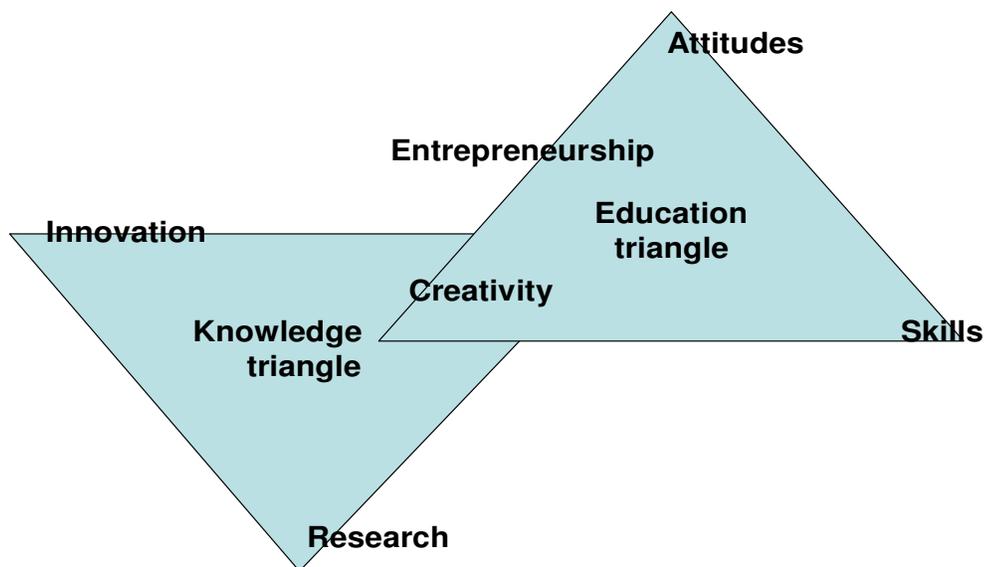




## LIFELONG LEARNING FOR CREATIVITY AND INNOVATION

### A Background Paper



February 2008

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## 1. INTRODUCTION

1. Innovation has become one of the main engines of long-term economic growth and is closely linked to knowledge, the major value-creating factor in modern society. In recent decades the concept of innovation has broadened: it refers not only to R&D-based technological inventions but also to non-technological and social innovations in public and private services.

2. Education and training are key factors for achieving the economic and social objectives of the Lisbon Strategy. As the Council emphasised in 2006, the equal consideration of the efficiency, quality and equity objectives of education and training systems is a "sine qua non of achieving the Lisbon goals while strengthening the European social model"<sup>1</sup>. Knowledge and innovation are at the centre of the revised Lisbon agenda for growth and jobs<sup>2</sup> and strengthening the links between education and innovation is a vital pre-requisite for innovation<sup>3</sup>. Education provides the appropriate skills and competences for innovation and creates new knowledge within the "knowledge triangle" of education, research and innovation.<sup>4</sup> The modern economy requires a broad creative skills base, involving the whole population. Research and innovation should be put at the heart of business by intensified university-industry partnerships, innovation poles and clusters, innovation management and support services<sup>5</sup>.

3. A fresh impetus is needed to enable European education and training to respond the future needs of innovativeness. This means supporting and cultivating creativity and skills, which is more challenging than improving the knowledge base and relatively easily measurable learning outcomes in academic disciplines. Researchers emphasise that creativity concerns all fields of human activity and all people and that all children are creative<sup>6</sup>. Many of them criticize the education systems for neglecting the development of creative capacity and skills. Creativity is the prerequisite of innovation and it should, as Ken Robertson puts it, be treated in education with the same respect as literacy<sup>7</sup>.

4. Creativity connects the education triangle with the knowledge triangle and puts them into mutual interaction, contributing to innovations in society and economy, as the front-page picture suggests. Ultimately, the debate on the relationship between education and innovation may lead to a very broad discussion, of the relationship between education and society in general and on the interaction of knowledge and creativity. Creativity and innovation are thus likely to stay in the European education agenda far beyond 2010.

5. The purpose of this document is – as the background paper of the Slovenian EU Presidency in the field of education and training in spring 2008 – to initiate a debate on how to enhance the contribution of lifelong learning for creativity and innovation in society and to strengthen innovative approaches and culture for better learning. The discussion on creativity and innovation will continue in the Presidency conference "Promoting creativity and innovation – schools' response to the challenges of future societies" in April 2008 at Brdo, Slovenia. The conference is aimed to give a contribution to the Education Council debate and to possible Council conclusions on the subject in May 2008. At the same time, the Council is, together with the European Parliament and the Commission, preparing the decision on the European Year of Creativity and Innovation 2009. The overall objective of the European Year is to support the EU Member States in promoting creativity through lifelong learning, as a driver for innovation and the development of personal, occupational and social competences and well-being of all.

## 2. CREATIVITY IS THE INFINITE SOURCE OF INNOVATION

6. Europe is facing enormous socio-economic and demographic challenges, including regional disparities, aging populations, high rates of low-skilled adults and of youth unemployment, etc. Innovative approaches and creative uses of new technological opportunities create new and better jobs in new industries and offer potential solutions for the quality, maintenance and sustainable development of public services, social-security and health-care systems, and as a basis for prosperity and economic development. At the same time many studies conclude that Europe is lagging behind the US and Japan in growth and competitiveness, but also on several innovation indicators.<sup>8</sup> Also the emerging Asian economies, like China and India, have grown to challenge Europe and US<sup>9</sup>.

7. Innovation – the creation, dissemination, and application of knowledge – has become a major engine of economic expansion and social development. In 1987, Robert Solow was awarded the Nobel Prize for developing a modern Growth Theory, which identifies technological progress and innovation as the greatest engines of growth. Since then, a consensus has emerged that innovation has a significant effect on productivity at the firm-, industry-, and country level<sup>10</sup>. Recent research suggests that innovation is a central mechanism that transforms social capital into economic growth<sup>11</sup>. The social perspective of innovation is gaining more attention, and many scholars highlight the importance of social cohesion<sup>12</sup>. Also EU Commission emphasises the importance of innovation to the development of sustainable inclusive societies in Europe<sup>13</sup>. There is a growing consensus that economic wealth and social cohesion are mutually reinforcing and innovation is increasingly relevant for both goals.

8. The Oslo manual<sup>14</sup> defines innovation as "*a new significant improved product (good or service), or process, a new marketing method, or a new organizational method, business practices, workplace organization or external relations.*" A key feature of innovativeness is the ability to combine knowledge across fields – from science and technologies to art and design – "thinking outside the box". Invention and innovation are not the same: invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out in practice.<sup>15</sup> The distinction implies that innovation is a more complex process involving more actors and more sources of learning. Innovation can take place at any time in all parts of the economy – including non-market sectors and public services.<sup>16</sup>

9. Innovations are driven by various sources, like demand, new R&D knowledge or new possibilities to apply existing knowledge in other contexts. A growing number of companies have shifted from large R&D departments to more *open innovation approaches*, combining in-house and external resources in order to maximize economic value. Also the creative and *innovative power of the "users"*<sup>17</sup> is used to create new innovations. Enterprises that work closely with users have a good innovation success rate<sup>18</sup>. Broadening of the innovation focus widens the group of innovators.<sup>19</sup> It emphasises the importance of *innovation management*, leadership, continuous training, and the development of organisational routines for knowledge application and innovation among all workers.

10. Creativity is a multidimensional phenomenon that manifests itself in many fields and contexts, from arts and crafts to design, science, research and entrepreneurship. It is regarded as a cognitive ability, but – though intelligence favours creative potential – it is not the same as 'intelligence'<sup>20</sup>. It involves the ability to synthesize and combine data and information, but also requires confidence to take risks<sup>21</sup>. Creativity and innovation are closely related but

different since innovation is using creativity – turning creative ideas into use as products or as active practices. All children are creative and in some sense also gifted. Indeed, creativity is one of the basic characteristics of being human.<sup>22</sup> Yet creativity can be supported, encouraged and cultivated – as well as weakened, suffocated, even killed<sup>23</sup>.

11. The importance of creativity for innovation and the value of the creative industries in the economy and society have been highlighted in recent debates on innovation. Richard Florida emphasises the importance of human capital and talented people for high-technology industries and growth in regional economies.<sup>24</sup> His research shows that one third of the American working population belongs to the creative class and works in creative industries and that the most successful city-regions are those that have a social environment open to creativity of all sorts. "Learning regions" attract creative people and are open to people of different ethnicities and lifestyles, which provide advantages in generating innovations, attracting high-tech industries and spurring economic growth. According to Florida<sup>25</sup>, to attract creative people, a place must have all the 3T's of economic development: *Technology, Talent and Tolerance*.

### – 3. EDUCATION AT ALL LEVELS CAN DEVELOP CREATIVITY AND INNOVATION

12. The skills needed for innovation tend to be contextual and there are differences in approaches to innovation between and within sectors. Innovation processes are often networked, multidisciplinary and problem-oriented, setting even higher demands for competences. Soft skills are increasingly important for all types of innovation in all sectors. "*Learning to learn*" is a crucial key competence in modern working life. Complex and rapidly-changing circumstances increase the demand for *creative problem solving*. Since most of the knowledge that companies use for innovation comes from outside', '*absorptive capacity*' – the ability to recognise the value of new, external information, to assimilate it, and to apply it – becomes key to performance<sup>26</sup>. An *entrepreneurial mindset* is widely considered as an overall attribute necessary for innovation-friendly societies.

13. The EU recommendation on key competences for lifelong learning<sup>27</sup> can be regarded as a response to the demand of soft skills and competencies. The recommendation sets out eight key competences, which are all considered equally important<sup>28</sup>. Many are soft skills, relevant also to creativity and innovation. The recommendation also lists other themes important for all key competences: critical thinking, creativity, initiative, problem solving, risk assessment, decision taking, and constructive management of feelings.

14. As the specific innovation skills are contextual, different innovation types listed in the 'Oslo manual' definition - product, process, marketing and organizational innovations – might require different kinds of specific skills and competences. Based on the vast amount of research on innovation and skills<sup>29</sup>, it is possible to highlight innovation skills for each context. The results indicate that one qualification rarely provides all innovation skills needed in working life (see annex, table 1)<sup>30</sup>.

15. All levels of education and training have different, if inter-dependent roles in the education system and their approach to creativity and innovation varies correspondingly. While the early stages of the education system need to focus on motivation, learning-to-learn skills and other key competences, the further stages focus on more specific skills and competences of a discipline or a field of industry. The Aho report gives special attention to

creating interest and excitement in science and technology<sup>31</sup>. However, skill needs change at an accelerating rate following close global competition and the development of knowledge, technology and organisations. Thus, learning-to-learn skills and other soft skills become more and more important also in vocational educational and training and in higher education.

#### **4. REFORMS IN EDUCATION REQUIRE NEW INNOVATIONS**

16. Education and training are necessary for future innovations, but innovations are also needed to improve education systems. Creativity and innovation should be a tool, a strategy to reach those objectives inherent in education: societal well-being through increasing understanding and promoting economic growth as well as improving societal cohesion and reducing social inequalities.<sup>32</sup> Why is learner-centred education, the leading paradigm of academic education research, not the education practice in most European schools and what should be done to change this? Are creativity and skills sufficiently valued among contemporary school education objectives<sup>33</sup> and are the current success criteria for education systems sufficiently oriented to promoting creativity? Can appropriate partnerships with local industries and organisations and the wider world create new viewpoints and thus support innovation in education? The ultimate question is whether we should re-think schools. Can they change into learning organisations whose own culture is built on learning?

##### *Learning first and learners in the centre*<sup>34</sup>

17. The learner-centred education paradigm should find support from the advocates of innovativeness in society and economy. It is based on cognitive theories of learners' active involvement in reflection, interpretation and self-evaluation. Knowledge and skills are acquired through exploration, drawing from the real world and applying learning in practice. Learning is social; it occurs in interaction, together with others, debating and creatively changing social practices. Learner-centred education supports deep learning<sup>35</sup> and creativity. However, changing in practice also meets resistance and institution and key actors may feel threatened. Sustainable change in teaching cannot be imposed from above. The commitment of teachers and policy-makers is crucial and requires dialogue, perhaps also social innovations. Evidence base and enhanced research of teaching and learning are equally important for change.

18. Teachers are at the forefront of educational innovation and reform. The profession is radically changing - new learning approaches see teachers more as learning guides rather than as transmitters of knowledge – setting new challenges to the up-dating of their own competences. Education reforms take time, but they do not necessarily require radical re-training of all teachers, as the key factors of change are motivation, leadership and incentives. The age structure of European teachers<sup>36</sup> could favour implementing reforms now, as a high proportion of teachers are close to retirement and many younger teachers may have more positive attitudes to change.

19. Institutions responsible for initial and continuing teacher training have a key role in reforms. To help teachers adopt learner-centred teaching methods, the teacher-training institutions should themselves apply those methods and arrange their own work in terms of better learning. Teacher training alone is not sufficient for reform, because the impact of initial teacher education on education practice is very slow. Therefore the socio-cultural context of education should also support reform.

20. Re-thinking curricula and assessment may be necessary to ensure the focus on learning and to allow schools enough flexibility to apply learner-centred methods. As learner-centred methods and the use of different learning approaches are based on the needs and abilities of different learners, they are likely to contribute efficiently learning and learning outcomes, but also to equity. "Learning by doing" and "learning by using" may help practically oriented learners to learn, achieve competences and solve problems.

***School should cultivate creativity***

21. We should also consider whether school education should aim to provide creative synergy of knowledge, skills and creativity. Putting creativity among the key objectives could be a major contribution to innovativeness in society. Support and encouragement of creativity and imagination in education could also increase the motivation and confidence of pupils and thus support them to reach their full potential. The suggestion of upgrading the value of creativity does not mean diminishing the value of knowledge. The future innovators need to have *both broad knowledge* e.g. in science, history, culture and arts *and creativity*. Creative thinking, new associations and unexpected viewpoints also require a wide knowledge base.

22. Creativity is a personal attribute of all people and it can be applied in all fields. It should not be seen as a subject in the school curriculum, like e.g. biology, nor is it reserved exclusively to arts subjects. It is not competing for resources with academic knowledge and disciplines – it is rather a complementary approach. But can it be taught at school? The answer is positive. First of all, creative skills can be improved the same way as all other skills – by practice. Secondly, creativity – as a cognitive ability to associate, combine and synthesise – can be applied to learning of all school subjects and that application is likely to produce deep learning and develop creativity.

***Partnerships for innovation***

23. The development and creativity and innovation requires open structures, democratic relationships in school, ongoing questioning, and openness. For this very reason the exchange of experiences, examples of good practice, ideas, and cooperation of students and teachers with various cultural backgrounds is extremely important.<sup>37</sup> Partnerships with the social environment are vital for vocational and higher education and training where qualifications reflect working life needs, but partnership could also be an efficient way to promote innovation at all levels of education. Internships, joint projects and course instructors from outside the educational settings expose pupils and students to new ideas, "real-world problems" and opportunities for finding solutions together. Structured stakeholder contacts support adaptation to the changing context, and help to anticipate future skill needs. User-driven innovation is a continuous interactive process between users and producer which applies 'learning by using' and 'learning by doing'.<sup>38</sup> A user could be a consumer, patient, employee, etc<sup>39</sup> – also a school class or a teacher group.

24. Europe needs to integrate better the three components of the knowledge triangle - education, research and innovation – also included in the blueprint of the future European Institute for Technology<sup>40</sup>. The complexity of innovation processes demands institutional setups which support interaction. Higher education and vocational training contribute innovation by teaching knowledge and skills, creating new knowledge and supporting partnerships and lifelong learning. The modernisation of European higher education<sup>41</sup> - reforms in quality, governance and funding – seeks to respond to the needs of society, including innovativeness. The wide understanding of the benefits of joint knowledge creation and sharing in universities, businesses and society at large is essential for Europe's innovation

capacity. The triple-helix model and the entrepreneurial university, subject to wide academic debate, are most important new forms of linking universities and businesses<sup>42</sup>.

***Building a culture of creativity and innovation in lifelong learning***

25. Organisational culture and a climate supporting openness and creativity are vital preconditions for a successful learning and innovation<sup>43</sup>. Demands for deep and more personalised learning are in line with the demand for creativeness. Educational institutions are responding to expectations by increased demand-orientation, partnerships and improving the role of educational institutions in innovation systems. A key policy issue is whether learners' greater capacities for innovation require more innovative, creative and development-oriented education institutions.

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26. Due to the continuous technological, economical and organisational changes lifelong learning in the workplace has become almost compulsory and enterprises are starting to see themselves as learning organisations. Open innovation and networking connect this trend with innovation and renewal of companies and work places. The open education resources of the internet and social software tools have a huge potential to attract people to informal learning. The involvement of employees in their firm's innovation processes makes for more successful innovations. Interactive management and better use of the people's knowledge and skills create and strengthen commitment. Furthermore, a creative environment is crucial for innovative organisations, as Florida advocates.<sup>44</sup>

27. ICT has already become an important tool in education, but it has the potential to become a key instrument for lifelong learning, innovation and learner-centred forms of education. There is evidence of successful new tools, like using role-playing games for learning teamwork or developing "Cognitive Tutor" software for mathematics learning<sup>45</sup>. Problem-based learning can be enhanced by immersive ICT-supported environments. Scenario and foresight methods providing alternative views of the future could also have pedagogic use, and computer-based simulations, "what if" analyses, could also be applied in education and training. Open educational resources<sup>46</sup> have huge potential to facilitate open education and, together with social software (Web 2.0), foster innovation and lifelong learning.

28. Re-thinking the organisation and governance of education and training could be necessary for introducing a new learning culture. Innovation requires experimentation, time and resources, but experimental innovation and tolerance of failure are too often lacking in contemporary educational systems. If the organisational and institutional context does not support the new learning methods, the effects of teacher training will remain limited. Responsiveness to change may imply more "responsible autonomy" for schools. Schools should develop learning routines that encourages creativity and innovation and promotes a culture of sharing. Creativity requires time and space – flexibility. Research suggests that giving more autonomy to schools promotes better pupil performance when autonomy is combined with accountability systems which provide the right incentives<sup>47</sup>.

29. Evidence-based policy and practice – education policy informed by knowledge from research and evaluations – is advocated by both the EU and the OECD. More research is certainly needed to build up a solid knowledge base e.g. on how to initiate and manage change in learning, including aspects such as the role of assessment and evaluation, certification and validation of learning. ICT-based systems or repositories for data-gathering and sharing of findings are used in many research fields and could also have potential for learning processes. Definition, identification, assessment and documentation of learning

outcomes in soft transversal skills, innovativeness and creativity are real challenges. Applicable research results would benefit all education systems and should be a key area for European co-operation.

30. The main tasks for policy makers are to provide the framework conditions, objectives, motivations and incentives for educational systems' development. At the same time, education practitioners need to be encouraged to participate actively in development processes, making the best use of their extensive knowledge and practical experiences.

## **5. FURTHER STEPS**

31. The Slovenian Presidency of the EU Council puts<sup>48</sup> building an innovative and creative knowledge-based society, the first of the four priority areas identified at the 2006 Spring European Council, into the heart of the renewed Lisbon Strategy. Europe must build its competitiveness on innovation and creativity, therefore investment in knowledge and creativity is the driving force for progress. Europe is faced with the challenge to create meaning and preserve values<sup>49</sup> for the whole world, thus taking the leading role again.

32. Education and training has an important role to play in fulfilling this responsible task, therefore we wish to give a boost to the changes needed for schools, including pre-school care, to be better able to promote creativity and innovative potential from the very beginning of learning processes. The Presidency flagship conference in education and training on 9 - 10 April 2008 aims to draw attention to the key challenges of European societies in the global age and to highlight innovation and creativity as one of the prerequisites for finding solutions. The conference will reflect on the role of education in promoting innovation and creativity and on the necessary conditions and measures for improvement, to foster both competences for innovation and creativity in learners and innovative approaches of schools in performing their tasks. Finally, the purpose of the conference is to take stock of existing evidence and expertise and to explore the contribution the EU could provide in fostering innovation in education and training.

33. EU Ministers for education are invited to exchange their ideas on the role of education in supporting creativity and innovation and their impact on equity and efficiency of education and training in the Education Council meeting in May 2008. The Slovenian Presidency has a clear view that the promotion of creativity and innovation in education and training systems also fulfils the requirement that they should strive for equity and efficiency by harnessing the potential of everyone, regardless of their cultural or social background. Presidency is confident that all the Member States are willing to agree on common guidelines for education and innovation which would provide a reference for further action on European level and in Member States.

34. Designating a European Year of Creativity and Innovation in 2009, is a way to meet the challenges by raising public awareness, disseminating information about good practices, stimulating research, promoting policy debate and creativity and innovation as key competences for all. The European Year provides an opportunity to bring the results of European cooperation in the field of education and training to the attention of decision-makers and the general public. It will therefore help to strengthen the impact of the Education and Training 2010 Work Programme and to provide a critical mass of measures targeting the development of skills related to creativity and innovation and further European cooperation beyond 2010. The focus on competitiveness and skills in the context of the Lisbon strategy is

likely to provide an environment in which stakeholders will be receptive to the outputs of the Year.

35. The open method of coordination, applied for the achievement of shared European objectives in education and training, offers the Member States opportunities for exchanging of experiences and good practices and peer learning in themes which are relevant for promoting creativity and innovation in education. Reflection on and planning for the continuation of European co-operation in education and training beyond 2010 are at hand. The present common objectives of quality, access and openness to the wider world have been complemented with efficiency and equity during the present E&T 2010 work programme. Putting a new emphasis on creativity and innovation in lifelong learning has the potential to contribute decisively to the sustainable economic and social development of Europe. National, regional and local efforts to improve learning need to be supported by cooperation as well as by research, surveys and analysis in order to define and create the knowledge basis to plan, implement and monitor policies for innovation and creativity in lifelong learning. Introducing relevant methodical tools for analysis and taking them into use could be a joint European objective to support the development of creativity and innovation in lifelong learning.

## NOTES

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<sup>1</sup> "Modernising education and training: a vital contribution to prosperity and social cohesion in Europe", 2006 joint interim report of the Council and of the Commission on progress under the "Education and Training 2010" work programme, Council, (2006/C79/01), OJ C79/1, 1.4.2006. and Presidency conclusions, Brussels European Council, 23/24 March 2006, Council, doc. 7775/06, Brussels, 24 March 2006.

<sup>2</sup> "Common Actions for Growth and Employment: The Community Lisbon Programme" – COM(2005) 330, 20.7.2005.

<sup>3</sup> "Putting knowledge into practice: A broad-based innovation strategy for the EU" – COM(2006) 502, 13.9.2006; and "An innovation-friendly, modern Europe" – COM(2006) 589, 12.10.2006.

<sup>4</sup> Presidency Conclusions – Brussels 8/9 March 2007.

<sup>5</sup> "More research and innovation – Investing for growth and employment: A Common Approach" – COM(2005) 488, 12.10.2005.

<sup>6</sup> E.g. Hargreaves Andy (2003) *Teaching in the Knowledge Society*, Teachers College Press; Robertson Ken (2006) *Do schools kill creativity*, <http://www.ted.com/index.php/speakers/view/id/69>; Tirri Kirsti & Uusikylä Kari (1994) "How teachers perceive of education among the gifted and talented". *Gifted and talented International*, 9/2004.

<sup>7</sup> See Ken Robertson on video *Do schools kill creativity*, <http://www.ted.com/index.php/speakers/view/id/69>.

<sup>8</sup> See Figures 1 and 2 in the annex. In 2003 the population with tertiary education was 38% in the US and 37% in Japan, whilst in 2005 it was still only 23% in Europe. According to the indicator on R&D investment, which is regarded as an important element in innovation, the EU still significantly trails behind the objectives that have been defined for 2010. The number of researchers in full time equivalent (FTE) per thousand labour force participants amounted to 5.4 in the EU in 2003, compared to 10 and 9 in Japan and the US respectively, and remains essentially unchanged since 1999. At Member State level, however, the picture is quite varied.

More comparisons are presented in *European Innovation Scoreboard 2006*; and in "2006 Global Innovation Scoreboard" Report. Prepared by Hugo Hollanders and Anthony Arundel (MERIT – Maastricht Economic and social Research and training centre on Innovation and Technology) as well as in Villalba, Ernesto (2007) "The Relationship between Education and Innovation, Evidence from European indicators" JRC Scientific and technical Reports, EUR 22797, 2007.

<sup>9</sup> European Commission, Directorate-General for Research (2007) *Towards a European Research Area, Science, Technology and Innovation, Key Figures 2007*, Brussels, 2007.

<sup>10</sup> Cameron Gavin (1996), "Innovation and Economic Growth", LSE Centre for Economic Performance, Discussion Paper No. 277, p. 10.

<sup>11</sup> Akçomak, İ. Semih & ter Weel, Bas (2006), "Social Capital, Innovation and Growth: Evidence from Europe", UNU-MERIT, Working Paper Series, NO 2006-040.

<sup>12</sup> E.g. Moulaert, F., F. Martinelli, E. Swyngedouw and S. Gonzalez (2005), "Towards Alternative Model(s) of Local Innovation", *Urban Studies*, Vol. 42(11), pp. 1969-1990, October.

<sup>13</sup> "Working together for growth and jobs. A new start for the Lisbon Strategy". - COM (2005) 24, 02.02.2005

<sup>14</sup> Oslo Manual, Guidelines for collecting and interpreting innovation data, third edition (2005) A joint publication of OECD and Eurostat, OECD; Frascati Manual, OECD (2002), Paris.

<sup>15</sup> *Oxford Handbook of Innovation*, (2004) Oxford University Press, Oxford.

<sup>16</sup> "While inventions may be carried out anywhere, for example in universities, innovations occur mostly in firms, though they may also occur in other types of organizations, such as public hospitals. To be able to turn an invention into an innovation, a firm normally needs to combine several different types of knowledge, capabilities, skills, and resources. For instance, the firm may require production knowledge, skills and facilities, market knowledge, a well functioning distribution system, sufficient financial resources, and so on...". *Oxford Handbook of Innovation*, (2004) Oxford University Press, Oxford.

<sup>17</sup> Eric Von Hippel, head of the Innovation and Entrepreneur Group at the MIT, even uses the concept "democratizing innovation" see Von Hippel, Eric (2005). *Democratizing Innovation*. MIT Press, Cambridge.

<sup>18</sup> E.g. Leonard-Barton Dorothy A. (1988), *Implementation characteristics of organizational innovations*, *Communication Research*, vol. 15, no. 5 pp. 603-31, October.

<sup>19</sup> Richard Florida remarks that "not just the scientific laboratory, but the factory itself can be an arena for creative work". See Florida, Richard (2004) *The rise of the creative class: and how it's transforming work, leisure, community and everyday life*. Perseus Books group.

<sup>20</sup> Florida Richard (2004) *ibid*; Boden Margaret (1990) *The Creative Mind: Myths and Mechanisms*. New York: Basic Books, 1990.

<sup>21</sup> Boden Margaret (1990) *ibid*. The summary is from Florida (2004) who cites Schumpeter (1942) and his famous notion of capitalism as "creative destruction".

<sup>22</sup> Andreja Barle Lakota – presentation at the meeting of High Level Group on Education Policies, Ljubljana, December 2007

<sup>23</sup> Sir Ken Robinson argues that we've been educated to become good workers, rather than creative thinkers. Students with restless minds and bodies -- far from being cultivated for their energy and curiosity -- are ignored or even stigmatized, with terrible consequences. "We are educating people out of their creativity," Robinson says. See Robertson Ken (2006) *Do schools kill creativity*, <http://www.ted.com/index.php/speakers/view/id/69>.

<sup>24</sup> Florida Richard (2004), *The rise of the creative class: and how it's transforming work, leisure, community and everyday life*. Perseus Books Group.

<sup>25</sup> Florida Richard (2004), *ibid*.

<sup>26</sup> Cohen Wesley M. and Levinthal, Daniel A (1990), 'Absorptive capacity: a new perspective on learning and innovation,' *Administrative Science Quarterly*, Vol 35 (1), March, pp. 128-152; see also Arnold Erik. R. Allinson Rebecca and Muscio Alessandro (2004), *Absorptive Capacity of Companies: A Review of Literature and Instruments*, Report for Forfás, Dublin and Allinson Rebecca (2006), "Shell Step Innovation Programme, Exploring the absorptive capacities of host SMEs", *Cyprus International Journal of Management*, Volume 11, Number 1, autumn 2006.

<sup>27</sup> Recommendation of the European Parliament and of the Council on key competences for lifelong learning, 18 December 2006/962/EC, OJ L 394/10.

<sup>28</sup> The eight key competences are: communication in mother tongue; communication in foreign languages; mathematical competence and basic competences in science and technology; digital competence (ICT skills), learning to learn; social and civic competences; sense of initiative and entrepreneurship; cultural awareness and expression.

<sup>29</sup> Tether et al. define 'skills' as "an ability or proficiency at a task that is normally acquired through education, training and/or experience", see Tether Bruce, Mina Andrea, Consoli Davide, Gagliardi Dimitri (2005) 'A Literature Review on Skills and Innovation. How Does Successful Innovation Impact on the Demand for Skills and How Do Skills Drive Innovation?' A CRIC report for the Department of Trade and Industry.

<sup>30</sup> See annex (table 1), the classification suggested by INNO GRIPS Mini Study 02. The study contains also other detailed proposals for taxonomy.

<sup>31</sup> Aho, Esko, "Creating an innovative Europe" Report of the Independent Expert Group on R&D and Innovation appointed following the Hampton Court Summit and chaired by Mr. Esko Aho (January 2006) .

<sup>32</sup> Andreja Barle Lakota, meeting of HLG on Education Policy, Ljubljana, December 2007

<sup>33</sup> Some researchers of creativity and education claim that the share of creativity diminishes drastically in the school curriculum after the very first years in education, see e.g. Hargreaves Andy (2003) *Teaching in the Knowledge Society*, Teachers College Press; Robertson Ken (2006) *Do schools kill creativity*, <http://www.ted.com/index.php/speakers/view/id/69>; Tirri Kirsti & Uusikylä Kari (1994) "How teachers perceive of education among the gifted and talented". *Gifted and talented International*, 9/2004.

<sup>34</sup> Professor Andy Hargreaves proposes a sustainable education reform strategy which should start "Putting learning first" see Hargreaves, Andy (2006) "The long and short educational change, in *Education Canada*, Canada Education Association.

<sup>35</sup> Hargreaves Andy (2006) "The long and short educational change, in *Education Canada*, Canada Education Association.

<sup>36</sup> The teaching profession has a high percentage of older workers. The proportion of teachers aged between 45 and 64 is over 40% in many countries while as many as 30% of the teaching population are aged between 50 and 64 years of age in some countries, see EU Commission Communication "*Improving the Quality of Teacher Education*" COM(2007) 392, Brussels, 3.8.2007.

<sup>37</sup> Andreja Barle Lakota, meeting of HLG on Education Policy, Ljubljana, December 2007

<sup>38</sup> Rosenberg Nathan (1976). *Perspectives on Technology*, Cambridge, Massachusetts: Cambridge University Press; Rosenberg, Nathan (1982). *Inside the Black Box: Technology and Economics*, Cambridge, Massachusetts: Cambridge University Press.

<sup>39</sup> Oudshoorn Nelly and Pinch Trevor (2003), *How Users Matter: The co-construction of users and technologies*, Cambridge Massachusetts: MIT Press.

<sup>40</sup> European Commission (2006), Proposal for a Regulation of the European Parliament and the Council establishing the European Institute of Technology, COM (2006) 604, 13.11.2006; EU Council (2008) Common Position adopted by the Council with a view to the adopting of a Regulation of the European Parliament and of the Council establishing the European Institute of Innovation and Technology, 15647/07, 11.01.2008.

<sup>41</sup> European Commission (2006c), Communication from the Commission to the Council and the European Parliament: "Delivering on the modernisation agenda for universities: Education, Research and Innovation". COM (2006) 208 final, 10.5.2006.

<sup>42</sup> Mowery David and Ziedonis Arvids (1998) Market failure or market magic? Structural change in the US national innovation system. STI Review, Paris – OECD, No 22, 1998; On entrepreneurial university, see e.g. Röpke Jochen (1998) The entrepreneurial university, Innovation, academic knowledge creation and regional development in a globalised economy; and on triple-helix see e.g; Leydesdorff Loet & Etzkowitz Henry (1998), "The Triple Helix as a model for Innovation Studies" In: *Science & Public Policy*, Vol. 25(3), 1998:195-203; Leydesdorff Loet & Etzkowitz Henry (2000), "The dynamics of innovation: from National Systems and 'Mode 2' to a Triple Helix of university-industry-government relations" In: *Research Policy*, vol. 29, 2000:109-123; Etzkowitz Henry (2002), "The Triple Helix of University- Industry-Government. Implications for Policy and Evaluation", Working Paper 2002:11, Stockholm: Science Policy Institute; Etzkowitz Henry (2003), "Innovation in Innovation: The Triple Helix of University-Industry-Government Relations" *Social Science Information*, 42: 293-337.

<sup>43</sup> Asheim, Björn (2006). "Learning firms in learning regions: Innovation, Cooperation, and Social Capital", in Taylor Michael and Oinas Päivi (eds.), *Understanding the Firm: Spatial and Organizational Dimensions*, Oxford: Oxford University Press pp. 214-234; Tushman Michael L. and O'Reilly Charles A. III (1997) *Winning through Innovation: A Practical Guide to Leading Organisational Change and Renewal*, Harvard Business School Press, Boston, MA; Parker Rachel and Bradley Lisa (2000, "Organizational culture in the public sector: evidence from six organizations", *The International Journal of Public Sector Management*, 13, 2, pp125-141.

<sup>44</sup> Florida Richard (2004), *The rise of the creative class: and how it's transforming work, leisure, community and everyday life*. Perseus Books Group.

<sup>45</sup> Koedinger Kenneth R. (2001) "Cognitive tutors as modelling tools and instructional models" in Forbus Kenneth D. and Feltovich Paul J. (2001) *Smart machines in education* Cambridge, MIT Press, 2001; and Csikszentmihályi, Mihály (1993) *Flow: The psychology of optimal experience* New York, Harper Perennial, 1993; both cited in "*A National Innovation Agenda, Progressive Policies for Economic growth and Opportunity through Science and Technology*" (2007) by Tom Kalil and John Irons. Center for American Progress, November 2007. [www.americanprogress.org](http://www.americanprogress.org).

<sup>46</sup> The Open Educational Resources (OER) refer to "digitised materials offered freely and openly for educators, students and self-learners to use and re-use for teaching, learning and research".

<sup>47</sup> Wössmann Lutger (2003) "Schooling Resources, Educational Institutions and Student Performance: The International Evidence", *Oxford Bulletin of Economics and Statistics* 65 (2).

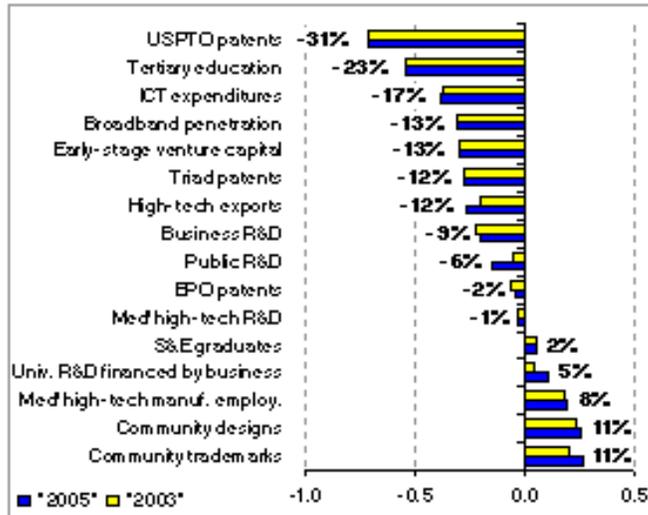
<sup>48</sup> Slovenian Presidency Programme: Si.nergy for Europe (January – June 2008)

[http://www.eu2008.si/en/The\\_Council\\_Presidency/Priorities\\_Programmes/index.html](http://www.eu2008.si/en/The_Council_Presidency/Priorities_Programmes/index.html)?

<sup>49</sup> Žiga Turk, Slovenian Minister for Growth, meeting of HLG on Education Policy, Ljubljana, December 2007

**Annexes**

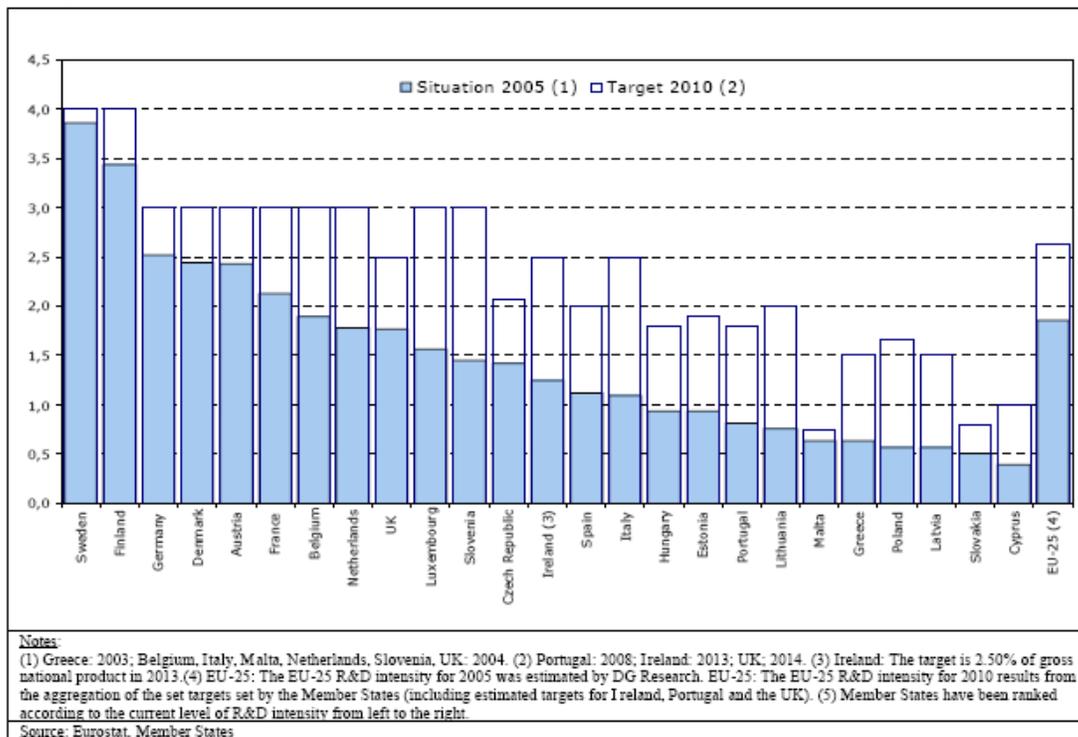
**Figure 1: Indicators of innovation, EU and US.**



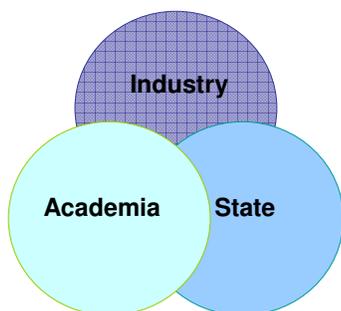
Source: European innovation scoreboard.

[http://trendchart.cordis.lu/scoreboards/scoreboard2005/gap\\_with\\_US.cfm](http://trendchart.cordis.lu/scoreboards/scoreboard2005/gap_with_US.cfm)

**Figure 2. R&D Intensity (Gross domestic expenditure on R&D (GERD) as % of GDP)**



**Figure 3: The Triple Helix institutional relationship between industry, state, and academia**



Source: *Etzkowitz, Henry (2002), "The Triple Helix of University-Industry-Government. Implications for Policy and Evaluation", Working Paper 2002:11, Stockholm: Science Policy Institute.*

**Table 1: Classes of Innovation and Associated Core Skills<sup>1</sup>**

<b>Class of Innovation</b>	<b>Skills</b>
Product and Technological	Scientific and Technological Engineering Design and Packaging Market and User Research
Process	Technical Project Management Organisational and Workflow Design Interaction and Relationship Management
Organisational	Opportunity Recognition Systems Design Leadership Communication
Marketing, Delivery and Interface	ICT & Systems Development Web Design and Content Development Data Analysis Language and Communication

Source: Mini Study 02 - Skills for Innovation, DRAFT for Discussion (*Ian Miles, Lawrence Green, Barbara Jones*), September 2007.

<sup>1</sup> Data in the table draws upon work by Tether Bruce et al (2005) *ibid.*, Tidd Joe, Besant John and Pavitt Keith (2001) *Managing Innovation: Integrating Technological, Market and Organizational Change*, Chichester; Wiley John and Utterback James M. (1996) *Mastering the Dynamics of Innovation*, Boston: Harvard Business School Press.

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