

Fostering Innovation

the role of education and training

A staff development seminar in cooperation with the NESSE network of experts

This was the third of a series of Commission staff development seminars on social aspects of education and training organised by DG-EAC and delivered by members of the [NESSE](#) network of experts. In this seminar, Professor Roger Dale from the University of Bristol was joined by Professor Palle Rasmussen from the University of Aalborg, to introduce the idea of innovation as a social process, and to outline the main features of its relationships with educational institutions, practices and outcomes.

In the first half of the seminar, [Professor Dale](#) examined



briefly the history of "Innovation" as a "policy-able" set of institutional practices and relationships. He also examined some forms taken by innovation policies and their assumptions about, and implications for, education. The main body of his contribution focused on current

discussions around elements of the relationships between Innovation and Higher Education, such as the conditions for the effectiveness of closer relationships between Universities and knowledge and human capital production, what can be learned from existing efforts in this area, and the impact of such changes on Universities' organisational and cognitive cultures.

Three main messages emerged from Professor Dale's presentation:

1. First, that **innovation is a social process**, neither spontaneous nor inevitable; it cannot be guaranteed, but it can be made more likely through effective policies, including education policies.
2. Second, that **innovation is not confined to scientific and technical innovation**: many of the most influential innovations have been developed in social and political fields. One particularly important example, said Professor Dale, is New Public Management, whose worldwide uptake has transformed the ways that we are governed. It was directly based on the work of academic political economists in the areas of public choice theory and transaction cost and principal-agent theories. These theories, said Professor Dale, were directly taken up and turned into government policy in New

Zealand in 1984, and the perceived success of that experiment led to the practices becoming installed across the world.

3. Third, that **higher education and universities have key parts to play in these developments**—though it is important to scrutinise the claims of, and learn from the implementation of, what are currently the most prominent approaches in the area.

In terms of the first of these messages, Professor Dale argued that **it is important to move beyond what might be seen as the original theory of innovation**, what is known as the "linear model", which sees the process occurring through the sequence: *Basic Research > Applied Research > Development > Production and Diffusion*. This had its origins in the Cold War, but is still quite prominent.

Professor Dale said that there have been key "push" and "pull" factors at work in the increasing and changing contributions expected from Universities in the process of innovation. From the pull side, he said, governments have become much keener to develop non-price means of competitiveness, and sustainability, and innovation is seen as central to this. From the push side, Universities have been forced by changing public funding regimes to find more of their income from non-state sources. This, argued Professor Dale, has led them to become innovative. One major form that this has taken has been the development of the "Entrepreneurial University", though this has not led to significantly increased contributions to innovations linked to economic competitiveness. For instance, argued the speaker, the main form taken by the Entrepreneurial University, certainly in Anglophone countries, has been an increased emphasis on the

recruitment of full-fee-paying students from overseas—demonstrating quite neatly that **entrepreneurialism is not the same as innovation**.

Professor Dale considered **three major sets of institutional conditions** associated with enhancing the contributions of Universities. The first was the means of codifying and commercialising knowledge produced by Universities, largely through patents. The main message here seemed to be that emulating the USA Bayh-Dole Act would not be effective, because (a) it was very USA-specific, except for the biotechnology area: (b) that evidence showed patenting was a less effective means than most others of University-firm collaboration: and (c) the "innovation relationship" is demand- rather than supply-driven.

The second set of institutional conditions discussed by Professor Dale was those associated with the Triple Helix/knowledge triangle approach to government-industry-university collaboration in innovation. This is a very prominent approach, said Professor Dale, but there is evidence that it is rather more difficult to achieve in practice than is suggested in the theoretical work.

The third set of institutional conditions that Professor Dale examined was forms of local knowledge spillover, with Silicon Valley the iconic example. However, said Professor Dale, this has a mixed record of success (e.g. science parks) suggesting that **it is particular combinations of institutions that produce conditions for success rather than natural or contrived proximity in itself**. For him, where Universities are concerned, it is important to consider their own self images, and that interpersonal ties are more effective than contrived conditions for cooperation.

Professor Dale argued that in both the second and third examples, there is evidence of "culture clashes" between University and Industry. These vary with particular national education and training traditions, and may not be susceptible to a single set of solutions.

The fourth set of institutional conditions Professor Dale examined was **the different roles that might be played by states**: as embracing the Republic of Science; as Entrepreneur; as Regulator and as Facilitator. Again, he said, the relative effectiveness of these models may be time, space and "national tradition" specific, though they should not be seen as mutually exclusive.

For Professor Dale, a possible general message from these examples is that **the generalisation of models based on biotechnology is likely to be misleading**: that extending "good practice" identified in particular (especially national) contexts to other contexts should be approached with care; both of these may create perverse incentives for Universities.

Especially given the OECD's finding that "priorities and biases in the Science Technology Innovation system are weakly linked to general economic performance and policies", said Professor Dale, it is important to consider other areas where Universities have important contributions to make to non-price based competitiveness. These include a wider range of relationships between them and firms, though it is neither realistic nor sensible to try to make the whole industry cooperate with the whole University. These include most prominently developing human capital through changing patterns of learning and competences.

For Professor Dale, the most important policy implication to be drawn from the three general messages of his contribution to the seminar may be that **one area where innovation is needed is in the relationships within and across the knowledge triangle itself**. It seems, he said, that juxtaposition, good faith and the strength of the benefits that might be accrued are not sufficient to enable the realisation of the potential of the knowledge triangle. This may involve such innovations as diversifying the roles of Universities, or differentiation of the higher education sector, or greater professionalisation of the management of relations across the knowledge triangle.

In the second half of the seminar, [Professor Rasmussen](#) focused on the forms and contexts of innovation in modern societies and on the role of education (defined broadly as institutionalised education and informal learning) for innovation. The speaker emphasized that **innovation is too often used indiscriminately as a buzz word** and that, for purposes of analysis and policy development, the character of and conditions for innovation processes should be highlighted.



Professor Rasmussen explained that **innovation** can be characterised by contrasting it with related concepts like **change** (a more general concept, which may include reactive adjustment to conditions), **invention** (the creation of a new device or workable idea, which may however remain unused), **creativity** (skills used in invention and innovation), **learning** (a more general process, which may also include socialization to given conditions) and **entrepreneurship** (skills in commercial venturing, often but not always linked to product or service innovation).

In parts of the literature, he said, a distinction is made between **two modes of innovation**. One is innovation based on science and technology (STI mode) and another is innovation based on experience and user-producer interaction (DUI mode). The first mode, said Professor Rasmussen, is mainly associated with the original and still widely-held linear model of innovation. For Professor Rasmussen, the distinction between the STI and DUI modes highlights the fact that although the promotion of innovation is often linked to science and technology, development of new products or services is often accomplished without specialized innovation departments, by practitioners with strong knowledge of the specific trade and its markets or users. For him, **innovation policies should include instruments to support not only STI mode, but also DUI mode intervention, preferably in combination.**

Professor Rasmussen argued that **the types and levels of innovation occurring in a given society reflect the structures, institutions and cultures of that society.** Thus, he said, it is possible to identify different *national systems of innovation*. If firms are assumed to be centres of innovation, the external context of a firm is defined by institutions and organizations such as other private firms, universities, government agencies and financial institutions, while the internal context is defined by the firm's institutions and organizational elements that are important for learning and promoting product and process innovation.

Nielsen (2006), said Professor Rasmussen, has traced relationships between innovation, education and organisational learning **in the Danish context**. Using survey data he identified firms that had been active in product development either on the national or the international level. He then compared patterns of job turnover, employee educational levels and the use of learning organisation procedure for non-innovative and innovative firms. Some important results are:

- The most innovative firms have the lowest job turnover. Innovation related to personnel policies of keeping knowledge resource and learning competences
- Firms with learning organization features have a much higher chance of product innovation
- Firms with learning organization features hired the largest proportion of higher educated persons
- Firms with high extensity of vocational training also give high priority to competence development. There is a positive relation between these two parts of innovative learning.
- The flows of unskilled employees in and out are lowest in the firms with high extensity of training, where unskilled often are included in the training activities

In sum, argued Professor Rasmussen, there seem to be strong links between firm competitiveness, product innovation, recruitment of employees with higher education, learning organisation procedures and low job turnover. New products or services on the market can be seen as materialisations of the firm's collective and dynamic ability to learn and generate knowledge.

For Professor Rasmussen, this raises the question of how innovative skills may be characterised and identified at the individual level. One attempt to do this, said the speaker, was **the Danish national competence audit**, which was published in 2005. Here "creative and innovative competence" was identified as one of 10 key competences, and these were then investigated through a national survey. Creative and innovative competence was defined as the capacity of a person, given that the resources and the situation allow it, to effect visible innovation in a domain of knowledge and practise. The competence included three components: (1) transfer and combination skills; (2) balanced autonomy and (3) focusing ability and discipline. Among the results from the survey were:

- In general the highly educated are more creative and innovative than persons with lower levels of education
- The highly educated employees with long working hours and management responsibility represent Denmark's most creative and innovative group
- Independent businesspersons are creative, but not very much so

- The average level of innovative competence in public sector is not lower than in the private sector
- Most Danes think that they work in innovative workplaces, but their own jobs do not to the same extent demand innovative thinking. This applies especially to unskilled workers
- Skills and tools for innovations are only to a very limited degree acquired through education and in-service training

Professor Rasmussen used **two examples to illustrate how educational programmes can foster innovative competence**. The first example was workplace-directed teaching in general adult education; the second was project-organised study in higher education.

The two examples generally agreed with the following principles for a curriculum based on the need for creative application of knowledge:

- Learning would be structured mainly through projects. Some projects would be individual, while many would be group-based.
- Students would repeatedly practice identifying and solving problems.
- Learning would take place in a range of contexts and use a range of methods.
- Knowledge and learning gains would be assessed from different perspectives – including that of the learner.
- Thinking and self-assessment would be embedded across the curriculum.
- Skills would be revisited and practiced over time, so that knowledge gained earlier in an educational career could be applied creatively to new problems.
- Students would gain depth of understanding in a number of disciplines, or domains of

knowledge, including traditional academic subjects.

For Professor Rasmussen, the fact that people seem to perceive of the educational system as contributing little to creative and innovative competence indicates that **there is much room for improvement through reform of curricula and pedagogy**. He argued that principles like the ones cited above are useful guidelines for this, but the specific conditions and resources of national and regional contexts should be taken into account.

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