Digital Knowledge Exploitation: ICT, Memory Institutions and Innovation from Cultural Assets

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ABSTRACT. There has been considerable recognition of the regional embeddedness of the knowledge-based economy and its uneven geographical incidence, with mainly urban or metropolitan areas being the crucibles of knowledge-intensive activities. Drawing from recent research conducted analysing cultural industries, the paper explores how the knowledge-based economy can be built upon, focussing on the value afforded by regional cultural diversity which offers a means of economic development and growth to peripheral regions.

Key words: regions, innovation, media, culture, creativity, institutions.

JEL Classification: L63, L82, M20, O10, O30

1. Introduction

It has been widely acknowledged that a process of structural transformation has been occurring with increasing rapidity in modern society and it is accepted that we have entered the knowledge economy.[1] Signs of the emerging knowledge economy are apparent in the increasing reliance on intangible and symbolic goods and the declining importance of traditional boundaries identified by business functions, industries and nations. Researchers have increasingly sought to understand and give a fuller recognition of the role that knowledge plays in economic development. Knowledge has been, and continues to be, a core foundation of the economic process and it is becoming the defining characteristic of economic activities (Castells, 1996; Neef, 1998). The knowledge economy refers to specific assets that consist of knowledge "how to", "who to" and "what to" deploy to create value. It is an active economic practice rather than a passive information space, upon which it nevertheless depends, but in ways that express value through the scarcity of "knowledgeable" expertise.

The challenge in the knowledge economy becomes the combination and integration of the knowledge assets held by individuals and "*communities of practice*" (Wenger, 1998) and a more "*reflexive relationship*" between the knowledge held by customers and employees (Nonaka and Teece, 2001). A response to this is the enhanced quest for knowledge management practice within organisations (Takeuchi, 1998; McAdam and McCreedy, 1999; Swan *et al.*, 1999). The pervasiveness of such structural changes has involved many *low-tech* sectors. Industries such as food production, machinery, printing and publishing, wood products and a range of services are intensively making use of scientific knowledge and their production systems are based on knowledge distributed across agents, institutions and knowledge fields. All industries in the economy can be knowledge intensive and, according to Cooke (2002), all economies are, in a sense, knowledge economies.

The knowledge economy does not rely solely on a few technology industries for growth and wealth production. Rather all industries in the economy can be knowledge intensive users if not producers. Knowledge economies are increasingly characterised by exploitation of knowledge in order to innovate. This is certainly the case in analysing the digital value chain (Williams, 2000), which emphasises the importance of the digitisation of knowledge and its incorporation as a resource in the value chain. The outcome of the digital value chain relies on the Digital Economy (DE) (Tapscott *et al.*, 1998; Brynjolfsson and Kahin, 2000), seen as an aspect of and electronic underpinning to knowledge economies.

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The cultural industries are one of the most affected sectors by the pervasiveness of the knowledge economy. Drawing from the results of two recent research projects, the paper illustrates how a more fundamental change of the cultural industries transformation relates to the dynamic of knowledge exploration and exploitation within the local and global digital value chain and the potential offered by digital resources exploitation in re-engaging peripheral regions, exploring and respecting regional diversity.

The paper argues that the growth of a knowledge economy creates great opportunities and, at the same time, poses great challenges for European localities, but particularly for those that are peripheral regions and those that are "lagging behind." Such lesser "knowledge economy" regions are often remote, insular, rural, agricultural and endowed of beautiful and touristic resources. "Traditional" sectoral activities, such as tourism, have been revitalised and reshaped in the knowledge economy. Innovation and new technologies can be seen as a mechanism for cities and regions characterised by traditional sectoral activities to enter the knowledge economy and to develop more knowledge-intensive activities. One of the first challenges that peripheral regions are facing for entering a knowledge economy is the development of a coherent strategy building more on their regional distinctiveness. It can be argued that, as this paper shows, the knowledge economy can be built focussing upon the value afforded by cultural assets in developing content for the emerging media activities that link with convergence.

Drawing from an analysis of the cultural industries in Wales, the paper aims to investigate how innovation can improve the competitiveness of memory institutions and media firms, analysing their ability to contribute towards regional development and to promote endogenous economic development in an increasingly globalised economy. As we shall see, organisations involved in such process are facing barriers and constraints that are hindering the development of a regional digital value chain (DVC). The paper starts with a description of the digital value chain concept and its importance in regional development. The paper then provides an account of the key actors responsible for DVC development and the barriers that are limiting its achievement. The paper concludes with an account of the progress being made in Wales.

2. Content production, cultural assets and innovation

The DE transforms raw materials into digital products, which can serve as the basis for developing new services; that is a form of knowledge exploitation. The digitisation of knowledge, meaning its transformation from analogue, real-world images, voice or text into digitised form on-line, on a CD-ROM or floppy disk means that the initial form of knowledge becomes a resource in the value chain. Such product will be compressed and stored waiting for the knowledge-bearing users to access those elements in the digitised resource that they aim to transform into a new product. This could be an e-learning training course, a television programme or a cultural product, combining in an imaginative and creative way archive materials into internet or off-line content.

The output of the digitisation process is content production. This, according to Enkenberg *et al.* (2002), can be defined as "the creation – for traditional and electronic media – of documentary, cultural, educational services; entertainment and marketing or communication-related programmes, and related business activities." It necessitates co-operation with cultural industries, software and hardware producers, publishers, tele-operators, and TV broadcasting companies, incorporating activities such as tourism, financing and commerce. The DE, therefore, is not just the provision of content for convergent media. The digital value chain can contribute to the creation of new systems based entirely upon the use of ICTs. These will range from the fields of e-learning, e-commerce and service provision to activities that pursue community development as a virtual interactive process.

Digital developments involve the merging of a number of diverse economic activities, from broadcasting through software development to design and advertising. The DE will grow around content provision within a new conception of publishing and broadcasting. Digitisation has created a new market triggering the demand for electronic products and services and one of the most striking effects of such a process is that this has

increased the demand for content. Content can be created out of a range of different resources and cultural assets can feed such need. One of the advantages, which Europe has within the global economy, is a rich vein of cultural diversity, which can serve as the basis for a leading content production-based economy. Cultural production could be seen as a full partner with scientific research and technology development in forging a knowledge-based economy. Regional natural resources can be seen as knowledge, which constitutes both economic and cultural capital (Graham, 2002) and, according to Florida *et al*. (2000, 2001, 2002) the presence of a rich and diverse cultural scene and a high concentration of people working in cultural and creative occupations, among attractiveness and condition of the natural environment and built form, can fuel innovation and growth.

This being the case, the commercialisation of cultural resources as raw materials has importance beyond the value of the products. Digital developments will enable peripheral regions to increase their competitiveness in the global economy, claiming that much of the content will derive from the particularism of cultural heritage, leading to ''the culturalisation of the market and the 'marketisation' of culture'' (European Commission, 2002). Europe's (and that elsewhere) digitised cultural content also contributes significantly to education, enhancing both formal and life-long learning; it also supports tourism and contributes to the development of content-related industries. It is also evident that no single region has sufficient diversity of such resources to satisfy the market (Williams, 2000; Williams and De Laurentis, 2003). This means that trans-regional co-operation is essential.

Cultural path dependency, which generates the focus for cultural transformation into the media, relies upon cultural resources and the institutional repository of such resources, namely ''memory institutions.'' It can, therefore, be argued that the cultural industries, both the media organisation and the memory institutions, can pursue a twofold objective. On the one hand, it is often suggested that the media sector may provide a new means to preserve and represent local culture and to safeguard the diversity of cultural identities in an increasingly global media environment (Kerr, 2000). This role can also be pursued by the memory institutions as they re-organise their holdings into interoperable digital archives, which become the basis for new forms of public service delivery.

On the other hand, diversity is increasingly becoming a valuable asset. Cultural identities are seen as a decisive factor, which allow regional actors to create the most suitable conditions for cultivating the formation of a multimedia industry by thorough deployment of their locale's resources, generated by entrepreneurial enterprises, public and private educational and service institutions and, especially, the labour force. The new media are seen as a frontier territory where small start-up companies can compete on an equal knowledge footing with large established multinationals and where innovation thrives. Innovation processes are key to the rejuvenation and growth of ''traditional'' economic activities in sectors such as resource-based products and cultural industries, becoming a means for cultural transmission and knowledge exploration and exploitation.

Memory institutions and media organisations are key actors that can lead the development of a regional digital value chain. However, as is explained and as the case of Wales shows, this process is not exempt from constraints and barriers.

3. Memory institutions: from repositories of knowledge to content producers

The term ''memory institutions'' appeared as early as 1975 (Burcaw, 1975), and is used to group together organisations such as museums, galleries, libraries and archives, also called cultural repositories (Bearman *et al*., 2002). Libraries, archives, museums and galleries are often recognised as the collective memory of a nation or community, repositories of knowledge and resources for learning (Chapman *et al*., 1999). Memory institutions have traditionally served as a bridge between the resource base and would-be users: they collect material in defined areas, store it, provide searching tools to identify and locate individual items within collections and provide varying forms of physical access to the items.

Memory organisations have a long tradition of catalogues, from the early handwritten guidebooks, through printed lists, card catalogues, and microfiche or microfilm catalogues, to

machine-readable records. The forms of catalogues have changed over the years, and collections have been catalogued with different degrees of thoroughness to facilitate access. Many archive repositories are still dependent upon manual catalogues, with an increasing proportion of repositories now beginning to generate the current output of search aids in database form or as encoded text.

Coming to terms with a changing environment, memory institutions, traditionally considered conservative institutions, designed to preserve and interpret static objects, are facing a threefold challenge (Trant, 2002; Manzhukh, 2003). First, traditional audiences are fragmenting and new audiences are increasingly more demanding; Second, there is a growing pressure to deal with documents, publications and information in electronic forms. Third, such institutions have lost their monopoly in the field of information services provision and, as the financial climate becomes more competitive and funding can no longer be taken for granted, they have to find ways of funding themselves. This new environment requires them to consider the innovative use of digital communication technologies in the activities of digitisation, archiving and presentation, providing new user services and working on new business models.

Although, digital technologies offer a great opportunity to make the collections, know-how and insights of cultural organisations more widely available, the potential associated with digital developments is wider. One of the consequences of the use of multimedia systems and networking technologies in memory institutions is a growing convergence among them. Archives, museums and libraries are actively connecting their collections to emerging knowledge networks; text, images and sound are digitally stored, processed and presented to the end-user via networks. Users can access archival records via library services, the presentation of historical records can be linked up with digital images of objects in museums and so forth.

Such new practices are providing value that make these institutions central to the interests of a learning society, providing access to learning opportunities and information. Through an innovative use of digital communication technologies, and through creative collaborations with other organisations – including some institutions not traditionally thought of as partners, such as private organisations – memory institutions can aim at developing the long-term digital memory of the knowledge society, and at adding value to electronic assets, the memory institutions themselves becoming content providers.

Memory institutions can produce digital exhibitions of work from their collections, including presentations of electronically based artwork, in-gallery kiosks, online and digital exhibitions and access to works that are infrequently on view due to their vast scale or fragile format. Ideally, all of this material would be accessible to any user for whom it had significance. The range of potential users of the resource is wide, from scholars in academic institutions and commercial research, to users in the wider community investigating particular interests. As Donnelly (2003) argues, there is a massive demand for digital images in sectors such as publishing, broadcasting and advertising, and cultural organisations lag behind commercial image libraries. Archive domains face a major challenge, as they need to convert retrospectively the vast mass of existing manual catalogues to electronic form and to upgrade and retro-digitise catalogue records to meet modern minimum standards.

The value associated with digitisation and retro-digitisation of archive resources can be explained with the example of archives such as the British Film Institute, which houses the world's largest collection of film and television programmes, including more than 275,000 films, 200,000 television programmes about 7000 still photographs, 15,000 film posters, 3000 designs and 20,000 original scripts, that are still waiting for being transformed into digital format (DCMS, 2001). *Clip*, a company which houses the rushes from the programming of the Welsh broadcasters, tagged and logged 1500 tapes in 2002, just a small portion of the 44,000 tapes in storage, hampering the further exploitation of such products.

Cultural content is expected to fuel the emerging knowledge economy and will find important exploitation channels in areas such as education (e-learning), creating new humanities-based distance learning opportunities related to the their permanent collections, and media, the traditional as well as the internet-enabled ones exploiting

edutainment applications – that is applications linked to educational games. Different resources located in museums, libraries and archives become the foundation for an innovative industry based on the use of cultural materials for content production.

The evolution of digital technologies has, therefore, imposed a re-think on basic paradigms, concepts and internal workflow by memory institutions in order to adopt the right technologies, exploit commercial opportunities, ensure long-term sustainability and embed the skills needed to manage the process. Therefore, the challenge for memory institutions is to develop strategies for content development going beyond their role of passive delivery of "traditional" information products and exploiting digital content generated by digitisation projects, stimulating radically new content and media. At the same time, such opportunities offer them a means to maximise their financial potential and accrue revenue from the licensing of their assets.

However, memory institutions seem to be reluctant to adopt new business models and they see their primary role as mere information providers, free at the point of access.

4. Digital development and the media industry

It is clear that there are various institutions and agencies that have an interest in developing and exploiting content. The media sector is particularly well placed to lead the transformation process due firstly to the transferable nature of its existing skills base and the centrality to endogenous firms of growth linked to the digital economy, and secondly to its importance in contributing to the creation of regional and other archives.

Defining the media sector goes beyond the aims of the paper, however it is important to underline how the recent digital developments have blurred the previously well-defined edges of the sector. The pervasiveness of digital technology has affected media production, media distribution and media consumption patterns. Cable and satellite technologies have contributed to the growth of broadcast channels; internet penetration and high speed internet are offering a complementary platform for traditional media. Digital Television, Video on Demand, Subscription Video on Demand, Personal Video Recorders and Interactive Television are just a few examples of new services and technologies being rolled out. Hence, the digitisation of information has increased economies of scope and scale; declining cost of production and transmission are generating new scenarios. Mergers and new strategic alliances between different media players are beginning to appear.

One of the most striking effects of new digital development is that it is allowing traditional and new services to use the same networks. Before convergence occurred, a communication service (such as television, Internet services and telephones) was linked to a specific type of infrastructure; nowadays, a large number of services can be delivered over any kind of network. This indicates that media actors can provide a range of services on different delivery platforms at a very low marginal cost. The new technology has lowered entry cost and has contributed to reducing marginal costs – digital information can be endlessly edited, copied and merged with other information and can reappear in many formats. Since production, reproduction and diffusion costs of content are decreasing, it could be possible to tailor contents to specific needs maximising opportunities of market segmentation and price discrimination for multimedia systems (Doyle, 2002b; Corrocher, 2002).

The opportunity to distribute media products at a very low marginal cost over additional and popular high capacity delivery platforms is seen, in media economics studies, as a *bonanza*, however, in practice, the vast majority of media operators have found it practically impossible to make money from investments in the Internet, interactivity and new multimedia products (Doyle, 2002a). Until recently, the Internet was seen as the future of the media business. It was going to reduce costs and boost revenues, lowering barriers to entry generating a number of new companies. As asserted by Doyle (2002a), it can be argued that the fundamental problem with Internet-based media provision as an economic activity is that few, if any, realistic models have been constructed for deriving revenues. Advertising, sales commissions and direct charge are just a few examples, but these models are not generating revenues to cover

the costs of the service in question. Other than pornography, consumers have never been willing to pay directly for audio/visual entertainment besides movies and sports (Waterman, 2001). Furthermore, issues such as electronic distribution and copyright pose serious implications for the economics of media content production and publishing. Hence, despite much propaganda about interactive television (iTV), interactivity continues to experience lower than anticipated audiences – as many people still have problems conceiving of their television as an interactive device and still remain non-profitable – as key players are searching for services that will be economically viable (Doyle, 2002a).

As discussed in the paper, digital technologies have also revolutionised the way training and education are conducted, developing new kinds of learning products and services, requiring co-operation and collaboration of different actors. In recent years, universities, investors and corporations have developed online courses, virtual universities, education portals and courseware, seeing online learning as the solution to all the problems confronting traditional education (Cavusgil *et al*., 2002). However, such traditional tasks as course development, faculty training, learning resources, student feedback and outcomes assessments delivered via electronic media are not attracting the expected level of demand that allows a return on investments and business models have not proven to be successful.

Many recent initiatives, Cardean University and Fathom.com to name but two, have failed with their initial offerings. Cardean started offering business curricula developed specifically for the online environment by faculty and experts associated with Carnegie Mellon, Stanford, and the London School of Economics among others. It has found that the market for courses leading to a degree is not as fruitful as anticipated and has moved towards delivering short courses to the corporate market. Fathom.com, initiated by Columbia University, in early 2000, offered digital content from Columbia University and 13 other academic and cultural institutions, such as the London School of Economics, Cambridge University Press, The British Library, Smithsonian Institution's National Museum of Natural History, and The New York Public Library. At its launch, the consortium educational site announced it was aimed at becoming a "main street" for knowledge and education, serving a worldwide audience of business and individual users, providing seminars and online courses. However, the site was not able to draw the numbers of paying online learners needed to make the dot-com venture succeed, forcing Columbia University to withdraw financial help and to move some of its resources into other digital-media projects at Columbia (Hane, 2003; Carlson, 2003). Many other projects led by universities (the Digital College in Wales is an example, Selwyn and Gorard, 2002) have terminated because the digital initiative, instead of attracting new students, was recycling traditional ones, raising issues of audience "*cannibalism*." Many authors (Cavusgil *et al*., 2002; Levis, 2002) claim that these early failures have been caused mainly by a lack of understanding of learning theory and practice, where practitioners have paid little attention to learning pedagogy and to the need for a new approach and new sets of skills that online teaching requires. At the same time, it has been argued that too much emphasis has been put into the technological developments *vis-à-vis* online learning without really understanding consumer needs and market demand.

5. Peripheral regions in the knowledge economy

Against this theoretical background the research conducted focussed on the opportunities that the development of a DVC can offer to peripheral regions, such as Wales, that lack a large urban centre and are distant from major markets, to forge a knowledge economy. Many authors argue that the rise of the knowledge economy is affecting the balance between peripheral and central locations (Polese and Shearmur, 2002; OECD, 2001) and it is most often cities and metropolitan areas that are the crucibles of knowledge-intensive activities. Knowledge economy is often an urban, even metropolitan or "primate city" phenomenon on the one hand, and a regional "high performance engineering" and related or complementary high value-added services city or region-wide phenomenon, on the other (Cooke and De Laurentis, 2002). This being

the case, it can be argued that the knowledge economy creates opportunities and at the same time poses great challenges for peripheral regions that lack leading international or national media and financial centres or major automotive or ICT engineering/manufacturing centres, which characterise the higher scoring localities.

The development of a DVC offers a means for peripheral regions to become engaged in more knowledge-intensive applications and cities and regions characterised by traditional sectoral activities can enter the knowledge economy not only as consumers but as producers. The establishment of a DVC is appealing to peripheral regions if only because of the great extent of linguistic and cultural diversity that lies in Europe's peripheral regions (Nelde *et al*., 1996). Many areas with low knowledge economy scores are often remote, insular, rural and endowed of historic and touristic resources. Several of these regions have also developed regional media presence and hold dynamic memory institutions, which provide the preconditions for path dependency entry into new media and digital activities. Wales is certainly one of these regions.

During recent decades Wales had transformed itself from an industrial region based on primary resources and subsidiary industries into an economy with a strong service sector and a heavy reliance on inward investment. The majority of jobs resulting from this strategy were low level assembly jobs with little value added. However, foreign direct investment did stimulate the local supply chain and require exacting standards which pushed up quality and productivity in Welsh small and medium sized firms. A downturn in foreign direct investment has signified a turn towards a more entrepreneurial based local economy with a strong level of local private sector involvement. Local economic development officials have tried to encourage networks between local firms, increase their innovative capacity, and generally re-orient the economy's efforts to produce endogenous economic growth turning their resources and attention on helping indigenous small and medium sized firms within industry specific clusters, such as ICT, multi-media, and healthcare.

Hence, Wales has a strongly decentralised regional governance, mainly associated with its existence as an historic region. The Welsh language has guaranteed for Wales a distinct identity. Such identity had contributed to the emergence of various regional institutions such as National Museum and Library and a strong broadcasting sector. The traditional Film and TV industry in Wales has generally been strong in relation to the size of the Welsh economy (annual GDP €30 billion) and Wales has the largest broadcast centre in the UK outside London, comprising one of the regional arms of the BBC UK–BBC Wales, the commissioning agency for Welsh language broadcast – S4C and a commercial broadcaster – HTV Wales. There is a rich diversity of museums, libraries and archives throughout Wales, ranging in size and nature of the collections they hold from local history to natural history, from art to archaeology, from industrial heritage to military heritage.

In undertaking the research, a qualitative methodology was followed. This involved both the scrutiny of secondary sources and in-depth interviews with the key stakeholders within the region. Such stakeholders represented institutions and firms within the region which were most likely to be involved in digital developments, a sample of media firms and memory institutions. The section that follows highlight the finding of this research, focusing primarily on the changes and challenges that the two key actors, memory institutions and media firms, are experiencing in building a DVC in Wales.

6. Developing a digital value chain: the case of Wales

The Welsh experience does not differ substantially from the theoretical account offered above. On the one hand, the media sector in Wales is a hybrid of two technologies and traditions: video and film for broadcast on the one hand and digital multimedia for all distribution channels including the Internet on the other. New media and multimedia technologies are being adopted by these firms, but there is also a rising generation of new media firms, which have based their entire strategies around these new activities. The sectors are important in both economic and cultural terms. The presence of three major broadcasters provides a key means of expressing Welsh identity, both in Wales and potentially across developing global

media markets. The industry accounts for about 300 firms in "traditional" media, multimedia, animation, graphics, creative arts and services firms. Some 18% are core multimedia producers (on-line or off-line producers). Of these firms, some twenty are specifically set up to produce on and off-line products such as CDs composed of film and TV clips for entertainment; CD-interactive musical instrument tutoring; Financial Trading CD databases and Media Business CD data-bases along with e-learning CDs. A further twenty are providers of Internet Services or Web Page Designers; the remainder are specialised in animation-related production.

The companies within the sectors are mostly young firms, the oldest having been established since 1980. Some of the older firms started production as "traditional media" firms which added multimedia production to their activities as regional broadcasting went digital. Some are spin-offs of other firms and some are former traders re-established under a new name. A relatively large proportion became established as TV, film or video companies at the time when the fourth terrestrial TV channel was established (1982) followed by the UK Broadcasting Act of 1990 which required broadcasters such as the BBC to outsource 25% of TV production to independent production companies. It is from these deregulatory actions that a substantial number of independent media and, subsequently, multimedia firms, emerged in Wales. The market for most of this activity in Wales is quite well defined – the Welsh language broadcaster (S4C), BBC Wales, and HTV are the customers for most activities in these areas. As well as having their own direct workforce they also commission production from a substantial group of independent companies. These are producing mainly video-based output, animation and film production and have started to embrace new media production. Media companies also demonstrated an interest in penetrating foreign markets via co-productions offering a means for increasing diversity within the industry. Those who extended their operations to accommodate multimedia activities are also offering local services and are seeking markets outside the region.

The commissioning agent, the Welsh language broadcaster, sought to develop a reliable network of production companies, which could specialise in the different genres of programmes, which it required. As a result, a bound-dependency relationship developed between S4C and many production companies. The contracts between them traded the guarantee of commissions for a lower return than is generally received in the industry. This meant that production costs for the Commissioning Agent were reduced and, at the same time, the broadcaster reserved the right to scrutinise the staff employed by the production companies in their respective productions. In this respect the network increasingly resembled the operations of a single firm. Such a network conforms to Burton-Jones' (1999) typology of "dependent entrepreneurs," referring to how firms use *flexihire* workers and mediated services, arguing that the critical factors involving a firm's selection of different types of supplier include the characteristics of the knowledge involved in the transaction and the form in which the knowledge is supplied. Within S4C and the independent media producers, tacit and specific knowledge plays a central role. Developing a dependent network of skilled experienced contractors can prove attractive to the core firm seeking to control their knowledge assets without incurring incremental costs or risks. However, such unbounded dependency seems to have generated a threefold effect that is hampering innovation, thus the development of a digital value chain.

Despite being one of the first broadcasters going digital, S4C lacked the resources to take advantage of this and the early entry was undertaken without the awareness of what was required in generating the appropriate services. Besides, the national broadcaster had a narrow vision of digital developments seeing digital technologies as a means for extending broadcasting hours in Welsh on its digital channel, requiring very little product innovation from its dependent entrepreneurs – the independent producers.

The media sector in Wales was affected by a high dependency on the regional market, generating dedicated but not widely marketable content, thus constraining further development. The production costs of the Welsh based producers are substantially lower than those of others, but there is a lack of understanding about how to exploit this advantage. This development was, to repeat, essentially meant to be a trade off where financial

profit was traded for security. The independent producers remain isolated from the UK network market and, more importantly, from new global markets. One reason given for this situation is that their relationship with S4C, while giving them security, obliges them to work with high workloads and small profit margins which does not allow for investment in project development. The national broadcaster is also claimed to be responsible for limiting the delegation of responsibility to, and training of, younger staff.

A third argument in analysing the barriers that are hampering digital developments in Wales involves the practice whereby S4C retains intellectual property rights, which limits the ability to expand the enterprise. This is being resolved by S4C conceding the right to recycle materials from rushes, etc. to the independent companies, but only for S4C productions. This does have potential for digital production but thus far there is not a digital archive fully developed and metadata and related issues remain unresolved. This means in effect that S4C suppliers need to focus, and may survive by successfully focusing on a Welsh market. The absence of development, understanding and imagination on the part of S4C is often claimed to be related to financial considerations – much of the finance is devoted to programme production, which can meet the expansion of broadcasting hours in Welsh on its digital channel. Similarly, the producers will not move to multimedia production while the associated digital infrastructure remains unfamiliar to the audience. In the UK less than 50% of the total audience has digital TV access in 2004.

Hence, if the most important external sources in firms' innovation performance are partners in the value chain and in particular clients and customers, as argued in the recent Community Innovation Survey (Eurostat, 2001), it cannot be denied that the inertia of S4C towards innovation, the strong reliance on the Welsh market, and the bounded relationship between S4C and the independent producers are posing a number of threats to the development of the industry. On the other hand, it can be argued that the other two major producers – BBC and HTV – that could be seen as the point of entry for the Welsh based independent producers, have not rushed to commission work from them. BBC has invested heavily in positioning itself as provider of content on the internet, establishing a strong online brand, but much of its digital development research activities are conducted outside Wales. BBC Wales, the regional branch of the BBC, has begun developing a digital archive in Cardiff and to develop innovative productions for its Welsh digital channel.

The Welsh media industry has, to some extent, clustered in Cardiff, the capital city, Caernarfon in the north and the Swansea region in the west and although proximity has been important to the development of the industry for accessing related and supplier industries, freelancers, potential employees, amenities, education and training facilities and networking with clients, there is considerable scepticism in the industry about the relevance of clustering. It can be argued that in the Welsh case, the media industry seems to be affected by a lack of innovation interaction among local firms and between firms and knowledge support organisations, including memory institutions. On the one hand, firms still deal with issues of secrecy and proprietary knowledge and co-operate very little with the other companies in the sector. All of the companies know one other and this "knowing" is largely conditioned by being part of overlapping cultural and production networks; they interact quite openly but such interaction involves mainly sharing information *vis-à-vis* process innovation. There is still a strong aversion to sharing any ideas that would result in product innovation. Even the tendency to segment production activities into different areas of expertise does not overcome this reluctance. The main commissioning agent – S4C – now requires smaller producers to merge together into larger units. This has led to some development, but the new components still remain aloof from one another *vis-à-vis* digital product development – many firms are still wary of networking and experimenting with new production formats for digital products. On the other hand, although Wales has developed an adequate institutional thickness, the absence of co-operation and interaction between the knowledge support organisations, the development agency, policy makers and the firms within the industry and memory institutions threatens innovation processes and slows the development of the knowledge economy.

However, memory institutions *per se*, such as key museums, libraries and archives, have committed to digitisation projects and partnerships that could lead to the development of a Digital Value Chain. Two major projects have pursued this aim, although with some limits. One of these is a regional version of a broader initiative by the UK government funded by the New Opportunities Fund (NoF). This digitisation programme, with an allocated budget of £50 million UK-wide, has provided funding to make learning materials available, free of charge, on the Internet. This is considered the largest and most ambitious UK-wide content creation initiative to date, aimed at ensuring that lifelong learners are able to access content that interests them. A range of innovative Welsh projects have received grants from the New Opportunities Fund to convert a wide range of local material on subjects like history, science and culture into digital format to become a valuable learning resource on the Internet. The "Gathering the Jewels" project is considered the most pervasive one – a "pioneering, large-scale project to give free, worldwide online access to a substantial part of Wales' cultural heritage" (NoF, 2001). The project, a partnership between about 170 Welsh museums and libraries, led by the two major Welsh memory institutions, the National Museum and Gallery of Wales, based in Cardiff, and the National Library of Wales, based in Aberystwyth, was aimed at digitising and making available on line cultural heritage material, such as manuscripts, artifacts, photographs, paintings and sound and moving images, promoting the diversity and significance of materials held in Welsh libraries, museums and archives. This initiative has been responsible for digitising 23,000 items gathered from hundreds of museums, libraries, record offices and archives throughout Wales, bringing the issue of digital content into the awareness of all these institutions and developing common metadata standards. The programme has helped to unlock the learning resources of libraries, archives, museums and galleries by converting them into electronic form.

Another initiative "*Cymru'n Creu*" (Wales Creating) which involves main institutions such as the National Museum, the National Library, The Welsh Tourist Board, major Welsh broadcasters and, among others, the Welsh Assembly Government, has been created to develop an integrated digital archive. The initiative has drawn considerable sums of public money and, since this initiative is being led by the National Museum and National Library there is a tendency for it to be seen as service delivery free at point of access and therefore does not develop the DVC in its entirety.

Despite the digitisation process going ahead in Welsh memory institutions, there remains a reluctance to move beyond the information container's role towards analysis and interpretation of contents and there is still an emphasis on service-oriented activities rather than value-oriented. This has resulted in organisations underestimating their potential contribution and the potential impact they can have on market-oriented opportunities. What is interesting in this respect is that the partnership of *Cymru'n Creu* involves not merely libraries and museums, the Welsh Tourist Board, the BBC and S4C all of which are public bodies, but also the Regional Development Agency and the SGRIN, the Media Development Agency for Wales, two bodies who are devoted to promoting the commercial development of the content industry. It will be interesting to see whether there are moves afoot to merge the library/museum collections with the media archives and on what terms. Hence, what is missing is the presence of any voice associated with the independent producers or the IT sector which would constitute the production end of the DVC (Williams and De Laurentis, 2002).

The concept of the Digital Value Chain links institutions which hitherto appear to have little in common – museums, libraries, data providers, analysts, broadcasters; but the Welsh experience shows that such organisations have yet to understand it. The key actors responsible for the development of a digital value chain are certainly in place, however there is little co-operation and networking across spheres that could interact fruitfully. The rudimentary partnerships that are in place do not resemble the functionality of a value chain. What is clear is that it is an industry in transition and without a future vision and essential commitment, both of skills and resources the future will be bleak. This does not mean that there is no content production but rather that it tends to

happen remote from the development of networking associated with archiving and accessing public archives. Having said that, the memory institutions have at least begun innovating on a not-for-profit bases. Hence, this could have potential for more value-yielding initiative if the broadcasters grasp that potential.

7. Concluding remarks

This paper has sought to draw a conceptual picture of the cultural industries in the knowledge economy. It then examined Wales in light of the knowledge economy, analysing the potential that current developments can offer to a peripheral region in entering the knowledge economy. It inquired about the role of cultural resources and the extent to which cultural diversity can play a role in driving the emergence of the digital economy as a key base of the knowledge economy.

It was argued that regional digital development could be driven by memory institutions. However, a number of obstacles may hamper such developments. Firstly, such organisations see product development as a "public service", therefore something which is not marketable, not for profit, a free-service. Libraries, museums and archives are developing their digital archives; however, these actors are unwilling to develop the capacity to create content from their assets, arguing that such institutions are associated with the provision of high quality, modern services rather than product development. Secondly, although cultural institutions are widely involved in digitisation work, this activity is still highly fragmented, involving a duplication of effort and investments, providing only limited access to resources and failing to make full use of available technology. The lack of technological familiarity, the scarcity of funds available to begin and maintain the expensive digitisation and retro-digitisation process and the scarce development of common standards are among the main challenges that memory institutions are facing. The potential for unchecked duplication and distribution of copyrighted material can be added to such a list, hindering substantial progress in this area. Nonetheless, the *Cymru'n Creu* initiative has drawn key players together. However, the problem here was that the number of participants who clearly understood the problem to hand was limited, and those who did have an understanding of the issue had quite divergent forms of comprehension which were related to their sectional interests. The failure to extend the interests of the memory institutions which are driving the process to incorporate the interests of other partners, including the broadcasters, results in a limited outcome

It was argued that regional digital development could be driven by media firms coming to terms with new technologies and media convergence. However, as discussed, media firms are striving to find profitable markets for their services and products. It can be argued that change in state-of-the-art of technology may create important conditions for the development of new or improved product; however, demand conditions are seen as factors that are likely to be fundamentals ones, influencing both the rate and the direction of technical progress (Dosi, 1988). The slow pace with which the digital computer developed and diffused, for instance, can be explained by the lack of demand for them, as van den Ende and Dolfsma (2002) argue.

Theoretically, such experiences can be explained under the concept of demand and technology interaction, where sources of innovation or the motivations for innovators is led by the interaction of demand and technology factors (Mowery and Rosenberg, 1979; Dosi, 1988). Further research is needed in order to analyse in more detail what is happening in the media market if it has to lead innovation and economic development in peripheral regions, however, research needs to take into account that, as early failures in experimental new media business models explain, the market is failing to allocate resources efficiently resembling what the literature denotes as market failure (Arrow, 1962; Demsetz, 1968; Stiglitz, 1998; Cowen and Crampton, 2003). The reliance on market processes alone is resulting in underinvestment in research and development, depressing demand and supply to levels below what would be potentially economically justified. Limited appropriability, financial market failure, external benefits to the production of knowledge and other factors suggest that strict reliance on a market system will result in underinvestment in innovation, relative to the socially desirable level.

It was argued that constraints to the development of a DVC could be overcome by further developing creative partnerships between the different communities of practice involved, the media on the one side and the memory institutions on the other. However new business models are needed and formerly innovative ones are facing several challenges explicable by the market failure argument. Thus far, in Wales, and elsewhere, the market for innovative memory institutions products has yet to materialise, whereas the market for computer games grow exponentially.

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Notes

1. The knowledge economy has an extensive empirical and theoretical literature on which to draw. The term, as used in this paper, relates to an economy in which knowledge processes – exploration, exploitation and examination – have become the essential input in production. A full genealogy of the concept would go back to the 1960s with Fritz Machlup (1962) work on the economics of the production and distribution of knowledge. A variety of terms related to the knowledge economy came into circulation in business, government and academic publications during the 1990s many of them deriving from perceptions that the landscape of economic activities was being transformed by advances in information technologies culminating in the deployment of computer-mediated electronic communications networks and an increasing proportion of the economy is becoming more and more knowledge-intensive. It is in this period that the term "knowledge-based economy" emerged (OECD, 1996), arising from limitations in National Systems of Innovation (Lundvall, 1992; Nelson, 1993) as argued in Godin (2003). For a full review of the terms knowledge economy and knowledge-based economy refer to Cooke and Leydesdorff's contribution in this special issue.

References

Arrow, K., 1962, *Economic Welfare and the Allocation of Resources for Invention' in Collected Papers of Kenneth J. Arrow*, Volume 5, Production and Capital edited in 1985, Cambridge: Belknap Press.

Bearman, D. and J. Trant, 2002, 'Cultural Institutions in a Networked Environment,' Stockholm, Available at http://www.archimuse.com.

Brynjolfsson E. and B. Kahin (eds.), 2000, *Understanding the Digital Economy, Data, Tools and Research*, Cambridge, Massachusetts: The MIT Press.

Burcaw, G.E., 1975, *Introduction to Museum Work*, Nashville, TN: American Association for State and Local History.

Burton-Jones, A., 1999, *Knowledge Capitalism – Business, Work and Learning in the New Economy*, Oxford: Oxford University Press.

Carlson, S., 2003, 'After Losing Millions, Columbia U. Will Close Online-Learning Venture', The Chronicle of Higher Education, available at http://dml.fandm.edu/news/CHE140103.html.

Castells, M., 1996, *The Rise of the Network Society*, Oxford: Blackwell.

Cavusgil, T.S., T. Kiyak, and I. Kiyak, 2002, 'Expanding Horizons with e-Learning,' in R.F. Sherer, S.T. Beaton, M.F. Ainia, and J. Meyer (eds.), *Internationalising the Business Curriculum: A Field Guide*,2nd edition, Euclid: Lakeshore Communications, .

Chapman, A., N. Kingsley, and L. Dempsey, 1999, 'Full disclosure – Realising the Value of Library and Archive Collections,' a Report to the Pathfinding Group, Available at http://www.ukoln.ac.uk/services/lic/fulldisclosure/report.pdf.

Cooke, P., 2002, *Knowledge Economies*, London: Routledge.

Cooke, P. and C. De Laurentis, 2002, *The Index of Knowledge Economies in the European Union: Performance Rankings of Cities and Regions, Regional Industrial Research Report No. 41*, Cardiff: Centre for Advanced Studies.

Corrocher, N., 2002, 'Internet Diffusion Dynamics in Europe: Demand Scenarios and the Digital Divide,' Report no. 29, STAR (Socio-Economic Trends Assessment for the Digital Revolution) Project, Available at http://www.databank.it/star/list_issue/f_2.html.

Cowen, T. and E. Crampton, 2003, *Market Failure or Success, The New Debate*, Northampton: Edward Elgar Publishing.

DCMS, 2001, *Culture Online*, London: DCMS, Department for Culture, Media and Sports.

Demsetz, H., 1968, 'Why Regulate Utilities?' *Journal of Law and Economics* **11**, 55–66.

Donnelly, M. and S. Ross, 2003, 'Technologies and New Socio-Economic Business Models,' DigiCULT Technology Watch Report 2, DigiCULT.

Dosi, G., 1988, 'Sources, Procedures and Microeconomic Effects of Innovation' *Journal of Economic Literature* **26** (3), 1120–1171.

Doyle, G., 2002a, 'Economics and 'New' Media,' Paper Presented at the 5th World Media Economics Conference, Turku, Finland Available at http://www.tukkk.fi/mediagroup/5WMEC%20PAPERS/Doyle.pdf.

Doyle, G., 2002b, *Understanding Media Economics*, London: Sage Publications.

Enkenberg, J. and M.J. Kents, 2002, Finland: WP3 – WP4 Final Report, Technology, Economics and Diversity in the Periphery Project, unpublished.

European Commission, 2002, 'European Digital Content in the Global Networks,' Available at http://www.cordis.lu/econtent/.

Eurostat, 2001, *Community Innovation Survey*, Brussels: Eurostat.

Florida, R., (2000). 'Competing in the Age of Talent: Quality of Place and the New Economy,' Report prepared for the Mellon R.K. Foundation, Heinz Endowments, and Sustainable Pittsburgh.

Florida, R., 2002, *The Rise of the Creative Class*, New York: Basic Books.

Florida, R. and G. Gates, 2001, *Technology and Tolerance: The Importance of Diversity to High-Technology Growth*, Washington, DC: Centre on Urban & Metropolitan Policy, The Brookings Institution.

Godin, B., 2003, 'The Knowledge-Based Economy: Conceptual Framework or Buzzword?' Project on the History and Sociology of S&T Statistics, Working Paper no. 24.

Graham, B., 2002, Heritage as Knowledge in the Innovative City: Capital or Culture? *New Media and Society* 2 (3), 286–312.

Hane, J.P., 2003, 'Columbia University to Close Fathom.com,' Available at http://www.infotoday.com/newsbreaks/nb030113-2.htm.

Kerr, A., 2000, 'Media Diversity and Cultural Identities – The Development of Multimedia Content in Ireland,' *New Media and Society* **2** (3), 286–312.

Levis, K., 2002, *The Business of (e)Learning: A Revolution in Training and Education*, London: Screen Digest Limited.

Lundvall, B., 1992, *National Systems of Innovation, Towards a Theory of Innovation and Interactive Learning*, London: Pinter.

Machlup, F., 1962, *The Production and Distribution of Knowledge in the United States*, Princeton: Princeton University Press.

Manzhukh, Z., 2003, 'Commercial Exploitation of Cultural Heritage in Memory Institutions' Presented at Inforum, Commercial Exploitation of Cultural Heritage in Memory Institutions, Prague, May 2003.

McAdam, R. and S. McCreedy, 1999, A Critical Review of Knowledge Management Models *The Learning Organisation* **6** (3), 91–100.

McCallum-Fournier, 1999, 'Entertainment and Education Join Forces for the Millennium' Available at http://www.fundandedutain.com/define.htm.

Mowery, D. and N. Rosenberg, 1979, The Influence of Market Demand upon Innovation: A Critical Review of Some Recent Empirical Studies *Research Policy* **8** (2), 102–153.

Neef, D., 1998, *The Knowledge Economy*, Boston: Butterworth-Heeinemann.

Nedle, P., M. Strubell, and G. Williams, 1996, *Euromosaic: The Production and Reproduction of Minority Language Groups in the EC*, Brussels: European Commission.

Nelson R. (ed.), 1993, *National Innovation Systems: A Comparative Analysis*, New York: Oxford University Press.

NoF, 2001, 'NoF-Digitise Programme, New Opportunities Fund,' Available at http://www.enrichuk.net/.

Nonaka, I. and D. Teece, 2001, *Managing Industrial Knowledge*, London: Sage.

OECD, 1996, *The Knowledge-Based Economy*, Paris: OECD.

OECD, 2001, 'The New Economy: Beyond the Hipe,' Final Report on the OECD Growth Project, Paris: OECD.

Polèse, M. and R. Shearmur, 2002, *The Periphery in the Knowledge Economy: The Spatial Dynamics of the Canadian Economy and the Future of Non-Metropolitan Regions in Quebec and the Atlantic Provinces, INRS Urbanisation*, Montreal: Culture et Société and the Canadian Institute for Research on Regional Development.

Selwyn, N. and S. Gorard, 2002, *The Information Age*, Cardiff: University of Wales Press.

Stiglitz, J., 1998, 'The Private Uses of Public Interests: Incentives and Institutions' *The Journal of Economic Perspectives* **12** (2), 3–22.

Swan, J., S. Newell, H. Scarbrough, and D. Hislop, 1999, 'Knowledge Management and Innovation: Networks and Networking' *Journal of Knowledge Management* **3** (4), 262–275.

Takeuchi, H., 1998, 'Beyond Knowledge Management: Lessons from Japan,' Available at http://www.sveiby.com/articles/lessonsjapan.htm.

Tapscott, D. and D. Lowi Ticoll, 1998, *Blueprint to the Digital Economy, Creating Wealth in the Era of E-Business*, New York: McGraw-Hill.

Trant, J., 2002, 'The Web of Collaboration: New Technologies, New Opportunities for the Visual Arts in a Digital Age,' Presented at the Smith College Symposium, The Visual Arts in the Digital Age, Stockholm.

van den Ende, J. and W. Dolfsma, 2002, 'Technology Push, Demand Pull and the Shaping of Technological Paradigms – Patterns in the Development of Computing Technology,' Erim Report Series Research in Management, Available at http://ideas.repec.org/p/dgr/eureri/2002248.html.

Waterman, D., 2001, 'The Economics of Internet TV: New Niches vs. Mass Audiences' *The Journal of Policy, Regulation and Strategy for Telecommunications Information and Media* 3 (3), 215–229.

Wenger, E., 1998, *Communities of Practice: Learning, Meaning and Identity*, Cambridge: Cambridge University Press.

Williams, G., 2000, 'The Digital Value Chain and Economic Transformation: Rethinking Regional Development in The New Economy' *Contemporary Wales* 13, 94–115.

Williams, G. and C. De Laurentis, 2003, 'Technology, Economics and Diversity in the Periphery, Technology, Economics and Diversity in the Periphery Project, EU IST-1999-20193,' Final Report.

Williams, G. and C. De Laurentis, 2002, 'Wales: WP3–WP4' Final Report, Technology, Economics and Diversity in the Periphery, unpublished.