

GTEP



**Knowledge and Technology Exchange
in Further Education Colleges**

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By

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GTEP



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¹ The New Engineering Foundation is a not for profit, independent and strategically focused organisation that works with key partners and stakeholders to ensure that the UK modern engineering industries have continued access, now and in the future, to the skills and talent they require. Our objectives and strategies reflect these responsibilities. It aims to nurture interest in Life-Long Learning of modern engineering and technology amongst educators across our schools, colleges and universities. (<http://www.neweng.org.uk/>)

² The New Engineering Advisory Panel consists of representatives from the following organisations:

- Association of Colleges
- CBI
- EEF
- Foundation Degrees Forward
- Gatsby Technical Education Projects
- Higher Education Academy -Engineering Subject Centre
- Institute of Directors
- New Engineering Foundation
- North West Development Agency
- Qualifications and Curriculum Authority

The Challenge

“By the end of this decade, China’s economy might be larger than Germany’s. Within a decade, it might overtake Japan to be the world’s second largest economy. The EU and US will account for a steadily diminishing share of world output.”

“The most successful economies will be those that are able to respond quickly to rapid technological and market changes, promote enterprise, productivity and innovation and thus move up the value chain.”

HM Treasury Report:
Long term global challenges and opportunities in Europe
March 2005

“.... productivity rates falling behind those of the USA; that is allowing more science graduates to be produced by India than by Europe; and that, on any relative index of a modern economy - skills, R&D, patents, IT, is going down not up. India will expand its biotechnology sector fivefold in the next five years. China has trebled its spending on R&D in the last five.”

Rt. Hon. Tony Blair MP
Prime Minister, United Kingdom
23 June 2005, European Parliament

Key Questions to be investigated are:

- Q:** What are the barriers to further education colleges playing a more active role in the development of knowledge and technology exchange activities?
- Q:** What more could be done at policy-maker level to increase and improve the contribution of further education colleges in terms of innovation, knowledge and technology exchange within their respective regions?

Study Aims

The aims of this research study are to:

- Identify the key challenges for developing and growing knowledge and technology exchange activities in further education colleges;
- Assess the level and type of knowledge and technology exchange activities in further education colleges;
- Suggest a set of principles that could strengthen and energise the knowledge and technology exchange activities in further education colleges;
- Recommend a mechanism that could act as the initial catalyst to develop better structured and coordinated knowledge and technology exchange activities in further education colleges.

Context

The role of further education colleges is changing and policy makers recognise the crucial role that FE colleges play in economic and social development through the generation of knowledge, training of labour, business support and other forms of economic development.

Knowledge and Technology Transfer (KTT) activities are considered key drivers for strengthening the UK level of innovation and entrepreneurship development. However, KTT activities do not form part of the remit of the further education (FE) sector³ in general.

In England, the Learning and Skills Council- the responsible government agency for funding further education colleges- provides no direct funding to colleges to enable them to pursue and engage in KTT activities⁴.

Other UK regions such as Wales have encouraged KTT activities across their FE colleges and have achieved clear benefits for all stakeholders involved (colleges, students and the local economy).

KTT activities do however exist in some FE colleges in England. Where they exist, albeit in a less structured way to those in the higher education sector, they tended to result in a number of noticeable benefits to all the stakeholders involved, including:

- Better collaboration and knowledge exchanges with local and regional businesses⁵;
- Opportunity for developing and growing the provision of higher education programmes and professional development courses;
- Better informed lecturers and relevant business and industry experience;
- Better managed students' expectations from the world of business and industry;
- An ethos of encouraging entrepreneurship and innovation amongst all involved.

³ The FE Sector comprises of 482 colleges of further education in England serving over 4 million students.

⁴ Colleges are increasingly considering new ways to reassert themselves as 'key actors' in the knowledge economy and they see business and industry as an alternative source of funding to help them achieve their strategic goals and overcome some of the budget cuts resulting from LSC reforms.

⁵ Production of knowledge, particularly localised tacit knowledge, is viewed as a valuable regional asset (OECD, 2001a) *Cities and Regions in the New Learning Economy*.

Definitions

Knowledge transfer is the action and flow by which largely tacit knowledge is transmitted among people. In other words, it describes a view of education in which knowledge is packaged and transmitted to learners.

Technology transfer is the process of developing practical applications from the results of scientific research and development with the intent to capitalise on new knowledge, research and development for commercial purposes. Successful technology transfer requires dealing with several kinds of knowledge. There is the knowledge that created the technology. There is knowledge about how to operate the technology. There is knowledge about the value and the quality of the technology. Any successful technology transfer will require some form of knowledge transfer.

The objective in this context is to enable and facilitate knowledge and technology transfer between colleges of further education and industry. The overall goal is to improve the competitiveness and the innovation level between such collaborative organisations. So, in Further Education Colleges, Knowledge and Technology Transfer activities involve lecturers and business representatives applying and sharing their collective expertise to important business problems. Such activities could include the following:

- Short training courses for industry
- Joint college-industry course development
- Joint college-industry product and sub-system development including product testing
- Joint college-industry process and market development
- Applied research and development
- Collaborative funding support for innovation

Innovation is about the successful exploitation of new ideas. So, in Colleges of Further Education innovation may be in the programmes and services offered or indeed, innovation can be exhibited in their processes (e.g. course delivery mechanisms, production process etc.)

Entrepreneurship is about assuming the risks of owning one's own business. Entrepreneurship often involves substantial innovation that gives the venture the competitive advantage that results in wealth creation.

Through entrepreneurship education, FE Colleges can help young people to build skills and unlock their entrepreneurial creativity thereby improving their business, academic and life skills. Entrepreneurship empowers young people to build a vision for the future through exploring new business and career opportunities and driving educational aspirations.

Creativity is the interplay between ability and process by which an individual or group produces an outcome or product that is both novel and useful, as defined within some social context. There are three reasons why people are motivated to be creative:

- Need for novel, varied, and complex stimulation
- Need to communicate ideas and values
- Need to solve problems.

1.0 Executive Summary

In the current changing economic environment, innovation and entrepreneurship have become more market-driven, and more rapid and intense, as well as being more closely linked to scientific and technological progress. Their growing recognition has been highlighted, at an EU level, by the Maastricht Communiqué in 2004, which expressed the need to improve links between education, skills, jobs and enterprise. It has also emphasised the important role that knowledge and technology transfer (KTT) can play in facilitating innovation.

At a national level, the UK is already a world leader in scientific advancement, boasting some of the world's premier research facilities, universities, and scientists. The UK also recognizes that innovation is key to a strong economy and global competitiveness.

In an effort to do more, the UK reviewed its innovation environment in 2003 through two key documents, the Lambert Review and the Innovation Report. The reports led to the Science and Innovation Investment Strategy, which outlines the UK's path over the next ten years to a more modern and thriving environment for scientific and technological innovation.

So far, the Government's recent policies to promote and improve UK innovation performance have mainly focused on increasing the knowledge and technology transfer activities between institutions of higher education and business and industry.

Whilst it is clear that higher education institutions are increasingly playing an important role in reducing the gap between the supply and demand for technology and knowledge transfer services, it is also worth not underestimating the role that further education colleges and their resources can also play in driving innovation and addressing the needs of business and industry, particularly micro and small businesses. **Hence, a twin-track approach is needed to create the step-change required to improve the level of innovation and entrepreneurship across the higher and further education sectors.**

The New Engineering Foundation has therefore undertaken this research study to assess the level and type of knowledge and technology transfer / exchange activities in the FE sector and to identify the challenges and recommendations to improve the capacity for maximising the drive for innovation and entrepreneurship.

This research study was conducted over the period of March – June 2005. It commenced by surveying just under 300 further education colleges mainly in England. 49 colleges (16%) have participated in the survey. In addition, 10 colleges have participated in depth interviews. Input was also sought from all other UK regions to enable a more comprehensive picture about the sector to be formulated. The study was also underpinned by desk research, web searches and communication exchanges with a number of key government departments and agencies, the European Commission, as well as contacting over 100 businesses of different sizes and from different sectors. In addition, the study also collected evidence from various professional associations and networks. Furthermore, the study has also responded to two Government reviews being conducted currently by Lord Sandy Leitch (HM Treasury) and Sir Andrew Foster (Department for Education and Skills).

This research study has highlighted the need for encouraging and further developing the knowledge and technology exchange activities between FE colleges and businesses.

In the majority of FE colleges that have participated in this study, the knowledge exchange activities were found to be eclectic and not well coordinated or focused enough in order to serve the needs of local and regional businesses.

However, the study identified a somewhat limited but healthy range of KTT activities in FE colleges. **Furthermore, the study also highlighted a growing trend of FE lecturers wishing to engage in more KTT activities, particularly in those colleges where they are involved in providing higher education programmes.** Examples of KTT activities are described in the following list.

Broxtowe College

KTT activities include:

- the development of a college-based 'hub' that enables the knowledge exchange with industry and other local stakeholders;
- Synergistic developments of specialised training and apprenticeship programmes that meet industry standards with a number of global companies such as Toyota and ServisAir;
- The use of guest lecturers from industry and access to industrial laboratories and equipment;
- Limited product development and enhancement (e.g. Non-destructive testing of products in collaboration with a local engineering precision firm).

The College has established a Technology Advisory Group to enable amongst other things the multi-directional flow of knowledge between the companies, local organisations and the college.

Broxtowe College also enjoys good links exist with De Montfort University. Special collaboration involving Toyota has been developed around lean manufacturing.

The teaching of entrepreneurship at Broxtowe is delivered in the main through giving business training to micro-organisations as well as by providing Enterprise Rehearsal courses to young people and job seekers. Innovation and creativity is taught both by organising specific games and exercises in dedicated classes and by ingraining fundamental principles in normal lessons. Overall the college sees that the teaching of these subjects needs to be fostered further and embedded as part of the college's culture.

Doncaster College

Whilst the Knowledge and Technology Transfer activities are in their infancy, the College has already made significant strides in developing this area. Examples of KTT activities include:

- Limited contract project-work with local firms. For example the college intends to utilise its Rapid Prototyping Machine to meet demands from local firms;
- Specialist training courses and development of qualifications to key local firms such as UK Coal, RWE Power, Transco and Grant Rail. For example, the College has developed a range of specialist qualifications in the area of welding where actual technical knowledge transfer and the sharing of best practice between the college and the firm takes place. Grant Rail is very familiar with one type of welding known as aluminothermic, whereas the college is proficient in other types including MIG and oxy-acetylene.
- Establishing their first Knowledge Transfer Partnership scheme and they are learning from it.

Currently, the teaching of entrepreneurship is not widely spread and it is mainly taught as a module on some of their Business courses.

The college also owns a business incubation building which it is trying to develop further. The College Business Development Manager has been focusing on helping young people to start up their own business once they have completed their studies at the college.

Somerset College of Arts and Technology

The college runs a limited number of KTT activities and has a healthy programme of Foundation Degrees and a well defined Entrepreneurship programme:

- The college runs 10 Foundation Degrees with dedicated employer advisory groups and is accredited by the University of Plymouth. The college is also a designated Centre of Vocational Excellence (CoVE) in Construction;
- Entrepreneurship has been embedded in the curriculum over the past two years. All students have to undertake an entrepreneurship module at Level 1 irrespective of the course that they are on. A range of assessment methods have been well developed in relation to this entrepreneurship programme;
- The College is in the process of establishing an on-site Incubation Unit to support graduates for an initial period of 12-18 months;
- The college regularly convenes Employer Steering Group events to provide students' mentoring and to promote employer engagement with the college. In addition, the College has an active programme of visits to industry and runs frequent business events;
- The college is growing its 'Blended Learning' capability to enable them to offer more specialised courses to industry cost-effectively as well as widening their business catchment areas.

Somerset College – Continued.../

The college believes that they are being held back from delivering more compelling KTT activities by such issues as:

- Lack of dedicated funding for establishing KTT activities in a focused way;
- Access to usable business and market intelligence in their local and regional economies;
- Lack of funding to support staff professional development to make them more marketable to business and industry.

Newbury College

The engineering (electrical and mechanical) and IT departments have made a conscious decision to pursue KTT, although presently KTT is not embraced as a college-wide strategy. Examples of existing KTT activities include:

- Development of specialised short courses and advisory services in Rapid Prototyping and rapid tooling services for Stereo-lithography for small and start up companies in the region (e.g. 3TRPD Limited – part of the supply chain to global firms such as companies as Mercedes and BMW);
- Students' involvements in product design and development. For example one of the outcomes is that college students have developed a centre console for the Smart Car, a part which was not originally fitted in the car.
- Seizing the opportunities afforded by the College's fortunate geographical position to help several local companies and organisations struggling to recruit engineering and technology staff into their workforce, and engage with them in the following ways:-
 - Williams F1 are currently running a recruitment campaign to attract the right people and have asked Newbury College to become a training provider of Level 3 skilled people that are able to operate on high-tech materials such as carbon fibre and other space age technologies;
 - The Atomic Weapons Establishment (AWE) Aldermaston are driving a recruitment campaign for a different set of reasons. They are mainly concerned with the number of their staff that are due for retirement which could impact the level of skills and internal competencies in the business. The College is therefore expanding their HND programmes in mechanical and electronic engineering to meet the regional business demand for such skills.

Innovation and entrepreneurship is taught to the students as a by-product of engaging with the companies.

The college has an ICT Foundation Degree. The links with higher education has been centred on the Foundation Degree programme accredited by the University of Reading. The College has received £45k from the National Technology Institute towards improving their technical resources.

Gorseinon College

Gorseinon is a small 6th Form College in Wales that has an outstanding A-level pass rate of 99.6% across the whole college. Knowledge and Technology Transfer / Exchange activities are considered at a strategic level to underpin the College's mission to achieve its funding needs and to improve its standing in the local business community. Some of the KTT activities include:

- Operating about 20 Knowledge Transfer Partnership (KTP) schemes;
- Establishing a dedicated business centre – The Kingsbridge Centre – to support businesses with specialist technical training and advisory services;
- Funding under the KEF (Knowledge Exploitation Fund) initiative to drive innovation. The College has established an “Entrepreneurship Champion” to support its development of entrepreneurship education;
- Being a Microsoft Academy accredited to Level 4.

The college provides limited higher education programmes (e.g. PGCE, Care and IT courses in association with University of Wales at Newport and University of West of England).

The College teaches entrepreneurship by offering team building sessions using K-NEX kits and using role models, who are specially trained to target certain subject groups. These two activities are currently funded by the Welsh Development Agency.

The college is also exploring ways to embed entrepreneurship into its curriculum at AS-level.

Writtle College

The College runs both higher and further education programmes and as such it receives funding for higher and further education from HEFCE and the LSC. The demarcation lines between the HE and FE provision can clearly be seen. The College is affiliated to the University of Essex. Over 10 lecturers from the College are involved in KTT activities which include the following:

- Delivering specialist courses to local companies. The College has established collaborative arrangements with Ford and ReMIT (Retail Motor Industry Training Association). Local companies such as KLAAS UK also run hands-on agricultural-engineering courses for college lecturers and students to update their knowledge of new processes and machinery;
- Running KTP schemes (currently 2); HEFCE funded knowledge exchange programme called KEEP. Examples of projects include “development of new packaging materials to protect food stuffs and other goods being dropped from high altitudes; and new instant freeze drying systems of foods”; and the i10 scheme which is a business support service provided by ten Higher Education Institutions in the East of England.

The College was involved with the Flying Start Event for graduates organised by the NCGE (National Council for Graduate Entrepreneurship). Entrepreneurship is taught on HE courses such as the land-based engineering and on the Masters in Rural Entrepreneurship. At FE level, entrepreneurship, creativity and innovation are presently not taught, although innovation games are included in the students' induction.

A number of **key challenges** were identified during this study:

- Generally, there seems to be a lack of understanding on what is meant by knowledge and technology transfer, although the term “knowledge transfer” was more readily understood by colleges than the term “technology transfer”;
- KTT activities are not considered to be part of the strategic plans of the majority of colleges and as such, these activities do not attract LSC funding (Learning and Skills Council which is the main funding body for the FE sector) or other direct government funding;
- Where KTT activities existed, the majority of such activities tended to be mainly offered in the form of specialist training and related consultancy services. Often these services were found to be bespoke designed and not scalable to satisfy wider industrial demand.
- There seems to be a ‘credibility issue’ in the way colleges are perceived by business and industry. This is partly due to a lack of commercial experience in colleges, and partly due to a lack of up-to-date knowledge that is often sought by companies. In addition, companies are often unclear as to how to interface with colleges and what are the colleges’ commercial terms and conditions.
- There seems to be a staff ‘self-confidence issue’ when considering engagement with business and industry representatives as they feel that they are not necessarily well equipped to engage in industrial activities, mainly due to the lack of scholarly and specialist professional development activities available to lecturers. This is exacerbated further by a lack of available generic set of principles or interaction models that could equip college staff to improve their skills of engagement with business and industry. Furthermore, the lack of a physically conducive environment within many colleges has also acted as another inhibitor in driving KTT activities.
- Whilst many regional and local government agencies have compiled market intelligence data, the majority of colleges seem to have a major issue in interpreting such market intelligence in a way that reflects the economic imperatives in their regions thereby enabling them to anticipate, prioritise and respond to the regional and local business demands accordingly.
- There seems to be a clear shrinkage of engineering and technology departments in FE colleges⁶, which are often considered the drivers for developing knowledge and technology transfer / exchange activities. This shrinkage is due to restructuring, budgetary cuts and related funding reforms in colleges.
- There is however a number of Government and EU funded initiatives that are open to FE colleges to apply for. Initiatives such as the Knowledge Transfer Partnership (KTP) and Leonardo da Vinci offer practical and financial support to colleges to improve the quality of vocational training and promote entrepreneurial skills through knowledge and technology transfer projects.

⁶ Maintaining Engineering and Technology departments are often less financially attractive for college senior management as they are more costly in terms of their needs for physical and capital investments than other softer skills courses.

Unfortunately, many of the colleges that were analysed in this study do not have the in-house expertise, time and resources that are required to bid under such initiatives and achieve successful results.

The **survey** element of the study has identified the following findings:

- 65% of the respondents surveyed claimed that they have engaged in KTT activities over the past 12 months.
- Over the past year, colleges that are embracing KTT have engaged in more than 5 projects which indicates that colleges have already placed staff and allocated time and resources on KTT projects and consider these activities to be important. In assessing the type of KTT activities that were undertaken by colleges, Industrial/Educational Collaboration leading to a new product/service or product/service enhancement came out as the top KTT activity.

Industrial / Educational Collaboration leading to a new product / service or product/service enhancement.	31%
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This result is pleasing to see as historically, companies looking to engage in collaboration on a particular product/service development have turned to higher education institutions for fulfilment of this need. The results of this study indicate that this tradition, in some areas, may be changing. Also this area of KTT activity indicates a balance of both the knowledge transfer and technology transfer elements of KTT, which is good, as most KTT activities in FE colleges have tended to gravitate towards the knowledge transfer, and focus less on the technology transfer elements. In addition, Educational and Industrial Staff Exchanges accounted for 23% of all activities, suggesting that exchanges are considered as important vehicles in the achievement of knowledge transfer.

The activity that achieved the smallest proportion was industrial/educational collaboration on a joint paper or publication, accounting for only 7% overall. This result is not surprising as the writing or collaborating to write a publication is very much a core HEI activity as it forms part of the higher education Research Assessment Exercise to secure research funding.

- In the majority of KTT activities that colleges are engaged in, structured detailed reporting was found to be not often required by senior college managers or by the industrial firms. Therefore, KTT findings and recommendations are mainly disseminated internally within colleges through such means as e-newsletters and emails. Much broader external dissemination is very limited.
- Colleges and their lecturers appreciate the fact that there are a number of benefits that could be gained from conducting KTT activities. Here are extracts from the survey that highlight the opportunities and benefits:

Providing opportunities for staff professional development	30%
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This response highlighted the synonymous connection between professional development and KTT activities. It also indicated that lecturers have a predisposition and acceptance of KTT as being a vehicle that drives professional staff development.

Enhanced curriculum design	26%
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This response showed that experiences of KTT, whether at the college or in an industrial environment, are feeding back into the curriculum.

Supplement course-content with real-life examples	23%
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Using real life examples in teaching and learning enhances the effectiveness of the student learning process.

Gaining up-to-date knowledge	33%
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This response analysed from both student and lecturer perspectives (which were validated during depth interviews) showed the positive impact of KTT in colleges in helping to deliver a more improved, relevant and responsive educational curriculum.

Improved student project work	24%
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Undertaking project work in colleges is an area where students often encounter some difficulties. Project work requires multi-disciplinary techniques, communication skills, problem-solving and an understanding of inter-dependency events within a project plan. Encouraging students, particularly those on work-based programmes such as Foundation Degrees, to take part in KTT activities improves their capabilities in their subject areas, as well as enhances their inter-personal skills such as communication, team-working and time management. Involvement in KTT also helps students to improve their project management and report writing skills.

The use of guest lecturers from business and industry	35%
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The popularity of guest lecturers from industry is understandable as historically, guest lecturers have been used to impart the latest techniques, technologies and related knowledge to students using real-world case studies.

The use of competitions and sponsorship	28%
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The use of competitions and sponsorship as a method for introducing KTT to students was also found to be the second most popular method. Traditionally, business competitions and sponsorship schemes have been successful in bringing education and industry together, hence their popularity in this survey.

Using entrepreneurship, innovation and creativity sessions	19%
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Using entrepreneurship, innovation and creativity sessions in educational programmes has been a successful method to introduce students to knowledge and technology transfer activities.

However, 71% of respondents claimed that they did not include entrepreneurship in their college programmes, and only 29% confirmed that they did include entrepreneurship⁷.

Teaching entrepreneurship included such elements as 'creating new business concepts', 'starting-up a new business', and 'developing a new prototype' as well as arranging visits to local businesses to hear views from real entrepreneurs.

The innovation and creativity subjects were found to be 40% more popular by college lecturers than entrepreneurship.

A number of possible methods for teaching innovation and creativity were identified in the survey. Problem solving games or exercises were identified as the most popular method and accounted for 26% of the overall methods.

KTT activities have been funded using different sources of funding initiatives including those offered by the EU, central / regional governments, local authorities and RDAs. It was also found that on a number of occasions colleges decided to fund KTT activities directly.

Government funded KTT activities	34%
Local government and RDAs funded KTT activities	20%
College self-funded KTT activities	20%

Over 90% of colleges intend to continue with their Knowledge and/or Technology Transfer activities after the initial programme funding has finished.

- On average colleges expect the level of income generated from knowledge transfer activities to be in the region of £50,000-£100,000 depending on the size of the college and their location. This response suggests that colleges have the capability for self-sustainability after their sources of funding have ceased.
- All surveyed colleges would like to take part in future KTT activities and would welcome the development of more programmes that are aimed at growing KTT activities in FE colleges.

⁷ The EC report 'Education and Training 2010' includes entrepreneurship in a framework of key competencies that everyone should learn by the end of compulsory education and be able to maintain and update through lifelong learning. The European Commission is currently considering ways in which to promote and develop entrepreneurship skills in vocational training.

The study has made the following **recommendations**:

- At EU level, whilst the new proposal for Competitiveness and Innovation Framework Programme (CIP)⁸ is being developed to bring industry closer with educational institutions, particular emphasis should also be given to pump-priming and encouraging the engagement of further and vocational training institutions to take up innovation, knowledge and technology transfer activities.
- At a national level, the study encourages UK Government to develop an adapted version of the HEIF (Higher Education Innovation Funds) initiative to encompass a two-track approach that embraces both higher and further education institutions. This will help to energise entrepreneurship across all stakeholders (FE and HE educational institutions; business and industry; intermediaries and support agencies) and improve the overall ‘absorptive capacity’ of innovation by companies, thereby strengthening the UK’s competitiveness position.
- At a regional level, the Government should also consider the development of a “Market Intelligence Service” to help FE colleges interpret and therefore respond to employer needs in a more meaningful way. There is a clear role for the Sector Skills Development Agency and its network of councils to provide this service to FE colleges, undertaking regular employer needs analysis and surveys to refresh and update their information. The interpretation of market data at a regional level should involve the participation of both the Regional Development Agencies and the Regional Offices of the Association of Colleges to ensure that the information is packaged and presented in a useful and college-friendly way.
- At the funding councils’ level, a more strategic approach to promoting and encouraging knowledge and technology exchange activities in FE colleges needs to be adopted. Any approach to improve the colleges’ method of engagement with business and industry should be clearly coordinated with other national and regional agencies such as the Sector Skills Development Agency and the Regional Development Agencies. Any strategies proposed should be flexible and incremental to enable colleges to adopt them and contextualise them to reflect their unique identities, priorities and core competencies. For example, HEFCE could take steps to encourage the location of future development of Centres for Excellence in Teaching and Learning (CETL) to be in FE colleges where HE provision exists⁹. This could help develop lecturing staff capabilities, provide great opportunities for creating innovative curriculum and engender better pedagogical development to overcome some of the credibility issues raised by lecturers.

⁸ The Competitiveness and Innovation Framework Programme aims to support innovation by bringing industry closer together with higher and further education institutions, to support take-up of research results, technology transfer and innovation.

⁹ CETLs were announced in the HE White Paper in 2003. Funding is provided over a period of five years from 2005-06 to 2009-10. HEFCE has recently funded 74 CETLs and all are located in higher education institutions. The White Paper alludes to a funding opportunity of a further 25 Centres for Excellence in Teaching and Learning.

In addition, the Higher Education Academy could also play an important role in disseminating good practice across the FE sector, to enable enhancements to be made to the quality of HE provision in FE colleges. Such enhancements could be made in such areas as flexible delivery, workforce development, work-based learning and e-learning. Naturally, considerations should be given as how these enhancement activities would be funded.

- Higher education institutions can be encouraged to play an important role in developing further their collaborative activities with FE colleges. In addition, higher education institutions could also offer college lecturers a range of appropriate scholarly and professional development activities to help them to improve their knowledge and skills thus enabling them to support and enhance the quality of the HE programmes offered by FE colleges.
- At college level, there needs to be a dedicated technology and knowledge transfer / exchange function that can internally coordinate KTT activities and develop compelling marketing plans to reflect on the one hand the college's capabilities and core competencies and on the other the local and regional needs.

Colleges also need to consider the development of incentives and levers for encouraging the participation of their lecturers. A more flexible staff timetabling mechanism needs to be offered to enable time relief for staff, giving them the opportunity to engage in KTT projects. This time-relief could be packaged as "**Entrepreneurial Leave**".

In providing specialist training, consultancy and support services, colleges should consider a more flexible approach to provision, including the effective use of e-learning and virtual support mechanisms to overcome the capacity and scalability limitations in delivery and geographical reach.

- The New Engineering Foundation recommends the development of **Knowledge and Technology Exchange Nodes (K/TEN)** to be created by FE colleges. The following K/TEN Node diagram highlights the way in which the joint FE college-industry collaboration could be undertaken.

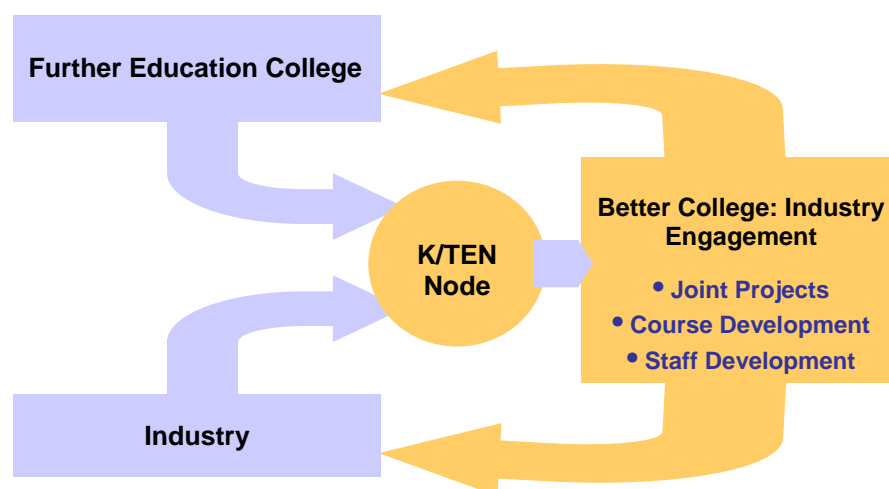


Figure 1 – K/TEN: Driving College: Industry Collaboration

It is envisaged that K/TENs will play a major role in developing market information and coordinating the business development activities to ensure relevance to the local and regional economic needs and to promote the core strengths of the college. In addition, K/TENs will undertake the acquisition, management and delivery of industrial projects. Furthermore, K/TENs should also help with creating the environment for encouraging, developing, incubating and supporting business start-ups.

The K/TEN model was tried out on the colleges that were interviewed during this study and received an overwhelmingly enthusiastic and encouraging reaction.

The K/TEN model offers the right ingredients for creating a market pull and supplier push scenario. The routes that drive the push-pull levers comprise of a route that is determined by industry and that comprises of their needs for specialist training courses, product development and enhancement and the development of specific sector-based skills.

To test this concept further, it is envisaged that the K/TENs should be funded for a minimum operational period of two years. Typical funding per K/TEN should be in the region of £25,000-£30,000 per annum.

The Study suggests that the Department of Trade and Industry (DTI) and Office of Science and Technology (OST) could consider the development of the K/TENs in FE colleges, to be tried out as a pilot scheme comprising of about 15 colleges in the first instance. If successful the scheme could be gradually expanded to encompass about 50 K/TENs in colleges.

The study also suggests that upon successful achievement of the K/TEN objectives, the DTI/OST could consider the possibility of extending the current Innovation Fund for Higher Education HEIF¹⁰ to embrace the FE sector. The study suggests the introduction of FEIF (Further Education Innovation Fund) as a subset of HEIF and should be administered by the higher education funding council HEFCE.

- The study also recommends the development of an FE College based “**Entrepreneurial Fellowship**” programme. Again, colleges have welcomed this type of approach to enable them to develop and embed entrepreneurship in their curriculum. It is envisaged that such a programme will help colleges to identify internal **champions** that could lead the entrepreneurship and creativity curriculum development.

The Higher Education Academy could play a role in providing advice and guidance in areas of curriculum development as well as supporting colleges in sharing good practice across the sector.

¹⁰ HEIF (Higher Education Innovation Fund) – A Government Initiative led by the OST to increase the capacity of higher education institutions to provide industry with technical expertise and business aware science and technology graduates.

The Study suggests a joint approach by the Department for Education and Skills and Department of Trade and Industry should be considered. Again, the Entrepreneurial Fellow should be funded for a period of two years. Funding should be granted to colleges on a competitive basis in order to create healthy sector dynamics.

Today, there exist a number of great opportunities that can energise the FE sector to play its full role in driving innovation and entrepreneurship as well as providing a strong foundation for the creation of a more productive and highly skilled workforce.

2.0 Introduction

Dynamism, constant innovation and speed are key driving factors in today's New Economy in the UK. Organisations increasingly look for their main competitive advantage from knowledge-driven innovations. What people know and how they create, share and use knowledge is at the heart of being effective in a competitive knowledge-driven economy. Therefore, the expectations of businesses and society at large of further education (FE) colleges are changing. Preparing the next generation workforce to be equipped with innovation, enterprise and creativity skills is becoming widely recognised as an integral part of creating new social and economic dynamics.

In many western economies, entrepreneurship education is now firmly established within their educational policies. Reports from the EU, OECD, EFMD and UNIDO¹¹ all highlight the critical importance of the educational and supportive environments in creating entrepreneurs. These reports have also stressed the need for strengthening knowledge and technology transfer activities in educational institutions in order to create the right level of synergy between academia and business to drive the competitiveness and innovation policies.

The UK Government has been creating a number of new public policy initiatives over the past few years to include: the commercialisation of science and technology activities in higher education institutions; the development of innovation strategies; and the establishment of competitiveness and productivity drivers and indicators.

However, the government's new policies and funding initiatives such as the Innovation Fund for Higher Education (HEIF) have focused mainly on the higher education sector and as such, many higher education institutions have inculcated knowledge and technology transfer activities as part of their strategic plans. Knowledge and technology transfer activities have also been considered by higher education institutions as key options to provide a means to enrich their educational and research programmes and to generate supplementary income.

Although knowledge and technology transfer has become a reasonably recognised term in the context of higher education, it is still a relatively new and not widely understood term in further education colleges.

Across many further education colleges today, knowledge and technology transfer activities are not recognised readily or interpreted correctly, and as such, these activities do not form an integral part of the strategic plans of these colleges. In addition, the Learning and Skills Council does not require the engagement of colleges in knowledge and technology transfer activities as part of the funding and development strategy of the FE sector. It is therefore, not surprising to see the lack of innovation, entrepreneurship and creativity education in FE colleges.

11 EU- European Union; OECD-Organisation for Economic Co-operation and Development; EFMD-The European Foundation for Management Development; UNIDO- United Nations Industrial Development Organization.

3.0 Rationale

Reflecting the dynamics of the UK economy and the paradigm shift in the labour market, self-employment and business ownership will increasingly become a viable and appealing goal for many of today's students, particularly those in further education colleges.

Vocational education in FE colleges must therefore extend beyond the delivery of occupational knowledge and skills to be effective in preparing students for a changing society and workplace. It must offer students an incentive for thinking creatively about an industry and broaden their understanding of the career opportunities afforded to them in that industry.

In addition, FE colleges can play an important brokerage and facilitation role for various community stakeholders, as well as subsuming the steady expansion of higher education provision, particularly through the development of foundation degrees. Like universities, FE colleges can also play a vital role in:

- Fostering the genesis and growth of new businesses;
- Developing vocational and professional training programmes that are credible and meet local and regional needs;
- Providing support to business and industry in the form of specialist consultancy and advisory services.

These college/industry links need to be further solidified and energised frequently to enable sustainable capacity and growth in Knowledge and Technology Transfer activities.

Developing a strategic need for technology and knowledge transfer / exchange activities in FE colleges can support and underpin the realisation of various Government recent policies on skills, innovation and productivity:

- Skills strategy- 'Getting on in business, getting on at work' 2005;
- Innovation Strategy- 'Investing in Innovation' 2003;
- Competitiveness Strategy: 'Progress towards a productive economy (March 2001), and, Enterprise and the productivity challenge (June 2001)

4.0 Research Methodology

The methodology used in this research study included the following elements:

- Desk research: including a review of relevant articles, reports and web searches;
- Primary research comprising of:
 - A questionnaire based survey of FE colleges that focused mainly on England. Although a selected number of colleges from other regions (Wales, Scotland and Northern Ireland) were also invited to participate in the survey and follow up discussions. The questionnaire, comprised of 16 questions, was designed and posted to colleges. An online version of the questionnaire was also made available through the New Engineering Foundation website.
 - Depth interviews with key staff from 10 FE colleges of different sizes and across various economic regions were undertaken;
- Discussions and exchanges with:
 - Selected number of businesses (approximately 100 companies of different sizes and across different sectors were contacted);
 - Government departments (DTI, DfES, DWP, HM Treasury);
 - Government Reviews;
 - Sir Andrew Foster Review commissioned by the Department for Education and Skills, and
 - Lord Leitch Review commissioned by HM Treasury;
 - Government agencies including:
Learning and Skills Council, Higher Education Funding Councils for England and for Scotland, Sector Skills Development Agency, 9 Sector Skills Councils, Qualification and Curriculum Authority, 9 Regional Development Agencies;
 - The European Commission (Director General for Education and Culture, and Director General for Research, Development, Technology and Innovation);
 - Employer Associations (CBI, Institute of Directors and EEF);
 - Teacher Associations and representative bodies (Association of Colleges, NATFE, NFEC);
- Seeking views from the New Engineering Foundation Advisory Panel.

5.0 Findings

5.1 The Survey

A database of 296 further education colleges was compiled. The survey was conducted between March and June 2005 using a four-page questionnaire that comprised of 16 questions designed to assess the level and type of knowledge and technology transfer / exchange activities in Further Education Colleges in England. The survey also sought to clarify whether the topics of Entrepreneurship, Innovation and Enterprise formed part of the teaching curriculum in engineering and technology departments.

A response rate of 16% (49) to the survey was received. Colleges¹² from all English economic regions have participated in the survey. The regional distribution of the responses to the survey is shown in Fig 1. In addition, the study also sought the participation of 2 colleges in Wales, 2 colleges in Scotland and 1 college in Northern Ireland to enable a more comprehensive analysis to be undertaken.

The following provides the analysis to the responses to each of the 16 questions¹³.

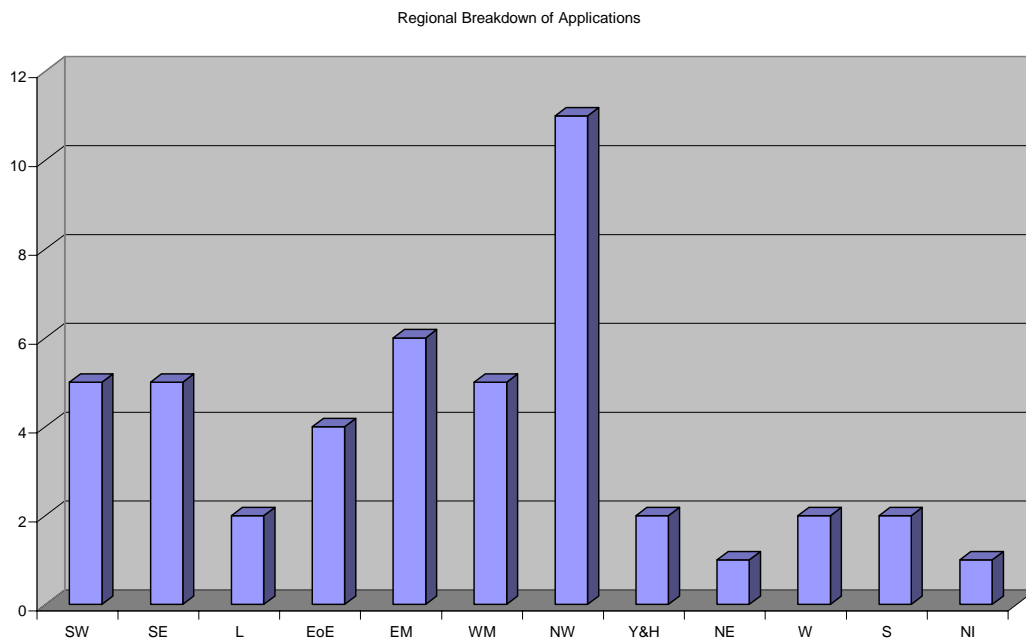


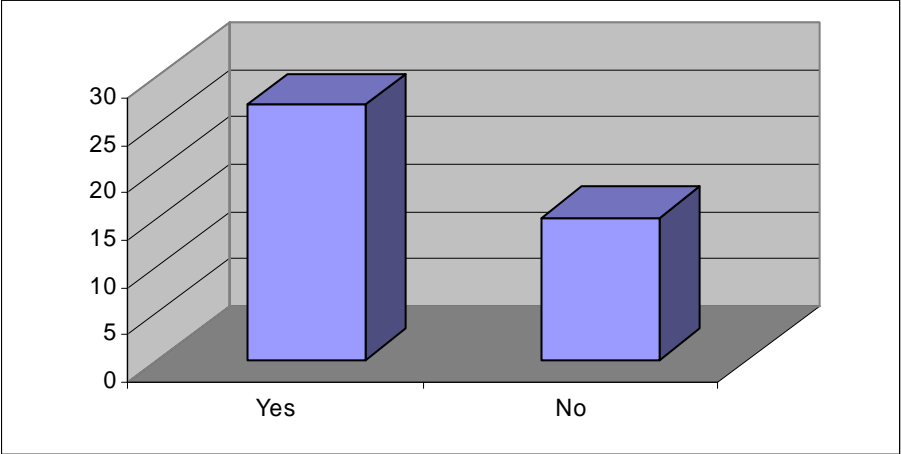
Figure 1- Responses from Colleges and their respective Economic Regions¹⁴

¹² A list of participating further education institutions is available in Appendix A.

¹³ An 8% error margin has been assumed to overcome analysis issues where Colleges have not provided a complete or precise answer to a given question.

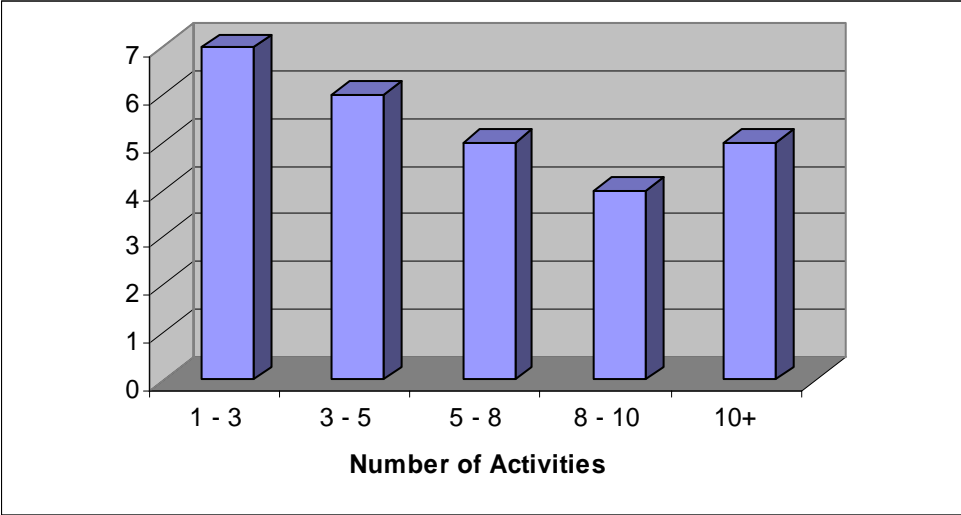
¹⁴ SW- South West; SE- South East; L- London; EM- East Midland; WM- West Midland; Y&H- Yorkshire and Humberside; NE- North East; W- Wales; S- Scotland; NI- Northern Ireland.

Q1: Does your College engage in any Knowledge and/or Technology Transfer activities?



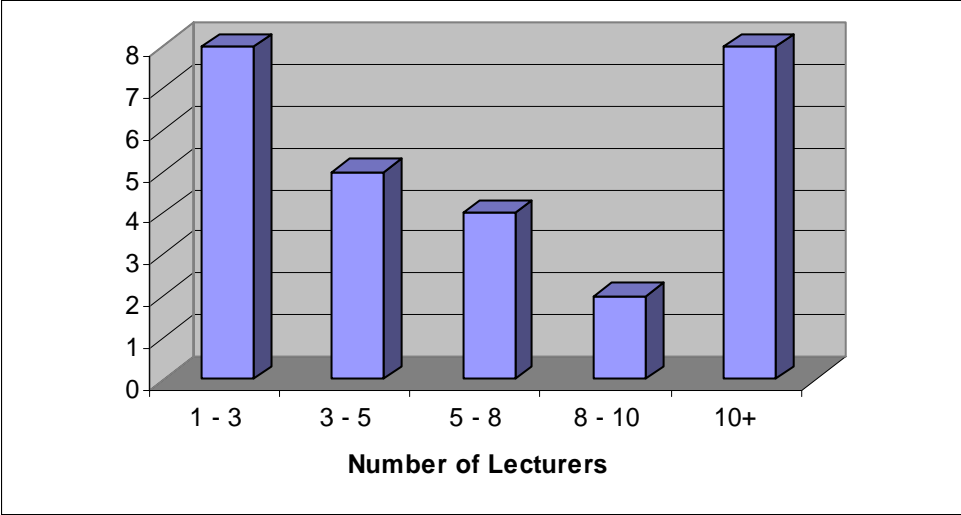
This question was a leading question, helping to determine the respondents' path through the questionnaire. From the respondent sample returned, 65% claimed that they engaged in Knowledge and/or Technology Transfer (KTT) activities. A third of the respondent colleges claimed that they did not, and proceeded to answer questions not relating to KTT activities.

Q2: How many Knowledge and/or Technology Transfer activities has your College engaged in over the past year? (please tick the box that applies to your number of activities).



This question sought to identify the number of KTT activities that a College had engaged in over the past year. Assessing the number of activities indicates the capability that Colleges have to engage in a range of KTT activities during the year. The results show that Colleges are engaging in a number of KTT activities during the year, with 22% advising on 3-5 activities and 18% of respondents advising that they have more than 10 activities in KTT per year. This response indicates that Colleges already placed people, time and resources on KTT and consider these activities important.

Q3: How many lecturers in your College engaged in Knowledge and/or Technology Transfer activities in the past year?



Analysing the number of lecturers' engaged in KTT would enable correlations to be made with the responses from Q.2. In Q.2 26% of respondents claimed that they engaged in 1-3 KTT activities per year. In this question, 30% of the respondents claimed 1-3 lecturers engaged in KTT activities during the past year. The activity and human resources applied to conduct such activities can be correlated.

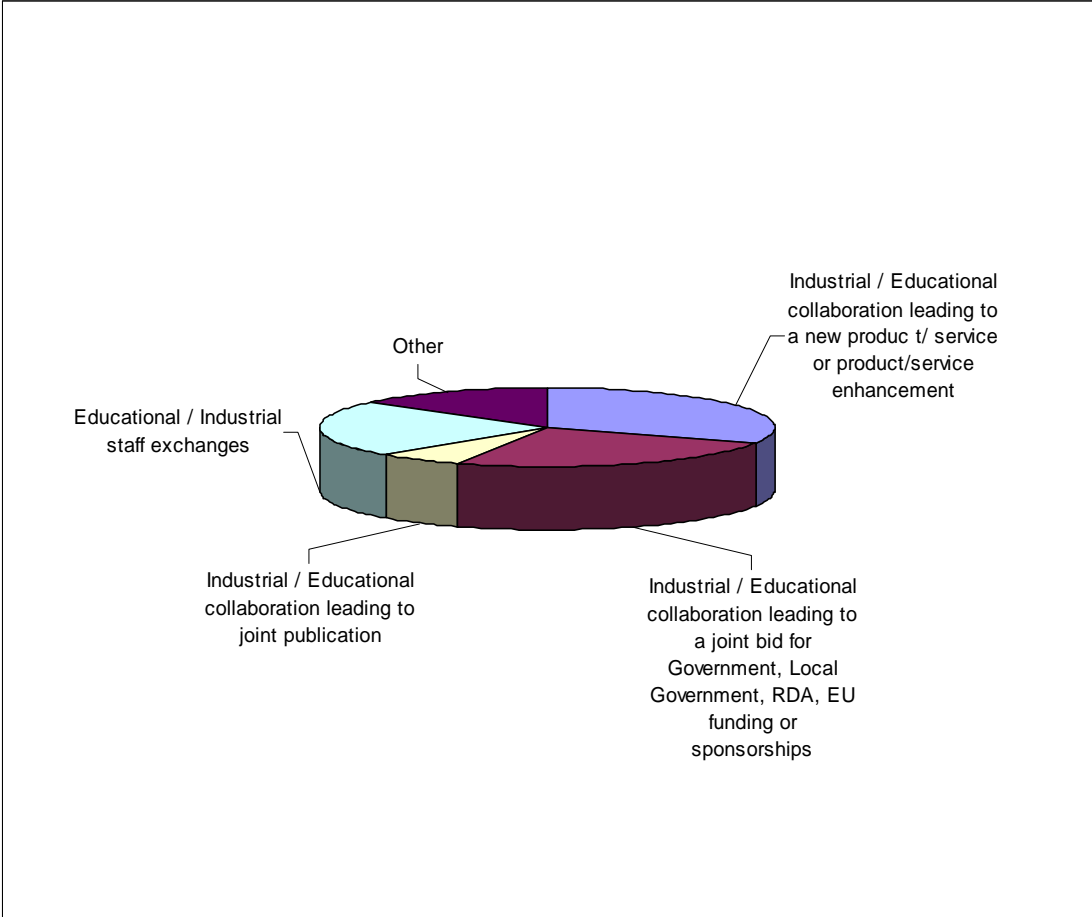
In Q.2, 18% of respondents claimed 10 or more KTT activities per year, however in this question the percentage of 10+ lecturers engaging in KTT activities is 30%.

It should be expected that the more lecturers engage in KTT the higher the number of KTT activities should be generated, but this is not the case. When further investigation was made, it was found that respondents were classifying short courses to industry as KTT, and therefore claimed that 10+ lecturers were engaged in KTT, when they were in fact running short courses.

This misinterpretation of terms has therefore caused a slight skew on the data responses, and the 10+ percentage response, instead of being a third of the respondents, once normalised, should be around 7%.

The average number of the lecturers engaging in KTT activities was found to be about 3-5 lecturers per Colleges, indicating that Colleges have a healthy and strong interest in engaging in KTT activities.

Q4: What type of Knowledge and/or Technology Transfer activities were undertaken by your College:



The purpose of this question was to focus the Colleges' understanding of what KTT activities really were, and to make them clarify which of the stated activities their College were engaging in. The areas were carefully selected to reflect the typical activities Colleges could engage in, given their obvious constraints on resources.

Out of all the activities, Industrial/Educational Collaboration leading to a new product/service or product/service enhancement came out as the top KTT activity with 31%. This result is pleasing to see as it shows that the Colleges who have selected this activity are engaging in KTT in its truest and most beneficial form. Joint collaboration on a new or enhanced product or service is an area where the Colleges could excel, as they could provide the hands-on expertise and knowledge exchange needed for industry to succeed in their new/enhanced product/service. This area of activity indicates a balance of both the knowledge transfer and technology transfer elements of KTT, which is good, as most KTT activities in FE gravitate towards the knowledge transfer, and focus less on the technology transfer elements.

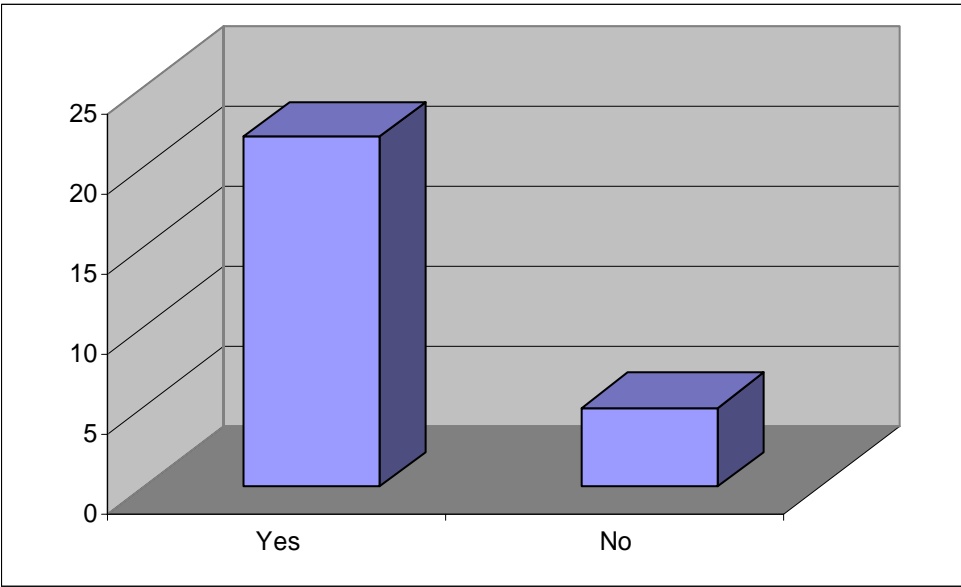
Historically, companies looking to engage in collaboration on a particular product/service development have turned to higher education for fulfilment of this need. The results of this question indicate that this tradition, in some areas, may be changing. This can only bode well for the Colleges who could find a good income stream from this type of activity.

Industrial/educational collaboration for a joint bid for government, local government, or EU funding came in second, accounting for 25% of all activities. It was expected that this activity would come high in the proportion of overall activities as it has a monetary motivation in the funding.

Educational and industrial staff exchanges accounted for 23% of all activities, suggesting that exchanges are considered as important vehicles in the achievement of knowledge transfer.

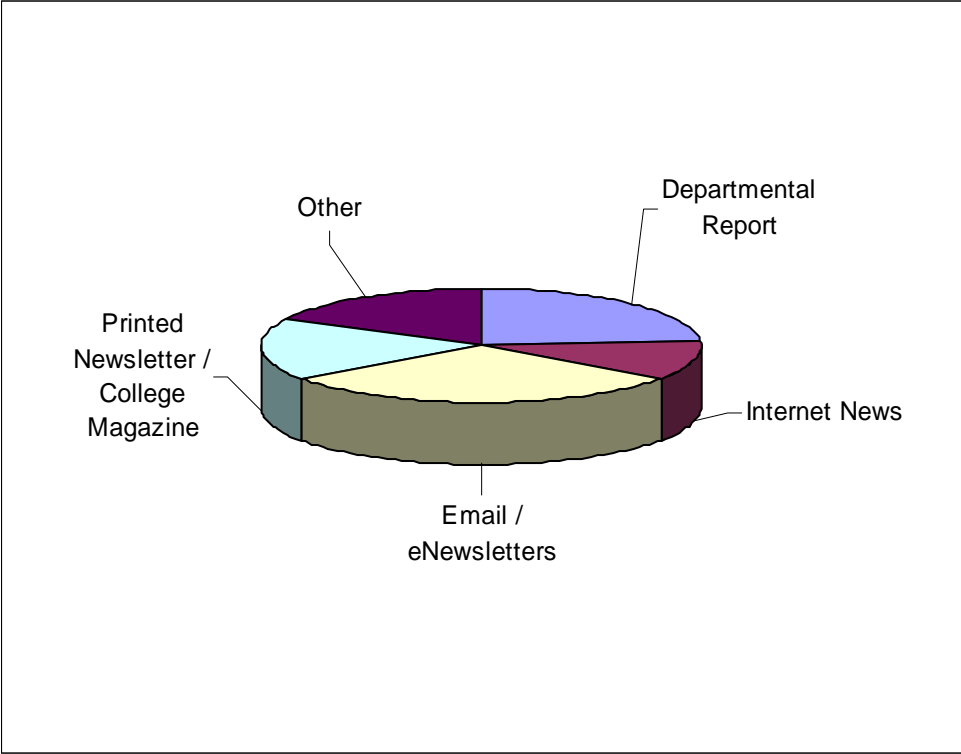
The activity that achieved the smallest proportion was industrial/educational collaboration on a joint paper or publication, accounting for only 7% overall. This result is not surprising as the writing or collaborating to write a publication is very much an HEI activity, and one that few Colleges would be interested in, as they have no statutory requirements to do so, unlike Universities that have to produce evidence of joint industrial/academic research (for requirements such as Research Assessment Exercise) to secure HEFCE funding.

5) Were these activities (in question 4) reported on and disseminated throughout your College?



From the respondents who answered Q4, 82% confirmed that they disseminated their KTT activities through a particular channel, and 18% responded that they did not disseminate at all.

The Colleges that confirmed that they did disseminate their KTT activities were then asked to qualify what channels were used. The question detailed typical channels: email/e-newsletter, departmental reports, internet news and printed College newsletter/magazine.



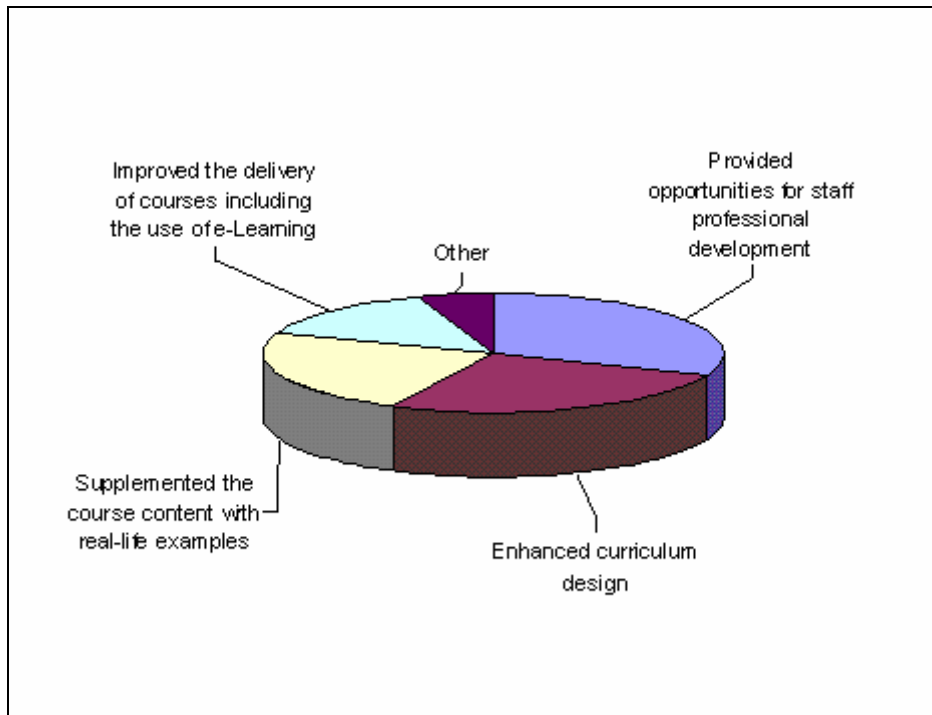
The most popular method of dissemination was found to be email and e-newsletters accounting for 31% of all channels. The immediacy of e-newsletters and email is often considered as good for promulgating ‘community’ information, and therefore, in a community like a College it is expected that this form of communication would come out as the most popular. The fact that email was considered as the most popular method of reporting also suggests that there is an ad-hoc nature to the business of KTT in Colleges. There is not currently a structured approach to KTT, requiring a detailed reporting method to be employed and therefore a high proportion of Colleges disseminate information and reports on KTT activities via email channels.

The responses showed 57% of the respondents who stated they reported through email or e-newsletter also disseminated their KTT activities through their Departmental report. This result indicates that in many Colleges, the departmental report is the main vehicle for dissemination, and email is a supporting channel of communication. Departmental reporting accounted for 24%.

From the respondent analysis, dissemination of KTT activities on printed college newsletters or in magazines was less popular, and they accounted for 17% of total activities. In recent years, education has seen a move away from printed magazines and newsletters to embrace the online alternative. This result could be conducive to such an approach.

The results from this question clearly indicate that Colleges want to disseminate and *are* disseminating through (mostly) immediate channels, information relating to their KTT activities.

6) How did these Knowledge and/or Technology Transfer activities help your lecturers?



This question sought to clarify the benefits that lecturers received when engaging in KTT activities. It is well understood that KTT should help lecturers in areas such as professional development, making the curriculum more relevant and exciting and supporting learning and teaching methods. The respondent analysis showed that these benefits were in line with the lecturers' expected benefits of KTT.

Out of all the benefits/outcomes to KTT expressed, 'providing opportunities for staff professional development' came out as the most popular benefit and accounted for a third of all benefits selected. This response highlighted the synonymous connection between professional development and KTT activities. It also indicated that lecturers have a predisposition and acceptance of KTT as being a vehicle that drives professional staff development. Clearly, as 23% of KTT are educational/industrial staff exchanges, the outcome of professional staff development is obvious.

Enhanced curriculum design accounted for 26% of all benefits for lecturers, showing that experiences of KTT whether at the College or in an industrial environment, are feeding back into the Curriculum.

31% of all KTT activities are industrial/educational collaborations on new or enhanced products/services, and it is apparent that new techniques, best practices, latest technologies and approaches would be employed in collaborative projects to develop or enhance the product or service, and therefore these new ways of working are being integrated back into the curriculum to reflect the industrial directions and demands.

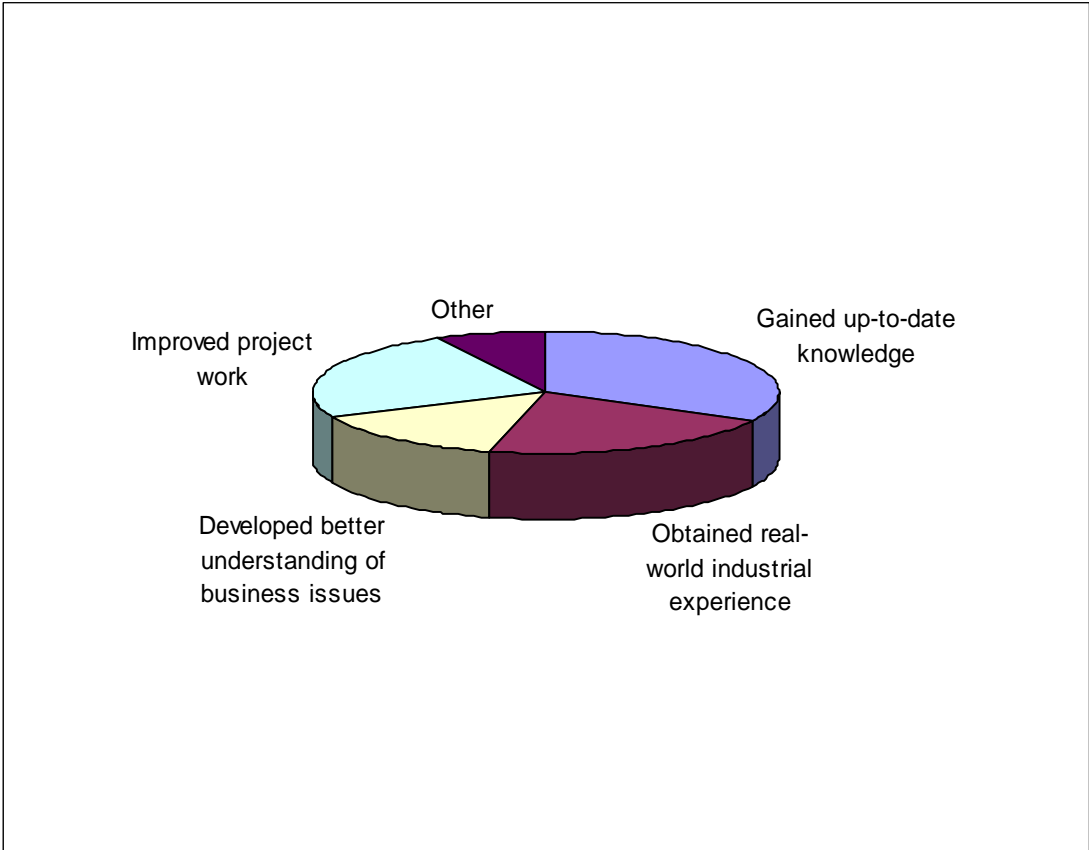
In Colleges, examples are often old and bear little resemblance of what happens in industry today. A major benefit, amounting to 23% of all benefits is lecturers' opportunity to supplement course-content with real-life examples. By engaging in KTT activities with industry, lecturers can bring to life their topics and thus make the subject more interesting and memorable for students. Such an improvement will help to increase student retention and make the students more employable after they achieve their qualification.

Real life examples make a subject more manageable to understand. In science, engineering and technology courses, some concepts are difficult to picture when cast in just theory, however placing these concepts in the real-world, using the experiences that KTT activities have given lecturers helps to deliver context and relevance to an abstract topic, and thus helps understanding and problem-solving.

With 75% of the respondents undertaking KTT activities having selected both enhanced curriculum design and the use of real-life examples in teaching as benefits, the symbiotic relationship between these two benefits is immediately apparent: good curriculum feeds off good content and vice versa.

The benefit 'improved delivery of courses including e-learning' accounted for 15% of all benefits, with 82% of all respondents selecting this benefit also selecting enhanced curriculum design, which indicates in these Colleges, changes may have been made to the Curriculum to enable e-learning to be adopted. 15% of all respondents have selected together the benefits of an enhanced curriculum, real-life examples and e-learning, indicating the important association between improving educational performance and engagement in KTT activities.

7) How did these Knowledge and/or Technology Transfer activities help your students?



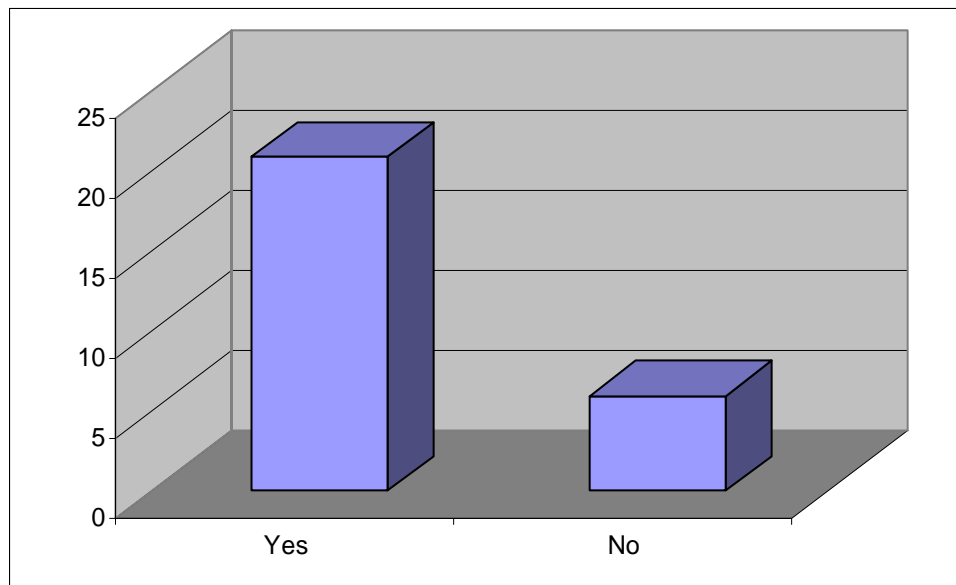
This question reflects the responses from Question 6, focusing on the benefits to the students from KTT activities. Gaining up to date knowledge was perceived by respondents as the most popular benefit for students, and accounted for 33% of all benefits to students. Mapping this response on to the responses for Q6, shows that 74% of those respondents who selected ‘gaining up to date knowledge’ also selected ‘supplementing content with real examples’. This response, analysed from both student and lecturer perspectives shows the positive impact of KTT in Colleges in helping to deliver a more improved, relevant and responsive educational curriculum.

Undertaking project work in Colleges is often an area where students encounter problems. Project work requires multi-disciplinary techniques, communication skills, problem-solving and understanding inter-dependency events in a project plan. As a result of KTT activities - most of which require teamwork and are project-based - improved project work should be a benefit. 67% of all respondents selecting this benefit and others confirmed that ‘improved project work’ was a benefit outcome from KTT engagement. Across all benefits, ‘improved project work’ accounted for 24%.

Obtaining real world industrial experience was rated high as a benefit and accounted for 21% of all benefits. 69% of all respondents who selected 'content with real life examples' also selected 'obtained real world industrial experience', suggesting that the need to bring the real-world experience into the classroom is a significant requirement for FE Colleges, and one that can be provided for by engaging in KTT activities.

Learning a subject in a vacuum will not deliver the transfer of knowledge that education is supposed to deliver. Subjects must be relevant to business today, not 20 years ago. A benefit of KTT engagement has been a 'better understanding of business issues'. This benefit accounted for 14% of all benefits. In engaging in KTT, a College can bring business issues to the fore, helping their students to appreciate them and more importantly, find resolutions or answers to these issues. Most business issues have a multi-disciplined angle, and thus students will learn to become multi-disciplined in their approach, seeing interdependencies and correlations between different topics. Such talents will make students more employable in the market.

8) Does your College have a methodology for introducing students to Knowledge and / or Technology Transfer activities?



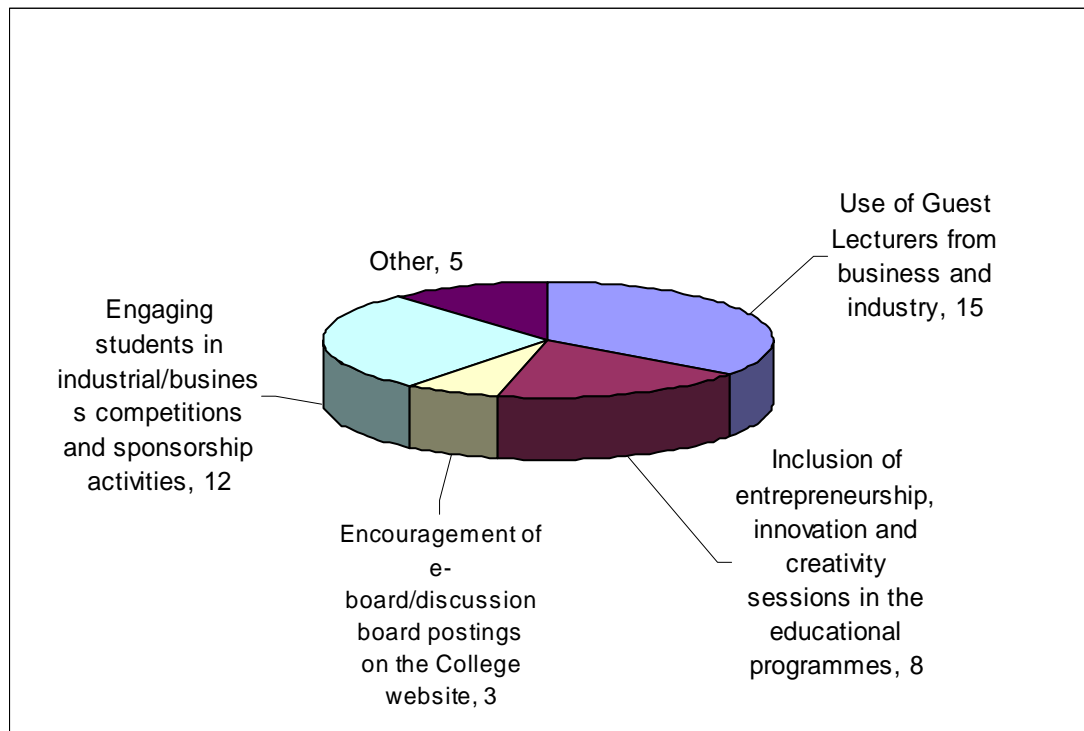
The connection between educational excellence and knowledge and technology transfer activities has been cited already. Encouraging students into taking part in KTT activities improves their capabilities in their subject areas, as well as enhances their inter-personal skills such as communication, team-working and time management. Involvement in KTT also makes students improve their project management and report writing skills.

Given the importance of KTT on the student, it is imperative for a College to adopt one or more methodologies for encouraging students to take part in KTT activities. In this question, 77% of respondents who claimed they took part in KTT activities also confirmed that they had one or more methodologies for introducing students to KTT.

From those respondents who had engaged in KTT, 23% confirmed that they had no methodology for introducing KTT to students.

A selection of methodologies were promoted, and out of the five choices, the use of guest lecturers from business and industry came out as most popular, amounting to 35% of all methods.

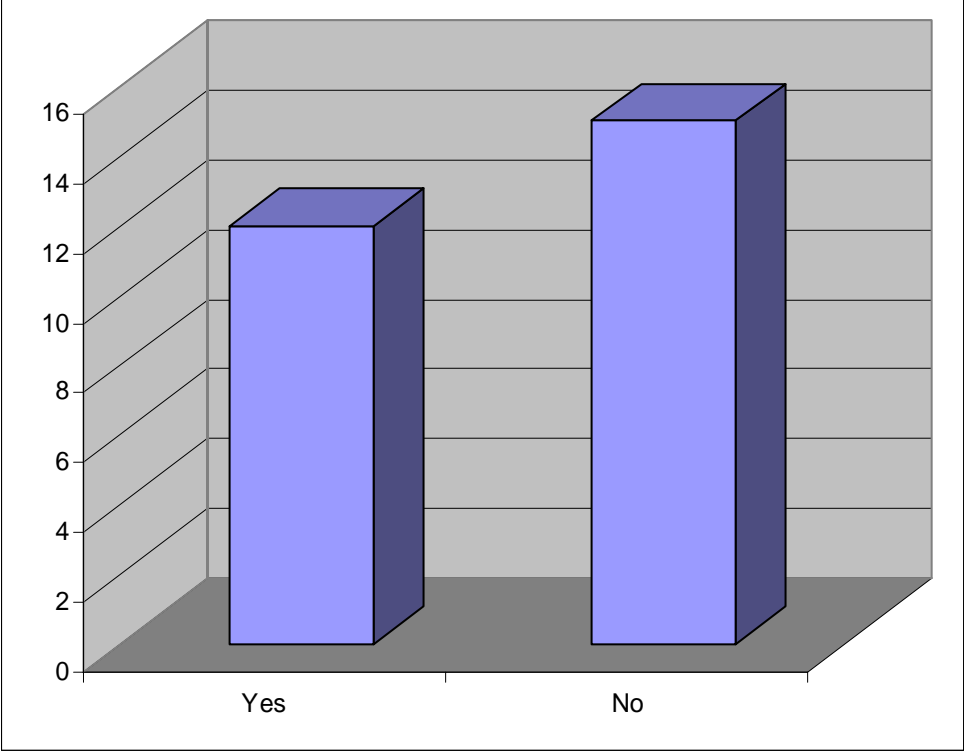
The popularity of guest lecturers from industry is understandable as historically, guest lecturers have been used to impart the latest knowledge to students using real-world case studies.



Using competitions and sponsorship was found to be second most popular method to introduce KTT to students, and accounted for 28% of all methods. Traditionally, business competitions and sponsorship schemes have been successful in bringing education and industry together, hence their popularity in this survey.

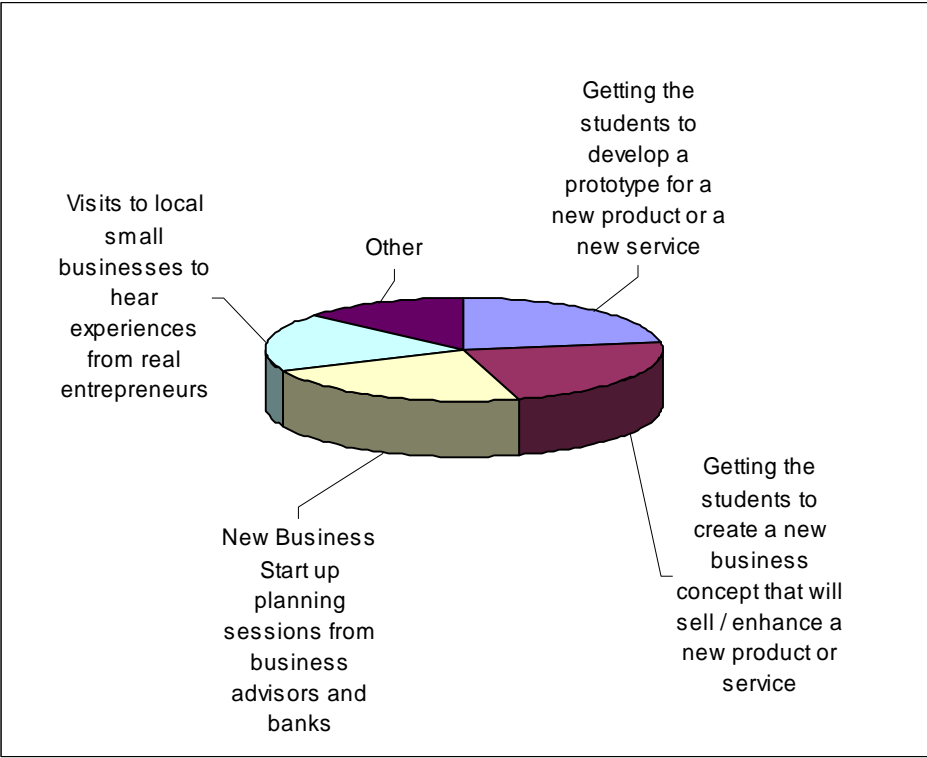
Using entrepreneurship, innovation and creativity sessions in educational programmes has been a successful method to introduce students to knowledge and technology transfer activities. This method accounted for 19% of all methods employed.

9) Do you include in your educational programmes the topic 'Entrepreneurship'?



Colleges across the board were questioned, including those that engaged in KTT activities and those that did not. Overall, 71% claimed that they did not include entrepreneurship in their programmes, and 29% confirmed that they did include entrepreneurship.

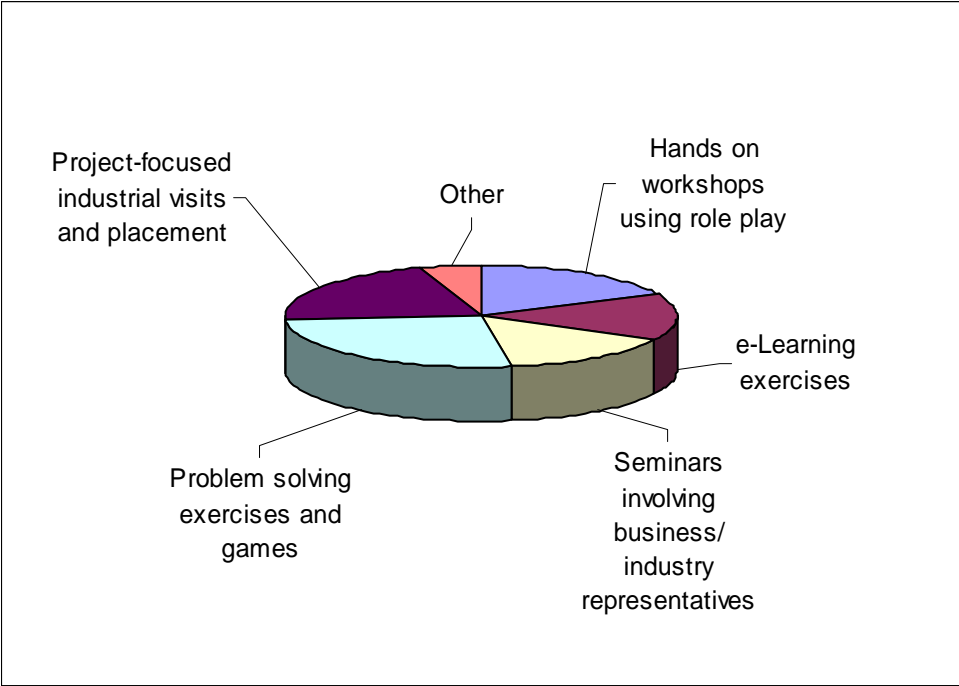
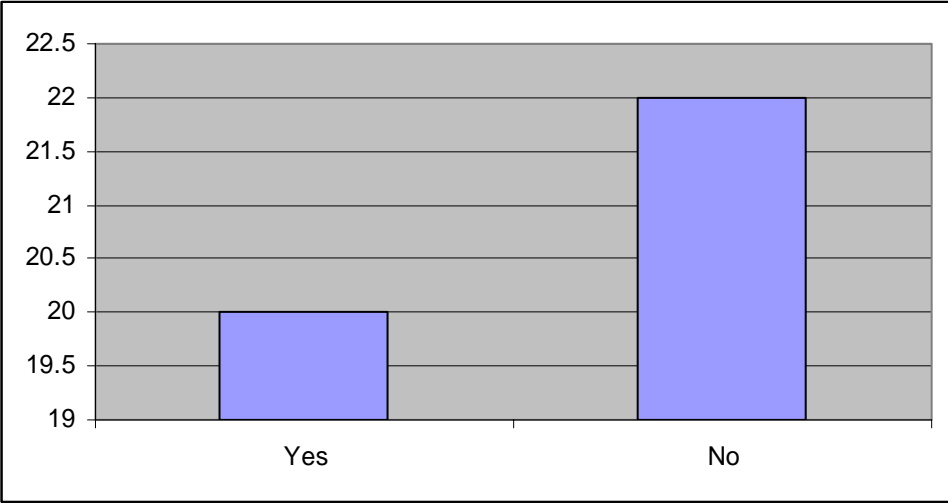
From those respondents that engaged in KTT activities 44% confirmed that they did include entrepreneurship in their programmes and 56% claimed that they did not.



Respondents answering yes to this question were then asked to select the type of entrepreneurial teaching methods. From the responses it was found that out of all the teaching methods employed to teach entrepreneurship, ‘creating new business concepts’, ‘new business start up advice’, and ‘developing a prototype’ came out as top, with each accounting for 23% of the total methods, making 69% as a whole.

Visits to local business to hear from real entrepreneurs accounted for 18% of all methods. From those respondents that claimed to include entrepreneurship in their programmes, 67% of these have confirmed that they regard the inclusion of entrepreneurship, innovation and creativity as way in which to introduce students to KTT activities.

10) Does your College teach innovation and creativity?



Respondents who engaged in KTT and those who didn't were asked whether their college taught innovation and creativity. The innovation and creativity subjects were seen as more popular, with 52% of the sample stating no, to 71% of the same sample stating no to whether they taught entrepreneurship.

Those respondents that stated yes increased by 42% from the same sample response for entrepreneurship to account for 48% of all respondents confirming that they taught innovation and creativity.

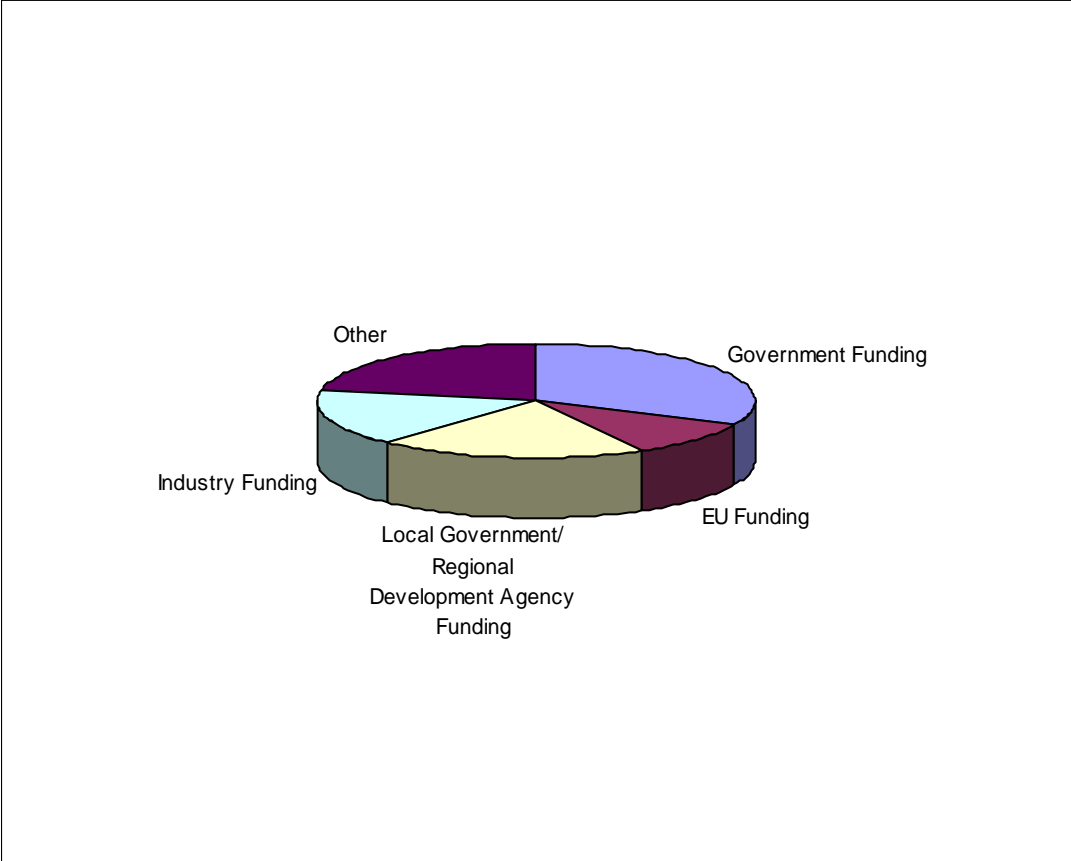
Of the respondents that did engage in KTT activities, 74% confirmed that they taught innovation and creativity. This response shows an increase of more than 40% on the response for entrepreneurship.

Reasons for this result could be in how entrepreneurship is viewed and perceived and how difficult it is to teach. The issue is that entrepreneurship is perceived as having a split personality, part energetic, passionate business person; part strange eccentric in a shed making the 'next big thing!'. Therefore, although innovation and creativity are just as intangible in many ways as entrepreneurship, they have a clearer focus from the teaching and learning perspective.

A number of possible methods for teaching innovation and creativity were identified in the survey. Problem solving games or exercises were identified as the most popular method and accounted for 26% of the overall methods.

Project focused industrial visits and placements accounted for 21% of all methods. This response correlates back to the entrepreneurship activities with 'visits to local business to hear entrepreneurs'

11) How are the Knowledge and/or Technology Transfer activities in your College funded?



This question focused on funding for KTT activities. The results show that Government funding was the most popular source at 34%, followed by local government and RDAs at 20%.

The 'other' category was mostly internal college funding and came in at 20%.

This shows that a fifth of funding for KTT is deriving directly from the Colleges themselves.

This response suggests that Colleges have the capability for self-sustainability after their sources of funding have ceased.

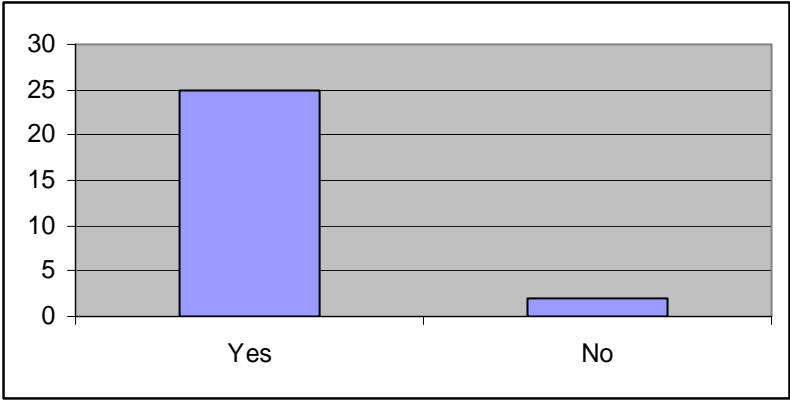
12) Please advise on the name of the Knowledge and/or Technology Transfer (KTT) programme, the fund size awarded and the duration of the programme:

17% of the respondents have attracted external funding for technology and knowledge transfer activities. The following table highlights some of the typical programmes and the annual funds attracted by colleges.

Programme	Typical funding per Annum	Typical project period
Industry funded short courses such as: <ul style="list-style-type: none"> • CAD/CAM/CNC • Installation • Refrigeration / Air-conditioning • Welding 	£30,000 – £50,000	On going
RDA funded Advanced Eng Skills	£20,000	2 years
High Level Skills for Industry	£3000-6000	2 years
LSC funded CoVEs	£100,000	3 years
Knowledge Transfer Partnership KTP / DTI funded	£50,000	2 years
NTI, The Humber, York and North Yorkshire New Technology Institute (NTI) funded learning and training programmes.	£50,000 – £60,000	2 years
ITC Vendor Skills Certification programmes	£20,000 – £30,000	On going
European Social funds	£30,000-100,000	2-3 years

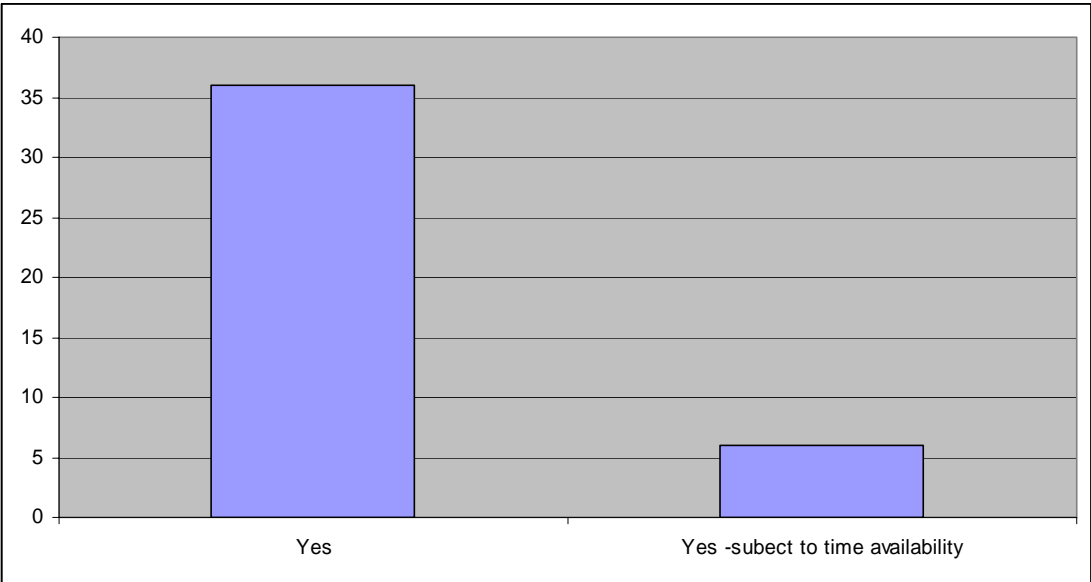
On average colleges expect level of income generated from knowledge transfer activities to be in the region of £50,000-£100,000 depending on the size of the college and their location.

13 Do you intend to continue with the Knowledge and/or Technology Transfer activities after the funding has finished?



The positive response from 96% of the respondents underlined the FE sector's commitment and enthusiasm to pursue and continue KTT activities even after their funding had finished.

14) Would your College be interested in taking part in a programme to improve Knowledge and/or Technology Transfer activities in the Further Education sector?



The response from all respondents was positive (100% response) agreeing that their College would like to take part in a KTT programme. However, out of the 100%, 4% stated a caveat that they would like to be involved in KTT activities subject to time being available to do so.

15) You answered No on Question 1. Please could you specify the reasons as to why you do not engage in Knowledge and/or Technology Transfer activities.

Lecturers' views / feedback: key issues raised by respondents:

- Lack of awareness of what is meant by innovation, knowledge and technology transfer;
- Lack of time / No staff time is available for these activities;
- Lack of resources available;
- No funding available to do these activities;
- Knowledge and technology transfer programmes are done in a fairly ad hoc and uncoordinated manner;
- Internal flow of information is poor therefore difficult to measure as it would be at individual lecturer level;
- There are many low technology micro-businesses that offer very little opportunities for technology transfer.

Lecturers' views / feedback: the potential for KTT activities:

- KTT initiatives would be very beneficial to all colleges;
- We were not aware of all the possibilities until recently;
- We do engage with employers for some small amounts of knowledge transfer like the business planning unit but this is no cost and on a voluntary basis;
- We engage in activities including training courses for industry and some business improvement projects;
- The KTT activities could complement the CoVEs initiative very well in underpinning work with employers to promote knowledge transfer;
- Previous staff have not done this in the past but our new Engineering staff within the department are passionate about improving knowledge and technology transfer.

16) If funding was available to start a Knowledge and/or Technology Transfer activity would you be interested in engaging your College in this activity?

The outstandingly positive and unanimous response of 100% to this question highlights the fact that the Colleges are deeply interested and excited by the prospect of engaging in KTT, if funding was to be made available.

5.2 Key Findings from Interviews of FE Colleges

10 colleges of further education were interviewed. The target audiences included:

- Principals / Deputy Principals
- Heads / Deputy Heads of Departments of Engineering and Technology
- Heads of Commercial Services and Business Development
- Other college senior managers.

The following statements reflect our understanding of the current status-quo of Innovation, Knowledge and Technology Transfer activities in FE colleges.

- The survey suggests that there is a fundamental lack of understanding of what is meant by technology transfer amongst the key target audiences in FE colleges. However, the reference point that is commonly shared by the target audiences is that technology transfer is a research related activity to create intellectual property and it is therefore confined to universities.
- However, the concept of Knowledge Transfer is more familiar to colleges as many of the surveyed colleges offer training services to business and industry and other local organisations.
- Many colleges were found to have a Commercial Services function. Such functions are often funded on a full-cost recover basis. They varied in size of operation and in their strategic importance. Their main activities tended to focus on responding to funding opportunities and initiatives created by Regional Development Agencies, European Commission and local government).
- Generally, there is an overall lack of coordination of innovation and technology and knowledge transfer activities. Engineering and technology departments tended to treat any enterprise activities on an ad-hoc basis with very short term planning in mind.
- Many Colleges are seeking to increase their higher education provision which attracts funding from the Higher Education Funding Council for England (HEFCE). Some colleges are establishing new campuses to cater for their HE provision.
- A number of the colleges interviewed offer Access to Degree courses, Foundation Degrees and in some cases undergraduate degrees (including engineering) as well as a limited number of postgraduate diplomas and degrees (e.g. business, education and healthcare).
- The majority of the interviewed colleges do not engage in industrial activities such as joint product / process development and enhancement.
- Training services (course delivery, assessment and evaluation, brokerage) in FE colleges form the main thrust of their offerings to business and industry.

- Scholarly activities when existed are mostly treated superficially. However, where colleges have university affiliation to deliver higher education programmes, the universities involved tended to offer professional development and updating events.

In discussing how innovation, knowledge and technology transfer can be developed in FE colleges, a number of issues were raised by college staff including:

- Institutional incentives:
A number of the heads of departments questioned as to how best they should intensify their staff to engage in knowledge and technology transfer activities. The use of supplementary financial incentives was cited as a typical mechanism, but they emphasised the need for better guidelines to avoid internal staffing problems. Those lecturers that engage in enterprise activities often do so because of two main reasons:
 - Seen to be an important career progression lever; and
 - Their employment contracts are dependant on externally generated income.
- Entrepreneurial organisational culture and key actors:
The innovation and entrepreneurship personality is generally missing in many of the FE colleges that were surveyed and visited. Their values and beliefs towards the whole aspect of innovation, enterprise, knowledge and technology management is still at its infancy although, there is a strong determination shown by heads of departments to encourage and embed these values. In addition, a number have also outlined enthusiastically their plans for expansion and growth, particularly in HE student numbers, and some were also keen to demonstrate their training services that they have developed or are intending to offer in the future. There is a general recognition that there is a need to adopt a more enterprising culture in colleges.
- Job descriptions:
Staff duties are often described in a very conventional way of using job descriptions as opposed to providing lecturers with guidelines for 'responsibilities' thus enabling a more proactive and dynamic culture to be cultivated.
- Performance evaluation measures:
Guidance on evaluation methods and progress monitoring is needed. The key is to present this aspect as a developmental and integral part of staff assessments and appraisal and not to be seen as yet another stick! This process will assist in determining special talents, skills, and capabilities that could drive knowledge and technology transfer activities in colleges that might otherwise not be noticed or recognised.
- Method of engagement with industry:
Engagement should be considered an integral part of the college's customer focus and a logical companion to its education and development missions.

However, in many of the FE Colleges the skills and methods that enable successful engagement (e.g. developing compelling business propositions, delivery timescales and costs, project management, standards and expectation of outcomes) are to a larger degree still undeveloped. External agencies and professional bodies can play an important role in developing these skills.

- **Currency of knowledge and experience:**
Many of the engineering and technology lecturers feel uncomfortable dealing with industry representatives. This issue has been mainly attributed to the lack of “specialist professional development” provision in engineering and technology. In addition, the lack of a dedicated centre to undertake scholarly activity was also cited. As a result, the scope for driving enterprise activities is currently very limited and confounded to a very small number of lecturers.
- **Teaching Entrepreneurship and Innovation:**
Clearly, many departments do not include innovation and enterprise teaching as part of their curriculum. Entrepreneurship and innovation as subjects are mainly taught on business courses. However, where these subjects are taught, there is an overwhelmingly positive attitude by staff and students towards these educational modules according to senior managers of FE colleges.
- **Embedding innovation, knowledge and technology transfer in the strategy:**
In a number of cases, college strategic plans paid little attention to innovation, knowledge and technology transfer activities. However, many colleges have focused on growing other forms of regional activities driven by funding initiatives from local governments and regional development agencies. Some have attracted funding as part of becoming Centres of Vocational Excellence (CoVE) in a specialist subject. Funding from European initiatives has also featured in a small way. However, when the strategic plans were probed further, it became apparent that what some colleges have identified in terms of innovation and enterprise activities have not been reflected in the views or plans of heads of engineering and technology departments.
- **Models for developing KTT activities:**
The Study team has explored and tested a number of approaches and models that could underpin and grow KTT activities and strengthen the development of Entrepreneurship and Creativity in colleges during the depth interviews.

Two models have emerged:

- I) The first concept focuses on KTT activities and proposes the establishment of designated Knowledge and Technology Exchange Nodes (K/TEN) where the KTT activities can be coordinated in a structured and strategic manner within colleges;
- II) The second concept focuses on Entrepreneurship and Creativity activities and proposes the establishment of an Entrepreneurial Fellowship Scheme that will identify named champions that will lead the development of Entrepreneurship and Creativity activities within colleges.

5.3 Professional Development

Scholarly activities that will encourage creative dialogue to stimulate collaboration within and across departments and undertaking related professional development are treated as a “nice to have” by most of colleges interviewed. There is also ambiguity about what is meant by Scholarly activities. In the context of FE colleges, scholarly activities in teaching could for example include the development of innovative pedagogical practices and course materials that will encourage independent learning and critical thinking of students and trainees.

The level of professional development in further education was examined by the New Engineering Foundation in an earlier research study report entitled New Engineering Fellowship Scheme - 25 October 2004. The report has highlighted some key issues including:

- The relatively low levels of finance allocated to staff development;
- The shortage of significant opportunities for lecturing staff to undertake industrial and professional updating;
- The low priority given to pedagogic skills and the use of e-learning;
- In engineering and technology, the skills level of teaching staff was mainly confined to level 2 (e.g. City and Guilds Certificate) and the lack of embracing any form of new engineering and technology subjects;
- Lack of opportunities to prepare for technical curriculum change.

During the survey, it became apparent that training in areas of innovation, technology and knowledge transfer practices, as well as creativity, is almost non-existent amongst the teaching community. Those lecturers that recently joined colleges from industry and those who teach on a part-time basis (researcher assistants from universities or industry) teach elements of innovation, enterprise and creativity that are mainly confined to business courses and these courses are not often spread across other departments. Undoubtedly, having a dedicated enterprise and innovation function in colleges can help with the development of knowledge and technology transfer activities, improve the dissemination flow internally and externally and will raise the overall educational standards.

5.4 Funding Knowledge Transfer / Exchange in FE Colleges

The Further Education sector has unfortunately suffered a chronic shortage of funding for the past two to three decades which become more evident following their incorporation in 1992 under the Further and Higher Education Act, and the establishment of initially the Further Education Funding Council and subsequently the Learning and Skills Council in April 2001. Many colleges experience problems with their campus facilities, resources and infrastructure, although some have been successful in attracting EU funding coupled with RDA funds to create updated campus facilities.

In addition, there have been significant changes in the demands made upon staff in FE colleges. The staffing profile of colleges has changed, there has been a steady but small increase in the number of full-time staff accompanied by a substantial increase of part-time staff and the sector has also experienced staff redundancies during the past 10 years.

However, these changes also mean that a higher proportion of staff that are now working in colleges have been relatively recently appointed and many of them are keen to engage in knowledge and technology transfer activities.

The publication of the 21st Century Skills Strategy in July 2003 alongside the new funding arrangements with the Further Education sector has emphasised the need to engage employers on issues of skills development and training first.

Over the past few years, the sector has experienced the development of some exciting and flexible programmes. These programmes in many ways have acted as a catalyst for establishing some of the ingredients for innovation and internal competitiveness thus encouraging colleges to strive towards real improvements in their vocational educational provisions.

For example, in November 2000, the Government announced the creation of the Centres of Vocational Excellence (CoVE) programme. Coordinated by the Learning and Skills Council, the programme was designed create a network of CoVEs in FE colleges and other training providers with a view to improving the quality of technical and vocational skills available in the economy. The programme has a focus on level 3 vocational specialisms, with a particular emphasis on adult education.

A further example can be seen in the recent Government Skills Strategy White Paper 2005¹⁵ in which it was announced that 12 new Skills Academies are to be established in partnership with employers and the Sector Skills Councils. The aim of these Skill Academies is to provide various industries with skilled and entrepreneurial employees. And in the words of the White Paper, these academies will become the 'national centres of excellence for the post-16 sector working closely with schools and colleges.'

One of the examples the White Paper cites is the Automotive Academy which intends to promote globally competitive standards of training and skills development throughout the UK's automotive industry. It provides opportunities to firms and individuals to access appropriate training that is directly relevant to the industry.

However, it is worth pointing out that with the emergence of the new Skills Academies, the format and development of the CoVE programme is being revised leaving many questions unanswered (e.g. national delivery vs. local needs of business).

Following discussions with many of the college lecturers and senior managers and representatives from the FE sector, it was suggested that colleges consume a significant proportion of their efforts and time mainly trying to address the criteria for securing funding and meeting the associated priorities set out by the Learning and Skills Council (e.g. meeting the completion target of courses offered to 16-18 years old students). These groups of stakeholders went further to add that the rigidity that is imposed by the funding mechanisms, which is broadly based on head-count methodology had often stifled the opportunity for developing a culture of innovation and creativity in FE colleges.

¹⁵ Skills: getting on in business, getting on at work, March 2005

Unfortunately, the level of freedom that Higher Education Institutions enjoy in developing their educational programme to reflect the needs of their students and markets is not available to the FE sector. Again, this is another inhibitor that prevents the development of innovative programmes and therefore discourages FE lecturing staff from engaging in innovation and enterprise activities.

Currently, the Learning and Skills Council does not offer funding that is aimed at improving innovation, technology and knowledge transfer. Therefore, many of the colleges that were interviewed in this study, particularly those that offer HE courses, were very keen to strengthen their HE provision and their collaborative relationship with the universities they work with. They also see such collaborations pay dividends towards improving their professional development and giving them the opportunity to engage in innovation, knowledge and technology transfer activities that are funded by the partner university.

In terms of future direction for FE, the Government has recently committed £1.5 billion of investment over the next five years to support the transformation of the further education sector. However, prior to these funds being allocated, the Secretary of State for Education is currently awaiting the out comes of Sir Andrew Foster's Review of FE. Commissioned last year, the Review is looking at the distinctive contribution that colleges can make to the learning and skills market, their long-term contribution to economic development and mechanisms that will help to transform the sector including systems to improve Business Planning and Income generation and the dissemination of best practice. The Review has finished gathering evidence and Sir Andrew presented his initial thoughts in June 2005 and will present a full Report in November 05. In addition, a further review is being undertaken by Lord Leitch under the auspices of HM Treasury to assess the long term skills needs in the UK.

However, the FE sector as a whole continues to lack clear differentiation in its provision and context (e.g. the way in which the FE colleges are structured, packaged and presented to the business and industry communities and the public in general).

The study has therefore made some early recommendations to both inquires mentioned above.

In terms of promoting entrepreneurship education in FE colleges, the DfES is implementing a policy of providing enterprise education to all Key Stage 4 students. *"The aims of the new work-related learning element of Key Stage 4 include enabling all young people to be enterprising and to support enterprise in others. Following a review of enterprise and the economy in education by Howard Davies, a new £60m enterprise education entitlement will, from 2005/06, also provide all pupils with the equivalent of five days' enterprise experience by the end of Key Stage 4. This experience will aim to develop enterprise capability, including innovation, creativity, risk-management and risk-taking, and financial and business understanding."* Indeed, this strategic provision is being already being implemented in colleges that the study team have visited and surveyed.

This follows a document published by the EC on 11th May 2000 called "Communication from the Commission: Challenges for enterprise policy in the knowledge-driven economy". It clearly states that *"Education for entrepreneurship is another driver towards a more dynamic enterprise culture."*

General knowledge about business and entrepreneurship needs to be taught, right through primary, secondary and tertiary education. Enterprise policy will aim at making specific enterprise and business-related modules or programmes an essential ingredient of education schemes at secondary level and at colleges and universities. For a scientist or an engineer, being able to draft a business plan should be as natural as doing a scientific experiment or writing a theoretical article. Entrepreneurship education should also include the development of a culture of service towards customers.”

It is too early to assess the impact of this policy. However, the feedback from most of the colleges that were interviewed during the course of this study has conveyed general satisfaction with this entrepreneurship educational requirement. Student feedback has so far been also encouraging. Learning and assessment methods will still need to be improved and contextualised to suit the disciplines taught and to enable subjects such as entrepreneurship and creativity to be more embedded in key curriculum activities. Also there continues to be the need for training the lecturers to be more comfortable in teaching subjects such as entrepreneurship and creativity as part of their specialist disciplines.

In terms of funding innovation in FE colleges, it was suggested that some of the recent KTT programmes that run mainly in higher education institutions such as the Higher Education Innovation Fund (HEIF) and the Centres for Excellence in Teaching and Learning could be extended further to embrace a wider participation of FE colleges.

One of the adjunct findings that the study wishes to highlight is the *unintended consequence* of growing HE programmes within FE colleges.

An increasing phenomenon!

During the course of the study it was found that a number of further education colleges - particularly the larger institutions with a higher number of students studying on higher education courses such as HNC/D and Foundation Degrees - are aiming to change their status to that of a Higher Education Institution (e.g. University Colleges).

Whilst the increase of such a HE provision is commendable, a better framework that enables progression and clearer pathways from vocationally-oriented further education courses to higher education degree programmes is desperately required. Such a framework will need to ensure that the quality, integrity and recognition of our HE provision is maintained both nationally and internationally. In addition, there is a great opportunity of interlocking such a framework with the requirements of the Bologna¹⁶ declaration.

Models such as the Australian TAFE (Technical and Further Education) tertiary Institutes, the American Community Colleges, the German Fachhochschule and, indeed, the old “Polytechnic” structure in England should be examined in developing a better system.

¹⁶ The Bologna declaration is the main guiding document of the Bologna process. It was adopted by ministers of education of 29 European countries at their meeting in Bologna in 1999. <http://europa.eu.int/comm/education/policies/educ/bologna/bologna.pdf>

5.5 Views of Business and Industry and Employer Associations

This study has targeted over 100 companies of different sizes across many sectors.

The majority of large organisations with over 250 employees do not tend to engage in technology and knowledge transfer activities with the FE sector. Their technology links are very largely aligned with the HE sector. Many large companies have established links with universities to meet their current and future technology needs.

However, specific areas that fall under the “Knowledge Transfer” area include:

- Where a company engages with college around a specific Apprenticeship Training programme (e.g. aerospace industry, advanced automotive and composite materials industry);
- Where a company is facing retirement of staff issues and needs to prepare new apprentices to take over;
- Where companies require specific training and qualification (e.g. Welding, electrification, signalling in the railway industry; component manufacturing using new materials such as titanium);
- Where a university and a college collaborate to develop and offer a Foundation Degree aimed at a key employer(s) in the region.

Medium-size businesses tend to use colleges a bit more for mainly:

- Running specific training courses;
- Offering guidance on training evaluation and assessment.

The engagement of small companies tends to vary from region to region and from industry segment to the other.

The three key messages that business and industry have highlighted include:

- The lack of clarity about what colleges can offer and their capabilities;
- Unsure as to how to engage with colleges in areas that would be regarded as knowledge and technology transfer;
- Commercial terms of engagement and delivery abilities.

Clearly, there is a need for developing a dedicated function in FE Colleges that will focus on innovation, knowledge and technology transfer activities.

Business and industry representatives also highlighted the need for a more targeted marketing and communication programme that promotes the college propositions in a compelling and clear way.

5.6 Roles of Higher Education Institutions

Government policies such as the Widening Participation in HE, increasing opportunities to pursue higher education (50% aged 18-30 should benefit from HE by 2010) and improving student outreach to increase participation in HE by under-represented groups have stimulated a significant growth in the provision of higher education courses. A key vehicle for delivering this growth in student numbers is through further education colleges. Today, many FE colleges offer HE programmes that lead to Foundation Degrees, HND/Cs, university-access courses and a limited number of undergraduate and postgraduate courses. In addition, the FE college environment seems to appeal to those students with non-traditional backgrounds wishing to pursue higher education courses - a key group that is targeted by the widening participation policy. Indeed, many colleges are planning significant developments in terms of their infrastructure, resources and staffing levels in their strategic plans to cater for the expansion of the HE provision by their colleges.

Against this background, students and employers (in the case of part-time students or work-based students) envisage FE lecturers to be reasonably up-to-date in their subjects and expect them to engage in scholarly activities that are driven by knowledge and technology transfer programmes. Indeed, it can be argued that as part of the quality assurance evaluation framework that QAA (the higher education Quality Assurance Agency) requires is for institutions to demonstrate the level of their staff expertise, updating and development.

This study has seen a number of bespoke good practices of joint scholarly activities, where an FE college has established a strong collaborative relationship with the higher education institution (particularly at lecturing staff level between the two institutions). These activities include amongst others the FE staff involvement with activities such as:

- Course development (e.g. Foundation Degrees, undergraduate and access programmes);
- Research seminars led by university lecturers and researchers;
- Workshops led by university lecturers and researchers outlining new technologies and demonstrating new computer based tools;
- Limited KTP (Knowledge Transfer Partnership) programmes that span across both the university and the college;
- Limited e-learning materials;
- Joint bids for funding under European and local government initiatives (e.g. ESF, regeneration programmes and the development of regional incubators).

These activities present an excellent vehicle for inspiring innovation, enterprise and knowledge transfer amongst staff from all the stakeholder organisations, as they often drive an element of competitiveness and creativity. A more coordinated approach by colleges will certainly present them with a better opportunity for sharing the knowledge and experience gained across their department and staff.

5.7 Roles of Regional Development Agencies

In the course of this study, 9 Regional Development Agencies have been contacted. We have received a varying degree of enthusiasm to our study. We sought the RDAs input with respect to the following two points:

- *Does your RDA have a specific policy that focuses on promoting and energising knowledge and technology transfer activities between FE Colleges and businesses in your region? If yes, could you please briefly advise us on your policy guidelines and the types of these activities. And if you don't have a specific programme that promotes these activities across the FE sector could you please state the reasons why not?*
- *What actions do you think are needed to be taken to enhance the collaborative knowledge and technology transfer activities between companies and partner FE colleges in your region?*

The RDAs response to these questions has shown that the majority of RDAs are currently reviewing their interactions with FE colleges and are in the process of developing regional Knowledge Transfer Strategies. A limited number of RDAs such as Yorkshire Forward and SEEDA have more developed plans and activities that intend to engage FE colleges in regional knowledge and technology transfer programmes.

However, the stated policies by all RDAs are to encourage the development of technology and knowledge transfer. The following table highlights some of the key RDA policies with respect to energising the knowledge and technology transfer activities in their respective regions:

East Midlands Development Agency	<ul style="list-style-type: none"> • The Regional Economic Strategy - Strand 1: focuses on Enterprise as a key activity that is aimed at stimulating creativity and entrepreneurial attitudes into the school curriculum and higher education establishments.
East of England Development Agency	<ul style="list-style-type: none"> • The Regional Economic Strategy - Theme 3: Creativity, innovation and enterprise – focuses on the development of enterprise hubs to provide opportunities for closer links between businesses and higher and further education and research.
London Development Agency	<ul style="list-style-type: none"> • The Regional Economic Strategy - Theme 3: Investment in Knowledge and Enterprise focuses on building creativity and imagination and fostering a supportive environment for innovation.
North East Development Agency	<ul style="list-style-type: none"> • The Regional Economic Strategy – Objective B2: Establishing a new entrepreneurial culture- focuses on addressing the needs of high growth businesses.

North West Development Agency	<ul style="list-style-type: none"> The Regional Economic Strategy – Objective 2: Improve the competitiveness and productivity of businesses- focuses on promoting and providing effective business support and developing social enterprises.
South East of England Development Agency	<ul style="list-style-type: none"> The Regional Economic Strategy – Priority 1: Enterprises – focuses on accelerating business start-ups and improve survival and growth rates of small businesses.
South West of England Development Agency	<ul style="list-style-type: none"> The Regional Economic Strategy – Objective 1: Raise business productivity and focuses on developing innovation and knowledge based businesses.
West Midlands Development Agency	<ul style="list-style-type: none"> The Regional Economic Strategy – Pillar 1: Enterprise – focuses on increasing and sustaining employment and productivity by developing a world-class enterprise culture and building the innovative potential of companies through increasing and exploiting R & D and promoting creative talent.
Yorkshire Forward	<ul style="list-style-type: none"> The Regional Economic Strategy – Objective 2: Enterprise – focuses on promoting and improving entrepreneurial and creativity skills by developing specific projects (e.g. modular foundation course in business practice).

In addition, a number of RDAs are using the Regional Skills Partnership initiatives to ensure that appropriate linkages are forged between FE/HE and business.

Furthermore, some of the RDAs work in knowledge transfer has been either through interaction with specific institutions, for example capital projects where an institution can bring specialist expertise, or pan-institution to support the creation of knowledge transfer professionals' network.

5.8 Key Findings from Discussions with Sector Skills Councils

The New Engineering Foundation has contacted the Sector Skills Development Agency (SSDA) and the following sector skills councils (SSCs) to seek their input on two points:

- If the SSCs have a specific programme to promote knowledge and technology transfer; and,
- What actions they felt needed to improve the level of the knowledge and technology transfer activities.

Automotive Skills	The retail motor industry
Cogent	Chemicals, nuclear, oil and gas, petroleum and polymer industries
ConstructionSkills / CITB	Construction Industry and the Built Environment
Energy and Utility Skills	Electricity, gas, waste management and water industries
e-skills UK	Information technology, telecommunications and contact centres
Improve	Food and drink manufacturing and processing
Lantra	Environmental and land-based industries
SEMTA	the sector skills council for the Science, engineering and manufacturing technologies
SummitSkills	Building services engineering (Electro-technical, heating, ventilating, air conditioning, refrigeration and plumbing)

Many of the SSCs feel that colleges can play an important role in developing the knowledge and technology transfer activities to complement what higher education institutions have on offer. There is also a general aspiration that many of the SSCs wish to develop programmes that will specifically promote KTT in the FE sector. However, it is worth highlighting that the SSCs are at their various stages of organisational development since their creation and are currently busily engaged in development of the sector skills agreements for their respective industry sectors.

A number of companies have highlighted that whilst the sector skills agreements are suitable for giving an overview of skills shortages in a specific sector, they do not necessarily deal with the issues of improving the level of innovation and technology and knowledge transfer activities between FE colleges and business and industry.

Suggestions to the Chair and Chief Executive of SSDA were made with respect to making the market information that has been gathered by SSCs available to colleges. The suggestions also pointed out the need to ensure that such market information should be packaged in a useful way to enable colleges to interpret them and use them effectively. The RDAs and the regional offices of the Association of Colleges should take part in the interpretation and contextualisation of the market information to maximise their use and ultimate benefit.

5.9 Impact on Students

All the colleges that were interviewed during the course of this study have highlighted the cascaded benefits to their engineering and technology students in the form of:

- Improved project work;
- Better and more relevant curriculum;
- Access to modern and specialised equipment and materials; and
- Motivating and inspiring students to be more enterprising and innovative.

For example, at Newbury College of Further Education, students are involved in the manufacturing of added value car parts such as a centre console for SMART cars using rapid prototyping technology.

Some of the industry-college collaborations have also led to the development of new Edexcel curriculum units which obviously will have a broader impact on teaching of new subjects across the FE sector.

However, the scale of the knowledge transfer activities is limited and often is confined to a small group of often very enthusiastic staff. Therefore, the spread of the benefits from the industrial engagement is limited. Also embedding good practices and new knowledge gained from industrial collaboration into the curriculum also has been very limited. This is partly due to the rigidity in the curriculum structure and content as well as the lack of time available for lecturers to undertake course development.

5.10 Summary of Findings

The research study has shown that there exists a healthy interest and an avid enthusiasm in Further Education Colleges to pursue Knowledge and Technology Transfer activities.

Although there is presently no formal structure or requirement for Colleges to engage in KTT, the study has shown that Colleges are in fact still engaging in KTT activities as they can see the benefits that such engagement delivers. In the FE sector, KTT is not viewed yet as strategic and thus, most of the Colleges' activities are eclectic and somewhat driven by opportunity, rather than strategic imperative. It is clear from the study that if Colleges were given a framework and a level of funding, they would become more strategic in their approach to KTT activities.

The study highlights the need for lecturers to gain professional development, as the lack of such development results in lecturers perceiving that they are not able to effectively interface with business and industry, as they do not have the latest skills that business and industry demand. Likewise, business and industry also need to be better informed on the capabilities of FE in providing them with support in areas of product development and enhancement, training and analysis.

Drivers of KTT are entrepreneurship, innovation and creativity, and as such, the study found that Colleges engaging in KTT activities are also teaching some or all of these subjects as part of an integrated programme in their College. The teaching of Innovation and Creativity was found to be more common than teaching Entrepreneurship. However, those Colleges who taught Entrepreneurship, had some form of Business Incubation or Start-up environment, enabling the subject matter to be more relevant to students. It is clear that if all the Colleges who responded had some form of Business Incubation centre they would be able to embed Entrepreneurship more effectively into their curriculum.

In all the Colleges who engaged in KTT, at least two benefits were secured as a result of their engagement. The study showed that benefits ranged from:

- Improvements in curriculum;
- Case-studies helped to make classroom content more relevant;
- Students and lecturers gained up to date knowledge;
- Opportunities were provided for staff professional development; and
- Entrepreneurship, innovation and creativity were used as vehicles to introduce students to KTT activities.

6.0 Recommendations

This research study has clearly highlighted the need for encouraging and further developing the knowledge and technology exchange activities between FE colleges and businesses. In the majority of FE colleges that have participated in this study, the knowledge exchange activities were found to be eclectic and not well coordinated or focused to serve local and regional needs.

However, in a limited number of colleges where knowledge exchange activities existed and were more strategically positioned, there was a noticeable ethos of entrepreneurship and innovation amongst the lecturing staff and their students. In addition, the level of vibrancy of college-business engagement was also apparent.

The surveyed and interviewed colleges have identified a number of steps and suggestions that were found to be commonly accepted as a means to develop a more proactive capability that can drive innovation, enterprise, knowledge and technology transfer. These included:

1. The need to adopt a more strategic approach to knowledge and technology exchange activities. They welcomed better models that can help them improve their method of engagement with business and industry but also recognise the unique identities, priorities and core competencies of each institution.
2. Establishing a dedicated technology and knowledge transfer / exchange function;
3. Identifying funding mechanisms that will enable:
 - a. Initial pump-priming to develop the institutional internal capability
 - b. Long-term sustainability of this function through strategic and recurrent income streams;
4. The need for clearer and more compelling marketing plans that reflect the development of colleges' capabilities to encourage better engagement with business and industry;
5. Developing incentives and levers for encouraging the participation of lecturers. A more flexible staff timetabling mechanism to enable time relief for staff to engage in consulting projects – this could be packaged as “Entrepreneurial Leave”;

6. Engaging staff in knowledge and technology transfer professional development activities such as:
 - a. Initial customer meetings and project scoping to develop their business acumen
 - b. Project contract writing and costings
 - c. Project management and delivery;
7. Establishing a more structured mechanism for maximising students engagement and benefit (e.g. scoping and developing projects work);
8. Improving internal and external communication channels so that college staff can speak with authority about their collective capabilities and their institutional vision;
9. Higher education institutions can play a mentoring role that could help in the development of a more scholarly culture in FE colleges. They can also provide more structured and relevant programmes of professional development for college staff;
10. The development of simple and clear Evaluation and Performance Assessment criteria.

The study has examined a number of models that could be used to help establish and grow knowledge and technology transfer activities in a more structured and coordinated way. Two models have emerged as possible contenders from this exercise. These are:

- **Entrepreneurial Fellowship Programme:**
Identify 3 lecturers who could act as the *champions* that could lead the entrepreneurship development in the curriculum. Entrepreneurial Fellows should be given time remission to enable them to undertake this role effectively.
- **Knowledge and Technology Exchange Nodes:**
Establish a “dedicated” college function that develops and promotes innovation, knowledge and technology exchange activities. The Knowledge and Technology Exchange Node (K/TEN) will have a named manager who will coordinate the Node’s activities against a published business plan. If the Entrepreneurial Fellowship Programme was considered along side the K/TEN, then the Fellows should operate closely with K/TEN.

7.0 The Knowledge and Technology Exchange Nodes (K-TEN)

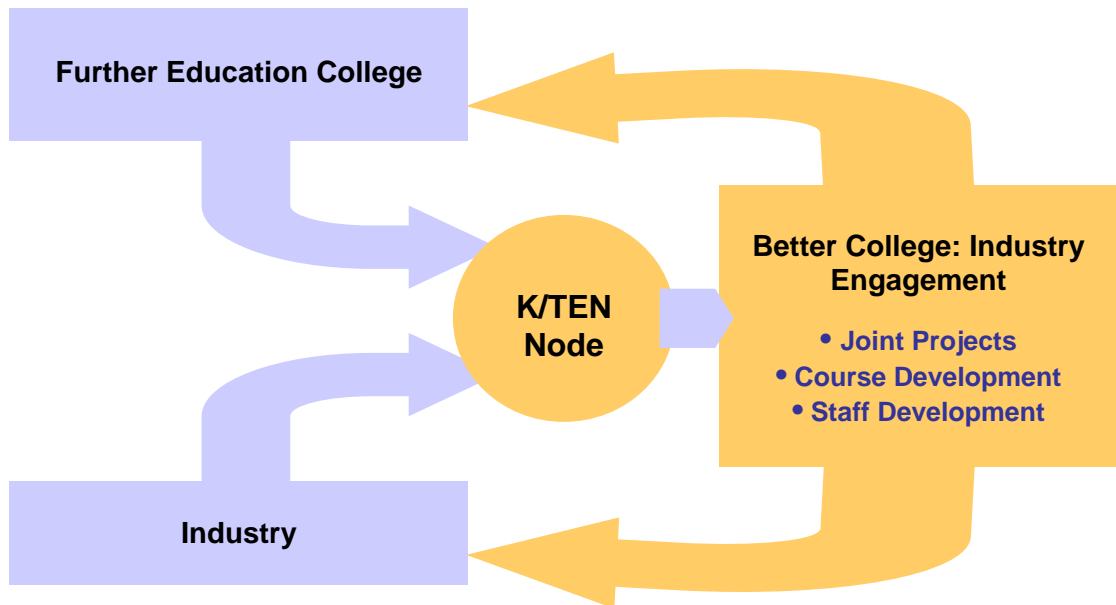


Figure 2: Knowledge and Technology Exchange Node

The aims of the Nodes are to:

- Promote networking between colleges and businesses and undertake business awareness activities;
- Develop the capability and infrastructure to transfer knowledge from colleges into business and the community;
- Seed funding to provide incentives for colleges to embrace knowledge and technology transfer activities;
- Contribute specialised knowledge to local/regional regeneration programmes;
- Act as exemplars of good practice in science, engineering and technology (SET) skills development, training and how to engage with businesses and industry;
- Provide a springboard for developing entrepreneurship training and continued professional development for students and staff respectively;
- Support the development of innovative Foundation Degrees with a particular focus on Work-Based Learning;
- Develop collaborative linkages and partnerships with other Government initiatives such as CoVEs and Skills Academies.

8.0 Establishing Good Practice for KTT

In reviewing a number of KTT activities in colleges, a suggested model of operation was proposed which comprises of two key propositions that drive the engagement of colleges with industry:

- Industry Pull - almost in every occasion when the study reviewed KTT college services, there was a very healthy requirement for such activities such as Skills Gap Analysis and Training Needs Analysis; and
- Educational Push – this is driven by the desire of many FE colleges wishing to deliver HE programmes such as Foundation Degrees which are normally accredited by higher education institutions. As part of the development and validation of a any new degree, there is a quality assurance requirement to seek industrial input and market research data which is enforced by QAA – the HE quality assurance agency).

The below figure highlights the typical activities that colleges could offer as part of their portfolio of specialised consultancy services and lists some of the benefits to students, staff and courses in the college.

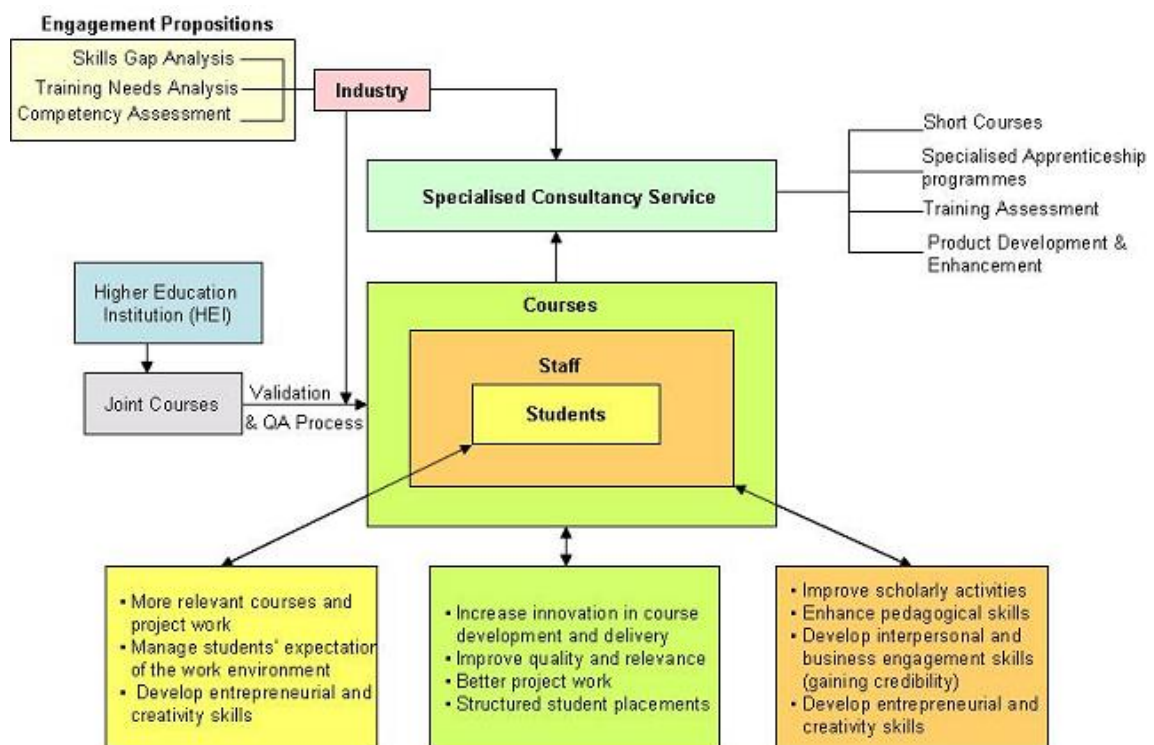


Figure 3: Drivers and Benefits of K/TEN

9.0 K/TEN Operational Structure

The typical activities of a “dedicated K/TEN” could include three groups of key activities:

- Sensitising and informing the market. This includes the development of market information and related networking activities (e.g. market intelligence, promotional information);
- Managing the acquisition and delivering industrial projects (e.g. product developments, bidding for funded schemes);
- Supporting the creation business start-ups (creating the environment for encouraging and incubating business start-ups).

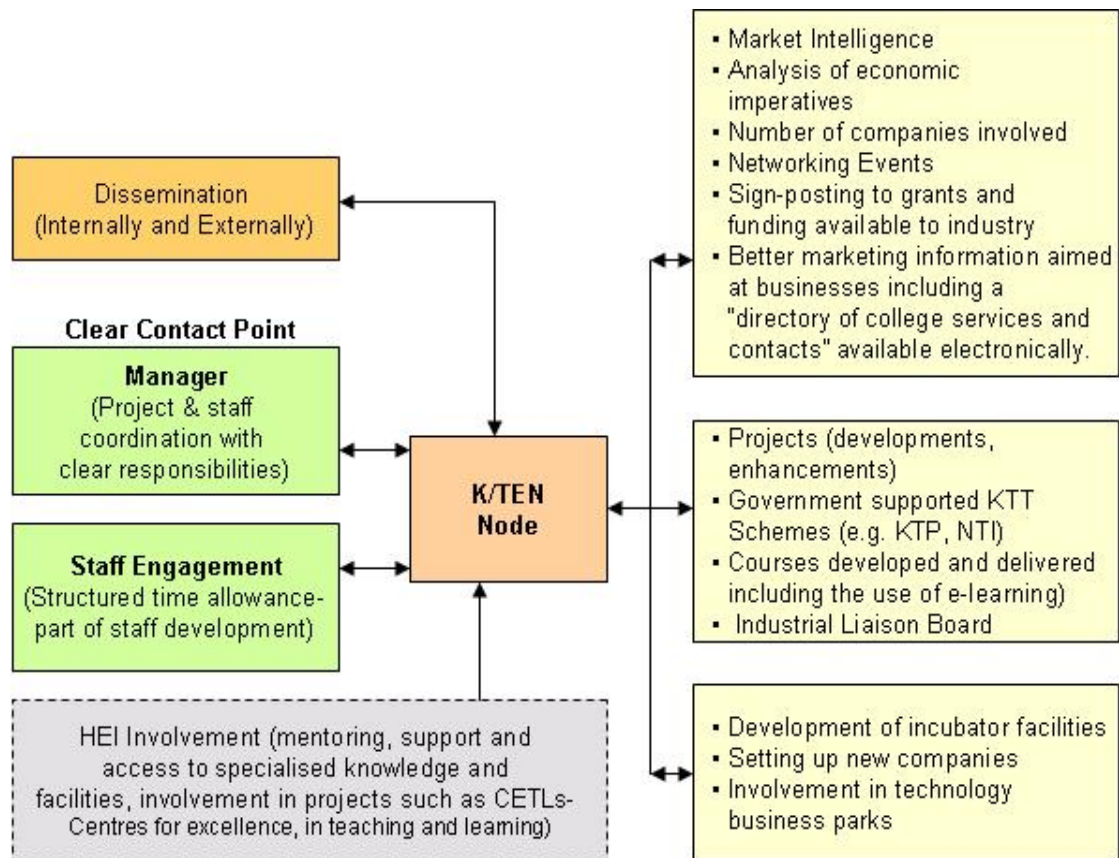


Figure 4: K/TEN Typical Activities

10.0 Overall Conclusions

Recognising the wide range of resources that exist within the FE sector, colleges can play an important role in underpinning and stimulating the educational and innovation systems in their regions, thus enhancing the different types of knowledge production and learning in that region.

Therefore, the development of knowledge and technology transfer / exchange activities is an important driver for strengthening the relationship between colleges of further education and their local and regional economies.

Unfortunately, at present, colleges suffer from a lack of differentiation in both their offerings and market positionings. The majority of their staffs' capabilities are limited to a narrow band of knowledge, hence constraining the opportunities for more advanced programme development, particularly at level 4. The cascading negative impact of this deficiency is that students that are being prepared for the labour market do not possess the quality and currency of skills required to drive market competitiveness. In fact, there could be a further adverse side effect, in that college leavers may not have the skills that will ensure longer term employability and business growth.

Therefore, knowledge and technology transfer / exchange activities are essential in providing the ingredients to:

- Close the gap between FE and HE to enable a more cohesive provision of educational and community-related services;
- Provide a springboard for raising the internal staff performance, capabilities and capacity to enable them to address level 4 and HE provision, reflecting the stated demands of business and industry;
- Create an 'ecosystem' that will drive synergies and partnerships between colleges and business and industry that address and meet the current and anticipated economic needs and opportunities as well as developing higher performance work practices;
- Ensure subjects of strategic importance are maintained and further developed as well as raising student competence and the demand for strategic provision (Science, Engineering and Technology);
- Create opportunities for supplementing income streams for colleges that will enable them to be less susceptible to central funding budgetary cuts.

The study has highlighted a number of recommendations that are aimed at stimulating innovation and entrepreneurship to enable multi-directional knowledge flows to be created and exploited by colleges and their industrial partners.

In addition, the study encourages policy makers to strongly consider the development of new strategies and supporting instruments to enable colleges to have limited autonomy, thus helping them become more strategic and entrepreneurial and able to respond to local and regional business needs.

The study suggests two instruments that could be introduced within FE colleges. The first is based on developing Knowledge and Technology Exchange Nodes (K/TENs) to support the development of KTT activities. The second is based developing an Entrepreneurial Fellowship Programme to drive the creation and embedding of innovation, entrepreneurship and creativity in the curriculum.

Although there exist a number of commendable activities and initiatives such as the Skills for Business Networks and the development of Sector Skills Councils that aim to improve the quality of the supply of vocational education, the net impact at the college level is yet to be realised. The College-Industry relationships need to be further developed and their dynamics regularly reinvigorated through direct initiatives, guidance and better information that bring the two constituents more closely together.

The window of opportunity for change in the FE sector is closing. The study calls for accelerating the implementation of the recommendations suggested in this report to ensure that the FE sector is well prepared to address the rapid economic changes and technological advancement in our society.

Appendix A

List of colleges that have participated in the survey:

Aylesbury College
Barnet College
Bedford College
Bridge College
Brooksby Melton college
Broxtowe College
Burton College
Carshalton College
City College Brighton & Hove
College of North West London
Deeside College
Doncaster College
Ealing, Hammersmith and West London College
Fareham College
Fermanagh College
Gorseinon College
Halton College
Highbury College
Huddersfield Technical Centre
Huntingdonshire Regional College
Kendal College
King Edward VI College
Lakes Colleges
Lambeth College
Leicester College
Lincoln College
Loughborough College
Macclesfield College
Mid-Cheshire College
Newbury College
Newcastle College
North Lindsey College
North Warwickshire & Hinckley College
Norton Radstock College
Preston College
Richmond College
Somerset College of Arts and Technology
Southport College
Stourbridge College
Strode College
Telford College of Arts & Technology
The College of North West London
The Oldham College
Thurrock & Basildon College
West Cheshire College
Westminster College
Wirral Metropolitan College
Writtle College
Yeovil College

Appendix B – Business and Industry Input

The study has contacted a number of businesses of different sizes representing different market sectors. A sample of companies that are already involved in KTT activities with colleges is shown below:

Airbus UK	Mahle Filter Systems
Alstom Power	Marshall Aerospace Limited
BAE Systems	McLaren Racing
Bentley	McVities
BOC	Microsoft
BOC Edwards	MKW Engineering Ltd
BPAC Ltd	MyTravel Engineering
Broughton Controls Ltd	National Grid
CCRLC Daresbury Laboratory	NETA
Cenit Desktop	Nissan (UK) Ltd
Computer Parts International Ltd	Parker Hannifin (UK) Ltd - Polyflex
Coors Brewery	Division
Corus Tubes	Prodrive
EEF Ltd	Race & Marine Ltd
Eurostar	RAF Henlow
Fairline Boats Plc	Ransomes Jacobsen Ltd
Ford Motor Company	Remploy
FW Developments/Dynojet UK	Rockwell Automation
GCD Security Ltd	Vauxhall Motor Company
General Dynamics UK Ltd	Scania Training
Goodrich Aerospace Ltd	Schott Industrial Glass
Greenoaks Ltd	Siemens Industrial Turbo machinery Ltd
Hanson Building Products	SMMT
Hartlepool Power Station	Solihull Metropolitan Borough Council
Hayden Young Ltd	The Welding Institute
Honda	TNT Aircraft Maintenance Services
Indesit	Torr Scientific Ltd
Innovative Technology Ltd	Total Communications Ltd
Intechweb	Toyota
J Deere UK Ltd	Transco Plc
J&E Halls	TRN Engineering Ltd
Jaguar	Tubelines
Johnson Control	Unilever
Kennametal UK Ltd	Utile Engineering
Klaas UK Ltd	Ward Hi Tech Ltd
Labman	WBB Materials
Lawday Engineering	Westland Helicopters
Leyland Trucks Ltd	Witter Towbars
Logica	

Appendix C - References

This references section is split into three areas:

C1 Text references

C2 Players in KTT

C3 European Commission related policies and initiative

C1 - Text References

- Final Project Report: Mapping Graduate Enterprise
National Council for Graduate Entrepreneurship
September 2004
- “Making the Journey from Student to Entrepreneur: A Review of the Existing Research into Graduate Entrepreneurship” Final Report
The National Council for Graduate Entrepreneurship
The Institute for Small Business Affairs Consortium
September 2004
- Entrepreneurship and higher education: an employability perspective
Neil Moreland
The Higher Education Academy
30th January 2004
- KEF Survey of Further Education college leavers to the National Council for Education and Training for Wales
Welsh Enterprise Institute
University of Glamorgan Business School
December 2003
- Productivity in the UK 5: Benchmarking UK productivity performance. A consultation on productivity indicators
Department of Trade and Industry
March 2004
- Global Entrepreneurial Monitor (GEM) (2000-3)
'GEM 2000 Global Report'
'GEM 2001 Global Report'
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'GEM 2003 Global Report'
<http://www.gemconsortium.org>
- Sustaining Success – Developing London’s Economy
Economic Development Strategy for Mayor of London/London Development Agency
January 2005

- Production Industries in London – Strategy and Action Plan 2005 – 2008
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- A Review of Enterprise and the Economy in Education
Howard Davies
Review for the DfES
February 2002
- Communication from the Commission : Challenges for enterprise policy in the knowledge-driven economy
European Commission (as part of the Lisbon Strategy)
May 2000
- Lambert Review of University-Business Collaboration
http://www.hm-treasury.gov.uk/media/DDE/65/lambert_review_final_450.pdf
Richard Lambert for HM Treasury
December 2003
- The Will Hutton Review: The Potential Contribution of the Learning and Skills Sector to the Lisbon Agenda.
An initial paper from the Learning and Skills Development Agency (2005)
<http://www.llda.org.uk/files/PDF/Resphuttonrev05.pdf>

C2 Players in Knowledge and Technology Transfer

This Appendix section highlights some of the key players and programmes that support knowledge and technology transfer.

<p>DTI / Office of Science and Technology</p>	<p>http://www.innovation.gov.uk/ http://www.ost.gov.uk/link/ http://www.dti.gov.uk/ktn/ http://www.ost.gov.uk/enterprise/</p>
<p>1. Innovation</p> <p>The DTI has a site dedicated to enhancing levels of innovation across the UK economy. It aims to measure innovation activity, offer advice to people and companies and to highlight research relevant to stimulating innovative activity.</p> <p>2. LINK Programme – Office of Science and Technology</p> <p>The LINK Programme operates across Government to support Collaborative Research & Development projects between business and the research base. Since its inception in 1986, LINK has become the Government’s principal mechanism for promoting partnership in pre-commercial research between business and the research base.</p> <p>As LINK has been running for several years, significant and relevant measurement can be made on the projects it has handled. A review was carried out to coincide with the publication of the Lambert Report and can be found at http://www.ost.gov.uk/link/linkreview/linkreviewpanelreport03.pdf.</p> <p>The review however makes no mention of FE colleges as it is primarily concerned with business, universities and the research councils.</p> <p>3. Knowledge Transfer Networks (KTN)</p> <p>A scheme set up in April 2004 by the DTI which offers grants to intermediaries who bring together companies, academia and trade associations in specific networks. There are three types of networks</p> <ul style="list-style-type: none"> • Managed Networks – these aim to encourage the exchange of knowledge and information, by way of outreach activities • Information Networks – these are designed to foster cross-sector and cross-border debate, in order to plug information gaps, by way of signposting activities • Issues Networks – these seek to draw industry players together to carry out problem-solving activities. <p>The one caveat to joining or starting a network is that organisations must prove that they are seeking technology-fuelled growth for their own ends.</p> <p>4. Science Enterprise Challenge</p> <p>Includes details and links to the 12 centres established under the Science Enterprise Challenge</p>	

Knowledge Transfer Partnership	http://www.ktponline.org/
<p>The Knowledge Transfer Partnership established by the DTI, offers grants to educational institutions to develop a piece of technology or an innovative process which otherwise would not have been possible due to lack of funds or networking.</p> <p>At the moment the programme claims to have 939 such partnerships active, however the vast majority of these are links between businesses and higher education institutions. There are four further education colleges listed, and of these only three have active projects. The three active colleges are Doncaster, Gorseinon and Pembrokeshire.</p> <p>As part of this study as a whole, it would be prudent to investigate these colleges and their links further, particularly Gorseinon College as it is handling 13 of the 15 active FE projects (this number is due to increase as Gorseinon currently have several applications being considered and other colleges are also starting to apply).</p>	
Association of Colleges	http://www.aoc.co.uk/
<p>The AoC do a scheme that runs under a separate name of AoC Workforce Development Ltd. This is designed for companies who want to update their staff's skills by enabling them to link with FE colleges.</p>	
Engineering Business Link Organisations (EBLO)	http://www.businesslink.gov.uk/
<p>The Engineering Business Link Organisations have links to a number of schemes designed to link business with academia and research associations. Obviously, different links will not be the same from region to region as the landscape changes, but the programmes have been set up by Government to help foster academia's links and contribution to business and vice-versa.</p>	
Small Business Research Initiative (SBRI)	http://www.sbri.org.uk/
<p>The SBRI is run by the Small Business Service (SBS). It does not give out grants but acts as an alert service to SME's who want to find out about publicly-funded R&D projects. As such it has no direct impact on knowledge and technology transfer beyond the introductory stage.</p>	
National Council for Graduate Entrepreneurship	http://www.ncge.org.uk/
<p>The National Council for Graduate Entrepreneurship is a new organisation set up to raise the profile of entrepreneurship and the option for students and graduates to start their own businesses as a career choice. This new website has a facility to register interest, gain further information and find out how you can work with the NCGE. (See references for research documentation)</p>	

The Shell Technology Enterprise Programme (STEP)	http://www.step.org.uk/
<p>A programme designed to give undergraduate students the chance to undertake a placement in industry during their university careers. The placements usually last four or eight weeks and allow the companies (usually SME's) to bring a fresh approach to a problem they might have.</p> <p>As the programme rarely touches on the FE world, it perhaps isn't of great relevance, but nonetheless, there is clear evidence that individuals have enhanced companies' revenues through their work and thus it is of importance.</p>	
Higher Education Funding Council / Higher Education Academy	http://www.hefce.ac.uk http://www.ltsn.ac.uk/
<p>This site provides an employability perspective which defines entrepreneurship and sets out a rationale for entrepreneurship in higher education. (See references for research documentation)</p>	
Lancaster University School of Management	http://www.lums.lancs.ac.uk/
<p>This site describes how the teaching of entrepreneurship is embedded in the HE curriculum at the Institute for Entrepreneurship and Enterprise Development at Lancaster University.</p> <p>They are doing some research around entrepreneurship in the North-West but there are no published results. The research is carried out by the Institute for Entrepreneurship and Enterprise Development. The strand of research which is most interesting to us is that surrounding enterprise policy and regional development in the North West, which considers regional development policy, examines North West regionalism and takes a critical perspective on policy, focusing on enterprise education and training. Critically they are also assessing not only HE but FE as well.</p> <p>The university also offers several modules which start to unpick entrepreneurship. They teach this, it would appear, through the usual lecture style, however in the third year of the four year BA in Management and Entrepreneurship, the student gains paid employment in an entrepreneurial setting.</p>	
The UK's Official Graduate Website	http://www.prospects.ac.uk
<p>This site covers why people set up their own businesses and what makes an entrepreneur. Describes also what you need to think about when setting up your own business.</p>	
Business Start-up @ Leeds Met	http://www.business-start-up.biz/
<p>A project at Leeds Metropolitan University designed to support young student and graduate entrepreneurs. (See references for research documentation)</p>	
The White Rose Centre for Enterprise	http://www.wrce.org.uk
<p>Working with academic colleagues in science and engineering, the Centre aims to increase the entrepreneurial skills and competency of graduates, postgraduates and research staff and give encouragement and support to technology transfer, particularly via the formation of new companies.</p>	

University of Nottingham Institute for Enterprise and Innovation	http://www.nottingham.ac.uk/enterprise
A brief outline of a postgraduate course designed for students with a first degree in science, engineering, technology or medical sciences. Shows examples of M level core modules in entrepreneurship.	
Internationalizing Entrepreneurship Education and Training Conference	http://intent05.som.surrey.ac.uk
IntEnt is an annual conference for university educators and practitioners to exchange their ideas on research and disseminate their results and experiences in the field of entrepreneurship education and training. This year is will be held on 10 – 13 July.	
Young Enterprise	http://www.young-enterprise.org.uk
A UK registered charity, Young Enterprise runs a range of business and enterprise education for more than 150,000 young people each year through the support of 2,000+ businesses and 11,000+ volunteers. The Graduate Programme launched in 1998/9 is designed for students aged primarily between 18 - 25+ on Higher Education courses. The students may come from a particular discipline or be drawn from a wide range of subject areas. The programme gives undergraduates the opportunity to experience running their own companies, and gives them insight into how their entrepreneurial skills could be used to set up in business for themselves.	
Case Studies – School of Geography, University of Leeds	http://www.geog.leeds.ac.uk/courses/other/casestudies/
The School of Geography at the University of Leeds provides useful examples of downloadable case studies of entrepreneurship. Whilst these are not specific to engineering, they provide ideas and examples which can be translated into the engineering context.	
Cambridge-MIT Institute (CMI)	http://www.cambridge-mit.org
The main strategic thrusts of CMI's current phase aim to create: Research projects, centred on an important idea, developed with consideration of use, and with imbedded innovations in knowledge exchange Studies in innovations in knowledge exchange, to systematically learn from our innovations, produce materials for education programmes, and impact more widely university, industry and government policy and practice. Educational programmes and materials for wider dissemination, aimed at educating a generation of learners with the knowledge, skills and attitudes required for effective knowledge exchange.	
High Level Skills for Industry project	http://www.hlsi.org.uk
<p>The Project has pioneered the use of a digital repository and authoring tools to enable subject specialists, lecturers, trainers and teachers to create e learning materials, targeted to meet the needs of learners in their care.</p> <p>Sharing through technology is a key objective because of the wealth of good quality learning practice ready to be converted to online materials and made available to all across the partnership. Examples of good practice exist in every institution and organisation and by sharing, the needs of learners are better met, assisting with retention and achievement and accelerating progression across the sectors.</p>	

<p>The project has been assisted and supported by a number of regional and national agencies, in particular the JISC Regional Support Centre for Yorkshire and the Humber, The West Yorkshire Consortium of Colleges, South Yorkshire Further Education Colleges (SYFEC) the North Yorkshire FE Principals Group, The National Learning Network (NLN) The Centre for Educational Technology Interoperability Standards (CETIS) FERL, BECTA as well as the Regional Development Agency Yorkshire Forward who, through its vision, made the project possible.</p>	
<p>Humber, York and North Yorkshire New Technology Institute (NTI)</p>	<p>http://www.yf-skills.org/hyny-nti.html</p>
<p>The Humber, York and North Yorkshire New Technology Institute (NTI) is designed to increase business use of new and advanced technologies and to support that by providing appropriate learning and training programmes. The NTI is based at the University of Hull and is fast emerging as the primary contact point for all digital development in the Humber sub-region.</p> <p>The NTI's activities include:</p> <ul style="list-style-type: none"> • Skills broker for Digital Industries for the Humberside Learning & Skills Council • Regional Centre for the Microsoft IT Professional and Office Specialist Academies • Prime contractor for Humberside for Yorkshire Forward's ICT Vendor Skills Programme <p>Within the Yorkshire Forward ICT Vendor Skills Programme, the courses offered by Humber, York and North Yorkshire NTI include:</p> <ul style="list-style-type: none"> • Adobe Certified Expert • Cisco Certified Network Associate • Macromedia Certified Professional • Microsoft Certified Professional (MCP) 2151/2152 <p>In delivering these courses, the NTI is working with:</p> <ul style="list-style-type: none"> • East Coast Media • Grimsby College • Hull City Learning Centre • Hull College • IB2K • IT Interface • North Lindsey College 	
<p>Knowledge Exploitation Fund, Wales</p>	<p>http://www.kef-wales.co.uk</p>
<p>The KEF was set up in 2000 by the Welsh Government in order to help boost the Welsh economy by organising knowledge transfer links between HE or FE and industry and by encouraging the teaching of entrepreneurship and innovation in schools, colleges and universities. They are managed by the Welsh Development Agency and it is supported by European Structural Funds.</p> <p>They have three goals</p> <ul style="list-style-type: none"> • To ensure a cultural change towards innovation and entrepreneurship within HE and FE institutions through activities designed to create, value and promote innovations with a view to commercialisation • To raise entrepreneurship and innovation skill levels, confidence and ability of both staff and students in Further and Higher Education institutions • To accelerate the successful application of knowledge and the commercialisation of ideas and products developed in institutions. 	

C3 European Commission Work

The EC's directorate for Enterprise and Industry have set out a number of objectives that aim to:

- Support the Lisbon process;
- Lower barriers to entrepreneurs in Europe and encourage potential entrepreneurs;
- Foster innovation both in the technical sphere as an adjunct to research, and in the business process;
- Continue to enhance the efficiency of the internal market, with particular attention paid to its operation in the new Member States, and aim to extend its benefits to other regions;
- Enhance the global competitiveness of European industry within a framework of sustainable development.

The study has utilised the following EC reference:

- Competitiveness and Innovation Framework Programme (CIP)
<http://europa.eu.int/rapid/pressReleasesAction.do?reference=IP/05/391&format=HTML&aged=0&language=EN&guiLanguage=en>
- Maastricht Communiqué 2004 on the Future Priorities of Enhanced European Cooperation in Vocational Education and Training
http://www.bologna-bergen2005.no/Docs/00-Main_doc/041214_Maastricht_com_en.pdf
- Policy Document - Mobilising the Brainpower of Europe
http://europa.eu.int/comm/education/policies/2010/doc/comuniv2005_en.pdf
- Policy Document - Education and Training 2010
http://europa.eu.int/comm/education/policies/2010/doc/jir_council_final.pdf

Appendix D - New Engineering Foundation Advisory Panel

Association of Colleges (London), Ms Jenny Lo
CBI, Richard Wainer
EEF, Janet Berkman
Foundation Degrees Forward, Charles Pickford
Gatsby Technical Education Projects, Dr John Williams
Higher Education Academy -Engineering Subject Centre
Institute of Directors, Dr Richard Wilson
New Engineering Foundation, Professor Sa'ad Medhat (Panel Chair)
New Engineering Foundation, George Willett (Panel Secretary & Project Coordinator)
North West Development Agency, Neil Wilton
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Input to this research was also kindly received from the following members of the Foundation's International Advisory Panel:

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