ACADEMIC EXPERTISE FOR BUSINESS (A4B)
Knowledge Exploitation Capacity Development

KNOWLEDGE EXCHANGE PROJECTS (KEPs)

A USW-BANGOR-SWANSEA project

Project: Low Impact Materials Network (LIMNet)

BACKDROUND TO QUESTIONNAIRE

Lead Institutions:

1. **Smart Multifunctional and Biomimetic Materials: Bangor University**
2. **3D Printing and Simulation for Industrial Fabrication: Swansea University**
3. **Building and Construction Materials: University of South Wales (USW)**

This project seeks to develop and evaluate new opportunities for the diversification of the economy of Wales and is closely aligned to two of the strategic priority areas (Advanced Materials and Manufacturing and Energy and Environment) and for funding in Higher Education by the Welsh Government (WG). It also falls within the Low Carbon Economy and Advanced Engineering and Manufacturing R&D priorities.

The LIMNet starter team (at USW, Bangor and Swansea) is aware of the importance of developing a network that will deliver and has a track-record of successful collaborative partnering. Thus, the project has the potential to deliver a new network for Wales that will deliver on key strategic aims aligned with both the WG and the TSB. Another key outcome of the project will be building strong relationships with enterprises/ SMEs in Wales and beyond. Building direct links between companies and major multinational organisations with significant market access and R & D capacity can only enhance this potential sector and cluster activities and lead to new prospects for collaborative R&D in Wales.

The purpose of this KEP is to establish a Low Impact Materials Network (LIMNet). This action is in response to the report by the Government Office for Science into the Technology and Innovation Futures: UK Growth Opportunities for the 2020s . The network will bring together Welsh Universities and companies that are interested in the development of low impact materials; it will seek to identify global trends, key players, new products and markets, identify future opportunities and map out the R&D capacity needed to achieve these aims at a UK level.

The Network will bring together three interest groups within the low impact materials cluster, 3D printing and fabrication (Swansea), construction materials (USW), and biomimetic materials (Bangor). The network will help support and increase the exchange of new knowledge and expertise through skilled people between academia and industry within each sub-sector.

To help achieve all of these aims the network will bring Welsh Academics together with leading UK/EU and Welsh companies. LIMNet will draw together a fast track insight into the future opportunities in the three low impact materials cluster areas. With this insight Wales will gain benefits through improved research proposals and greater grant capture. The final report will illustrate the opportunities through a series of case studies that will demonstrate the market opportunities that could exist through the exploitation of innovation. It is also hoped that at the end of the project a number of collaborative research projects will be in place with funding through the Technology Strategy Board (TSB).

The report by the Governments office for Science on the Technology and Innovation Futures: UK Growth Opportunities for the 2020s identified some of the priority areas for science development in the UK. This KEP will explore these opportunities in the context of this report from a Welsh perspective. It will lead to a new collaboration in Wales that will further support the science and innovation agenda.

In 2012 the Welsh Government published their strategic agenda for science and innovation in Wales. The development of a strong and dynamic science base that supports the economic and national development of Wales was highlighted as a key goal. The strategy also recognises the need to increase the share of UK Research Council Funding and improve the quality of research. LIMNet will help achieve these aims by providing a focussed approach to a select area of priority. This will enable the development of a stronger co-ordination of resources across Welsh Universities and engagement with key anchor companies in Wales and the UK. Three of the Welsh Government's priority industry sectors will be targeted in LIMNet; Advanced Materials and Manufacturing, Construction and Energy and Environment. It will also focus on two of the Welsh R&D priorities, i) The Low Carbon Economy and ii) Advanced Engineering and Manufacturing.

Low Impact Materials

The development of Low Impact Materials is important for the sustainability of the Welsh and UK economies. These materials use less resources such as energy, virgin raw materials and can be easily recycled or disposed at the end of their life cycles. The impact of the development of these materials will be significant in the construction industry. New materials with lower embodied energy and improved technical performance are in high demand in building applications. Manufacturing companies will be looking to reduce the amount of energy they us to produce products in the future. Technologies that can assist them develop new production processes need development. 3D Printing and Fabrication will be increasingly used to manufacture new products in low and high volumes. This capability will change the way manufacturing companies operate in the future. There is also an increasing demand for new materials that are multifunctional. Examples of multifunctional materials of so called "Smart" materials are that they can sense and adapt to changes in their environment. Changes in humidity, light or load are "recognised" by the material which then alters it's performance. Mimicking the performance of natural materials is a growing area of interest as in many examples nature has already develop SMART materials.

Events

A key to developing a proactive network is the quality and range of events that will be developed in the KEP. A series of quality workshops will be hosted by all three project partners in South and North Wales. Steering group meetings will be established to plan and organise these events. The steering group will be responsible for selecting key note speakers and facilitators, developing the workshop programme, allocating resources, organising venues and marketing.

Low Impact Building and Construction Materials

Lead Institution: University of South Wales (USW)

The embodied energy of many building and general construction materials is high, and the use of recycled materials is still low despite recent endeavours to increase recycling and reuse waste and by-product materials. The development of new materials that are low in energy, have reduced global warming potential, and that will help save energy is critical for the sector to improve its environmental performance. At the University of South Wales, there is an active research team into sustainable building design and the manufacture and use of low carbon construction materials. The work at the Centre for Engineering, Research and Environmental Applications (CEREA) combines applied research, consultancy and knowledge transfer to deliver a commercial service to businesses in Wales and the UK. A significant proportion of this endeavour is relevant to the current LIMNet project. At CEREA, research into novel cements for the partial or total replacement of traditional binders of Lime and Portland Cement is well-established. A range of technologies have been developed, utilising natural, industrial and agricultural waste and by-product materials in the novel formulations. Using these novel binders, other waste and by-products have been successfully bound to produce building and construction materials of very low environmental impact. A few examples are shown in Figures 1 – 3 below.

Figure 1 – Low-impact building bricks developed at the University of South Wales to simulate the popular fired "London" bricks. The USW "eco" bricks are unfired, and bound using a novel binder that does not contain any Portland Cement. Industrial trials were carried out in collaboration with Hanson Brick Ltd., at their fired clay brick plant at Stewartby, Bedfordshire, England. In South Wales, industrial trial were also carried out with PD Edenhall brick company, at their concrete brick plant at Eweny, near Bridgend

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Figure 2 – Low-impact Portland cement-free building blocks and jointing mortar, developed at the University of South Wales to simulate typical products made using Portland Cement (Industrial Trials were carried out in collaboration with WD Lewis concrete block company at Aberdare, South Wales).

Figure 3 – Low-impact building polymer "timber" material ideal for decking, all weather furniture, fencing, shelving, and other uses. (Ongoing Research and Development Industrial trials in collaboration with a polymer recycling company at Ebbw Vale, South Wales)