Innovation and Knowledge Transfer the Role of the Individual

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Abstract. Innovation and knowledge transfer will be the keywords in the coming decade. There are several reasons for this; we will have to be innovative to combat the major challenges of climate change and the different aspects of security from terrorism and rogue states to pandemics. Poverty in some parts of the world remains a challenge and there is a need to create sustainable jobs as global competition intensifies. This paper dissects the key elements of innovation and knowledge transfer and emphasises the role that individuals play in both breakthrough technologies and innovation through continuous improvement. Trends in open innovation are included and the responses that are required of management and business models are outlined. The increased role of Universities in knowledge transfer is discussed as part of increased professionalism in higher education. Finally the role of the Institute of Knowledge Transfer, the recognised professional body for knowledge transfer professionals, is referred to as well as the requirements of a new profession.

1 Components of Innovation and Knowledge Transfer

Innovation is a heavily overused word and there is a risk that it is thought of as a panacea. To retain clarity about the elements of innovation it is helpful to break down the process of innovation into five component parts. This recognises that innovation is built on a knowledge base that it requires certain specific skills, and that there is always a problem to address. Centrality of the problem Centrality of a problem is obvious in conventional R&D fields, but it is equally applicable to an entrepreneur, where a market need or perceived market needs provides the necessary focus. But marshalling the necessary knowledge and skills to tackle a problem is not in itself sufficient for innovation. There has to be a creative contribution before there can be benefits to either to the economy or society.

The impact of innovation varies very widely. We are all clear that some innovations, radically change the way we live. These ‘eureka’ events occur when the creativity released in tackling a problem has consequences that go well beyond the initial problem. Such transformational effects, nearly always begin with one or two individuals, but will often dependent on others for realisation. Consider Fleming's discovery of penicillin, and the vital contributions of Florey and Chain with biochemistry skills. Watson and Crick's proposal for the structure of DNA needed the experimental data of Wilkins and Franklin. At the time, no one could have

R.J. Howlett (Ed.): Innovation through Knowledge Transfer, SIST 5, pp. 15–25.
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seen the enormous commercial use of lasers. However both Gould and Townes separately demonstrated great imagination in their pursuit of the production of coherent light sources [1].

How does knowledge transfer relate to innovation? It is now necessary to recognise that although creativity is an essential step in innovation it does not itself necessarily lead to a benefit. What the innovative process delivers is an outcome which may be advancement in research, or a proposal for a new drug or the development of a prototype etc. The role of knowledge transfer is to take the outcomes of an innovative process and bring them to commercial or societal value. This is achieved by matching market needs or potential market needs to the innovative outcome and helping to outline a developmental pathway. Alternatively, knowledge transfer involves taking successfully exploited innovation in one field and applying it to another.

2 Research into Innovation

Describing the components of innovation and knowledge transfer is clearly not sufficient for an understanding of these very important processes. More research is certainly needed. Current research is conveniently grouped into areas where the focus is on economic, geographic, process and social dimensions [2]. Economic interests focus on economic growth competitiveness and employment. Geographic research has an interest in local or regional factors such as the clustering of funds in a similar industry; national policies and the effects of globalisation. Research into the processes of innovation is concerned with how innovation is nurtured in organisational structures and the measurement of impact. The social dimension, of growing importance, involves the balance of explicit and tacit knowledge in the diffusion of ideas. It is also concerned with the creation of networks and the competencies necessary for practitioners. The relationship between these research areas and the components of innovation and knowledge transfer are given in figure 1 below.

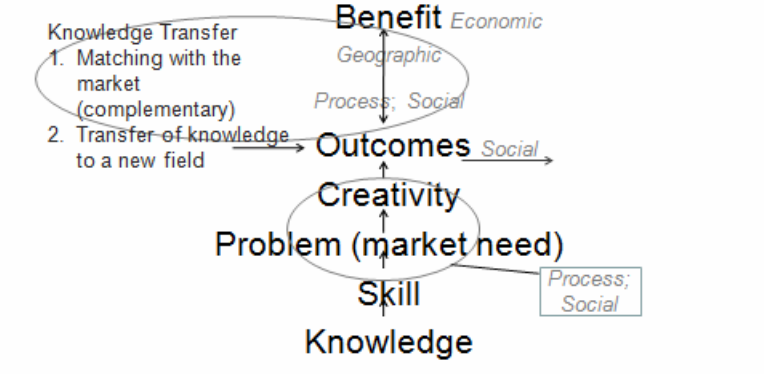

Fig. 1 Components of Innovation and Knowledge Transfer with related research areas

3 Innovation and Improvement; Endoscopy as a Case History [3]

The major innovations referred to earlier are by their nature unpredictable. More typical are developments, which combine mixture of innovation and improvement. The development of the endoscope, see figure 2, is an excellent illustration of evolution of a powerful medical tool.

The early stages of endoscopy in the 1930s involved a semi-flexible gastroscope a very primitive and probably painful way of viewing our insides. This became a much more promising instrument with the advent of fibre optics in the early 1950s. The early use of optic fibre bundles in endoscopy however was far

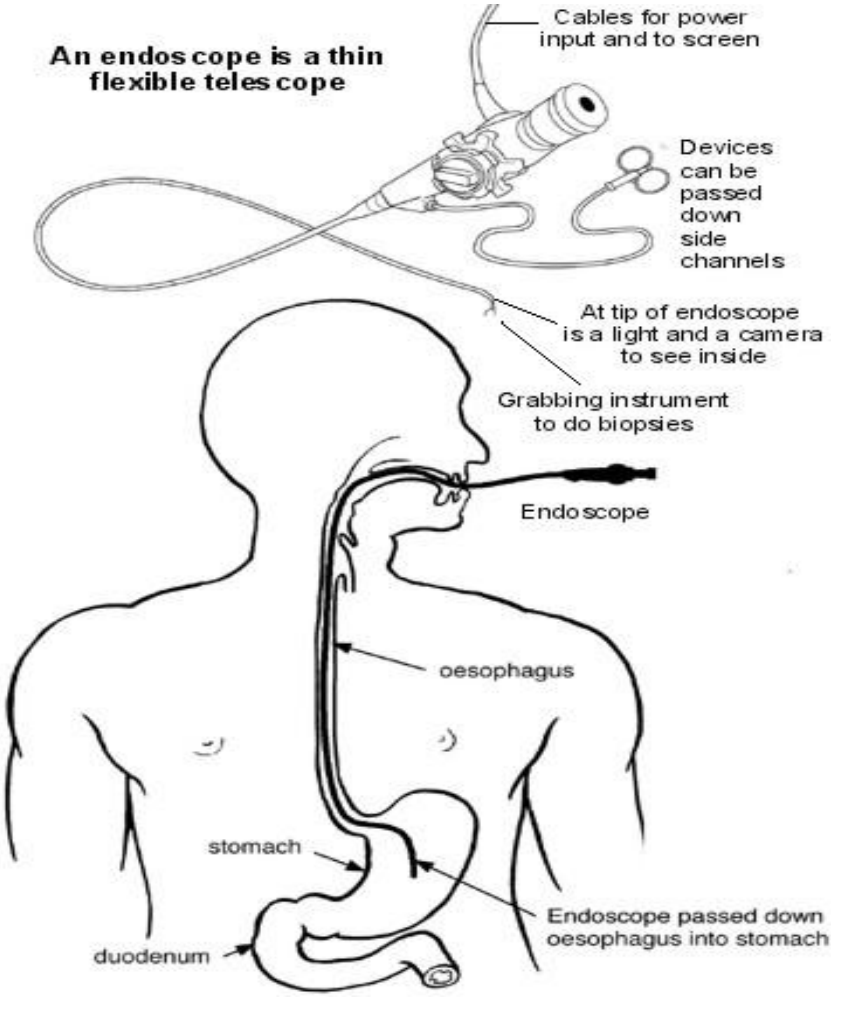

Fig. 2 A modern endoscope

from satisfactory. Not only were the fibre bundles difficult to form, the glass was imperfect, and the image degraded by crosstalk between fibres. Major improvements arose from the group of Peters, Curtis, and Hirshowitz at the Ann Arbour campus of the University of Michigan.

According to reports, Hirshowitz was attracted to Ann Arbour by the high reputation of the University of Michigan, and a stimulating research environment. Creating the right environment for innovation remains a very important consideration in 2010.

The critical innovation in making the endoscope a much more attractive tool came from Curtis, an undergraduate at the time, who created a composite glass fibre which enhanced the image and attracted development work from manufacturers. The improved instrument brought video guided endoscopy, and then in the early 80s, the introduction of the CDD chip to replace the multi-fibre bundle simplified the manufacture and improved the visual resolution. With the collaboration between gynaecologist and manufacturers endoscopy evolved from simply a viewing device into a guide for minimally intrusive surgery laparoscopy. By the 1990s, gallstone surgery, which had previously been a major surgical operation with traditional techniques have become largely a laparoscopic procedure.

What are the general lessons are to be learnt from the endoscopic case history? One is that continuous improvement over a sustained period of time can more than match a single major innovation. Secondly that important benefit arises from the collaboration between the innovators (discoverers) and users (market). The ideal, of course, is for the technical development and market development to occur as closely as possible together. A third lesson comes from the observation that the time taken to adopt the new techniques into general surgical practice was longer than might have been expected on purely technical grounds. The new surgical opportunities provided by laparoscopy were resisted by older surgeons; a new generation of surgeons needed to be trained for the technique to become generally applicable. It must be expected that for innovation to be effective social adaptation, education and training must occur.

4 The Battle for Hearts and Minds

The focus of innovation today is often on new systems, rather than simply finding new products. We need a concerted effort from many innovators and knowledge transfer practitioners to make a dent in some of the biggest challenges. One approach is illustrated by the US National Academy of Engineering [4]. In 2007, a group of academics, businessmen, and opinion makers were asked to draw up a list of the biggest challenges facing engineering in this century. The list of topics is intriguing, reflecting as it does the broadening horizons of engineering. The debate about these 14 grand challenges was initiated by asking for views on priorities and from more than 25,000 responses a priority order was drawn up which ran from make solar energy economical through reverse engineer the brain, advance health economic informatics, to secure cyberspace. Subsequently, each of these topics has been discussed, the opportunities identified and possible approaches debated. Considerable effort has been put into making the results of these

discussions, widely available. What motivates the Academy of Engineering? It is not in itself a grant giving body, so this is not an exercise to assess the scope for investment. In fact, progress in tackling the challenges is only part of the Academy‘s purpose. Of major importance is that the debate around the challenges draws attention to educators of the skills in engineering and related disciplines that will be necessary to foster the necessary intensity of innovation. The complexity of the challenges and the requirements for an input of disciplines other than engineering focuses attention on the creativity also necessary. The Academy is in effect, marketing engineering. It is attempting to maximise the concentrations of skill and creativity around its perception of the major problems that fall within the scope of engineering. It is an appeal to individuals, to teach or to study or to be engaged in creative activity through the nature of the intellectual challenges.

5 Open Innovation

As well as attempts to draw talent into the innovation arena there have been attempts to better conceptualise innovation. The most important contribution is that championed by Henry Chesbrough and colleagues using the term ‘Open Innovation’. Open Innovation is defined as: ‘the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the market for external use of innovation, respectively. Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology’[5].

In UK, we can see this approach exemplified in two ways by GlaxoSmithKline. The first is exemplified by the creation a centre of excellence for drug discovery. The goal is described succinctly as ‘supporting the development of the best from anywhere. The focus is on developing alliances with world-class research and development organisation that like us are open to innovation. Not just in science but in all aspects of the discovery process.’ The second approach aimed at providing relatively easy access to developing technologies was announced in the latter part of 2009. It involves the creation of a world class Science Park, near GSK Stevenage research base. The campus supported by UK government, academia and the Wellcome trust, as well as the Company aims to pioneer a new operating model of open innovation which should strengthen and grow the UK bioscience sector. It is hoped that the new campus will compete with similar Parks in Boston, California and North Carolina in the United States.

The aim of open innovation is not just to provide easier access to early stage discoveries. It is to harness what James Surowiecki has famously described as the wisdom of crowds. Here, the key element is to access to an individual's knowledge and experience not just that of an organisation. On the multinational scale this is best illustrated by IBM in a series of so-called Jams. The first in 2001 aimed through consultation, to capture best practices on 10 urgent IBM issues by consulting staff suppliers and customers. IBM captured 268,000 views from 6000 inputs. By 2006 the innovation Jam was broadened both in ambition, and scale. The aim of the consultation was how to combine IBM's new technologies with real-world insights to create new market opportunities. 150,000 people contributed

from 104 countries and 67 companies. As a result 10 new businesses were created with the seed investment of $100 million. In 2008 [6] vision was bolder; to advance IBM's vision of the 'enterprise of the future' and to draw on the brains of individuals from many more companies. In practice, staff from 1000 companies, plus the IBM cohort engaged in a conversation over a 90 hour period around the themes of 'Built for Change; Customers as Partners; Globally Integrated, and The Planet and its People.'

In addition, IBM conducts worldwide debates around themes which are likely to have a significant IBM interest for the Company. The aims, reminiscent of the American Academy of Engineering's, grand challenges, are designed to draw attention to the skills and creativity needs around general themes of global interest. This allows also allows the Company to engage with individuals in emerging economies. In one recent debate on Security and Society, the contributors from the Far East outnumbered those from the US. By associating IBM with topics such as the security of 3 billion mobile phones the risks associated with the highly extended food supply chain of for example the hamburger, the high global volumes of identity theft and car theft it is pointing to technology's role (and that of IBM) , in innovation and knowledge transfer that impinges on everyday lives.

It is not just large companies exercising open innovation. Use of search engines reveals a plethora of portals, and individual sites, with relatively small-scale offers of problems and solutions. This is open innovation as an Exchange and Mart and very much the home for individual contributors.

6 The Digital Phenomenon

We referred earlier to the role of individuals in breakthrough advances such as penicillin, lasers, and the structure of DNA. Equally striking is the role of individuals in leading models of social communication. The digital revolution associated with Facebook is an outstanding example. Created by Mark Zuckerbrook and friends at Harvard Facebook exemplifies not only in youthful entrepreneurship but also, trust in the company's users to sustain innovation. The Facebook platform was opened up in 2007 and within months there were 5000 applications and the company was worth $15 billion. There are other now well-known examples such as YouTube (Chad Hurley et al) and Napster (Shawn Fanning). The appetite of the younger generation for Web 2.0 was such that it was plausible for John Palfrey and Urs Gasser as late as 2008 [7] to describe a born digital generation (digital natives b>1980) which was at home with the web in a manner greatly more intense than older generations. Jack Dorsey the creator of Twitter changed all that. Users of the Twitter site grew to 10 million in less than two years, and across a wide age range. We are all digital natives now.

A consequence of that is that mass collaboration using digital technologies is transforming all aspects of the knowledge society even more rapidly than was envisaged. It is still possible however to construct a hierarchy based on digital impact. Knowledge and information-based services, obviously lead, closely followed by the creative and cultural sectors, in particular media advertising software and in entertainment, film and television. Not far behind are communications and

publishing. The impact on less obviously affected areas such education, health and public administration is growing constantly as it is in the retail trade, financial and business services.

7 Innovation and Management

One area relatively untouched by innovation and knowledge transfer is management. Some would agree with Gary Hamel that modern management has reached the limits of improvement. If management is to change what are the challenges? Inspired by the National Academy of Engineering's grand engineering challenges, a group of scholars and business leaders met in 2008 and subsequently laid out a roadmap for reinventing management which contains 25 challenges. Some of those are given below in Fig 3:

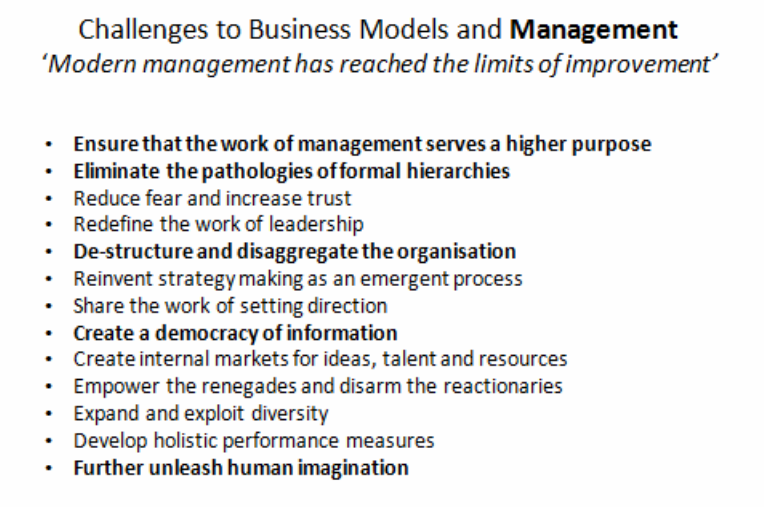

Fig. 3 Challenges to Management taken from reference [8]; the authors emphasis in bold

What is immediately evident is the emphasis on an enhanced role for individuals reflecting the imperative for organisations in future to make the most imaginative use of internal and external networks.

8 Open Innovation and Business Models

As well as management structures, business models will need to change to account for more open and systematic innovation [9]. The business environment will increasingly be affected by emerging product markets, emerging ecosystem and changes in established industries that are driven by open innovation. We are likely

to see increased differentiation between niche products and services, and those which contain a convergence of different elements. The mobile phone is a classic example of the latter containing, phone, music player, camera and aspect of a PC. Medicines tailored to meet patients with particular genetic requirements would be an example of the former. Particularly exciting examples of the potential for convergence is a virtual power station were elements of production, such as the conventional power station, nuclear power station, windmills and solar power are linked with the consumers varied and variable demands .

9 The Innovation Environment and the UK in 2010

The importance of innovation and knowledge transfer demands an environment which encourages both activities. It is important to recognise the government has an influential role on both the discoverers and developers of new ideas, and the market. That triple helix of university -- industry -- government has been very well described by Henry Etzkowitz [10]. There is a case also for the consideration of facilitators such as patent experts or intermediate, e.g. biotechnology, companies as important separate players.

The government's biggest contribution to the innovation and knowledge transfer environment has been the increase in government investment in the Science Budget from £1.3 billion in 1997 to £3.7 billion now. Together with additional funding through the higher education funding councils research in the UK has ever been better funded although some way short of the overall target for R&D spend of 2.5%. But the increased investment plans with higher expectations of delivery by higher education of economic and social benefits. This burden of expectation is likely to be severely tested by whatever government comes into place after the next election.

One structural change that should be permanent is the creation of the Technology Strategy Board. There is a need for a national body to ‘connect, and catalyse through strategic debate and competitive funding’. The development of application areas such as environmental sustainability, energy generation and supply, healthcare and the creative industries alongside technology areas such as high-value manufacturing and nanotechnology is a welcome step and one more likely to be fruitful than complicating the funding of the highest quality of research in universities with difficult assessments of economic and social impact.

10 The Contribution of Universities

Universities, play an absolutely crucial role in the stimulation of discovery and the early-stage developments in innovation and knowledge transfer. They have responded very well to this is challenge. In this context, universities are very different institutions than a decade ago. The adoption of knowledge transfer of the third mission for universities, sits well with the developments or potential developments in teaching and research. Figure 4 encapsulates some of the essential elements in today's universities, but emphasises the interrelationship between the three missions.

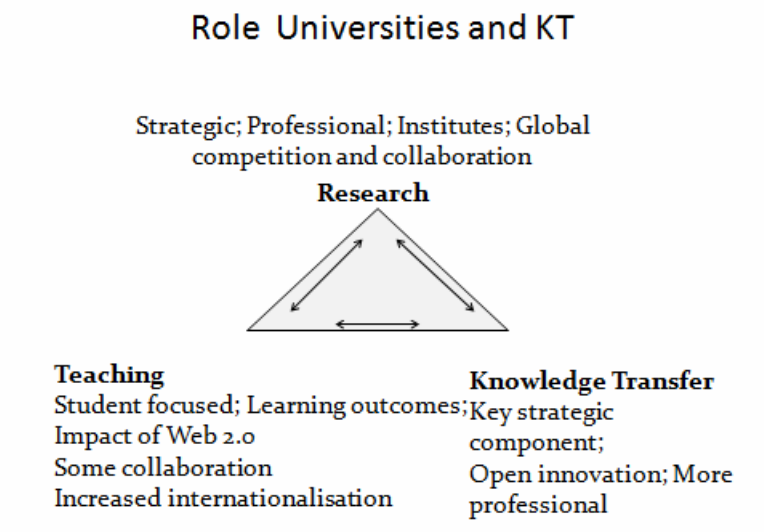

Fig. 4 Universities now or in the near future

The perception of the nature of the contribution to innovation has also changed in the last 10 years. The original emphasis was very much focused on the commercialisation of intellectual property. Now there is recognition that tacit knowledge plays at least as important a role as explicit knowledge. This can be readily seen from the income universities derive from knowledge transfer activities [11] where the income associated with intellectual property is much lower is much lower than that for partnership and collaborative research or consultancy. The highly successful Knowledge Transfer Partnership scheme illustrates this point very well. The KTP associates play a key role in managing and implementing strategic development projects. But they also broker, tacit knowledge exchange between universities and business. Continuing professional development is also an important contributor to knowledge transfer as a source of ideas and personal connections as well as education and training.

11 The Institute of Knowledge Transfer

The realisation that successful knowledge transfer depends critically on the quality of personal interactions has led to the growth of practitioners specialising in knowledge transfer and a discussion of the individual competencies that the necessary for success. There have been discussions in both Europe and the UK about competency frameworks. A personal list of the key elements is given in figure 5.

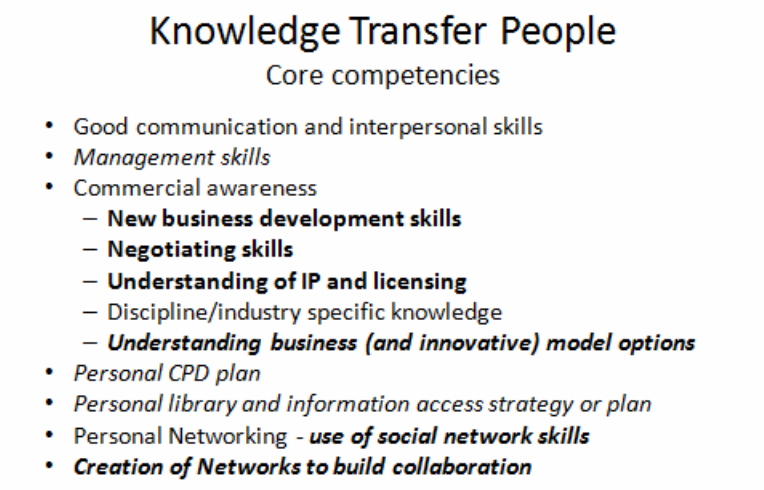

Fig. 5 Important personal competences in KT cf key elements of the education programme for Certified Trans-national TT professionals EC report 2007; authors additions (italics) and emphasis (bold); see also reference [12]

The distinctive list of competencies associated with knowledge transfer heralds the birth of a new profession. This has been recognised by the creation of the Institute of Knowledge Transfer [13]. IKT is an individual membership body based on professional standards. These standards are set by a peer review of workplace learning and CPD as well as an assessment of the articulation of skills and competencies required for professional success. The Institute provides a range of services which are outlined in Figure 6:

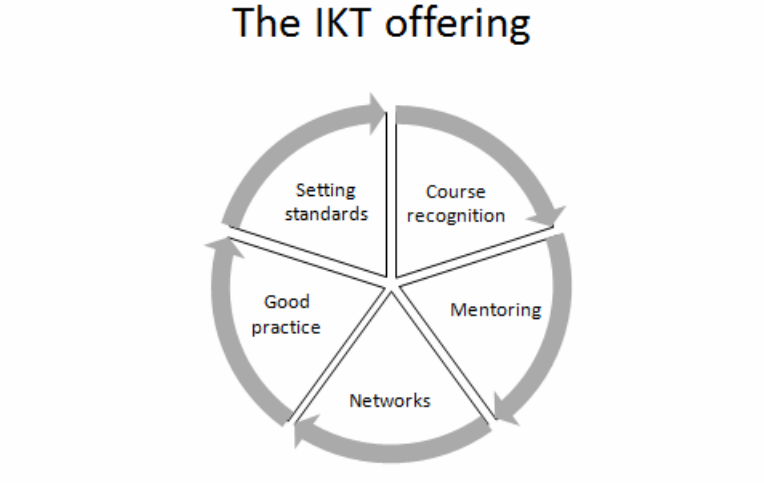

Fig. 6 IKT services

A key feature of the Institute is a is that it defines knowledge transfer broadly, which enables members to network with and between more focused KT organisation it is open to members from the private and public sectors and its membership is indeed drawn from business/industry research/discovery, as well as intermediate companies and facilitators. Figure 6 illustrates the services offered and is an explicit recognition that our future innovation and knowledge transfer depends on individual initiative.

12 Conclusions

We are at the birth of a new profession which encompasses both innovation and knowledge transfer. The emergence of a profession promotes reflection on the boundaries of the new professional activity although these boundaries will be subject to constant review and revision. The discipline of a profession also requires us not only to look at its scope, but to research the underpinning processes. We need to know more about the environments that stimulate innovation and the mechanisms which lead to successful knowledge transfer. Because of the complexities of interactions involved in innovation and knowledge transfer, both within and outside organisations, this paper argues that the profession will develop most quickly if it recognises the powerful role of individuals. Open innovation implicitly recognises this dimension and it is now for managements to make the changes in management structures, culture and business models that are necessary for success.

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