Paper presented at "Beyond Clusters Beyond clusters: current practices & future strategies" held in Ballarat on June 30- July 1, 2005 University of Ballarat.

Mapping Industry Clusters in the Digital Economy – Using Cluster Analysis to Identify Emerging Industries.

Tim Mazzarol
Centre for Entrepreneurial Management & Innovation (CEMI)
Graduate School of Management
University of Western Australia
35 Stirling Highway
Crawley WA 6009
Tel: 618 6488-3981
Fax:618 6488-1072
Email: mazzarol@gsm.uwa.edu.au

Raphe Patmore
Managing Director
Modus Operandi Media Pty Ltd
34/184 Rokeby Road
Subiaco WA 6008
Tel: 618 9382-1755
Fax:618 9382-1766
Email: raphe@modusoperandi.com.au

Natasha van Heemst
Centre for Entrepreneurial Management & Innovation (CEMI)
Graduate School of Management
University of Western Australia
35 Stirling Highway
Crawley WA 6009
Tel: 618 6488-7916
Fax:618 6488-1072
Email: nvanheem@graduate.uwa.edu.au

Tim Mazzarol is Director of CEMI and an Associate Professor at the UWA GSM where he teaches entrepreneurship, innovation and strategic networking within industries within the MBA program. Raphe Patmore is the founder and Managing Director of Modus Operandi Media Pty Ltd, a producer of interactive multimedia marketing tools. Natasha van Heemst holds an MBA from UWA and has a background in agricultural economics and modelling. She is a Research Fellow with CEMI.

Mapping Industry Clusters in the Digital Economy – Using Cluster Analysis to Identify Emerging Industries.

This paper examines the methodology employed in a project undertaken in Western Australia to identify and map the existence of industry clusters within the creative digital industries. Utilising a standard industry concentration and location quotient technique, the study team identified above average industry and employment concentrations in 59 selected industries considered to have high levels of digital content intensity. The study found industry and employment concentrations in seven key areas: i) spatial sciences; ii) engineering; iii) construction; iv) education and training; v) creative; vi) media and vii) medical science. These were then grouped into two potential industry clusters. The first focused on the Digital Spatial Industries and the second on the Digital Creative Industries. Analysis of longitudinal data sets found emerging and established industry segments within these two clusters and case study and survey findings identified issues facing businesses within these sectors. These findings point to the need for cluster development to be based on both statistical foundations from established employment and industry data sets, and an in-depth assessment of the activities at the business unit level gathered through survey and case studies.

Defining and Measuring Industrial Clusters

Clusters are groups of interrelated companies and associated institutions (e.g. industry associations, universities) that cooperate and compete to drive wealth creation within a defined geographic area (Porter, 2000). Generally, the geographic boundaries that define a cluster are of little significance, what is important is the nature of the interaction between companies and how this facilitates additional competitive advantage. Focusing on industry clusters rather than the individual industries or firms is preferred because it provides a richer more realistic description of the reality of industrial competition and the creation of competitive advantage.

Defining an industry cluster is difficult because part of the definition relies on available data and methodological constraints. Rosenfeld (1997) noted that *"there are as many definitions (of clusters) as there are types of organisations using the term"*. Numerous agencies have made use of cluster analysis to address the needs of academic or public policy research, with many different definitions used. Few definitions of clusters, although useful, fully explain how clusters actually work or how the firms within them interact to generate the necessary synergies that make clusters so dynamic (Rosenfeld, 1997).

The measurement and analysis of clusters using employment and industry concentrations have become well recognised (Baptista, 1998). However, this methodology does not answer all the questions relating to the dynamic nature of clusters. What also needs to be measured are factors such as the flow of information, innovation, skills and people, as well as the social factors affecting trust and openness between company owners. According to Doeringer and Terkla (1995):

> "Although inter-industry transactions incorporated within production channels can sometimes be detected in input-output tables, neither the character of relationships among firms nor the benefits of clustering can be discerned in this way."

It is the contention of this paper that a more holistic approach is required to the measurement of clusters; one that encompasses both the macro employment and industry concentration data from industrial economics, and the micro-level examination of what takes place at the firm level. To achieve this additional methodologies are required that draw from the strategic network theory of the firm.

Cluster Theory – A Brief Overview

The theoretical framework for industrial clustering evolved in the 1970s with the identification of what was described as the "Third Italy", whereby small to medium sized firms collaborated to create enhanced employment and economic growth despite the decline of other, usually larger companies (Isaksen, 1996). Such firms not only expanded their export behaviour, but strengthened their competitive advantage and innovation levels through such collaboration (Rosenfeld, 1997). Porter's (1990) examination of how some regions secured a competitive advantage despite their comparative disadvantages in

natural resources served to highlight role of industry clustering as a source of industry enhancement.

Porter (1990) recognised the need to examine four elements of what has been referred to as the "Diamond Model". These elements include: i) firm strategy, structure and rivalry (e.g. industry concentration and competitiveness); ii) factor conditions (e.g. land, labour and capital); iii) demand conditions (e.g. size and accessibility of markets); and iv) related and supporting industries (e.g. financial, educational and research sectors). Also considered were the indirect influences of both government policy and historical chance. Drawing from industrial economic theory, this framework recognises the formation and growth of industry clusters as being driven by the transfer of goods and services between industry participants, and also the nature of relationships between such firms. Of importance is the quality of "buyer-supplier relationships" and "competitor and collaborator relationships" which are viewed as essential for cluster growth and development (Anderson, 1994).

In addition to the importance of industry supply chain relationships, cluster theory has seen recognition of the role of human capital and the positive benefit it has when enhanced via education and then concentrated within a region (Lucas, 1988). Glaeser (1998) identified the concentration of human capital (i.e. *highly educated people*) as important in cluster development as "*places with higher levels of human capital are more innovative and grow more rapidly and robustly over time"* (Gertler, Florida, Gates & Vinodrai, 2002). The recognition that the nature of human capital is important was extended by Florida (2000) who emphasised the importance of creative human capital in cluster formation and growth. The capacity of a particular geographic region to attract and retain talented, creative people able foster a culture of intellectual diversity was recognised as a key to encouraging innovation and wealth creation (Florida, 2002). The rejuvenation of many otherwise economically stagnant urban regions has also been attributed to the concentration of intellectual talent and creativity producing "learning cities" (Larsen, 1999).

Custer Studies and Methodologies

Despite the high level of interest in clusters there remains a body of opinion that industry clusters have been in existence for centuries and occur whenever agglomerations of industries are found, and that such clusters may not offer any intrinsic innovation (Enright, 1996). A major challenge in developing industry policies using cluster analysis methodologies is the difficulties of establishing clear definitions and agreed measures for mapping and analysis. Government interest in cluster research and analysis has been driven by the anticipation that such studies can provide guidance to policy makers seeking to enhance the economic development of regions. However, while such analysis can provide valuable insights into the factors influencing regional economic growth and change, caution needs to be taken to avoid using cluster studies as a means of "picking winners" (Porter, 2000).

Cluster analysis can be useful for mapping industry landscapes to reveal what already exists within a given region, or to determine if a given region appears to have suitable underlying potential to support certain types of cluster. These studies are often used to either encourage industry and regional economic growth by promoting synergies between existing firms or industries, and those seeking to facilitate the growth of new industries (Fesser & Bergman, 2000). Studies can either be micro-level cluster applications (e.g. targeting single industries or specific firms and their supply chain networks), or "meso-level" cluster applications (e.g. examining regional industries by sector) (Fesser & Bergman, 2000). Micro level studies tend to employ methodologies that are labour intensive such as face-to-face interviews and focus groups. These techniques yield a rich level of data at the industry or firm level, but are expensive and time consuming. However, the micro level analysis is appropriate when researchers are seeking to study a tightly defined and specific industry looking for evidence of clustering behaviour. By comparison, the meso-level analysis provides a more complete picture of entire industries and is more likely to make use of secondary source statistical data such as employment or industry concentration tables.

While micro-level analysis techniques offer rich data and an opportunity to find out directly from actors within the region's industries what is being experienced, they suffer from problems of external validity as the findings may not be representative of all regions or even other industries found within the same region. By comparison, meso-level analysis, while often able to provide useful benchmarking, is limited by problems with comparability of data. For example, the standard industry classification index (ANZSIC) forms a useful benchmark for comparison of regional employment and industry concentrations. However, this data is focused on industry sectors not industry clusters that tend to overlap standard sectoral boundaries. Furthermore, these SIC codes are often of limited use when seeking to measure new industries that are not well classified by the established industry schema.

The field of industry cluster analysis has emerged as something of a hybrid discipline, with contributions from economics, geography and management studies to name only three (Baptisa, 1998). An examination of the current cluster measurement approaches suggests that there appears to be no standardised approach to cluster analysis, and only a few generally accepted procedures. As Fesser and Bergman (2000) point out:

> "The analysis of industry clusters has become a popular focus in local and regional development practice. Such analyses are accumulating in many journals and for many regions, but their findings are typically so uniquely derived and depicted that little can be usefully generalised about the structure of key industrial clusters."

Use of location quotients identifying employment and industry concentrations or similar concentrations of human capital (e.g. talent, creativity and diversity indices) provides only a partial picture explaining the dynamics of clusters. Also required are micro-level analysis techniques designed to drill down to the firm level and explore the value chain relationships and strategic networks that provide the basis for understanding the full dynamics of industry cluster behaviour.

Mapping the Digital Economy - Definitions

In 2004 the authors were tasked to undertake an industry cluster study designed to determine the prospects for the development of the digital content industries in Western Australia (Mazzarol, Patmore, van Heemst, Wong & Adam, 2004). Funded by the Government of Western Australia, the primary objective of this study was to:

> "Identify opportunities for enabling the formation of a Digital Content Industry cluster in Western Australia. The focus of the industry development and skills development needs necessary for such an industry to be viable."

A major initial challenge for the study team was to develop a workable definition of the "Digital Content Industry". Like many newly emerging industries digital content is poorly defined and has not yet generated any universal agreement in relation to its exact boundaries or structure. Digital technologies, particularly those involving information and communications technologies (ICT), have developed at such rapid pace in the past three decades that they have spawned entirely new industry sectors. Furthermore, digital applications have forced a convergence of existing industry activities that were once conducted as separate and discrete sectors (Baldwin, 2004). This has served to blur the boundaries of the established industry classifications making mapping difficult.

Most definitions of the digital economy are very broad, encompassing almost all areas that make use of digital information and technology. However, as the spread of digital technologies widens to encompass an ever increasing number of industry sectors, such definitions become of limited value. Most relevant studies of the digital content industry focused attention on isolating out the creative industries engaged in the production of original digital content (e.g. computer gaming, multimedia, digital film) (Cutler, 2002; NOIE, 2002).

The Australian Federal Government's *Digital Content Industry Action Agenda* provided the following definition of the broader creative Industries that complement the digital content industry. This definition is as follows:

> "The broader Creative Industries have been defined as 'those industries which have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property', *(UK Creative Industries Taskforce*, 199*8).*

> Digital content production includes an extremely wide range of industry sectors, such as interactive multimedia, digital film and television production and post-production, interactive and digital television, digital video arts production, computer and online games, design and advertising, educational content production, digital publishing, digital and online music, and digital applications."

The above definitions of the creative industry are fairly universal, but need to be qualified in the context of the digital content sector. To resolve this problem with finding an adequate definition for the digital content industry a distinction was drawn between digital content and digital applications and services. While digital ICT networks and

systems can carry a wide range of applications and be employed within a wide range of industries such applications and services are not integral to these sectors and tend to play and enabling or facilitative function whatever their relative importance (Pattinson, 2003). Of key importance to the definition of creative digital content were those industry sectors where there was an identifiable intersection of the three key areas of telecommunications, information technology and information content (OECD, 1999). A particular focus was placed on those sectors that contained digital content originators who held some or all of the intellectual property (IP) rights to the material they generated.

Our definition of the creative digital content industry was digital content production that involves the creation of intellectual property and is generally economically disruptive, creating threats and opportunities. This definition provided a broad framework for a study of creative digital content clusters that avoided some of the issues previously discussed. In particular the definition was useful in that it did not exclude industries that fell outside traditional descriptions of what constitute creative industries, nor did it exclude communities of practice where participants are difficult to identify as belonging to a particular industry (Wenger, et.al. 2002). For the purposes of this study the digital content industry as it applied to Western Australia was defined as follows:

> "The digital content industry which is of strategic importance within Western Australia can be defined as those activities that generate digitally storable and transferable content in which the intellectual property ownership remains primarily in the state and which use creative and/or technical skills to produce commercially valuable products or services."

This definition was used because it recognised that attention needs to be given to those industry actors and activities that are strategically important to the growth and development of the local digital content sector. Further, the definition highlighted the importance of locally generated and owned IP as a key ingredient in the future of the sector. The definition did not suggest that all the IP should be retained locally, but if the WA digital content industry was not able to control the IP or secure its value, the longer term growth prospects of the sector were likely to be doubtful.

Methodology

As noted earlier in this paper the methodologies used for identifying and facilitating industry clusters are still evolving and can adopt a wide range of techniques. The methodology used in this study comprised several phases that involved both meso-level analysis using employment and industry concentrations based on ANZSIC codes, and micro-level analysis using case studies from personal interviews.

During the first phase of the project, employment and business concentrations or "location quotients" within the WA Digital Content sector were determined by using ABS for employment statistics and Telstra Sensis data for business statistics. Initial industry categories were selected from those used by the NOIE (2002) study of the Australian digital content cluster analysis. From within the 2,600 Level 5 industry categories within the Sensis database and 400 ANZSIC Level 4 categories used by the

ABS a list of 59 industry sectors were selected. These were chosen for their potential to be engaged in the digital content industry according to the definition employed.

Having selected these potential industry categories a telephone survey was conducted with a sample of 216 businesses drawn from within these industry segments. This survey was conducted with senior managers from each firm and explored their involvement in the digital content industry, how many years the firm had been in the industry and aspects of their production of digital content, plus size and nature of operations. Using the data gathered from the survey and the data on industry and employment concentrations, it was possible to identify potential cluster groupings based on conventional supply chain interactions. Sensis business statistics also offered an indication of growth of these industries with data tracking from 1999 to 2003.

Following the completion of this meso-level data analysis the study moved onto micro-level analysis via the preparation of a series of 10 case studies of 'focal' firms within those industry sub-sectors identified at the meso-level to be of potential interest. Case study methodology allows investigation of research issues that cannot be appropriately studied using solely quantitative methods (Yin, 1989). It is particularly useful in seeking to undertake investigations that require an in-depth understanding of behaviour that is common when studying small business entrepreneurs (Chetty, 1996). The case studies were examined against a framework of strategic networking theory mapping their production network or supply chain relationships (e.g. customers and suppliers), as well as their links to resource network actors (e.g. financial institutions, universities and colleges), and also the social networks of their key managers and owners (Holmlund & Tornroos, 1997). A key part of this analysis was the preparation of strategic network diagrams illustrating their production, resource and social networks, indicating both the strength and nature of these relationships.

During the final phase of the project the research team took the findings generated from the first four phases and staged a series of industry and stakeholder workshops designed to draw together representatives from the key industry clusters identified to that stage of the study. A total of four workshops were held, attracting representatives from a wide cross-section of industry sectors found within the digital content industry of the State. These workshops provided the research team with valuable market intelligence from which to design and develop future cluster enhancement strategies and make subsequent recommendations.

Findings

The majority (92%) of digital businesses in WA are concentrated in the Perth metropolitan area, with 82 percent of employment in the digital sector also located in the city. An examination of industry concentrations and industry growth rates over the past three years identified a cluster of high growth, high concentration industries, a second cluster of potential emerging industries and a third cluster of industries requiring attention.

Table 1: Business Growth and Concentrations in the Digital Content Industries

GROWTH:*	LOW	HIGH
CONCENTRATIONS:** HIGH	• Design engineers • Electrical engineers	• mining engineers • surveyors • cartographers • naval architects • marine engineers
LOW	• photography & video schools • music publishers • film & TV schools • Data processing	• Combustion engineers • Designers • Planners • Newspapers • Book Publishers • Cartoonists • Writers • Commercial artists • Media information services

* High Growth = those industries with annual average growth > 1
** High concentrations = those industries with location quotients > 1

Table 1 shows the findings from this analysis listing those key industry sectors in each category of interest to the study. A high or low industry or employment concentration is reflective of a location quotient. To derive employment and business concentration ratios for an industry, the percentage of regional employment/business in an industry is divided by the percentage of city, state or national employment/business in that same industry. A concentration ratio that is greater than 1 is evidence of an industry or employment concentration within a specific sector that may be important in the formation of a cluster. The calculation for employment concentrations within industry classifications in relation to Perth is shown below:

$$\frac{\textit{(Perth industry employment/Total Perth employment)}}{\textit{(National industry employment/Total National employment)}}$$

High or low growth industries are those that have experienced an annual average growth rate of greater than 1 over the time period, which in this case was 5 years of trend data for specified industry sectors.

The high growth, high concentration sectors reflect the nature of Western Australia's core industries, which are based on mining and resources, property development and construction, and shipbuilding. Each of these sectors makes use of digital content to generate 2-dimensional and 3-dimensional models and related software programs used in design and construction or spatial science applications. By contrast the high growth, low concentration sectors reflect a range of creative industries that comprise digital content

focusing more on multimedia, graphics and design. These are potential emerging industries within the state.

Two broad communities were identified from this analysis. The first was the creative artistic or Creative (A) community, and the second was the creative technical or Creative (T) community. Most of the Creative (T) industries were located within the high growth high concentration sectors, reflecting their strong footprint in the resource rich WA economy. Most of the Creative (A) industries were located in the high growth, low concentration sectors, suggesting that they may be potential emerging industries.

Of the 216 firms surveyed from within the 59 selected industry sectors the majority (92%) confirmed that they considered their firm was actively engaged in the digital content industry, and 61 percent reported that they were generating such content in-house. Seventy-six percent said that they were aware of examples within their industry in which product would be produced in a purely digital form. The majority of respondents (64%) indicated that they would expect to be moving more into digital content generation in the future. The majority of firms (92%) expressed satisfaction with the skills of their existing workforce. The level of digital intensity of these firms was also examined.

Drawing together the industry and employment concentration data with the findings of this survey a series of seven industry concentrations were identified as comprising the general landscape of the WA digital content industry. These were:

1. Spatial industries (e.g. surveying, map making and satellite imaging)
2. Engineering industries (e.g. mining, electrical, electronic, computer)
3. Construction industries (e.g. architects, civil engineers, structural engineers)
4. Medical and scientific (e.g. medical imaging and virtual reality training)
5. Creative industries (e.g. graphic design, multimedia, film & TV, advertising)
6. Media industries (e.g. newspapers, TV, libraries)
7. Education and Training (e.g. universities and VET colleges)

These seven industry concentrations are illustrated in Figure 1 which shows their relative employment and business concentration ratios as well as the level of digital intensity (shown by size). Two potential clusters were identified comprising a Spatial Industries Cluster that draws together the spatial, engineering, construction and medical scientific sectors, and a Digital Creative Industries Cluster comprising the creative and media sectors. The education and training sector is supportive of both clusters.

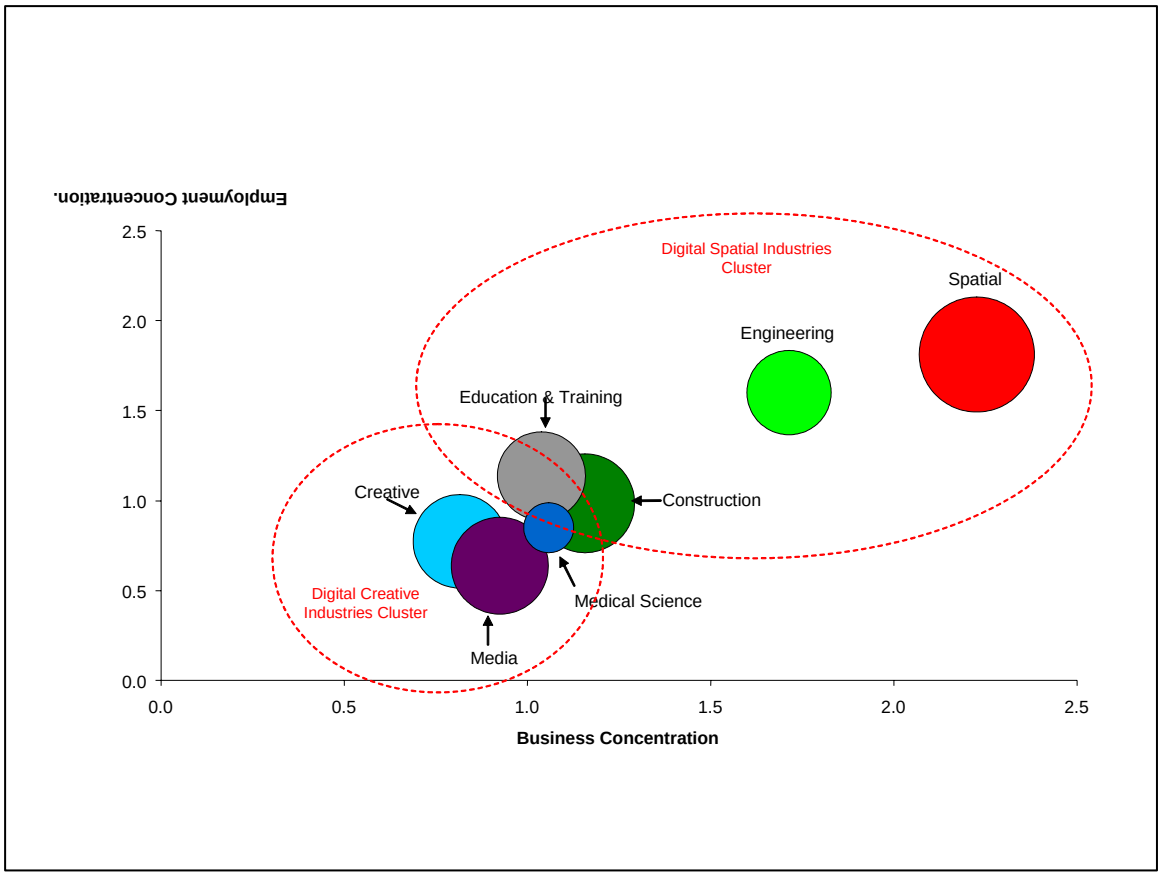

Figure 1: Business & Employment Concentrations in the WA Digital Content Sector

The 10 case studies undertaken for the project highlighted the strong dependency of the spatial industries cluster to the mining and resources sector, and the key role of the WA Government through its Department of Land Information in controlling digital spatial data. Within the digital creative industries cluster these cases highlighted the lack of local market access for WA firms, as well as a shortage of investment capital for these industries. Most of these firms were very small and operated more via communities of practice than conventional industry supply chains. The need for enhanced industry support schemes targeting management skills development, incubators, marketing and investment attraction were identified from these cases and the industry workshops that followed them.

Discussion & Conclusions

This study illustrates the benefits of utilising a range of methodologies when seeking to undertake cluster mapping projects. The combination of meso-level and micro-level analysis techniques provided a more comprehensive picture than would have been the case with only the former or latter. Using employment and business concentration ratio data to help locate potential points of cluster formation is a well-recognised approach to cluster analysis. However, as this study found, such data analysis is limited by the amount of industry data that can be accessed, the aging of some of this data (e.g. census data capture is only every 5 years), and the limitations of the ANZSIC codes. With new

emerging industry sectors such as found in digital content producers, ANZSIC codes do not adequate map what have become highly convergent industry sectors. Business data based on registered firms and ANZSIC coding also overlooks the more informal grouping of communities of practice. An example of this was the group PORT-80, a collective of creative digital content originators based largely in WA who communicate mainly via the Internet and occasional meetings at hotels. This group is an important community of practice linking creative talents and stimulating innovation within the sector. However, it has no profile within formal employment or business statistical databases and would be missed with meso-level data analysis alone.

Use of micro-level data analysis techniques such as telephone surveys of firms within the targeted sectors, case studies from interview and industry workshops and focus groups, provides an opportunity to balance some of the limitations of meso-level data analysis. It also offers a powerful learning opportunity with new information emerging about how innovation takes place at the individual firm level. Such analysis allows better targeting of industry support initiatives by policy makers as it has identified specific problems facing the industries that are likely to form potential clusters. Despite these advantages micro-level data analysis is time consuming and expensive to undertake and continues to suffer from issues of external validity.

Future research should focus on development of mapping techniques that allow reliable measures of the business and employment landscape, the human capital landscape and the firm-level environment. Quantitative measurement of business, employment and human capital concentrations is already possible, additional measures are required to provide similar measures for firm-level strategic networking.

References

Anderson, G. (1994). "Industry Clustering for Economic Development." *Economic Development Review* **12**(2): 26-32.

Baldwin. R. MP et al, (2004), *From Reel to Unreal: Future Opportunities for Australia's Film, Animation, Special Effects and Electronic Games Industries*, House of Representatives Standing Committee on Communications, Information Technology and the Arts June. Commonwealth of Australia, Canberra.

Baptista, R. (1998). "Clusters, Innovation, and Growth: A Survey of the Literature". *The Dynamics of Industrial Clustering: International Comparisons in Computing and Biotechnology*. P. Swann, Prevezer, M., and Stout, D. Oxford, Oxford University Press**:** 13-51.

Chetty, S. (1996). "The Case Study Method for Research in Small and Medium-Sized Firms." *International Small Business Journal* **15**(1): 73-85.

Cutler & Co, (2002) *"Producing Digital Content - A Consultancy To Examine And Advance The Understanding Of The Production Of Digital Content"* Cutler & Company – Melbourne, Australia.

Doeringer, P. and Terkla, D. (1995) "Business Strategy and Cross-Industry Clusters", *Economic Development Quarterly*, **9**(3): 225-237.

Enright, M. J. (1996). Regional Clusters and Economic Development: A Research Agenda. *Business Networks: Prospects for Regional Development*. Stabler (eds). Berlin, Walter de Gruyter.

Fesser, E. J., and Bergman, E.M. (2000). "National Industry Cluster Templates: A Framework for Applied Regional Cluster Analysis." *Regional Studies* **34**(1).

Florida, R. (2000). "The Economic Geography of Talent." *Annals of the Association of Geographers* **94**(2): 734-755.

Florida, R. (2002). *The Rise of the Creative Class: An how its transforming work, leisure, community and everyday life*. New York, Basic Books.

Gertler, M. S., Florida, R., Gates, G., and Vinodrai, T. (2002). *Competiting on Creativity: Placing Ontario's Cities in North American Context*. Institute for Competitiveness and Prosperity, Ontario Ministry of Enterprise.

Glaeser, E. L. (1998). "Are Cities Dying?" *The Journal of Economic Perspectives* **12**(2): 139-160.

Holmlund, M., and Tornroos, J-A. (1997). "What Are Relationships in Business Networks?" *Management Decision* **35**(4): 304-309.

Isaksen, A. (1996). Regional Clusters and Competitiveness: The Norwegian Case. Oslo, Norway, STEP Group: Studies in Technology, Innovation and Economic Policy**:** R-16 pp.25.

Larsen, K. (1999). "Learning Cities: The new recipe in regional development." *OECD Observer* **Summer**(217/218): 73-76.

Lucas, R. (1988) “On the mechanics of economic development”, *Journal of Monetary Economics,* **22**(3):1.-42.

Mazzarol, T., Patmore, R., van Heemst, N., Wong, J., and Adam, D. (2004). *Digital Communities: A Study to Determine the Feasibility of Creating a Digital Content Industry Cluster in Western Australia*. Perth, Centre for Entrepreneurial Management and Innovation, Graduate School of Management, UWA.

NOIE (2002) *Creative Industries Cluster Study: Stage One Report*, National Office of the Information Economy, Department of Communications, Information Technology and the Arts, Canberra.

OECD (1999), *Working Party on Indicators for the Information Society, “Defining the Content Sector: A Discussion Paper*. April, Organisation of Economic Co-operation and Development, European Union, Eurostat.

Pattinson. R. , (2003), *The Measurement of Creative Digital ContentA Study to Assess User Requirements for Creative Digital Content Statistics and a Possible Collection Strategy to Address Them”* - A Report for the Department of Communications, Information Technology and the Arts, Commonwealth of Australia, Canberra.

Porter, M. E. (1990). *The Competitive Advantage of Nations*. New York, MacMillan Press.

Porter, M. E. (2000). "Location, competition, and economic development: Local clusters in a global economy." *Economic Development Quarterly* **14**(1): 15-34.

Porter, M. E. (2000). "Location, competition, and economic development: Local clusters in a global economy." *Economic Development Quarterly* **14**(1): 15-34.

Rosenfeld, S. (1997). "Bringing Business Clusters into the Mainstream of Economic Development." *European Planning Studies* **5**(1): 3-21.

Wenger E, McDermott. R, Snyder W, (2002), *Cultivating Communities of Practice* Harvard Business School Press, Boston Mass USA

Yin, R. K. (1989). *Case Study Research: Design and Methods*. London, Sage Publications.