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**Engineering, Knowledge Transfer and the Further Education sector:**  
submission to the Innovation, Universities and Skills Committee inquiry into  
engineering by Professor Sa'ad Medhat, Chief Executive, New Engineering Foundation.

## **Executive Summary**

1. Further Education (FE) colleges are responsible for much of the actual and potential supply of engineering skills. However, the sector is often overlooked by relevant stakeholders, with attention dominated by the Higher Education Institutions.
2. Of particular concern is New Engineering Foundation (NEF) research identifying a lack of up-to-date industrial experience amongst FE lecturers in engineering; and that funding of these subjects is insufficient to provide the necessary equipment.
3. Since 2004, the NEF, with support from the Gatsby Technical Education Projects, has been investigating and supporting the opportunities for Knowledge and Technology Transfer (KTT) between FE colleges and local industry. The NEF Fellowship Programme grants bursaries of £10,000 for FE faculty to take up secondments in businesses and now covers over 180 lecturers in over 70 colleges.
4. With support from the Department for Innovation, Universities and Skills, further research is being undertaken with educators, entrepreneurs and policy-makers to expand KTT schemes in the FE sector. This includes a series of nationwide focus groups hosted by Regional Development Agencies.
5. There are five central issues to address in the further promotion of KTT between engineering enterprises and engineering educators: **a)** college leadership and governance; **b)** college access to market intelligence; **c)** capacity-building in and between colleges and businesses; **d)** adapting college administration and human resources systems; **e)** long-term availability of funding to colleges.
6. Top-line recommendations include: **i)** systems for auditing employer-college links; **ii)** encouraging higher-level training that reflects local and regional needs; **iii)** reconfiguration of training budgets to allow staff regular, short returns to industry; **iv)** employer leasing of workshop space or equipment to colleges; **v)** RDA-led employer engagement strategies to support communication with colleges; **vi)** a review of Learning & Skills Council Policy to introduce unit-based funding for qualifications; **vii)** improving college-university connectivity through HEFCE, LSC, the QAA and OfSTED.

## **Introduction**

7. The New Engineering Foundation (NEF) was established by Professor Sa'ad Medhat, its current Chief Executive, in 2004 to address the unrealised potential of engineering training in FE colleges, particularly with regard to knowledge transfer. As a grant awarding charity, it supports the development of vocational education in science, engineering and technology through providing policy advice and advocacy, undertaking and commissioning research studies and impact analyses, and developing and delivering educational programmes and resources.
8. As well as the recent establishment of on-line masterclasses in science and engineering and programmes designed to help Higher Education fulfil the economic potential of Work-Based Learning, the NEF provides financial support of up to £12,000 per time for FE lecturers to take up secondments with local engineering and technology companies and improve their current knowledge of industry best-practice and cutting-edge developments.
9. Until very recently, Professor Sa'ad Medhat was a member of the Higher Education Funding Council for England's (HEFCE) Quality Assurance in Learning and Teaching (QALT) Committee; and was a member of the advisory panel that led the development of HEFCE's Centres for Excellence in Teaching and Learning (CETLs) and subsequently acted as an assessor of the initiative.
10. Prof Medhat is a Visiting Professor to Bournemouth University, a Court member of the University of Bristol, and a member of the Industrial Board at Loughborough University. He is also a member of the Steering Groups responsible for the development of the new Specialised Diplomas in Engineering and Manufacturing and he continues to be actively involved with the Specialist Schools and Academies Trust (Engineering).
11. Other industrial and academic positions he has held include:
  - Founding Director of the Engineering Technology Board- a professional association
  - Chairman of Productivity4you Limited – an e-learning technology provider
  - Vice President of Futuremedia PLC, a NASDAQ technology Company
  - Founding Principal and Chief Executive of Dubai University College (modelled on the British educational system with extensive partnership links to UK HEIs)
  - IBM Professor of Concurrent Engineering
  - Intergraph Professor of Electronic Design Automation
  - First Head of Research at Bournemouth University

## **The challenges of improving Knowledge and Technology Transfer (KTT) in Further Education.**

12. Knowledge transfer is the action of transmitting both tacit and implicit knowledge is among various stakeholders in an educational and/or entrepreneurial project. In pedagogical terms, it describes the packaging and transmission of knowledge to learners.
13. Technology transfer is the process of developing practical applications from the results of scientific research and development with the intent to capitalise for commercial purposes. Successful technology transfer requires dealing with several kinds of knowledge: that which creates the technology; the knowledge of how to operate it; and that concerning the value and the quality of the technology. Any successful technology transfer will require some form of knowledge transfer.
14. According to the annual report 2006/07 of the Technology Strategy Board's Knowledge Transfer Partnership (KTP), for every £1 million pound invested (in the case of KTP, by the Government), there is annual £2.9 million profit increase in the economy, 43 new jobs, 190 existing staff trained.
15. The New Engineering Foundation proposes that government should help enable greater knowledge and technology transfer between colleges of further education and industry in order to improve the competitiveness and the innovation level between such collaborative organisations so that the UK's economic potential and students' employment potential can be fulfilled.
16. In Further Education colleges, KTT activities should involve lecturers and business representatives sharing their collective expertise to and applying it to commercial challenges. This can include:
  - 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
17. In essence, the teacher becomes the learner, but in a way that enthuses and educates them in their subject with clear pedagogical benefits for the 'final' learner: the engineering student.
18. A survey of 49 FE colleges and over 100 businesses, conducted between March and June 2005, by the NEF (with the support of Gatsby Technical Education Projects) identified the need to:
  - Close the gap between FE and Higher Education to enable a more cohesive provision of educational and community-related services.

- Provide a springboard for raising internal staff performance, capabilities and capacity to enable them to address level 4 and Higher Education 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 in 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.

(source: Knowledge and Technology Exchange in FE Colleges; NEF, September 2006)

19. In November 2006, the New Engineering Foundation (again with the support of Gatsby Technical Education Projects) surveyed 200 lecturers in the FE sector and found that those teaching in subjects that should be considered central to the development of a high-skills, high-technology, globalised economy were not engaged with the relevant business and industrial sector. The claims around key economic subjects were as follows:

20. <b>Subject</b>	<b>% level engagement by FE lecturers</b>
Aerospace and precision engineering	25%
Advanced manufacturing	23%
Advanced materials and composites	15%
Process and chemical manufacturing	12%
Microelectronics	8%
Rapid and new construction techniques	7%
Nuclear	4%
Advanced telecommunications	4%
Environmental technologies and renewables	2%

(source: Building for the Future: Understanding the Needs of Lecturers of Engineering and Technology in FE Colleges; NEF, November 2006)

21. In 2008, the NEF, in collaboration with the DIUS, has begun holding a series of nationwide focus groups (6 in total), hosted by Regional Development Agencies (and including employers, Sector Skills Councils and representatives of both FE and HE), in order to identify the obstacles and to expanding KTT, and some possible solutions.

22. The headline aim of these groups is to inform what a national KTT framework might look like for further education, that will enable more FE colleges to play a full part in the provision of innovative knowledge and technology transfer solutions with business and the community, thereby strengthening the overall economic and social development at local, regional and sectoral level.

### **Issues of leadership and governance.**

23. Internal motivation and support for individuals in colleges promoting and taking part in KTT can be greatly enhanced by the right leadership and the reflection of its values throughout the institution.
24. Colleges are beginning to appoint individuals on their senior management teams (e.g. deputy or assistant Principals) with the responsibility to drive forward employer engagement activity, although predominantly this activity focuses on meeting skills needs and not a broader KTT agenda.
25. KTT activity in its broadest sense has not as yet been embedded in the 'fabric' of FE colleges and there is a need to re-orientate college provision to support KTT as a core activity through longer term strategies that seek to bring about cultural and behavioural change
26. FE colleges already engaged in KTT activity have recognised the agenda's cross-cutting nature – it can apply to all subject areas and economic sectors – yet there is still a need for many of those colleges to clarify what it means in practice to be a business-facing college and the implications of moving in this direction.
27. Clarifying the 'offer' to business will help FE colleges to create the coherence required as well as to build on and extend existing activity (and business links), which have tended to be highly 'localised' and short-term in nature.
28. Mitigating the risk of broadening or refocusing a college's offer to encompass KTT activity is still a central concern for senior managers – colleges serious about this agenda have had to make substantial investments to build capacity and realign structures, processes and systems.

### **Issues of market intelligence, dynamics and growth.**

29. There appears to be a lack of high understanding within colleges of what business needs and within businesses of what colleges can offer.
30. There is still inertia in the system which is inhibiting the extent to which FE colleges and businesses (public, private and voluntary and community sector) are engaging in KTT activity
31. FE colleges are not necessarily clear about the needs of business (except those larger enterprises or corporations) or the market opportunities that exist.

32. Businesses (especially micro and small enterprises) are not engaging in higher value added activity which is likely to demand new knowledge and innovation and those that are tend not to be aware of how FE colleges could help.
33. 'Language' continues to be a barrier to engagement and as a consequence building a shared understanding of where each other is coming from can prove problematic and gets in the way of establishing successful partnerships between the further education sector and business.
34. Existing relationships with business tend to be focused around an individual who has recognised expertise in a particular field and/or a specific project, and as such relationships tend not to be strategic apart from a few notable exceptions.
35. Where colleges are engaging in KTT activity this typically involves larger enterprises – untapped opportunities exist in relation to the SME market which has traditionally been a sector that is more difficult to sustain a 'critical mass'.
36. Colleges have been very opportunistic in opening up new markets for their KTT activity – more could be done to enhance a college's market building activities through the use of robust labour market information to underpin a planned and well targeted approach (which is likely to exploit a college's areas of specialism).
37. While colleges are working with and making use of intermediaries (e.g. Business Link, Train to Gain skills brokers, SSCs), they have recognised that relying on these agencies to provide sufficient volume of new business is not a viable proposition and increasing amounts of internal effort will need to be directed towards market building activities.

#### **Issues of capacity and capability.**

38. Greater capacity and capability have been identified as the most limiting factors in FE-business KTT activity.
39. Many colleges have invested in employer-facing teams, however, the extent to which these teams are well integrated into and can influence the workings of a college's faculties varies – a factor which affects the responsive of a college in designing a solution to meet an identified business need
40. Expertise in training needs analysis at an organisational, business unit, team and individual level are lacking within the college sector, and the degree to which businesses are clear about their specific needs varies
41. A limited amount of research and development is conducted by FE colleges and where it is the activity is very much at the margins – a factor which again is seen as limiting the potential of the sector to support KTT activity

42. Interventions to support staff development have been initiated – locally, regionally and nationally – yet more needs to be done to ensure colleges are ‘customer focused’ and deliver a professional and responsive service
43. The extent to which FE colleges have established partnerships with other providers to create an integrated ‘package’ of KTT solutions has been limited to date – potential therefore exists to build collaborative arrangements with other FE colleges, universities and indeed private sector consultancies.

#### **Issues of structures, systems and processes.**

44. College structures are being realigned and ‘gateways’ for business have been established to improve access to FE college expertise and facilities.
45. Investment is also being made by many colleges to ensure relationships with a wide range of customers are better managed, e.g. CRM systems are being introduced to track interactions and collate intelligence on any business with which a college engages.
46. Bureaucracy attributed to national and regional funding streams (e.g. Train to Gain) has worked against strong FE-business relationships emerging and in many instances colleges have had to protect businesses from the nuisances of these different funding regimes
47. Quality assurance procedures which are perceived to be ‘fit for purpose’ for mainstream educational provision and felt to hinder the design and delivery of responsive solutions.
48. Human resource policies and procedures (including working hours and reward strategies) were also identified as ‘getting in the way’ of encouraging college staff to adopt a more flexible approach to working in responding to business (customer) needs.

#### **Issues of finance.**

49. Funding (and outputs required of that funding) drives behaviour and affects the dynamics of the relationship between FE colleges and businesses – as a consequence KTT activity has to date been focused on the ‘here and now’ rather than creating longer-term, more sustainable FE-business relationships.
50. New funding streams, which mitigate a proportion of the risk for colleges, are required to build capacity in the FE sector to better respond to the KTT agenda.
51. The FE reform agenda has the potential to significantly impact on the nature and scale of KTT activity that is supported by FE colleges – an increasing number of colleges are likely to become ‘business-facing’ and their reliance on mainstream funding to support young people engaging in learning is likely to be reduced.

**Principles to support the improvement of KTT in FE (further findings of the NEF/DIUS focus groups to date).**

52. The opportunities for FE colleges to build and sustain a market for KTT activity lie in extending existing and exploiting new business links, especially in respect to SMEs.
53. Colleges are also likely to establish regional and local markets that align a college's expertise with sectors of strategic importance.
54. The characteristics of possible models of operation could include:
  - Horizon scanning functionality to ensure that colleges are aware of new and forthcoming opportunities.
  - Regional or sub-regional provider (FE-FE, FE-HE, FE-private sector) collaborations
  - Sectoral models (e.g. National Skills Academies, SSCs)
  - 'Hub and spoke' models which provide a gateway to expertise, utilise physical and virtual and operate at a national, regional or local level
  - Integrated with intermediaries (e.g. Business Link, Train to Gain) as part of a brokerage function
  - Provides a portfolio of KTT solutions (e.g. consultancy, facilities, skills training) that draws on the expertise that lies in FE staff and students
55. The principles underpinning any strategic investment made by public sector agencies should include:
  - Strategic and long-term approaches that underpin a culture change, focussing on outcomes rather than outputs
  - Building capacity and capability in FE colleges to respond to the KTT agenda
  - Strengthening structures, systems and processes
  - Supporting a breadth of KTT activity not just the development of workforce skills
  - Recognising track records in delivering KTT solutions and/or potential
  - Enabling collaborative working and building partnerships
  - Quality assured responsive solutions (e.g. through the use of the new standard)
  - Co-funding whereby the public 'subsidy' is matched by the employer's contribution (e.g. SME voucher scheme operating in the West Midlands)
  - Mitigating risk to FE colleges
  - Sustainability that enables elements to be mainstreamed
  - Generating a significant return on investment
56. Perhaps, if the Government were to provide funds for students to start their own businesses in collaboration with the college and a business, and if the college then continued to own shares in the company, this could provide significant new revenue streams.

## **Other recommendations to government and initiatives for supporting wider KTT.**

57. The NEF also recommends that the government pursues the following in support of the expansion of KTT, especially in the FE sector:
  - Systems for auditing employer-college links
  - Encouraging higher-level training that reflects local and regional needs
  - Reconfiguration of training budgets to allow staff regular, short returns to industry
  - Employer leasing of workshop space or equipment to colleges
  - RDA-led employer engagement strategies to support communication with colleges
  - A review of Learning & Skills Council Policy to introduce unit-based funding for qualifications
  - Improving college-university connectivity through HEFCE, LSC, the QAA and OfSTED.
58. For its own part, the NEF is expanding KTT through the promotion of nationwide 'masterclasses' for FE lecturers: one-day workshops run by industry practitioners and higher education academics, and held at university laboratories and companies' scientific facilities.
59. Initially, 10 of these will run per year, 2008-10 in different locations covering the North, Midlands and South. Those attending will gain valuable insight into areas such as optoelectronics, nanoscale systems and technologies, new materials, nuclear decommissioning and radiation prevention, environmental engineering and digital communications.
60. Although limited to 20 participants a session, five of the classes will be recorded and made freely available on-line and specialist television channels, such as Teachers TV.