

Marshall, Alison ORCID: <https://orcid.org/0000-0001-6816-2362> , Quinlan, Patrick and Berry, John (2013) Supporting regional growth from the higher education community: the Energy Coast Campus Programme in West Cumbria. In: Innovation through Knowledge Transfer 2013, 11-12 April 2013, Derry-Londonderry, Northern Ireland.

Downloaded from: <http://insight.cumbria.ac.uk/id/eprint/1459/>

Usage of any items from the University of Cumbria's institutional repository 'Insight' must conform to the following fair usage guidelines.

Any item and its associated metadata held in the University of Cumbria's institutional repository Insight (unless stated otherwise on the metadata record) may be copied, displayed or performed, and stored in line with the JISC fair dealing guidelines (available [here](#)) for educational and not-for-profit activities

provided that

- the authors, title and full bibliographic details of the item are cited clearly when any part of the work is referred to verbally or in the written form
 - a hyperlink/URL to the original Insight record of that item is included in any citations of the work
- the content is not changed in any way
- all files required for usage of the item are kept together with the main item file.

You may not

- sell any part of an item
- refer to any part of an item without citation
- amend any item or contextualise it in a way that will impugn the creator's reputation
- remove or alter the copyright statement on an item.

The full policy can be found [here](#).

Alternatively contact the University of Cumbria Repository Editor by emailing insight@cumbria.ac.uk.

Supporting regional growth from the higher education community: the Energy Coast Campus Programme in West Cumbria

Alison Marshall^a, Patrick Quinlan^b, John Berry^b.

^aFaculty of Health & Wellbeing, University of Cumbria, Bowerham Road, Lancaster LA1 3JD, UK, alison.marshall@cumbria.ac.uk. ^bFaculty of Arts, Business and Science, Energen Building, Lillyhall, Workington CA14 4JW, UK.

Abstract

West Cumbria is a predominantly rural, but post-industrial region undergoing a transition from one that has been dominated by heavy industry over a 200 year period. The regional economy has latterly been dominated by one of the world's largest nuclear technology hubs, which continues to influence the structure of the economy. The region has aspirations to evolve a high technology manufacturing base, with a continued strong role for nuclear, but with a more diversified economy, including an expanded focus on low carbon and renewable energy generation. The region has aspirations to evolve a high technology manufacturing base, with a continued strong role for nuclear, but with a more diversified economy. As part of this strategy, a large investment has been made to build a higher education community in this largely rural area, to support its strategic objectives to promote innovation through applied research, research demonstration, enterprise, business support, skills and training and other transformational actions. Three case studies are described in detail: the Cumbrian Centre for Health Technologies (CaCHeT), the Sustainable Energy Technology Group and the Knowledge Action Network (KAN). The lessons learned are evaluated and presented, with details of future plans.

1. Introduction

West Cumbria is a region that faces significant challenges, but which also has a major opportunity to take advantage of government investment in future energy security and in diversification as part of the decommissioning of Sellafield, one of Europe's largest nuclear technology hubs. A specific area, comprising the districts of Allerdale and Copeland, has been targeted for investment. Britain's Energy Coast (BEC) is a public body that has been formed to lead and manage a regeneration programme and receives funding from the Nuclear Decommissioning Agency, Sellafield Ltd and Nuclear Management Partners, with an aspiration to create 3000 jobs. BEC covers an area of 800 square miles, over half of which lies within the boundary of the Lake District National Park with 70 miles of coastline. The total population size is over 166,000, of which the working age population is 103,500. There are 6,400 enterprises operating over a diverse range of sectors, although many are within the supply chain to the major employer, Sellafield Ltd. The strategy for economic development of West Cumbria includes an aim to strengthen the role and presence of higher education within the region. Transformational actions have been and will continue to be supported that meet innovation objectives of applied research, R&D demonstration, enterprise, business support, skills and training.

For the period 2008-2013, an investment of £10m was made in the Energy Coast Campus Programme [1], managed by the University of Cumbria. Three of the projects funded under this investment are described as case studies in this paper.

Alongside the economic strategy, there are distinct health and wellbeing needs for the population. These include issues in delivering the 'closer to home' strategy to a rural, dispersed population, the increasing focus on chronic illness management and the needs of an ageing population. At a strategic level, these issues are addressed by the North East-North Cumbria Academic Health Science Network and the Local Education Training Boards of Health Education England.

2. The role of higher education in regional development

Just as castles provided the source of strength for medieval towns, and factories provided prosperity in the industrial age, universities are the source of strength in the knowledge-based economy of the twenty-first century.

Lord Dearing, September 2002

Over the recent 20-30 years, higher education has changed its role, as society and industry has developed and higher education itself has evolved to meet new challenges. Government priorities in the UK for university-business interaction for economic growth have been guided by key reviews. The Lambert Review in 2003 [2] highlighted the importance of knowledge transfer and skills exchange, alongside more traditional research and technology transfer activities. The potential for universities to contribute to regional development was discussed in detail, with recommendations to strengthen policy and funding mechanisms for this. Nearly 10 years later, Sir Tim Wilson undertook a similar review in 2012, within a very different environment financially and politically. The Wilson Review [3] focuses much more on skills development, student experience and work experience in industry. At a time when regional development agencies no longer exist in the UK and in the year after Government subsidies of course fees were withdrawn, the contribution by universities to regional growth takes place in a very different economic context.

The ways in which universities in the UK have responded to these challenges have been various and have had varying degrees of success. In the first flush of the entrepreneurialism by universities in the 1980s and 1990s, the emphasis was very much on exploiting research outputs as spin off companies and the expectation was that investors, universities and the inventors would all get rich as a result, providing a way to sustain future activities. In more realistic times, and in response to identified needs of both large and small companies at a regional level, the types of engagement broadened significantly. The concept of a region as an 'innovation system'[4] through which policy makers can engage enables all organisations, including universities, to define their role, is useful. A report by the World Bank in 2001 [5], identified at least four critical successful factors for a regional innovation system:

- an economic regime that provides incentives for the creation and efficient use of knowledge;
- an education and training system that provides educated and skilled people, able to create and use knowledge;

- an innovation system that comprises networks of firms, research centres, universities and other organisations able to adapt global knowledge to local needs and opportunities;
- a dynamic information infrastructure that enables effective information sharing.

The types of interaction between academia and business, especially at a regional level, have developed significantly with the influence of specific funding mechanisms from national and EU government. Universities have the potential to provide a resource for regional business that is objective, scholarly and 'joined up', if 'virtuous circles' are possible for both the region and the university, in which both sides get a 'return on investment' [6]. For universities, financial 'return' is closely related to direct income from teaching and indirect income from 'research excellence' (in the UK, core government funding for research is allocated against a periodic review under the Research Excellence Framework [7]). For regions, return is linked to competitiveness of local businesses. The challenge is to make this synergy sustainable and to last beyond the initial funding period. Although many examples exist of successful regional innovation systems over a relatively short period [8], this goal remains elusive and is compromised by changes in funding policy by governments.

A number of studies highlight differing regional engagement for different types of university. Research led universities have struggled to make applied research and technical services fit their key objective of creating new knowledge at a world class level, while teaching-led institutions (post-1992 universities in the UK) are often more able to develop local teaching markets that sustain such activities, but frequently lack sufficient infrastructure to invest [9]. A summary of economic drivers for higher education institutes [9] is as follows:

- local support for their global aspirations in research and student recruitment;
- increased student enrolments from the local population;
- additional income from services provided to local businesses through consultancy and professional training;
- indirect benefits of a local environment that can attract and retain creative academics and motivated students.

The University of Cumbria [10] is one of the UK's newest universities, established in 2007 with a mission and vision '*to provide and promote excellent and accessible higher education which enhances the lives of individuals and fosters the development of the communities to which we belong. In so doing, the university will embrace four guiding themes: sustainability; creativity; employability and enterprise. We will be a dynamic, creative and entrepreneurial university, rooted in our region, with strong and sustainable national and international connections. We will be a larger university than in 2012, more sustainable and more resilient. Our work will be focussed on the professions and be both business-relevant and research-informed.*' [11] This strong regional and community based focus differentiates it from research-intensive Universities, whose contribution to economic and regional development is more often through intellectual property commercialisation. An example where regional business and research objectives came into conflict is described by Goddard et al [12], in a bold regional experiment to establish Technology Innovation Centres with the University of Newcastle. The University benefited from the arrangement as long as external funding was

available, but found its pursuit of international research excellence became compromised by the shorter term needs of industry.

Measuring and evaluating the impact of a university on a region is notoriously hard to do, although it is generally recognised that there is a contribution. While it is recognised that the knowledge base of an economy increases the value and associated generation of wealth, some regions and universities are clearly better at taking global knowledge and applying it locally. However, universities seem to be relatively more important in uncompetitive regions [13].

In focusing on the benefits to the regional economies, it is easy to overlook the 'elephant in the room' that is the need for financial sustainability. Universities in the 21st century cannot afford pure altruism and regional funding for university-business collaboration assumes initiatives will reach financial break-even point, often on a wildly optimistic time scale. Is this really possible?

Funding in England (but also similar for devolved administrations in the UK, Wales, Scotland and Northern Ireland) for regional engagement by universities has in the recent past come from two sources, the regional development agencies up to 2010 when they were disbanded and central government via the Higher Education Funding Council for England (HEFCE) Higher Education Innovation Fund (HEIF) [14], with some regions also benefiting from EU funding via the European Regional Development Fund and other EU structural funds. All such funding is project based, rather than co-investment, and geared to targets usually over a timescale of less than five years. The BEC funding in West Cumbria is intended to be more collaborative, strategic and linked to a regional plan (the Blueprint) [1].

The aim of this paper is to explore how universities can contribute to regional development, through our particular case studies, and whether there are transferable lessons of best practice that can be used elsewhere. A reflective evaluation is given, comparing the three different approaches and describing future developments based on our experience so far of this 'work in progress.' We consider how realistic the case studies are economically, in terms of the return on investment that is implied by the funding model.

3. Case studies

The three case studies described here are not the only projects funded by the Energy Coast Campus Programme and indeed are not the largest of those projects, but are selected as they are relatively mature at the time of writing and have already achieved some tangible outputs.

3.1. Modern Waterwheel

This applied research and demonstration project is part of the Sustainable Engineering activity, based in the Faculty of Arts, Business and Science. The vision is to develop alternative approaches to energy generation based in West Cumbria, to diversify the industrial base, while drawing on strong skills within the indigenous supply chain. Two full time engineering academic staff are employed, with expertise in Life Cycle Assessment (LCA) and engineering design along with a business development manager and a recently appointed research professor. The scope of the research lies on wet renewables and wind energy.

The Sustainable Engineering project aims to support local industry and innovation, develop relationships between the University of Cumbria and West Cumbrian businesses, leading to a portfolio of applied research in sustainable engineering and associated teaching and learning in Sustainable Energy Technology.

The Modern Waterwheel project was selected as it brings together these objectives and provides strategic benefit to three local businesses. The goal is to design a working prototype of a hydro electric modern waterwheel, leading to full scale implementation. This builds on a long history as there are several thousand watermill sites within Cumbria [15] most of which are now in disrepair.

The project was initiated in conjunction with a local renewable energy company, who saw the potential in using modern waterwheels to generate electricity at these old sites. A local hotel on whose site there were a number of existing waterwheels were approached and expressed interest in commissioning a modern waterwheel. Finally, a local engineering firm with a strong track record in innovative design was approached about the proposals. The University of Cumbria was to provide expertise in undertaking a literature review of existing designs, testing of the prototypes and undertaking a LCA.

The proposed project was to take a two phased approach.

1. The development of a small scale water wheel (1m diameter) to optimise the design and de-risk commercial deployment of the full scale wheel.
2. Construction of a full scale water wheel (4m diameter) and installation

There was a focus on 5 key development areas where there were perceived problems of implementation:

1. Maximising efficiency through bucket shape design
2. Minimising noise levels
3. Transmission design for electricity generation
4. Productionisation of design for commercial deployment
5. Minimising the environmental impacts mainly through maximising the efficient use of materials through as identified by the LCA study.

Key outputs of the project were:

1. Design a wheel that could compete with Archimedes Screw type turbines in both performance and commercial return
2. Develop a product that could be produced in Cumbria and sold throughout the UK and Europe, securing jobs and strengthening Cumbria's engineering base
3. Contribute to the University of Cumbria's applied research in renewable energies.
4. Contribute to the teaching and learning of University of Cumbria undergraduate engineering students.
5. Develop a portable waterwheel for use in academic open days and exhibitions.

An approximate amount of £40,000 was used with matched funding from the companies for their engineering and commercial development time. A prototype with a number of wheel designs has now been built as shown in Figure 1 below.

The initial wheel and buckets are made from sheet metal and a submersible pump returns the water to a launder which feeds the water back onto the wheel. Electricity is generated via an induction motor to light up a low voltage LED lighting display. Initial tests on the prototype modern waterwheel have shown it is effective and can provide a platform for further redesign.



Figure 1: Prototype 1m diameter overshot waterwheel with water return by a submersible pump and connection to an LED lighting display.

Further plans are for the development and installation of the full scale waterwheel once a satisfactory design has been achieved. There may also be the development of a local modern waterwheel testing and commissioning site to develop research into full scale models. Progression to this stage will require financial and strategic commitment from business partners. The three companies involved are currently reviewing the plans and test results, prior to progression. Further funding will be available from grant sources, but at a tapering rate. Hence the businesses need to see a clear business case to continue, based on likely sales for the renewable energy and engineering companies and a reduction of costs for the hotel partner.

Although it is too soon to know what the business partners will decide to do, the data, test outputs and engineering evaluations from the University of Cumbria are clearly critical. Without this project, the business risk would have been substantially higher. The prototype can also be used to perform further tests to assess the economic benefits and to make more informed estimates of the costs of production. Hence, the first outcome of this project is making the business opportunity possible.

Secondary outcomes are in supporting the University's growing reputation in sustainable energy technology applied research; a track record in working successfully with the local manufacturing base and associated contributions to the teaching and learning programmes.

3.2. Knowledge Action Network

The Knowledge Action Network (KAN) is managed and delivered by the Research & Enterprise Team, rather than the academic staff within the Faculty of Arts, Business, and Science. The team have been working with SMEs for over 10 years on a variety of programmes include leadership , graduate placements, knowledge transfer partnerships and innovation support. The Knowledge Action Network was devised after the successful delivery of the LEAD programme by a number of partners across the north west. LEAD was a 10 month leadership development programme using a blended learning style to equip SME owners with the skills to work on their business rather than in it. A partnership was developed with Manchester Metropolitan University, the University of Chester and University of Cumbria, based on a recognition of the benefits to SMEs of sharing knowledge, good practice and exploring the potential for collaboratively working. The Universities submitted a bid to the European Regional Development Fund to enable delivery of a programme aimed at assisting SMEs with their innovation potential. We recognised the need to support smaller firms with incremental innovation, where much less work has been done than on support to disruptive innovation. The Knowledge Action Network in April 2012 and started delivery in September 2012.

We employ an innovative approach to knowledge transfer through a blended learning approach of peer-to-peer learning, coaching to encourage reflection, and the use of academics and specialists to share intelligence and information. Delivery of the Knowledge Action Network is blended learning with a number of elements built around the core Knowledge Action Groups, shown in Figure 2 below.

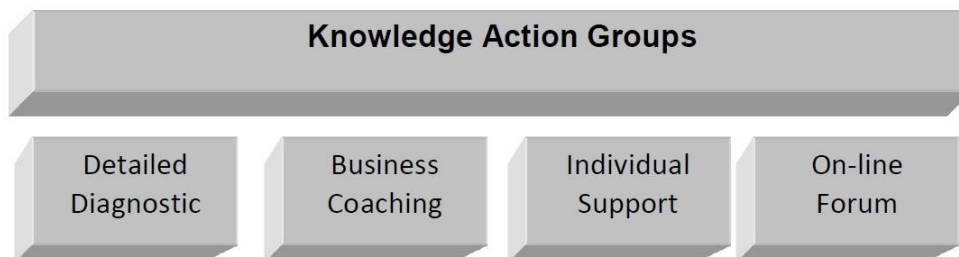


Figure 2: Schematic overview of the implementation framework for the Knowledge Action Network

The overall aims of the Knowledge Action Network are:

- To educate companies in innovation processes and encourage creativity
- To encourage companies to become more innovative in their approach to energy and resource management such as energy generation or energy efficiencies
- Build capacity of the renewable technology sector within Cumbria

The specific objectives are to:

- Kick-start new relationships, nurturing and growing innovation capacity both individually and jointly;
- Provide the opportunity for peer-to-peer learning across different business models, sectors and experience;

- Investigate opportunities and encourage individual businesses to work in collaboration to improve cross-company capacity;
- To give delegates across the wider network access to specialist and generic speakers;
- To build a strong group with lasting bonds, working towards the network becoming self-sustaining beyond the lifetime of the programme.

Delegates are recruited into cohorts with specific themes we have developed so they already have an interest in the subject matter. Within each cohort there are between 6 and 8 delegates who will work closely with one another on knowledge transfer and exchange of the particular theme. Each cohort is also given the opportunity to network with the wider Cumbrian based companies working on different themes. This encourage cross-sector working, raises the profile of participants and promotes the opportunity for partnership working. A safe environment is built by the facilitators where individuals feel able to share concerns and doubts without judgement. We use a form of action learning to build individual confidence whilst imparting experience that is valuable to the group. The facilitators of the group also use collaborative inquiry to share knowledge and experience between the individuals within the cohort.

The aim of KAN is for the groups to become self-sustaining beyond the lifetime of the programme so the group are encouraged to take ownership and decide on the content required by external speakers. This is an innovative and potentially has a risk of failure, but can work well and allow the programme to be genuinely tailored to the requirements of the delegates.

An example of a theme is the Building Design cohort which aims for the group to work together and investigate innovative approaches to low-carbon building design in existing and new buildings. The group brings together energy advisers, architects and renewable installers who share knowledge and experience with one another whilst investigating the potential for collaborative working.

All cohorts have a sustainable or renewable energy theme including a hydro focused one which links with the Modern Waterwheel project.

The business coaching element assists delegates to harness and apply creativity and innovation in their chosen project. In order to drive innovation a 'solutions focused' approach is often used. There are 6 one hour sessions across the length of the programme – 5 of which are telephone based allowing for the rural area in which we work.

The Knowledge Action Network [16] is interpreted and delivered differently by the three partner universities across the North West, with each university establishing their own local network according to the needs of their area. However, best practice is shared via the website. All delegates are granted access to a log-in area of the website where they can participate in discussions and build relationships with companies outside of the local area. This also provides the delegates with the opportunity to find support with the wider group for projects or bids they may wish to work on with partners. The project manager, employed by the University of Cumbria, is responsible for co-ordinating and sharing best practice within the Network.

The final element of the programme is the technical support provided to the delegates. This is a 4 hour session of knowledge transfer delivered at their premises on a one-to-one basis by a member of the academic staff or an external consultant. It is flexible and tailored to the needs of the company as identified during the diagnostic process. Usually the subject is specific in nature around the innovation the company are progressing or technical information around a specific technology.

Still in its first year, outcomes are limited. The targets include 13 jobs safeguarded, 9 jobs created and 28 business with improved performance, most of which cannot yet be measured. However, qualitative evidence is that the programme is reaching the objectives set and having a positive influence on the participating SMEs. So far 24 companies have enrolled on the programme in Cumbria and contributed to the knowledge action groups. Another 24 companies are currently being recruited to participate in the next round of cohorts commencing in Spring 2013. The intention is to run further cohorts both within renewable technologies, but also looking at wider sectors such as manufacturing, construction and tourism.

An impartial evaluation is being commissioned in order to measure the effectiveness of the programme, using both formative and outcome based evaluation to ensure that we react and implement improvements for current and future delegates. Some of the best evidence comes from delegate testimonials, examples of which are given below.

“The Knowledge Action Network has helped Quality Guild to review its portfolio and design new products that fit withnew emerging markets.”

Brian Lightowler, Quality Guild

“The Knowledge Action Network is opening doors to other businesses that I was aware of but hadn’t worked with before. Coming together and leading the way in Cumbria can only help to make our business making us more competitive and I’m thrilled the be involved.”

Suzanne Burgess, Solway Renewable Energy

“The Knowledge Action Network is giving us the opportunity to share market information in a trusted, collaborative way. Inevitably this approach will help us all define strategies to help our clients in better more informed ways....”

Simon Sjenitzer, Westlakes Energy

3.3. Health-nuclear synergies – the Cumbrian Centre for Health Technologies (CaHeT)

The third case study is delivered with the Faculty of Health & Wellbeing and builds on links with the nuclear industry and the healthcare sector. Two themes have emerged, which exploit synergies within these differing domains. Firstly, a need has been identified for vocational skills development in Radiation Protection, Medical and Health Physics Technology, where formal education lags practical experience and there is an opportunity for professionalisation of the career path. Secondly, the use of technology in delivery of learning and in delivery of healthcare have been seen to have common challenges.

A number of activities are being developed within CaCHeT:

- A number of part time vocational courses, CPD and short courses in Radiation Protection, Medical Physics Technology, for employees within the NHS and the nuclear sector;
- Commercial sample analysis services, using unused capacity within the teaching laboratories;
- A research programme developing new models for designing telehealth and rural health services;
- Specialist e-learning tools, including the Stilwell Virtual Community, used internally and commercially launched in mid 2013.

CaCHeT's objectives are:

- To build a sustainable research, development and demonstration Centre to develop, promote and transfer health technologies and innovations;
- To improve the skills of the West Cumbria workforce, through market-focused, part time higher education;
- To create opportunities for wealth generation within a diversified West Cumbria economy.

The University of Cumbria has identified a number of different partners, who are involved in the different strands. Sellafield Ltd, one of Europe's largest nuclear re-processing centres based in West Cumbria, has driven the development of the Foundation Degree and BSc in Radiation Protection, which now has national intake and a demand for distance learning delivery with an accompanying (non-accredited) short course programme. Expansion into the healthcare sector is now in progress, working closely with the West Cumbria University Hospital NHS Trust and other healthcare trusts elsewhere in the North West. The University is a partner with the University of Manchester Dalton Cumbria Facility, National Nuclear Laboratories, the Nuclear Decommissioning Authority and other partners to look at technology transfer from nuclear to medicine, currently focusing on novel techniques for producing radio-isotopes. A demonstration facility in telehealth, linked to a 'health park' concept, is being planned.

The most mature of CaCHeT's innovations is the Stilwell Virtual Community [17], a repository of linked videos, text and multimedia files based around approximately 70 characters in a fictional community. This is being used already in corporate training contracts with the Cumbria Partnership Foundation NHS Trust and Cumbria County Council and is shortly to be rolled out as a commercial product to the higher education market.

Initial outcomes are the income generation from vocational training and contract services, but CaCHeT is 3-4 years away from covering its costs. A second phase business plan is being developed to generate sufficient critical mass from the activities to support core staff. The strategic need to address education and healthcare rural delivery challenges is supported by strong partners within three of the major employers of West Cumbria.

4. Evaluation of the case studies

We have selected three case studies that are quite disparate in their approach, their focus and key partnerships. However, all are linked by a number of factors.

Firstly, they all meet strategic objectives of Britain's Energy Coast regeneration plan, as delivered through the Energy Coast Campus Programme. In particular, they resonate with four of the high level objectives – applied research, R&D demonstration, higher level skills and training, business support. Secondly, all are germane to the key priorities for the University of Cumbria, as a regionally based, new and developing university. They support priorities to grow research activity within specialist niches and to provide relevant higher education to the local community within Cumbria. Thirdly, they build on strong partnerships with other organisations within West Cumbria, developing complementary expertise and specialisms.

Perhaps most importantly, all of these case studies are currently – and for the foreseeable medium term – reliant on regional development funding. The real outcomes and benefits are likely to occur beyond the lifetime of the funding and hence there is pressure to develop longer term business plans that show financial stability. This is by no means unusual. Many such initiatives within higher education have highlighted similar issues.

For the University of Cumbria, the economic benefits can be examined in terms of the economic drivers identified above [9]. Increased student enrolments from the local population will necessarily be limited as this is a sparse, rural area, but is nevertheless an important driver. The additional income from services, particularly in the waterwheel project is potentially significant, provided the small companies involved can justify and secure the investment required once the external funding ends. The more strategic and long term aims to support the University's global aspirations in research and student recruitment and the indirect benefits of a more innovative local environment to attract academics and students is possibly the most obvious, but the least tangible.

At some point in the future, when regional development funding from Britain's Energy Coast ceases, local businesses and organisations will be expected to fund and lead these activities – and to generate benefits to justify their support. It is to be hoped that in West Cumbria the gap between pump priming and income generation can be fulfilled in order to reap these benefits and get a return on the investment.

5. Conclusion

A regionally focused University can offer value to a regional development strategy that supports its objectives in improving skills, innovation and wealth creation. For a University focused on applied research and community partnerships, such activities can support its strategy. The three case studies are already generating qualitative benefits and are well embedded with local stakeholders within West Cumbria. There is always a difficulty in sustaining activities such as these beyond the initial funding, that need to be addressed through careful business planning.

An ongoing programme of evaluation will look at successes within other regions, particularly at how they have benefited the region in a longer term than the initial funding.

6. Acknowledgements

We are grateful for support from Britain's Energy Coast, the Energy Coast Campus Programme, the European Regional Development Fund and the University of Cumbria.

7. References

1. Britain's Energy Coast Campus online at <http://www.britainsenergycoastcampus.org.uk/>
2. Lambert Review of Business-University Collaboration – Final Report. HM Treasury, London. 2003. Available online at http://www.hm-treasury.gov.uk/d/lambert_review_final_450.pdf
3. Sir Tim Wilson. Review of Business University Collaboration. 2012. Available online at <http://www.hefce.ac.uk/news/newsarchive/2012/name,69548,en.html>
4. Braczyk, H.-J., P. Cook and M. Heidenreich (eds.) (1998), Regional Innovation Systems: The Role of Governance in a Globalized World, Routledge, London.
5. The Knowledge Economy, World Bank Institute, 2001, Geneva.
6. Goddard, J. B. and P. Chatterton (2003), "The Response of Universities to Regional Needs", in F.Boekema, E. Kuypers, R. Rutten (eds.), Economic Geography of Higher Education: Knowledge, Infrastructure and Learning Regions, Routledge, London.
7. Research Excellence Framework online at <http://www.ref.ac.uk>
8. Peter Arbo and Paul Benneworth, 'Understanding the Regional Contribution of Higher Education Institutions: A Literature Review' (Education Working Paper No. 9). Research report prepared for the OECD-IMHE project "Supporting the Contribution of Higher Education Institutions to Regional Development". OECD 2007.
9. John Goddard and Jaana Puukka. The Engagement of Higher Education Institutions in Regional Development: An Overview of the Opportunities and Challenges by Higher Education Management and Policy, Volume 20, No. 2, OECD 2008.
10. University of Cumbria online at <http://www.cumbria.ac.uk>
11. University of Cumbria Corporate Strategy 2012-17 online at <http://www.cumbria.ac.uk/Public/VCO/Documents/Communications/Publications/Corporate-Strategy-2012-17.pdf>
12. John Goddard, Douglas Robertson and Paul Vallance. Universities, Technology and Innovation Centres and regional development: the case of the North-East of England. Cambridge Journal of Economics 2012, 36, 609–627. Advance Access publication 26 April 2012
13. Huggins R, Johnston A, 2009, "The economic and innovation contribution of universities: a regional perspective." Environment and Planning C: Government and Policy 27(6) 1088 – 1106
14. Higher Education Innovation Fund – online at <http://www.hefce.ac.uk/whatwedo/kes/heif/>
15. Davies-Shiel M. Watermills of Cumbria, The Dalesman Publishing Company, 1978.
16. Website for the Knowledge Action Network, online at <http://www.knowledge-action.co.uk/>
17. Stilwell Virtual Community, online at <http://www.stilwelleducation.com/>