, 29 January, p. 6.

Atherton, A. & Johnston, A. (2008) ‘Clusters formation from the 'bottom-up': a process perspective’ in: C. Karlsson (Ed.) *Handbook of Research on Cluster Theory* (pp. 93-118). Cheltenham: Edward Elgar Publishing Limited.

BBC News (2011) ‘Online game APB reloaded brings Scottish jobs’, BBC News online, 21 March.

BBC Radio Scotland (2010) ‘The Spielberg of Gaming’, 5th April, 11am.

Benneworth, P., & Henry, N. (2004) ‘Where is the Value Added in the Cluster Approach? Hermeneutic Theorising, Economic Geography and Clusters. AMutiperspectival Approach’, *Urban Studies,* 41 (5/6), pp. 1011-1023.

Bevens, N. (2055) ‘It’s game over for VIS’, 8 April, p. 47.

Boschma, R. & Fornahl, D. (2011) ‘Cluster Evolution and a roadmap for future research’, *Papers in Evolutionary Economic Geography (PEEG) 1117*, Utrecht University, October 2011. Accessible at http://econ.geog.uu.nl/peeg/peeg1117.pdf.

Boschma, R. & Frenken, K. (2011) 'The emerging empirics of evolutionary economic geography', *Journal of Economic Geography,* 11(2), pp. 295-307.

Brown, R. (2000) 'Cluster Dynamics in Theory and Practice with Application to Scotland', *Regional and Industrial Policy Research Paper,* 38, March. Glasgow: European Policies Research Centre, University of Strathclyde.

Braunerhjelm, P. (2005) 'Madonna and the Music Miracle: The genesis and evolution of a globally competitive cluster', *CESIS Electronic Working Paper Series in Economics and Institutions of Innovation*, Paper No. 29, April. Stockholm: Royal Institute of Technology, Centre of Excellence for Science and Innovation Studies (CESIS)

Burrell, G. & Morgan, G. (1979) *Sociological Paradigms and Organisational Analysis.* Aldershot: Ashgate Publishing Limited.

Bushnell, N (n.d.) *Good Reads.* Accessible at http://www.goodreads.com/quotes/show/54394

Cadin, L., Guerin, F. & DeFillippi, R. (2006) 'HRM Practices in the Video Game Industry: Industry or Country?' *European Management Journal,* 24 (4), pp. 288–298.

Cadin, L. & Guerin, F. (2006), 'What can we learn from the video games industry?", *European Management Journal,* 24 (4), pp. 248-255.

Calder, M. (2001) 'Game for a Degree?; New Course in Computer Games Technology at Paisley University', *Daily Record,* 2 August, 2001.

CIHE (2010) '*The Fuse: Igniting High Growth for Creative, Digital and Information Technology Industries.'* London:CIHE. Available at: http://www.cihe.co.uk/wp-content/themes/cihe/document.php?file=1009TheFuse.pdf.

Chapain, C., Cooke, P., De Propris, L., MacNeill, S. and Mateos-Garcia, J. (2010) *Creative clusters and innovation. Putting creativity on the map*. London: NESTA

Cheshire, P. C. & Malecki, E. J. (2004) 'Growth, development, and innovation: A look backward and forward', *Regional Science,* 83, pp. 249-267.

Chua, W. F. (1986) 'Radical Developments in Accounting Thought', *The Accounting Review,* 61 (4), pp. 601-632.

Collis, J. & Hussey, R. (2003) *Business research: A practical guide for undergraduate and postgraduate students* (2nd ed.). Basingstoke: Palgrave Macmillan.

Cook, G. A. & Pandit, N. R. (2008) 'Clustering in the broadcast industry', in: C. Karlsson, *Handbook of research on innovation and clusters: cases and policies,* pp. 274-291. Cheltenham, MA: Edward Elgar Publishing Limited.

Cooke, P. & Lazzeretti, L. (2008) *Creative Cities, Cultural Clusters and Local Economic Development.* Cheltenham: Edward Elgar Publishing Ltd.

Bygrave (2007) 'The entrepreneurship paradigm (I) revisited'. In: H. Neergaard & J. P. Ulhoi (Eds.), *Handbook of Qualitative Research Methods in Entrepreneurship*, pp. 17-48. Cheltenham: Edward Elgar Publishing Ltd.

Cornford and Naylor (2001) 'Cutting edges in strange places: new media debates and the computer and video games industry in the UK', *CURDS Discussion Paper 01/01 Centre for Urban and Regional development studies*, University of Newcastle Upon Tyne, UK

Cresswell, J. W. (2003) *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* (2nd ed.). London: Sage Publications Ltd.

Crilly, R. (2001) 'Scotland's computer games entrepreneurs began their careers in their bedrooms, hunched over Sinclair Spectrums', *Aberdeen Press and Journal*, 31 July, p. 11

Crone, M. (2008) 'Entrepreneurship and Innovation – Organizations, Institutions, Systems and Regions: The emergence of dynamic SMEs in cluster context', Paper to be presented at *DRUID, the 25th Celebration Conference 2008*, Copenhagen Business School, Denmark, June 17 - 20, 2008.

Crossley, R. (2010) 'RealTimeWorlds reborn as eeEeo', *Develop Online*, 25 May. Accessible at http://www.develop-online.net/news/37767/Realtime-Worlds-reborn-as-new-studio-eeGeo

Cumbers, A., MacKinnon, D. & Chapman, K. (2003) 'Innovation, collaboration and learning in regional clusters: a study of SMEs in the Aberdeen oil complex', *Environment and Planning,* 35, pp. 327-344.

Cumbers, A. & MacKinnon, D. (2004) 'Introduction: Clusters in Urban and Regional Development', *Urban Studies,* 41(5/6, May), pp.959-969.

Dahl, M. S., Pedersen, C. O. R. & Dalum, B. (2005) 'Entrepreneurial founder effects in the growth of regional: how early success is a key determinant', *DRUID Working Paper 05-18,* Aalborg University, Denmark.

Dailly, M (n.d.) *The complete history of DMA Design*. Accessible at http://www.dmadesign.org/

Dailly, M. (2010) *The Spielberg of Gaming*, BBC Radio Scotland, 5 April, 1130.

Daily Record (1997) 'Game on for States show; Scots computer games firms to attend multimedia show in Atlanta', *Daily Record,* 14 June, p. 49.

Daily Record (1999) ‘Centring on Quality: By July 2001, Absolute Quality aim to have 120 staff supporting and boosting the country’s computer games industry’, 27 May, p. 8.

Delgado, M., Porter, M. E. & Stern, S. (2010) ‘Clusters and Entrepreneurship”, *Journal of Economic Geography*, 10(4), pp. 495-518.

Department of Culture Media and Sport (2009) *What we do: Creative Industries*. Accessible at http://www.culture.gov.uk/what_we_do/creative_industries/default.aspx

DePropris, L., Chapain, C. Cooke, P., MacNeill, S. & Mateos-Garcia, J. (2009) *The geography of creativity.* London: NESTA

Donald, C. (2009) “Games Industry offers route map to export revival”, *The Glasgow Herald*, 8 November.

Dorsey, K. (2000) ‘Changing games writers into big players’, The Glasgow Herald, 21 August.

Downes, B. (1998) ‘Scots score at US event’, *Aberdeen Press and Journal*, 17 June, p. 11.

Downes, B. & Botham, R. (1999) ‘Industrial clusters: Scotland’s route to economic success’, *Scottish Affairs*, (29), pp. 43-58.

DTI (1998), *Our Competitive Future: Building the Knowledge Driven Economy.* Accessible at http://webarchive.nationalarchives.gov.uk/+/http://www.dti.gov.uk/comp/competitive/main.htm.

DTI (2004) *A Practical Guide to Cluster Development* London:DTI

Dilthey, W. (1976) 'The Task of laying a Psychological Foundation for the Human Studies', in: H. P. Rickman (Ed.), *W. Dilthey: Selected Writings* (H. P. Rickman, Trans.). Cambridge: Cambridge Universal Press.

Durrant, P. (2000). In K. Dorsey 'Changing games writers into big players', The Glasgow Herald, 21 August.

Easterby-Smith, M., Thorpe, R. and Lowe, A. (1991), *Management Research*. (3rd edn) London: Sage Publications Ltd.

Education Scotland (2010) *Education Scotland and Games Based Learning.* Accessible at http://www.ltscotland.org.uk/usingglowandict/gamesbasedlearning/consolarium.asp

Einsten, A (n.d.) *Brainy Quote.* Accessible at http://www.brainyquote.com/quotes/quotes/a/alberteins148837.html#ixzz17Ny9G2sM

Eisenhardt, K. M. (1989) 'Building Theories from Case Study Research', *The Academy of Management Review,* 14, 4(October), pp. 532-550.

ELSPA (2009a) '*AskAboutGames:Facts and Figures*.' Accessible at http://www.askaboutgames.com/?c=/pages/factsFigures.jsp [19 November 2009]

ELSPA (2009b) '*Ask About Games: Games Info:Genres'*. Accessible at http://www.askaboutgames.com/?c=/pages/genres.jsp [17 November, 2009]

ELSPA and ChartTrack (2001) 'Enterprise in Scotland: Software Success Smiles on Tayside1. *The Scotsman,* 26 January, p. 6.

ESRC (n.d.) *Framework for Research Ethics.* Accessible at http://www.esrc.ac.uk/_images/Framework_for_Research_Ethics_tcm8-4586.pdf.

Ettle, M. (2000). In A. MacDonald 'Scots alliance key player in computer games sector', *Aberdeen Press and Journal,* 8 November, p. 11.

European Cluster Policy Group (2010) *Final Recommendations: A Call for Policy Action.* Accessible at http://www.proinno-europe.eu/ecpg/newsroom/ecpg-final-recommendations.

Evans, G. (2009) 'Creative Cities, Creative Spaces and Urban Policy', *Urban Studies,* 46 (5&6), pp. 1003-1040.

Feldman, M. P. (2001) 'The Entrepreneurial Event Revisited: Firm Formation in a Regional Context', *Industrial and Corporate Change,* 10 (4), pp. 861-891.

Feldman, M. P. & Francis, J. L. (2004) 'Homegrown Solutions: Fostering Cluster Formation', *Economic Development Quarterly*, 18 (2), pp. 127-137.

Feldman, M. P., Francis, J. & Bercovitz, J. (2005) 'Creating a Cluster While Building a Firm: Entrepreneurs and the Formation of Industrial Clusters', *Regional Studies,* 39 (1), pp. 129-141.

Fink, A. (1998) *Conducting research literature reviews: from paper to the Internet.* Thousand Oaks, California: Sage Publications.

Flew, T. & Cunningham, S. (2010) 'Creative Industries After the First Decade of Debate', *The Information Society*, 26, pp. 1–11 (In Press). Accessible at QUT Digital Repository: http://eprints.qut.edu.au/

Florida, R. (2002) *The rise of the creative class: and how it's transforming work, leisure, community and everyday life*. New York: Basic Books.

Fornahl, D., Henn, S. and Menzel, M. P. (2010) *Emerging clusters: Theoretical, Empirical and Political perspectives on the Initial Stage of Cluster Evolution,* Cheltenham: Edward Elgar.

Frenken, K., Cefis, E. and Stam, E. (2011) 'Industrial dynamics and economic geography. A survey', *Working Paper 11.01* Eindhoven Centre for Innovation Studies, Eindhoven University of Techology, The Netherlands.

Friedli, D. (2004a) 'DC Studios set to cash in with Game Boy videos', *Scotland on Sunday,* 16 May, p. 2.

Friedli, D. (2004b) 'State of Emergency for Game Developer's owner', *Scotland on Sunday,* 26 September, p. 1.

Friedli, D. (2004c) 'Digital Looks to Develop in California', *Scotland on Sunday,* 21 November, p.2.

Games Investor Consulting (2008) *Raise the Game:The competitiveness of the UK's games development sector and the impact of governmental support in other countries*. London: NESTA.

Gartner, W. B. (1989) 'Some Suggestions for Research on Entrepreneurial Traits and Characteristics', *Entrepreneurship, Theory and Practice,* 14, pp. 27-37.

Glasgow Herald (1997) 'Work and play a virtual reality for students', 8th October, p. 9.

Grant, P. & Perren, L. (2002) 'Small Business and Entrepreneurial Research: Meta-theories, Paradigms and Prejudices', *International Small Business Journal ,* 20 (2), pp. 185-211.

Harrison, R. T., Cooper, S. Y. & Mason, C. M. (2004) 'Entrepreneurial Activity and the Dynamics of Technology-Based Cluster Development: The Case of Ottawa', *Urban Studies,* 41 (5/6), pp. 1045–1070.

Hauser, H. (2008) *BBC Micro ignites memories of revolution*. Accessible at http://news.bbc.co.uk/1/hi/technology/7307636.stm [Accessed January 2011]

Heebels, B. & Boschma, R. (2011) 'Performing in Dutch book publishing 1880-2008: the importance of entrepreneurial experience and the Amsterdam cluster, *Journal of Economic Geography,* 11(6), pp.1007-1029.

Henry, N. & Pinch, S. (2000) 'Spatialising knowledge: placing the knowledge community of Motor Sport Valley', *Geoforum,* 31, pp 191-208.

Henry, N. & Pinch, S. (2001) 'Neo-Marshallian nodes, institutional thickness, and Britain's 'Motor Sport Valley': thick or thin?', *Environment and Planning,* 33, pp. 1169-1183.

Henry, H. and Pinch, S. (2006) Knowledge and clusters. In: C. Pitelis, R. Sugden and J. R. Wilson (Eds.) *Clusters and Globalisation: The Development of Urban and Regional Economies* (pp. 114-132). Cheltenham, UK: Edward Elgar

Hepburn, I. (1999) ‘Firm vows to stay in Dundee’, *Aberdeen Press and Journal,* 8 June, p. 1.

Hilliard, R. & Jacobson, D. (2011) ‘Cluster versus Firm-specific Factors in the Development of Dynamic Capabilities in the Pharmaceutical Industry in Ireland: A Study of Responses to Changes in Environmental Protection Regulations’, *Regional Studies,* 45:10, pp. 1319-1328.

House of Commons Scottish Affairs Committee (2011) *Video games industry in Scotland: Second report of Session 2010-2011, Volume II, Additional written evidence, 7 February*. HMSO: London

HSBC (2009) *The Future of Business: the Changing Face of Business in 21st Century Britain. Executive Summary.* London:HSBC.

Husserl, E. (1965) *Phenomenology and the crisis of philosophy: 'Philosophy as a rigorous science' and ' Philosophy and the crisis of European man'.* New York: Harper and Row.

Izushi, H. and Aoyama, Y. (2006) ‘Industry evolution and cross-sectoral skill transfers: a comparative analaysis of the video games industry in Japan, the United States, and the United Kingdom’, *Environment and Planning A* 38(10), pp. 1843-1861.

Inside Sinclair (1982) 'Inside Sinclair', 22 May. Accessible at http://www.sincuser.f9.co.uk/002/insinc.htm.

Ivarsson, I. and Alvstam, C. G. (2010) 'Upgrading in global value-chains: a case study of technology-learning among IKEA-suppliers in China and Southeast Asia', *Journal of Economic Geography,* Volume 11, pp 731-752.

Jayne, M. (2005) 'Creative industries: the regional dimension?', *Environment and Planning C: Government Policy,* 23 (4), pp. 537-556.

Johns, J. (2006) 'Video games production networks: value capture, power relationships and embeddedness', *Journal of Economic Geography ,* 6, pp. 151-180.

Johns, J. (2010) 'Manchester's Film and Television Industry: Project Ecologies and Network Hierarchies', *Urban Studies,* 47(5), pp 1059-1077.

Johnston, I. (1998) 'Software and hard work is putting Scots on the hi-tech map', *Evening News (Edinburgh),* 9 September, p 23.

Jones, D. (2001). In R. Crilly (2001) 'Scotland's computer games entrepreneurs began their careers in their bedrooms, hunched over Sinclair Spectrums', *Aberdeen Press and Journal,* 31 July, p. 11

Jones, D. (2010) *The Spielberg of Gaming,* BBC Radio Scotland, 5 April, 11am.

Karlsson, C. (2008a) *Handbook of Research on Cluster Theory*. Cheltenham: Edward Elgar Publishing Ltd.

Karlsson, C. (2008b) *Handbook of research on innovation and clusters: cases and policies.* Cheltenham: Edward Elgar Publishing Ltd.

Kennedy, B. (2000) 'Dundee holds key role in Scots games sector', *Aberdeen Press and Journal,* 26 October, p. 14.

Kerr, A. (2003) 'Live Life to the Power of PS2: Locating the digital games industry in the new media environment', *Irish Communication Review,* 9, pp. 1-14.

Klein, H. K. & Myers, M. D. (1999) 'A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems', *MIS Quarterly,* 23 (1), pp. 67-94.

Klepper, S. (2007) 'Disagreements, spin-offs, and the Evolution of Detroit as the capital of the U.S. Automobile industry', *Management Science*, 53(4), pp. 616-631.

Knox, K. (2004) 'A researcher's dilemma - philosophical and methodological pluralism', *Electronic Journal of Business Research Methods,* 2 (2), pp. 119-128.

Krugman, P. (2009). In C. Donald "Games Industry offers route map to export revival", *The Glasgow Herald,* 8 November.

Krugman, P. (1991) *Geography and Trade,* Cambridge, MA: The MIT Press

Leadbetter, C. & Oakley, K. (2001) *Surfing the Long Wave: Knowledge entrepreneurship in Britain.* London: Demos.

Leibovitz, J. (2004) ‘'Embryonic' Knowledge-based Clusters and Cities: The Case of Biotechnology in Scotland’, *Urban Studies,* 41 (5/6), pp. 1133-1155.

Leitch, C. M., Hill, F. M. & Harrison, R. T. (2010) ‘The Philosophy and Practice of Interpretivist Research in Entrepreneurship’, *Organisational Research Methods,* 13 (1), pp.67-84.

Livingston, I. & Hope, A. (2011) *‘Next Gen: Transforming the UK into the world’s leading talent hub for the video games and visual effects industries’*. London: NESTA

MacDonald, A. (2000) ‘Scots alliance key player in computer games sector’, *Aberdeen Press and Journal,* 8 November, p. 11.

Macfarlane, R. (1998) *Game Developer Awards, Stirling*. Accessible at http://web.archive.org/web/19981201060055/www.scottigames.org/s01p01.html

MacKinnon, D., Cumbers, A. & Chapman, K. (2002) ‘Learning, innovation and regional development: a critical appraisal of recent debates’ *Progress in human geography,* 26(3), pp. 293-311.

Markusen, A. (1996) 'Sticky places in slippery space: A typology of industrial districts', *Economic Geography* , 72, pp. 293-313.

Marshall, A. (1920) Principles of Economics, 8th Edition. Macmillan:London.

Marshall, C. & Rossman, G. B. (1999) *Designing qualitative research* (3rd Ed.). London: Sage Publications Ltd.

Martin, R. & Sunley, P. (2003) 'Deconstructing clusters: chaotic concept or policy panacea?', *Journal of Economic Geography, 3*, pp. 5-35.

Martin, R. & Sunley, P. (2011) 'Conceptualizing Cluster Evolution: Beyond the Life Cycle Model?' *Regional Studies*, 45:10, 1299-1318.

Maskell, P. & Kebir, L. (2005) 'What Qualifies as a Cluster Theory?*', DRUID Working Paper 05-09*, Danish Research Unit for Industrial Dynamics, University of Aalborg & Copenhagen Business School. Accessible at http://www3.druid.dk/wp/20050009.pdf

Mason, C. (2008) 'Entrepreneurial dynamics and the origin and growth of high-tech clusters'. In: C. Karlsson (Ed.), *Handbook of research on innovation and clusters: cases and policies,* pp. 33-53. Cheltenham: Edward Elgar.

Matthew, J. (2000). In K. Dorsey 'Changing games writers into big players', The Glasgow Herald, 21 August.

May, W., Mason, C. & Pinch, H. (2001) 'Explaining industrial agglomeration: the case of the British high-fidelity industry, *Geoforum,* 32(3), pp. 363-376.

McCallum, T. (1998) 'Open House: Staying ahead of the computer games', *Business World,* 12th February, p. 15.

McCann, P. (2008) 'Agglomoration economics' in: C. Karlsson (Ed.). *Handbook of research on innovation and clusters,* pp. 23-38 Cheltenham: Edward Elgar Publishing Ltd.

McDowell, L. (1992) 'Doing Gender: Feminism, Feminists and Research Methods in Human Geography', *Transactions of the Institute of British Geographers, New Series,* 17 (4), pp. 399-416.

Menzel, M. P. & Fornahl, D. (2010) 'Cluster life cycles – dimensions and rationales of cluster evolution' *Industrical and Corporate Change,* 19(1), pp. 205-238.

The Mirror (2000) 'Whizzkid signs for Kuyl £4m', 19 September, p. 7.

Miles, M. & Huberman, A. (2002) 'Reflections and Advice'. In: M. Miles & A. Huberman (Eds.), *The Qualitative Researcher's Companion.* London: Sage Publications Ltd.

Miller, P. (2000) 'Digital Animation course in the frame', *The Scotsman,* 7 June, p. 11.

Morgan, G. & Smircich, L. (1980) 'The Case for Qualitative Research', *Academy of Management Review,* 5 (4), pp. 491-500.

Murden, T. & Dixon, G (2005) 'New state of emergency declared as Glasgow firm takes on game', *Scotland on Sunday,* 1 May, p. 3.

Murray-Watson, A (2002) '£25m boost to Video Gamers', *The Scotsman,* 24 May, p. 3.

Mytelka, L. K. & Farinelli, F. (2000) Local clusters, innovation systems and sustained competitiveness. *UNU/INTECH Discussion Paper No. 2005*, Maastrict, Netherlands.

Myint, Y. M., Vyakarnum, S. & New, M. J. (2005) 'The effect of social capital in new venture creation; the Cambridge high-technology cluster', *Strategic Change,* 14, pp. 190-208.

Nachum, L. & Keeble, D. (2003) 'Neo-Marshallian Clusters and Global Networks', *Long Range Planning,* 36, pp. 459-480.

Neck, H. M., Meyer, G. D., Cohen, B. & Corbett, A. C. (2004) 'An entrepreneurial system view of new venture creation', *Journal of Small Business Management,* 42, pp. 165-177.

Neergaard, H. & Ulhoi, J. P. (2007) 'Introduction: Methodological variety in entrepreneurship research',. In: H. Neergaard & J. P. Ulhoi (Eds.), *Handbook of Qualitative Research Methods in Entrepreneurship* (p. 8). Cheltenham: Edward Elgar.

NMP (2008) *Digital Markets Research*. Glasgow: Scottish Enterprise.

Oakley, K. (2001). In R. Crilly 'Scotland's computer games entrepreneurs began their careers in their bedrooms, hunched over Sinclair Spectrums', *Press and Journal,* 31 July, p. 11.

Oakley, K. (2004) 'Not so cool Britannia', *International Journal of Cultural Studies,* 7 (1), pp.67-77.

O'Connor, J. (2007) *The cultural and creative industries: a review of the literature. A report for Creative Partnerships.* London: Arts Council England. Accessible at ww.creative-partnerships.com/literaturereviews.

OECD (2009) *Clusters, Innovation and Entrepreneurship.* Paris: OECD.

Ogbor, J. O. (2000) 'Mythicizing and Reification in Entrepreneurial Discourse: Ideology-critique of Entrepreneurial Studies', *Journal of Management Studies,* 37 (5), pp. 605-635.

Oxford Economics (2008) *The Economic contribution of the Games Development Industry.* Oxford:Oxford Economics. Accessible at http://www.oef.com/FREE/PDFS/gamesimpact.pdf

Parker, R. and Cox, S. (2011) ' Power Relations and Small and Medium sized Enterprise Strategies for Capturing Value in Global production networks: visual effects (VFX) Service firms in the Hollywood Film Industry', *Regional Studies, iFirst, pp. 1-16*

Patton, M. Q. (2002) *Qualitative research and evaluation methods* (3rd ed.). London: Sage Publications Ltd.

Perren, L. & Ram, M. (2004) 'Case Study Method in Small Business and Entrepreneurial Research: Mapping Boundaries and Perspectives', *International Small Business Journal,* 22 (1), pp. 83-101.

Pittaway, L. (2005) 'Philosophies in Entrepreneurship: A Focus on Economic Theories', *Discussion Paper No. 2005.01.* Sheffield: Sheffield University Management School.

Podsakoff, P. and Organ, D. (1986). "Self-Reports in Organizational Research: Problems and Prospects" *Journal of Management* 12(4) 531-545

Porter, M. E. (1998) *On Competition.* Boston, MA: Harvard Business School Press

Potter, J. (2009) 'Policy Issues in Clusters, Innovation and Entrepreneurship'. In: J. Potter & G. Miranda (Eds.), *Clusters, Innovation and Entrepreneurship,* pp. 21-41. Paris: OECD.

PriceWaterhouseCoopers (2008) *Global Entertainment and Media Outlook: 2008-2012*
London: PriceWaterhouseCoopers

Proust, M (n.d.) *The Quotations Page.* Accessible at http://www.quotationspage.com/search.php3?homesearch=discovery.

Radcliffe, J. (2008) *BBC Micro ignites memories of revolution*, 21 March. Accessible at http://news.bbc.co.uk/1/hi/technology/7307636.stm.

Randolph, J. J. (2009) 'A Guide to Writing the Dissertation Literature Review', *Practical Assessment Research and Evaluation*, 14 (13). Accessible online: http://pareonline.net/getvn.asp?v=14&n=13

Readman, J. & Grantham, A. (2006) 'Shopping for Buyers of Product Development Expertise:How Video Games Developers Stay Ahead', *European Management Journal* , 24 ( 4), , pp. 256–269

Reimer, S., Pinch, S. & Sunley, P. (2008) 'Design spaces: agglomeration and creativity in British design agencies.' *Geografiska Annaler , Series B, Human Geography*, 90, (2), 151-172. (doi:10.1111/j.1468-0467.2008.00284.x)

Rocha, H. O. (2004) ‘Entrepreneurship and Development: The Role of Clusters. A Literature Review’, *Small Business Economics,* 23 (15), pp 363-400 - GET

Rocha, H. O. & Sternberg, R. (2005) ‘Entrepreneurship: The Role of Clusters Theoretical Perspectives and Empirical Evidence from Germany’, *Small Business Economics,* 24, pp. 267-292.

Sagen, C. (n.d.) *ThinkExist.* Accessible at http://thinkexist.com/quotation/somewhere-something_incredible_is_waiting_to_be/154069.html

Saunders, M., Lewis, P. & Thornhill, A. (2009) *Research methods for business students* (5th ed.). Harlow: Pearson Education Ltd.

Schoenberger, E. (1991) 'The Corporate Interview as a Research Method in Economic Geography’, *The Professional Geographer*, 43 (2), pp. 180-189.

Scotland on Sunday (2000) ‘Steven Spielberg of Computer games to head Scottish Studios’, 26 March, p. 2.

Scotland on Sunday (2003) ‘VIS Funding close to a state of emergency’, 27 July, p. 1.

Scotland on Sunday (2004) ‘Blow to investors as BAM dropped from Nasdaq’, 17 October, p. 1.

Scotland on Sunday (2009) ‘Scotland’s role as games industry player threatened by foreign rivals’, 1 November, p. 4.

The Scotsman (2000) ‘Ones to Watch’, 6 October, Pg. 12.

Scottish Development International (2008), *“Creative and Dynamic Scotland: Games – A Business Case for Scotland”,* October 2008. Glasgow: Scottish Development International.

Scottish Enterprise, Digital Media Advisory Group (2009) *Digital Inspiration:Strategy for Scotland's Digital Media Industry.* Glasgow: Scottish Enterprise.

Scottish Enterprise (2010a) *Scottish Enterprise Busienss Plan 2010-2013.* Glasgow: Scottish Enterprise. Accessible at http://www.scottish-enterprise.com/~/media/SE/Resources/Documents/ABC/Business-plan-2010-13.ashx

Scottish Enterprise (2010b). In: House of Commons Scottish Affairs Committee *‘Video games industry in Scotland, Second Report of Session 2010-11.Volume II Additional written Evidence’*, London: The Stationery Office Ltd

Scottish Games Alliance (n.d.) ‘Scottish Games Alliance’. Accessible at - http://web.archive.org/web/19981206200701/www.scottigames.org/s02p01.html

Scottish Government (2007) *The Government Economic Strategy*. Edinburgh: Scottish Government.

Scottish Government. (2009a) *The Scottish Government:Topics:Statistics:Scottish Annual Business Statistics:Creative Industries*. Accessible at http://www.scotland.gov.uk/Topics/Statistics/16170/CreativeIndustriesSector

Scottish Government (2009b) *The Creative Industries:Key Sector Report.* Edinburgh: Scottish Government, November.

Segal Quince & Partners (1985) *The Cambridge Phenomenon: The Growth of High Technology Industry in a University Town*. Cambridge: Segal, Quince, Wicksteed Ltd.

Szent-Gyorgyi, A. (n.d). *BrainyQuotes* Accessible at http://www.brainyquote.com/quotes/authors/a/albert_szentgyorgyi.html

Shane, S. (2003) *A General Theory of Entrepreneurship. The Individual-Opportunity Nexus.* Cheltenham UK: Edward Elgar

Shin, D.H. & Hassink, R. (2011) 'Cluster Life Cycles: The Case of the Shipbuilding Industry Cluster in South Korea', *Regional Studies*, iFirst, pp. 1-16

Skillset (2009a) *Skillset:Computer Games: About the Computer Games Industry:Computer Games Sector Profile.* Accessible at http://publications.skillset.org/index.php?id=31&page=88#_ftn1

Skillset (2009b) *Computer Games Labour Market Intelligence Digest* . Accessible at http://www.skillset.org/uploads/pdf/asset_13239.pdf?3

Smith, R. (2002) 'Techmaps: A Tool for Understanding Social Capital for Technological Innovation at a Regional Level'. In: J. J. Chrisman, J. A. D. Holbrook & J. H. Chua (Eds.) *Innovation and Entrepreneurship in Western Canada: From Family Business to Multinationals.* (pp. 59-76) University of Calgary Press: Calgary, Alberta

Solvell, O. (2003) 'Cluster Initiative Cases'. In: O. L. Solvell, G. Lindqvist & C. Ketels (Eds.) *The Cluster Initiative Greenbook* (pp. 59-63). Stockholm: Ivory Tower AB.

Solvell, O., Lindqvist, G. & Ketels, C. (2003) *The Cluster Initiative Greenbook*. Stockholm: Ivory Tower AB.

Stake, R. E. (2005) Qualitative Case Studies, in: N. Denzin & Y. Lincoln, *Sage Handbook of Qualitative Research* (3rd ed.). London: Sage Publications Ltd.

The Sunday Herald (2007) 'Dundee triumphant in games industry BAFTAs', 28 October, p. 84.

Sunley, P., Pinch, S., Reimer, S. & Macmillen, J. (2008) 'Innovation in a creative production system: the case of design', *Journal of Economic Geography*, 8 pp. 675-698.

Teipen, C. (2008). Work and Employment in Creative Industries: The Video Games Industry in Germany, Sweden and Poland". *Economic and Industrial Democracy, Vol 29 (3)* , 309-335.

Telfer. D. (2010) 'Realtime chief Scottish director of the year', *Aberdeen Press and Journal,* 19 March, p. 18.

Ter Wal, A. L. J & Boschma, R. (2011), 'Co-evolution of firms, industries and networks in space', *Regional Studies,* 45(7) pp. 919-933.

The Times (2002) 'Rage says it faces collapse if cash call is flop', 28 May.

The Times Educational Supplement (2010) 'ICT Computer games – Play it forward', 14 May, p. 42.

Tolkein, J. R. R. (n.d.) *Think Exist*. Accessible at http://thinkexist.com/quotations/research/

Torney, C. (2003) 'Gamesfest', *The Express,* 12 August, p. 50.

Tschang, F. T. & Vang, J. (2008) 'Explaining the spatial organization of creative industries: the case of the US videogames industry', *DRUID, Paper presented at the 25th Celebration Conference 2008 on Entrepreneurship and innovation –*

*organizations, institutions, systems and regions,* Copenhagen, CBS, Denmark, June 17-20, 2008. Accessible at http://www2.druid.dk/conferences/viewpaper.php?id=3432&cf=29

Turok, I. (2003) 'Cities, Clusters and Creative Industries: The Case of Film and TV in Scotland', *European Planning Studies,* 11 (5), pp. 549-565.

Turok, I (1993) 'Inward investment and local linkages: how deeply embedded is Silicon Glen?', *Regional Studies,* 27, pp. 401-417.

Van der Kuyl, C. (2004) in C. Devine 'How the rules changed in game of high stakes', *The Glasgow Herald*, 21 February, p. 12.

Van Heur, B. (2009), 'The Clustering of Creative Networks: Between Myth and Reality', *Urban Studies,* 46 (8), pp. 1531-1552.

Whittet, M. (2000a) 'Creative industries' strategy launched', *The Glasgow Herald*, 25 August, p. 28.

Whittet, M. (2000b) 'Vis set to open Xbox File; Scots software developer joins Microsoft pack for assault on games market', *The Glasgow Herald*, 22 September, p. 27.

Willets, D. (2010) 'Science, Innovation and the Economy', *The Royal Institution, London*, 9th July 2010. Accessible at

http://www.bis.gov.uk/news/speeches/david-willetts-science-innovation-and-the-economy

Welter, F. (2010) 'Contextualizing Entrepreneurship – Conceptual Challenges and Ways Forward', *Entrepreneurship Theory and Practice,* January 2011, DOI: 10.111/j.1540-6520.2010.00427.x

Wenting (2008) 'Spinoff dynamics and the spatial formation of the fashion industry 1858-2005, *Journal of Economic Geography*, 8, pp. 593-614.

Wolfe, D. A., & Gertler, M. S. (2004) 'Clusters from the inside and out: Local Dynamics and Global Linkages', *Urban Studies* 41 (4/5), pp.1071-1093.

Xu, S. X. & McNaughton, R. B. (2006) 'High-technology cluster evolution: a network analysis of Canada's Technology Triangle', *International Journal of Entrepreneurship and Innovation Management ,* 6 (6), pp, 591-608.

Yin, R. K. (1981) 'The Case Study Crisis: Some Answers', *Administratve Science Quarterly,* 26 (1), pp. 58-65.

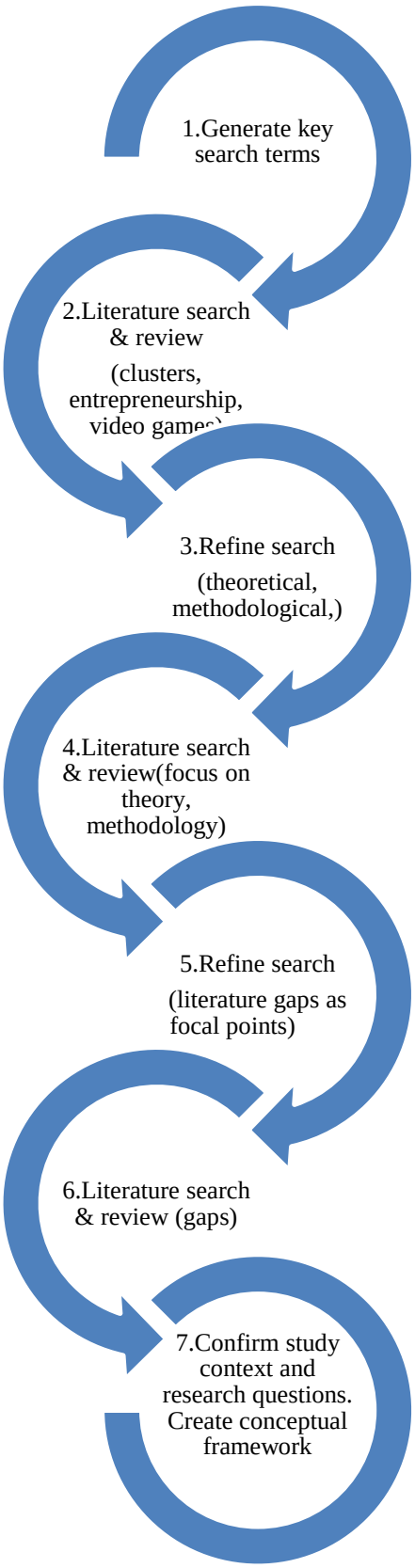
Yin, R. K. (2009) *Case study research: design and methods* (4th ed.), London: Sage Publications Ltd.

Young Company Finance (2008), *YCF Special Report Digital Entertainment in Scotland,* March 2008.

Zoltan, J. Acs., Braunerhjelm, P., Audretsch, D. B. & Carlsson, B. (2009) 'The knowledge spillover theory of entrepreneurship, *Small Business Economics*, 32, pp. 15-30.

# Appendices

## Appendix 1 – Literature review process



Prior to undertaking the literature review, key words and authors were identified. These included 'clusters', 'entrepreneurship', 'creative industries', 'computer and/or video games' and combinations thereof. These were the core themes. As the review progressed, further key words were identified that allowed a narrower focus on more relevant material. The term 'clusters' in particularly was problematic as a single search term and usually had to be accompanied by another term, for example 'industrial clusters', 'spatial clusters', "small business clusters" "regional clusters" as well as the use of specific industries plus cluster (e.g. biotechnology clusters). The review involved online and offline searches including the use of general academic resources such as Google Scholar[49] and EthOS[50] (Electronic Theses Online); general resources including standard search engines for web resources such as Google[51], search engines for specialist databases such as CompletePlanet[52], educational media such as YouTubeEDU[53] and Internet Archive[54] . The university library's resources were used via SUPrimo[55] as well as databases such as ISI Web of Knowledge, JSTOR, Emerald and Nexis UK among others. In addition, academic journals from different disciplines were reviewed together with research reports from the public and private sectors, books, newspaper, working papers, conference papers and industry publications.

[49]http://scholar.google.co.uk

[50]http://ethos.bl.uk
[51] http://www.google.co.uk
[52] http://completeplanet.com
[53]http://www.youtube.com/channels?s=ytedu_m
[54] http://www.archive.org
[55]http://suprimo.lib.strath.ac.uk

# Appendix 2 - Interview Guide – Non Founders

**Interview Guide – Non-Founders**

University of Strathclyde Glasgow

1. **Introduction**

   Project aims, confidentiality and interviewee rights

2. **Personal Background**

   - Current position
   - Involvement in the sector – type, rationale, timescale
   - Perception of the sector from investment point of view – key issues

3. **The Sector**

   - Sector origination
   - Sector development – key stages, events people
   - Status of the sector at the outset
   - Barriers/enablers?
   - Important organisations (academic, government, companies, people?) and why?
   - Current status
   - Future impact
   - Hindsight – what should have been done? By whom?

4. **The Entrepreneurs**

   - Generate names and companies – what them? Origins? Impact on sector?
   - Involvement with interviewee?
   - Role of entrepreneurship in the sector?
   - Role of policy in encouraging entrepreneurship

5. **Other**

   - What is needed to make this a credible study in terms of people/organisations that should be considered?
   - What should I know but haven't asked?
   - Questions

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# Appendix 3 - Interview Guide – Founders

**Interview Guide – Company Founders**

University of Strathclyde Glasgow

**1. Introduction**

Project aims, confidentiality and interviewee rights.

**2. Personal background (refer to secondary data for verification)**

- Birthplace and background to current location
- Education
- Employment/self employment history
- Family background (including self employment)
- Personal details

**3. Start-up**

- Year of establishment
- Company status
- Triggers and motivations
- Co-founder details
- Company activities and rationale– products, services, customers.
- Roles
- Funding sources
- Premises
- Location rationale
- External support/barriers.

**4. Company development**

- Role
- Company status
- Premises
- Location rationale
- Business activities
- Interaction in the sector
- Barriers and enablers
- Employees leaving to start-up - rationale, success, cooperation, support
- Changes with hindsight

*For interviewees that departed*
- Rationale, co-operation, support received, subsequent activities

*For interviewees that closed their businesses and/or departed*
- Trigger
- Impact on interviewee
- Learning

*For multiple start-ups, repeat 3 and 4 plus*
- What learning was applied to new business?

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**4. The Sector**

- Perception of the sector from interviewee's start-up until now.
- Key people and organisations that developed the sector.
- Impact of policy on (i) the sector and (ii) their company
- Enablers and barriers to sector development
- Key ways in which the cluster/sector has changed
- Strengths, weaknesses, future needs
- Hindsight – what should have been done?

**5. Other**

- What is needed to make this a credible study to the sector in terms of people/organisations that should be considered
- What should I know but haven't asked?
- Questions

# Appendix 4 – Information for Respondents

University of Strathclyde Glasgow

**Research Project**

*"The origination and development of the computer games sector in Scotland: The role of entrepreneurship"*

Thank you for agreeing to be interviewed as part of this research project. I really appreciate your input. This document provides confirmation about a range of issues related to the project and your participation within it.

## 1. Project overview

The research project is being undertaken as part of the Masters programme in Research Methodology in Business and Management (MRes) at the University of Strathclyde (www.mresearch.org). The project focuses on the emergence/development of the computer games sector in Scotland and the role of entrepreneurship within this. It is being supervised by Professor Colin Mason (Colin.Mason@strath.ac.uk) and Dr. Jason Cope (Jason.Cope@strath.ac.uk) at The Hunter Centre for Entrepreneurship, The University of Strathclyde (www.strath.ac.uk/huntercentre).

## 2. Data Collection and usage

The interview is of approximately 60 minutes duration. Notes are taken during this time and, if you agree, a recording is created.

The data that you provide will be used (i) to create a report that will fulfil the Dissertation element of the MRes programme which will be submitted in September 2010 and (ii) to develop articles for publication.

You will not be identified by name or organisation in any publications using data from the interview and your confidentiality will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and organisations. All of your data will be stored and used in accordance with Data Protection requirements.

The only person present at the interview, and who will have access to the notes will be Helen Mullen. This prevents any individual comments from having negative consequences.

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**3. Participation**

I appreciate your voluntary participation in this study and no payment is being made. Please know that if you feel uncomfortable about any elements of the research, you have the right to decline to answer. Should you at any time wish to withdraw and discontinue participation, this can occur at any time without having to give a reason and without consequence.

**4. Contact details**

If you have any questions or concerns during or after this study, or wish to contact an independent person to whom any questions may be directed, please contact myself or my supervisors as follows:

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**Thank you again for your time and input**

## Appendix 5 - Verification of cluster genealogy tree by respondents

This appendix contains a list of comments received from study respondents about the draft cluster genealogy tree. The comments were collected from September to end December 2010. Twenty eight of the forty respondents provided feedback about the genealogy trees. Fifteen respondents made additional comments over and above those specifically related to modifications required.

| Respondent | Comment |
|---|---|
| 26 | "Thanks Helen. Just had a chance to have a look at this and found it very interesting, thanks [...]. You've tracked a lot of people." |
| 27 | "Map looks good. Three main things needed are timeline, company start up info and the people that spun out." |
| 35 | "I've had a quick look over the master, Glasgow and Dundee documents. I can't see anything really out of place." |
| 16 | "Overall the maps (sic) pretty good." |
| 31 | "Wow... looks very comprehensive and well thought out." |
| 5 | "I have to say you pretty much have the whole picture here. Only a few very minor comments I can add." |
| 38 | "[...] wow those maps get big, what a lot of companies to consider." |
| 18 | "These look really good". |
| 40 | "I did have a look at the maps and nothing glared out about the info you've collated. Unless you're going to get down to the migration of more individuals I don't think it looks wrong." |
| 12 | "Looks good Helen." |
| 13 | "Thanks for this - quite an impressive outcome! I had a quick look and I think you've captured everyone." |
| 21 | **"**I have had a look. I am not sure I can add to what looks like a comprehensive list." |
| 17 | "I have looked at the maps and they looked pretty good, I am not sure I followed the splintering of the companies properly as you had some connected at the root of the graph that I know sprung out of other companies, but I am not sure what criteria you used to decide on when a company spawned from another or whether it started on its own (was it only company collapse and then enforced start-ups, or someone leaving of their own accord and then starting up)." |
| 39 | "I think this is a really ambitious and fascinating project. It is obviously a challenge to present in a way in which you can display the big picture. As for the details, I don't see any alternate to publicizing it (either publicly or privately) and invite corrections." |
| 28 | **"**That all looks fine to me. Everything that is in my part of the tree looks correct." |

## Appendix 6 – Characteristics of UK game players

- 38.2% of the UK population is an active computer gamer.
- 51.2% of British men and 25.1% of British women aged 10-35 play games regularly
- The average computer gamer has been playing for over 10 years, with younger players having spent proportionately more of their lives with interactive entertainment.
- On average, gamers play for 12.6 hours per week.
- UK female players spend more on games than any other demographic in Western Europe (except UK males).
- 27.2% of all active gamers in the UK are women
- The average computer gamer has been playing for over 10 years, with younger players having spent proportionately more of their lives with interactive entertainment.
- The average age of the UK female gamer is 30-35 years old.
- More people play more games in the UK than anywhere else in Europe.
- UK gamers spend more than their European counterparts.

Source: ELSPA (2009a)

## Appendix 7 - Classification of video and computer games

| | |
|---|---|
| Action Adventure | Player controls a character with puzzle-solving and/or combat tasks, eg Tomb Raider. |
| Adventure | Players are assigned roles and the game is based on puzzle-solving, eg Monkey Island, Broken Sword. |
| Handheld | Mobile gaming consoles, eg Game Boy. |
| MMO | Massively Multiplayer Online gaming, where up to thousands of players from all over the world can join in the same game via the internet and play each other. |
| Platform/Platformer | Revolves around players jumping from platform to platform, e.g. Donkey Kong. |
| Puzzle | Easy to play, usually available on handheld consoles or via internet browsers, e.g. Tetris, Bejewelled, Zoo Keeper. |
| RPG | Role Playing Game involving turn-based combat. |
| Racer | A driving game involving completing courses in a given time or against other competitors, e.g. Burnout, Gran Turismo. |
| Rhythm-Dance | Player moves in time with game/music, e.g. Dance Dance Revolution. |
| Shoot 'em Up | Gameplay revolves around shooting objects, e.g. Space Invaders, Galaxian, Defender. |
| Sim | Simulations of real activities, e.g. fight sims, SimCity, The Sims |
| Sports | Simulation of sport, e.g. FIFA, Pro Evolution Soccer. |
| Strategy | Evolving from strategic board game principles, the players take turns to make their manoeuvres, e.g. Command & Conquer, Total War. |
| Survival Horror | An adventure game, nearly always presented in the third person, with emphasis on surviving a horror film cliché such as a haunted house (Alone In The Dark). |

Source: ELSPA (2009b)

## Appendix 8 - Cluster genealogy tree