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Background note by the Secretariat*

I. Introduction

1. This note is presented by the UNECE secretariat for discussion at the International Conference "From Applied Research to Entrepreneurship: Promoting Innovation-driven Start-ups and Academic Spin-offs", which will take place in Kiev, Ukraine, on 9 – 11 November 2010. Its objective is to assist the decision makers, particularly in the emerging market economies (EMEs) of the ECE region[1] in developing policies conducive to the commercialization of Research and Development (R&D) outputs produced by universities and other research institutions.

2. The note highlights the major factors influencing the development of innovation-based enterprises in the EMEs of the ECE region, identifies problems encountered by universities and other research institutions when commercializing the results of their research and development (R&D) activities, and discusses the major components of institutional setup, which fosters the collaboration of academia with the business sector and is conducive to the development of innovation-driven start-ups and academic spin-offs.

II. Factors influencing the commercialization of R&D results

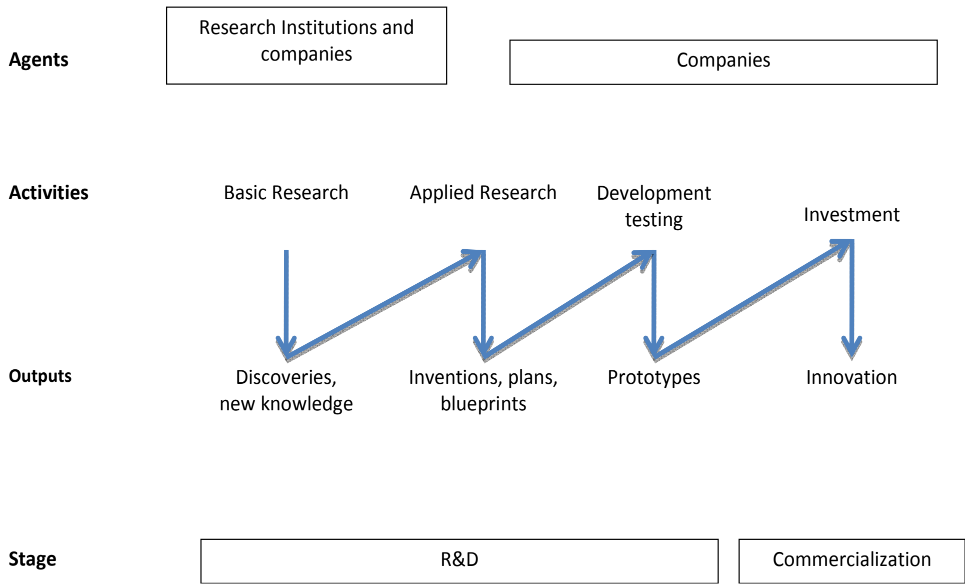
3. In broad terms, the commercialization of R&D results can be defined as the process of turning an invention into a product or service, which could be sold on the market providing returns to the investment by the commercializing company. Continued

* The secretariat would like to thank Ms. Radoslava Sentova and Mr. Thomas Nicolas de Lamballerie, interns with the secretariat, for their contribution to this note.

1 The term "emerging market economies" is used to define the group of ten new EU Member States (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia), countries of South-East Europe (Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia and The former Yugoslav Republic of Macedonia), as well as the countries of Eastern Europe, Caucasus, and Central Asia (EECCA) – that is, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

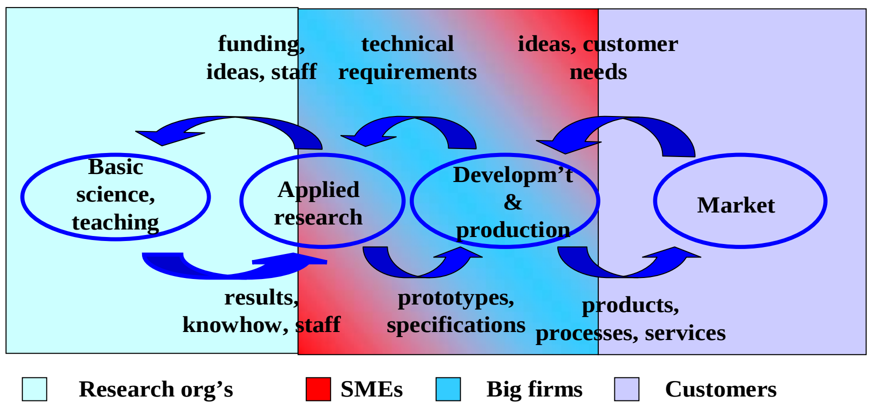
commercialization nurtures the process of innovation, which is pivotal to sustained economic growth. Its major stages and actors involved are presented schematically in Box 1 and Box 2. While Box 1 illustrates a traditional ('linear') model of innovation and commercialization, Box 2 highlights an interactive or "feedback" approach to these processes.

Box 1. Innovation process: stages and actors involved



Source: Based on Christine Greenhalgh and Mark Rogers, *Innovation, intellectual property, and economic growth*, Princeton University Press, 2010, p. 97.

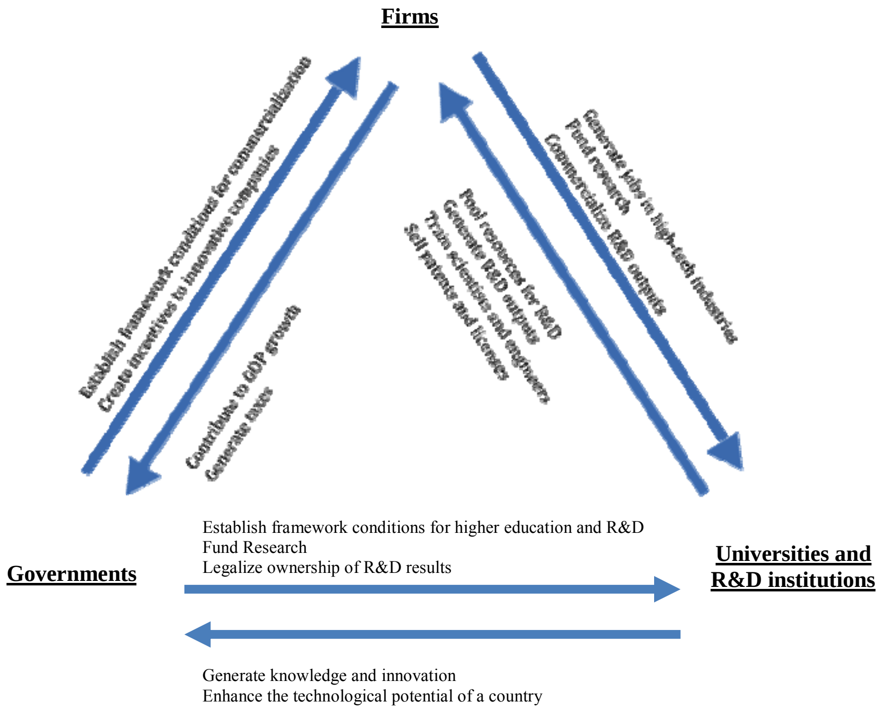
Box 2. Innovative process: interaction of major actors and processes



Source: UNECE Secretariat

4. The process of commercialization of R&D results involves various stakeholders, the roles of which are summarized in Box 3.

Box 3. Roles of Major Stakeholders in Innovation



Source: UNECE Secretariat

5. The main drivers of commercialization include factors such as:

(a) The scope of **Research and Development** (R&D), which determines the stock of inventions and innovations to be commercialized. Among other factors, the scope of R&D depends on the number of universities and research institutions in the country, the number and qualifications of research workers in public research organizations and the corporate sector, investment in R&D from public and private sources and its effectiveness (indicators being the number of scientific articles published and their citation index). The scope and effectiveness of R&D also depends on how well domestic research organizations and companies are connected internationally, how easy it is for them to draw on results generated abroad, and to cooperate with foreign partners in order to leverage domestic resources and capabilities.

(b) **Human resources** available for R&D. The availability of highly qualified personnel depends on the quality of education, in particular higher (university) education. The latter is determined by the funds allocated to education by the state, enrolment rates in universities and the quality of education and training therein. Efficient health services and lower revenue inequalities are also important for sustaining a motivated and efficient workforce.

(c) **Regulatory and institutional environment** conducive to innovation, which implies transparency and accountability in public spending and investment, stable property rights including intellectual property rights, independence of the judiciary, transparent and stable rules, low costs and simple procedures governing the registration and operation of enterprises, hiring of workers and the registration of intellectual property, transparent tax administration and reasonable taxation rates, ease of access to finance at various stages of enterprise development, as well as a level playing field for foreign enterprises potentially interested in investing in the country, including in R&D. These factors influence the business climate in which the innovation-based enterprises operate, and thus determine the demand for innovation.

(d) Wide use of **information and communication** technology (ICT) as evidenced by international experience. The latter shows that well developed internet and mobile phone networks both provide support for enterprises and render the business environment more conducive to entrepreneurship. Moreover, they are important for enabling domestic research organizations and firms to tap into knowledge generated abroad and to cooperate internationally in R&D and commercialization.

6. The Innovation for Development Report recently prepared by the European Business School in collaboration with the World Bank used a number of indicators to position countries with respect to the conditions created therein for innovation.[2] The report ranked Sweden as the leading country in innovation, and Box 4 highlights the major strengths of this country in innovation and commercialization of R&D results.

[2] The Innovation for Development Report 2009-2010, Strengthening Innovation for the Prosperity of Nations, Palgrave Macmillan December 22, 2009, pp 38-39.

Box 4. Sweden, the leader in Innovation and Commercialization of R&D results.

Sweden holds the first place in terms of transparency of governance, low levels of corruption, developed e-administration and favourable "doing business" indicators. It has also a rank of 2 with respect to the number of scientific and technical journal articles per capita, and levels of R&D expenditure in relation to GDP (public and private). In addition, Sweden is a leader in the number of patent registrations per million inhabitants and is one of the top countries with respect to rates of university enrolment.

Having enjoyed budget surpluses for a number of years, the Government of Sweden has used them to deal with long-term issues. Among those one notes considerable investments in knowledge and training of the labour force to raise labour productivity and foster R&D effort. Relatively high taxation rates have not discouraged entrepreneurship and innovation, because public revenues have been consistently and transparently invested in education, infrastructure building, R&D and public health, improving the business climate and benefiting the private sector.

Swedish universities and entrepreneurs have established and sustained multiple links, conducive to the commercialization of R&D results. Along the same lines, the collaboration in research (revenues sharing contracts) between public and private institutions is encouraged.

Source: The Innovation for Development Report 2009-2010, Strengthening Innovation or the prosperity of Nations, Augusto Lopez-Claros, Palgrave Macmillan December 22, 2009, pp 38-39

7. The example of Sweden shows the pivotal role of Governments in innovation and commercialization of R&D results, which determine the operational environment through regulations, education policy, public services, infrastructure development and direct funding of R&D.

8. In the second half of the twentieth century, the evolving structure of R&D funding has been a particularly important factor in the commercialization of innovation. States in Western Europe and North America have progressively abandoned the idea of all results of publicly-financed scientific research automatically entering the public domain, and have awarded universities with more liberty to manage their own intellectual property policies. Universities have responded to this policy change by increasingly patenting the results of their research, licensing patents to industries and/or establishing new companies to commercialize the R&D results. In turn, the prospect of being able to obtain exclusive intellectual property rights to research results has made it more attractive for private companies to fund university research. In the United States, for example, the non-government funding of university research in 2000 constant US dollars increased from about 0.5 million in 1972 to over 17.2 million in 2008, that is 34 times. In relative terms, over the same period the share of non-government financing of university research increased from 21.5 to 33.3 per cent.[3]

[3] Sources: National Science Foundation, Web CASPAR database, NSF Survey of Research and Development Expenditures at Universities and Colleges.

III. Emerging market economies.

9. In the 2000s, the drivers of innovation in emerging market economies of the UNECE region were generally less advanced than those in developed market economies. Many EMEs have relatively well-educated labour forces and a good tradition of scientific research. In particular, important investments in education, and science and technology at the time of the Soviet Union have credited its successor States with a solid scientific background and a high academic research potential. The Russian Federation, for example, has an impressive number of Nobel prize laureates in natural sciences, and has one of the leading schools of mathematicians. However, in the second half of the 2000s, the number of scientists in EMEs was generally lower than that in development market economies.

10. In the period under review, the number of researchers per million inhabitants was about 1800 – 1900 in the new EU member States and selected successor states of the Soviet Union (see table 1). This is equivalent to about 45 per cent of the OECD average. In countries of South-East Europe this indicator was significantly lower (about 17 per cent of the OECD average). At the same time, this share varied widely across countries. While in the Russian Federation and Slovenia the number of researchers was as high as 83 and 75 per cent of the OECD average, in the former Yugoslav Republic of Macedonia and Bosnia and Herzegovina the respective numbers did not exceed respectively 13 and 5 per cent of this average.

Table 1
Number of researchers per million inhabitants in selected emerging market economies, 2006-2007

Country group/Country		*2006*	*2007*
New EU Member States (selected countries)	Bulgaria	1344	1466
	Czech Republic	2569	2715
	Hungary	1745	1733
	Poland	1561	1610
	Romania	952	877
	Slovakia	2185	2290
	Slovenia	2921	3109
	Average (countries above)	1897	1971
South-East Europe (selected countries)	Bosnia and Herzegovina	177	197
	Croatia	1303	1384
	The former Yugoslav Republic of Macedonia	521	…
	Average (countries above)	667	790
Eastern Europe Caucasus and Central Asia (selected countries)	Belarus	1904	1961
	Moldova	698	724
	Russian Federation	3258	3305
	Ukraine	1476	1458
	Average (countries above)	1834	1862
Memo item: OECD average		3981	…

Source: World Bank Databank.

11. In the second half of the 2000s, R&D expenditures as percentage of GDP in the emerging market economies of the region were significantly lower than the OECD averages (see table 2). In the new EU member states they made up about 35 per cent of the OECD indicator, in countries of South-east Europe - about 24 per cent and in the EECCA countries - less than 20 per cent.

Table 2
Research and development expenditure in selected emerging market economies, 2006 – 2007 (percentage of GDP)

Country group/Country		*2006*	*2007*
New EU Member States (selected countries)	Bulgaria	0.48	0.48
	Czech Republic	1.54	1.59
	Hungary	1	0.97
	Poland	0.56	0.57
	Romania	0.46	0.54
	Slovakia	0.49	0.46
	Slovenia	1.59	1.48
	average (countries above)	0.87	0.87
SEE	Bosnia and Herzegovina	0.02	0.03
	Croatia	0.87	0.93
	Macedonia, FYR	0.21	…
	Montenegro	1.24	1.18
	Serbia	0.45	0.34
	average (countries above)	0.56	0.62
EECCA	Armenia	0.24	0.21
	Azerbaijan	0.17	0.18
	Belarus	0.66	0.97
	Kazakhstan	0.24	0.21
	Kyrgyzstan	0.23	0.25
	Moldova	0.41	0.55
	Russian Federation	1.07	1.12
	Tajikistan	0.1	0.06
	Ukraine	0.95	0.87
	average (countries above)	0.45	0.49
Memo item: OECD average		2.42	2.5

Source: World Bank databank.

12. The low level of investment in R&D is compounded by a lack of cooperation and information exchange between academia and industry (see below). As a result, on the one hand, the resource potential of academia is used less productively and less knowledge is generated. On the other hand, industry does not make efficient use of the theoretical knowledge generated through academic research and does not translate it into as many patented inventions and industrial innovations as it would have been possible.

13. It is noted in the literature, that the overall business environment in most of the successor states of the Soviet Union is not sufficiently conducive to innovation and commercialization of R&D results. Violations of property rights, including IPRs, protracted procedures of patent registration, heavy bureaucracy and corruption, lack of judiciary

independence – all these factors hamper innovation.[4] The World Bank's Doing Business Report 2010 points out that in the Russian Federation the property registration required as many as 6 procedures and an average of 43 days. In the same year, to register property ownership in OECD countries required about 4.7 procedures and took on average 25 days.[5]

14. Another major obstacle to the commercialization of R&D results in emerging market economies is the lack of communication and collaboration between the scientific community and manufacturers on the one hand, and the lack of private investment in R&D, on the other. The latter is in part a consequence of the poor business environment, which generally weakens the incentives to invest, and this disincentive effect is particularly strong when the risks are high, i.e. when investing in innovation. It should be emphasized that close collaboration between higher education institutions and the private sector coupled with the substantive private financing of R&D was a key growth factor of innovation-based start-ups in the 1990s – early 2000s, especially in the United States. Partly, the lack of investment in R&D in emerging market economies can be explained by weak funding as a result of competing demands for public resources during the transition. However, it is the low level of financing from private sources that is the major cause of insufficient funding for R&D in most of these countries.

15. In 2007, in the 16 countries of the Euro zone[6] the private R&D spending made up 56.8 per cent of the total spending, 34 per cent coming from Governments and 0.9 per cent from universities (see Table 3). In the same year, in the United States the percentage share of private R&D funding was as high as 66.4. In contrast, the share of R&D investment coming from the private sector did not exceed 40 per cent in the new EU member States and was as low as 30 per cent in selected countries of EECCA.

16. In the same year, the level of private R&D expenditure per inhabitant in the new EU member States made up the equivalent of 26.5 euros and in the countries of EECCA 15.8 euros. These figures are equivalent to only 9 per cent and 5 per cent, respectively, of private R&D expenditure in the countries of Euro zone (293.6 euros par inhabitant) and less than 5 per cent and 3 per cent, respectively, of similar figures in the USA (the equivalent of 576.9 euros par inhabitant). Even in more advanced new EU member States such as Slovenia and the Czech Republic the spending of enterprises on R&D per inhabitant constituted in 2007 only 35 and 49 per cent of the Euro zone average, and in Croatia, the Russian Federation and Turkey the corresponding ratio was less than 10 per cent.

17. It is argued that to render the commercialization and technology transfer more effective, the private sector in EMEs has to invest and be involved in this process on a considerably more massive scale.[7]

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4 National experiences in alleviating obstacles to entrepreneurship in emerging market economies are examined in: UNECE. Developing Entrepreneurship in the UNECE Region. Country Experiences in reducing Barriers to Enterprise Development. United Nations, New York and Geneva, 2008.

5 Doing Business Report 2010, World Bank and International Finance Corporation, http://www.doingbusiness.org/

6 The Euro zone countries include Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, and Spain.

7 According to the European Commission's thematic portal dedicated to Information Society: "…the private sector must provide the lion's share of research funding if cutting-edge technologies are to be developed and widely exploited by industry." (http://ec.europa.eu/information_society/tl/research/priv_invest/index_en.htm); See also I. Semenova, Current issues in the process of technopark establishment in the Russian Federation (in Russian), St-Petersburg University Journal, Geographical section, 2009, No.3, p. 132-138.

Table 3

R&D Expenditure in selected emerging market economies by origin of funds, 2007

Country group/country		*Unit of measurement*	*Total*	*Enter-prises*	*Govern-ments*	*Univer-sities*	*Other sources*
New EU Member States (selected countries)	Czech Republic	Euro per inhabitant	188.1	101.5	77.5	1.5	7.7
		Per cent	100.0	54.0	41.2	0.8	4.1
	Estonia	Euro per inhabitant	132.8	55.3	60.6	1.1	15.7
		Per cent	100.0	41.6	45.6	0.9	11.9
	Hungary	Euro per inhabitant	98.6	43.2	43.8	…	…
		Per cent	100.0	43.9	44.4	…	…
	Latvia	Euro per inhabitant	56.0	20.3	30.9	0.5	4.2
		Per cent	100.0	36.4	55.2	0.9	7.5
	Lithuania	Euro per inhabitant	65.3	16.0	31.3	4.9	13.1
		Per cent	100.0	24.5	47.9	7.5	20.1
	Poland	Euro per inhabitant	45.9	15.7	26.9	0.1	3.2
		Per cent	100.0	34.3	58.6	0.2	6.9
	Romania	Euro per inhabitant	29.3	7.9	19.7	0.4	1.3
		Per cent	100.0	26.9	67.1	1.4	4.6
	Slovakia	Euro per inhabitant	46.2	16.4	24.9	0.1	4.8
		Per cent	100.0	35.6	53.9	0.2	10.3
	Slovenia	Euro per inhabitant	140.0	81.6	49.9	0.5	8.1
		Per cent	100.0	58.3	35.6	0.4	5.8
	average (countries above)	Euro per inhabitant	67.1	26.5	32.5	0.5	7.6
		Per cent	100.0	39.4	48.5	0.8	11.4
SEE (selected countries)	Croatia	Euro per inhabitant	78.5	27.9	39.5	2.4	8.7
		Per cent	100.0	35.5	50.4	3.0	11.1
EECCA (selected countries)	Armenia	Euro per inhabitant	4.4	…	2.2	…	…
		Per cent	100.0	…	50.3	…	…
	Azerbaijan	Euro per inhabitant	4.4	0.9	3.3	…	…
		Per cent	100.0	20.8	76.5	…	…
	Belarus	Euro per inhabitant	31.8	14.4	15.7	0.1	1.7
		Per cent	100.0	45.1	49.2	0.3	5.3
	Kazakhstan	Euro per inhabitant	9.9	4.4	3.7	1.5	0.3
		Per cent	100.0	44.5	37.4	15.3	2.7
	Mongolia	Euro per inhabitant	2.1	0.1	1.8	0.0	0.3
		Per cent	100.0	3.1	82.4	0.5	14.0
	Russian Federation	Euro per inhabitant	74.7	22.0	46.8	0.5	5.5
		Per cent	100.0	29.4	62.6	0.6	7.3
	Ukraine	Euro per inhabitant	19.5	5.9	10.2	0.0	3.4
		Per cent	100.0	30.2	52.2	0.2	17.3
	average (countries above)	Euro per inhabitant	52.5	15.8	32.1	0.4	4.2
		Per cent	100.0	30.0	61.2	0.8	8.0
Turkey		Euro per inhabitant	47.0	22.8	22.1	0.0	2.1
		Per cent	100.0	48.4	47.1	0.0	4.5
United States of America		Euro per inhabitant	868.4	576.9	240.8	23.2	27.4
		Per cent	100.0	66.4	27.7	2.7	3.2
Euro zone		Euro per inhabitant	516.9	293.6	176	4.6	42.7
		Per cent	100.0	56.8	34.0	0.9	8.3

Source: UNESCO data centre.

18. Skilled human resources and high education standards, especially those of higher education, are central to making innovation and commercialization sustainable. Table 4 shows that in 2006, public spending on education as percentage of GDP was lower than the OECD average by about 0.9 percentage points in the selected new EU countries and by 1.3 percentage points in the selected former USSR republics (excluding the Russian Federation and Ukraine).

Table 4

Public spending on education in selected emerging market economies as percentage of GDP, 2006

Country group/Country		*Per cent*
New EU Member States (selected countries)	Bulgaria	4.2
	Poland	5.7
	Slovakia	3.8
	average (countries above)	4.6
EECCA (selected countries)	Armenia	2.7
	Azerbaijan	2.0
	Belarus	6.1
	Georgia	3.0
	Kazakhstan	2.6
	Kyrgyzstan	5.5
	Moldova	7.5
	average (countries above)	4.2
Memo item: OECD average		5.5

Source: World Bank Databank.

19. The data presented in Table 5 show that in 2006, in new EU member States the expenditure per student enrolled in higher education as percentage of GDP per capita amounted to 86 per cent of the OECD average, and in the Czech Republic it was significantly higher than that average (by almost 30 per cent). In the EECCA countries, a number of states (Moldova, Belarus and Ukraine) had the expenses on tertiary education at the OECD level or even higher, while in the other members of that group (Azerbaijan, Kazakhstan, the Russian Federation and Tajikistan) it did not exceed 45 per cent of the OECD level. In the case of EECCA countries, one should take into account significantly lower GDP per capita values as compared to developed market economies meaning that even relatively high indicators of expenditures on higher education as percentage of GDP in absolute terms (per capita) in the former are much lower than similar indicators in the latter.

Table 5

Enrolment and expenditure per student in tertiary (higher) education in selected emerging market economies as percentage of GDP, 2006 – 2007

Country group/Country		Enrolment in tertiary education (gross enrolment ratio, per cent)		Expenditure per student enrolled in tertiary education (higher education) as a percentage of GDP per capita
		2006	2007	2006
New EU Member States (selected countries)	Bulgaria	45.9	49.7	23.2
	Czech Republic	…	…	37.4
	Hungary	…	…	23.8
	Poland	65.6	66.9	18.4
	Romania	52.2	58.3	…
	Slovakia	44.8	50.1	…
	Slovenia	…	…	21.6
	average (countries above)	52.1	56.3	24.9
EECCA (selected countries)	Armenia	31.8	34.2	…
	Azerbaijan	15.1	15.2	8.9
	Belarus	65.8	68.4	29
	Georgia	38	37	…
	Kazakhstan	52.7	51.1	8.4
	Kyrgyzstan	42.7	42.8	22.2
	Moldova	39.8	40.7	37.6
	Russian Federation	72.8	75	13.2
	Tajikistan	18.6	19.8	11.1
	Ukraine	72.8	76.4	31.2
	Uzbekistan	9.9	9.9	…
	average (countries above)	41.8	42.8	20.2
SEE	Bosnia and Herzegovina	…	33.5	…
	Croatia	45.1	47	…
	Macedonia, FYR	29.3	35.5	…
	Serbia	…	48	…
	average (selected countries)	37.2	41	…
Turkey		35.3	37.1	…
Memo item: OECD average		71.1	71.6	29.0

Note: Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown.

Source: World Bank Databank.

20. Most emerging market economies seem to face important future efforts in terms of tertiary education enrolment: in 2006 – 2007, the OECD level was above 71 per cent of the corresponding age group and only Russia, Ukraine and Belarus had a similar level of tertiary enrolment, whereas the figures for most of other countries were below 50 per cent.

21. Insufficient development of telecommunications and information technology is also characteristic of the business environment in many of emerging market economies. Table 6

shows that among the countries under consideration, in 2008 the successor states of the Soviet Union had the lowest indicators of the number of internet users and telephone lines per 100 inhabitants. While in the new EU member states the respective values represented 71 per cent and 61 per cent of the OECD average, and in countries of South-east Europe 57 per cent and 71 per cent, respectively, in the emerging EECCA economies, the number of internet users and of telephone lines per 100 inhabitants made up about 24 per cent and 40 per cent, respectively, of the indicated OECD average.

Table 6
Rates of Information and Communication Technology (ICT) penetration in selected emerging market economies, 2008.

Country group/Country		*Internet users (per 100 inhabitants)*	*Telephone lines (per 100 inhabitants)*
New EU Member States (selected countries)	Bulgaria	34.7	28.7
	Czech Republic	57.8	21.7
	Hungary	58.5	30.8
	Romania	28.8	23.4
	Slovakia	66.0	20.3
	Slovenia	55.7	50.0
	average (countries above)	50.3	29.2
SEE	Albania	23.9	10.9
	Bosnia and Herzegovina	34.7	27.3
	Croatia	50.5	42.4
	The former Yugoslav Republic of Macedonia	41.5	22.4
	Montenegro	47.2	58.2
	Serbia	44.9	42.0
	average (countries above)	40.4	33.9
EECCA	Armenia	6.2	20.3
	Azerbaijan	28.2	15.1
	Belarus	32.1	38.4
	Georgia	23.8	14.3
	Kazakhstan	10.9	22.1
	Kyrgyzstan	16.1	9.4
	Moldova	23.4	30.7
	Russian Federation	31.9	31.6
	Tajikistan	8.8	4.2
	Turkmenistan	1.5	9.5
	Ukraine	10.5	28.5
	Uzbekistan	9.0	6.8
	average (countries above)	16.9	19.2
Memo item: OECD		71.1	47.9

Source: World Bank databank.

22. Weak ICT infrastructure handicaps the commercialization of R&D results in general, and the development of innovative start-ups, in particular.

23. Thus the available data show that in the second half of the 2000s, the EMEs of the region lagged behind the OECD countries in terms of public and private investment in research and development, public expenditure on education and enrolment into higher education as well as the development of information and communication technologies. This has widened the gap between the resources invested in R&D and its commercial outputs,

one of its measures being number of patents registered. At the same time, the lack of direct involvement of private companies in the process of applied research has limited the demand for commercialized products of research, since it discourages the orientation of research towards commercial needs.

IV. The role of patenting

24. By definition, a patent is an exclusive right granted by the Government to the patent holder for an invention (a new product or a process), that represents a new technical solution or a new way of doing something[8].

25. The economic rationale for patenting is to obtain temporary monopoly power over the use of an invention and to increase the profits of the patent holder through its commercialization thereby recompensing him for the investment made. Owners may also file patents for defensive reasons deterring competitors from using the invention. Once the patent expires, the protected invention becomes part of the public domain, so that the owner no longer holds exclusive rights on it, and it becomes available for commercial exploitation, free of charge, by others.

26. As a general trend, as compared with members of the Euro zone, in the 2000s the EMEs had rather low resident patent applications per million inhabitants. In new EU member States this ratio was about 33 - 42 per cent of the Euro zone average, in selected countries of South-East Europe between 25 and 46 per cent and in the former Soviet Union Republics between 35 - 57 per cent. One also notes that during the period under review in some countries the number of resident patent filings per million inhabitants was significantly higher than for country groups on average. This applies to Slovenia and the Russian Federation where in certain years the number of filings was higher than in the countries of Euro zone. On the other hand, such countries as Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Kyrgyzstan, Lithuania and Tajikistan had the levels of patent filings much lower than averages for their country groups.

[8] http://www.wipo.int/patentscope/en/patents_faq.html#patent, http://www.uspto.gov/patents/index.jsp. Thus acquired patent protection means that the invention cannot be used, distributed or sold on a commercial scale without the patent owner’s consent. The protection is granted for a limited period of usually 20 years as stipulated by the TRIPS agreements (http://www.wto.org/english/docs_e/legal_e/legal_e.htm#TRIPs). Patents are always national, i.e. a separate patent is needed for each country in which the inventor seeks legal protection, and the decision whether or not to grant a patent for the invention in question is made by national patent offices based on national law. However, the process of applying for patent protection can be done country by country (the so called ‘national route’), regionally (the so-called ‘regional route’ applicable to the contracting parties to the European Patent Convention, http://www.epo.org/patents/Grant-procedure/Filing-an-application.html), or internationally through the Patent Cooperation Treaty of the World Intellectual Property Organization (http://www.wipo.int/pct/en/treaty/about.html). European patents granted by the European Patent Office may be extended to some states non-members of European Patent Convention, such as Albania, Bosnia and Herzegovina, Montenegro and Serbia.

Table 7

Resident patent filings per million inhabitants in selected emerging market economies,2001 – 2007

Country group/Country		*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*
New EU Member States	Bulgaria	35.8	36.7	35.5	33.8	33.7	31.6	27.6
	Latvia	49.6	64.2	39.1	46.7	48.7	49.8	
	Lithuania	19.5	24.5	18.5	20.4	19.9	19.2	18.4
	Poland	57.6	60.5	59.4	62.4	53.1	56.6	62.8
	Romania	51.0	67.8	40.5	43.2	42.3	37.7	38.4
	Slovakia	45.7	48.2	39.0	39.9	28.8	35.8	44.3
	Slovenia	151.1	150.5	155.3	171.3	172.0	143.0	164.0
	Average (countries above)	58.6	64.6	55.4	59.7	56.9	53.4	59.2
SEE	Bosnia and Herzegovina	14.0	…	8.5	13.3	17.5	14.6	…
	Croatia	81.5	73.9	87.2	86.7	81.7	71.4	77.6
	Serbia	…	…	…	…	…	…	53.5
	The former Yugoslav Republic of Macedonia	32.7	20.8	22.7	18.2	…	…	…
	Average (countries above)	42.8	47.3	39.5	39.4	49.6	43.0	65.5
EECCA	Azerbaijan	…	…	…	…	33.5	…	…
	Belarus	93.3	90.2	109.6	108.4	119.3	122.1	…
	Kazakhstan	108.2	…	113.8	…	100.6	93.6	…
	Kyrgyzstan	17.0	24.6	35.5	…	…	…	29.6
	Moldova	106.9	59.3	73.7	75.7	97.3	79.1	87.6
	Russian Federation	169.8	163.2	172.7	159.8	165.2	195.7	193.6
	Tajikistan	13.3	6.2	4.7	5.0	4.6	3.9	…
	Ukraine	148.1	33.2	34.2	86.2	75.1	74.3	…
	Uzbekistan	32.2	28.3	36.4	10.6	10.1	12.2	12.1
	Average (countries above)	86.1	57.8	72.6	74.3	75.7	83.0	80.7
Turkey		4.9	6.0	6.9	9.6	12.9	14.7	24.5
Memo item: United States of America		622.6	640.0	650.5	646.5	702.5	742.4	800.2
Memo item: Euro zone		176.74	168.14	158.59	161.02	159.88	169.10	140.91

Note: Patenting rates are not fully comparable across countries due to differences in laws and regulations which affect the breadth of patents. In some countries, the rules favour the filing of relatively fewer broad patents with many claims, in other countries the rules favour the filing of a larger number of narrower patents with few claims.

Source: WIPO Statistics Database and World Bank (World Development Indicators), June 2009.

27. It is noted in the literature that given the existing stock of inventions, major reasons for low patenting inter alia relate to protracted procedures for and high cost of patenting.[9] Generally, the entire procedure from patent application to granting will take over 12 months

[9] However, lengthy procedures can also be a result of inadequate resources of patent offices relative to the volume of applications, and this problem in turn can be the result of excessively low patenting fees.

and may frequently take more than 18 months, depending on legal regulations in a country[10]. In the United States, the process typically takes 24-36 months.[11]

28. This being said, the cost of intellectual property (IP) protection (especially, for patents) can be high, and, therefore, may not be easily affordable for SMEs or public research organizations. The cost of patent protection comprises several fees and depends on the route for patent protection chosen (national, European Patent or Patent Cooperation Treaty system). Even when the initial costs for a national patent are manageable, they can rise rapidly if protection is sought outside of the country. For example, in the United States the issuing of a US patent costs about USD 10 000. However, an additional USD 20 000 has to be paid for each country where the invention needs to be protected[12]. The bulk of costs, however, arise from renewal fees (which are increasing over time) and from the need to enforce the patent against infringers (see Box 5).

Box 5. Costs and Fees related to Patent Registration and Protection

The costs of patenting may be divided into the four types of costs:

1. Application fees (e.g. filing fees paid to the patent office; professional charges paid to the patent attorneys or agents for the preparation of the patent application)
2. Costs of translation (relevant when seeking IP protection in foreign countries)
3. Fees for maintaining registered patents. These fees are paid to the patent office every year or every five years.
4. Prosecution fees (e.g. the fees paid to the patent representative/attorney to argue a patent case)

Source: WIPO website.

29. SMEs willing to apply for patent protection in various countries can benefit from WIPO-administered PCT system, which can considerably simplify procedures and reduce costs of patenting.[13]

30. Because of the potentially significant costs of patenting, SMEs and research organizations need to carefully consider whether patenting is the best available strategy to exploit their intellectual property.

V. Financing innovation-based SMEs

31. While financial needs of innovation projects vary considerably, several stages in the financing requirements of a start-up are usually distinguished.

[10] http://www.wipo.int/sme/en/faq/pat_faqs_q4.html.
[11] The patent search takes typically 3-6 weeks, an application preparation about 6-8 weeks, the so-called prosecution phase takes 18-24 months, and the patent issuing typically 3-9 months (http://pw1.netcom.com/~patents2/What per cent20Does per cent20It per cent20Cost per cent20Patent.htm) http://www.gordonrees.com/pubs/pdf/bmhm_11.pdf.
[12] http://www.uspto.gov/inventors/patents.jsp#heading-7, http://www.bpmlegal.com/ptofeepat.html.
[13] This system does not provide "an international patent", but simplifies the process of filing patent applications, delays the expenses associated with applying for patent protection in foreign countries, and allows the inventor more time to assess the invention's commercial viability. Under the PCT, an inventor can file a single international patent application in one language with one patent office in order to simultaneously seek protection for an invention in the PCT member countries. The registration becomes valid internationally, and there is no need to apply for patent registration at the National Patent Offices of each country where companies seek IP protection (http://www.wipo.int/pct/en/).

(a) The ***seed*** stage covers the initial research and development of a commercial idea or business concept, focused on determining its technical feasibility, market potential and economic viability.

(b) The ***start-up*** stage covers the development of a product prototype; initial market research and market-reach activities, and the establishment of a formal business organization.

(c) The ***early-growth*** stage pertains to small-scale commercialization and growth as well as to the development of basis for future growth.

(d) The ***expansion*** stage refers to the stage of substantial growth in the scale and market impact of the business. [14]

For purposes of the current note, we consider here only the first two stages of enterprise financing, which are particularly pertinent for start-ups.

32. Because of the risky nature of their activities, innovative SMEs often have difficulties in obtaining bank loans at the early stage of their development. They are known to rarely have collateral to back up loans and they often encounter a period of negative cash-flows at the beginning of their life cycle. This problem of early-stage financing is aggravated in emerging market economies by the underdevelopment of the financial services market. In order to fill the financing gap, a diversified range of capital providers and specialised financial intermediaries is required. These actors intervene at various development stages of the innovation-based enterprise.

33. Initially, the capital for innovative SMEs often comes from the **founders and their close collaborators and friends**. Given the limited funding capacity of these sources, at this stage, publicly-sponsored merit-based awards and feasibility grants are of particular value. The difficulty of selecting the most promising projects, with high growth perspectives, can be addressed by establishing a specialized agency dedicated to awarding grants and working in close relation with scientists and would-be entrepreneurs, or by delegating a private actor to manage a public budget for the selection of companies and projects. In both cases, these intermediary structures have to be decentralized, transparent, close to the entrepreneurs, and aware of the entrepreneurs' difficulties.

34. That is how the Russian START Programme launched in 2004 by the Foundation for Assistance to Small Innovative Enterprises to stimulate spin-off activity from universities and research institutes of the Russian Academy of Sciences operates. Under the programme, the evaluation of applications is highly decentralized involving over a thousand experts from the regions of Russia where applications are made. Final recommendations are made by 35 Councils composed of scientists, Government officials and entrepreneurs.[15]

35. Another source of early-stage capital comes from **business angels**. Business angels are individuals that make equity investments in ventures with high growth potential and share their time, expertise and network of contacts with the entrepreneurial team. According to the EBAN (European Business Angel Network) in 2007 in Europe the average amount invested by a business angel in enterprises was around Euro 170,000, while an individual investment ranged between Euro 25,000 and Euro 250,000[16]. Business angels making smaller investments provide finance to SMEs at an earlier stage than venture capitalists.

[14] UNECE, Policy Options and Instruments for Financing Innovation, 2009, pp. 2-3.
[15] Ibid. p 14.
[16] EBAN, Statistics Compendium, 2008.

36. **Corporate Venture Capital (CVC)** investors also provide funding for commercialization bridging the gap between inventors and industry. The CVC investor is usually a large company (often a well-established multinational company), which brings in capital and managerial support to small innovative companies (often start-ups) selected on the basis of careful screening. Giving the start-up enough independence to preserve its creativity, the large company benefits in its turn from the growth potential of the start-up. CVC companies may intervene at an earlier stage of the start-up life cycle as compared with traditional venture capital investors (see below). The corporate venture capital investors may be also less concerned with financial returns and more with the strategic value that the entrepreneurial firm may eventually bring to the parent organization. From this point of view, a long-term strategic commitment by the corporate venture capital can be seen as a vehicle for technology transfer from a small innovative company towards a larger enterprise, thus facilitating the commercialization.

37. In the United States, during 1995 and 2010 corporate venture capital became a major vehicle for transferring funds from big multinational companies to small innovative start-ups. In the 2000s, CVC deals represented up to 20 per cent of the total number of venture capital deals and between 7 – 15 per cent of venture capital invested[17]. Since the CVC investment tends to fall during the times of the economic recession stakeholders need to target ways of combining the CVC financing with other sources.

38. Finally, in certain cases m**icro-credits** can also serve as seed financing. While loans offered though micro-credits in most cases do not exceed Euro 25 000 and often can not satisfy the requirements of start-ups, in certain cases they can substitute for the financing by the founders at initial stages of the enterprise life cycle.

39. When the initial sources of finance become insufficient for growing innovative companies they typically draw on the services of **venture capitalists**, which provide professionally managed capital to enterprises in exchange for equity stakes, with the objective to eventually sell those stakes in the future at a premium that justifies the investor risk. Serving as intermediaries channelling funds from institutional investors to enterprises, venture capital firms also provide companies with business advisory services, network contacts and play an active role in the recruitment and training of management.

40. There is an agreement in the literature that government co-financing of new innovation-based companies can be a critical policy instrument to get a venture capital industry off the ground. Without government support, the development of venture capital is constrained by chicken-and-egg problem: in order to raise funding, venture capital funds ideally need a track record of successful past investments, but in order to invest successfully, they need funding. The promotion of this sector should be a part of a more general innovation policy, which tries to improve the framework business environment, including the rules of establishment, operation and taxation of enterprises.

VI. The R&D output: methods of commercialization

41. The main objective of universities and R&D institutions is teaching, training and research, as well as the dissemination of the new knowledge generated. This objective does not necessarily agree with the objective of earning profit from commercialization of inventions. In order to harmonize to the extent possible the conflicting interests of stakeholders in the process of commercialization of R&D results, universities and R&D

[17] Pricewaterhouse Coopers/National Venture Capital Association, MoneyTree Report http://www.nvca.org/index.php?option=com_docman&task=cat_view&gid=99&Itemid=317.

institutions should address a number of pertinent issues. Government policy supporting commercialization and innovation typically seeks to facilitate this process targeting issues such as:

- Facilitating the use of R&D outputs generated within the institution in the interest of the public at large through licensing or other forms of commercialization;
- Ensuring compliance of commercialization with existing laws and regulations and enabling a university or R&D institution to secure sponsored research funding;
- Ensuring operational freedom for university researchers by making certain that planned research does not infringe on third party intellectual property and by acquiring rights to use the third party intellectual property, if necessary;
- Ensuring a fair distribution of income stemming from commercial results according to inventors' and other stakeholders' contributions.
- Ensuring that research results remain available in the public domain for use in future research. [18]

42. A coherent innovation and commercialization policy will facilitate the transfer of academic knowledge produced by public research to the business sector (technology transfer). Methods of technology transfer include the sale or assignment of intellectual property rights, licensing, establishment of spin-offs and start-ups, various types of cooperation between academia and industry, and cooperation of companies with the educational system.

A. Sale or Assignment / Transfer of IP Rights

43. The sale or assignment/transfer of IP rights involves a change in the ownership of the patent by the owner (or "assignor") to a third party ("assignee"); this transfer is permanent and irrevocable. The advantage of this strategy of commercialization for a patent owner may be an opportunity to quickly raise funding for future research. For example, a biotechnology start-up company can decide to sell its patent through an assignment agreement and thus be able to invest in continued research and development to increase its patent portfolio.

B. Licensing

44. Licensing of a patented invention represents permission ('license') of the owner of a patented invention ('licensor') granted to a third party ('licensee') to use the invention in specified geographical areas against a fee to be paid to the licensor. By selling a license the patent owner obtains the right for a flow of income over a number of years and reduces the uncertainty related to future income inflow.[19] At the same time, purchasing a license, an enterprise obtains access to innovations that otherwise would be difficult to obtain, and expects to increase its market share and profit.[20]

45. In a number of countries, the patent law may require that an instrument of assignment of patent rights or a license contract be presented to the patent office for

[18] http://www.wto.org/english/tratop_e/trips_e/intel1_e.htm.

[19] Depending on the desired allocation of business risks, the income can be in the form of upfront fees, payments stipulated by the achievement of pre-set milestones, royalties based on the number of units sold, a share of profits, or a stake in the company undertaking the commercialization, or a combination of these.

[20] http://www.ehow.com/list_6299066_advantages-disadvantages-licensing-agreements.html.

registration. By the act of registration, the government recognizes the assignee or the licensee as the holder of the rights transferred by the assignment or of those conferred by the license.

C. Establishment of spin-offs and start-ups

46. Spin-off companies are created by universities or scientists themselves to commercialize the outcomes of their research. They are often located on university campuses or in close proximity to the latter, enjoying access to laboratories, scientific equipment and peers assistance. To help spin-offs, universities may establish research parks or science parks (see below).

47. The inventor or a spin-off company has no motivation to commercialize the invention unless there is certainty and clear rules regarding its ownership.[21] The ownership rights to inventions are in general determined by national laws and regulations. Having said that, in developed market economies, a university or R&D institution would normally own or co-own the products of research created by a member of staff, students or guest researchers with the use of the institution's resources (including institution-administered funds, facilities and equipment), unless otherwise stipulated by a number of written agreements between the person in question and the institution.[22] Alternatively, if the invention is made without any use of institution's resources, it belongs to its inventor. In this case, the research institution would ask the inventor to testify that the invention was made without significant use of its resources. If the institution is satisfied with the testimony, it would then give the inventor a written acknowledgement that it has no claim on ownership of the invention in question.[23] The procedure of invention disclosure is presented in Annex I.

48. Where an invention made by an employee of an institution (using university resources) is patented and commercialized, up to 100 per cent of the revenue can go to the institution until all out-of-pocket expenses[24] associated with protection and exploitation of the patent have been reimbursed. The net income is shared between the inventor and the institution. When the total net revenue increases, the inventor's share may decrease whereas the one of the institution increase. For example, in the United States, a university may give the inventor as much as 50 per cent for the first USD 100,000 of net revenue, 40 per cent for the next USD 300,000, and 30 per cent for the subsequent USD 600, 000.[25]

49. Patenting costs and complexities of related procedures may become important factors discouraging academic scientists from commercializing their intellectual property themselves. The alleged infringements of intellectual property rights can undermine or

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[21] C. Greenhalgh, M. Rogers, Innovation, intellectual property, and economic growth, Princeton University Press, 2010, p.97.

[22] E.g. material transfer agreement, confidentiality agreement, service agreement and similar.

[23] In some countries (e.g. the United States), while the university or R&D institution is assigned the rights on intellectual property generated in the course of government-funded research, the government retains the option to claim ownership. In the event of the government not exercising its option, it does retain a non-exclusive, non-transferable, irrevocable, royalty free, worldwide license on the invention under government sponsorship. Where a university or R&D institution is a joint inventor with one or more individuals from other institutions (or business entities) and where income is shared between the participating entities, the patents are normally jointly owned by the participating institutions. Moreover, the rights to use the invention and the distribution of royalties among the institutions are generally negotiated before the patent application is filed (http://www.bitlaw.com/source/35usc/202.html).

[24] Such expenses include fees associated with patent filing and copyright registration or other continuing costs related to commercialization of intellectual property.

[25] http://olv.duke.edu/Inventors/PoliciesAndProcedures/policy_on_inventions.pdf.

even force to stop the spin-off operation when those concern the core of its technological advantage.[26]

50. Apart from the proper regulation of ownership rights, most universities and R&D institutions in EMEs face additional, specific problems related to intellectual property commercialization such as:

- lack of competent staff and internal expertise in the intellectual property area;
- lack of financial autonomy in universities which hampers them to develop their own policy versus their research workers and IP protection of university's inventions;
- insufficient resources to bear the costs associated with patent registration, renewal and litigation.

51. One of the ways to facilitate the establishment of spin-offs by universities and strengthen the technology transfer from laboratories to industry is to improve the institutional environment making it conducive to commercialization (see below).

VII. Different types of industry-science linkages

52. As already mentioned, the successful commercialization crucially depends on the effective interaction between the institutions which generate knowledge and those which transform this into commercially viable products. The three major players here are governments, universities and research institutions, and companies. Currently, the links between public research organizations and industry in many emerging market economies are rather weak, which creates additional obstacle to the process of commercialization of R&D results.

53. While the variety of industry-academia linkages is presented in Annex 2, the most relevant for commercialization include:

- cooperation in R&D
- cooperation in education
- mobility of research personnel
- cooperation within the innovation support institutions.

A. Cooperation in R&D and Open Innovation

54. Cooperation in research and development takes place when universities and companies join their resources to create and develop a new product or technology. This can take different forms, for example when the firm's scientists work hand in hand with academic researchers, or when a company finances a research project at a university to have ownership of the results and the right to commercially exploit them. The research joint ventures accelerate the transfer of technology from fundamental and applied research to commercial applications because both parties have a better understanding of the problems to be solved at various stages of this process.

55. Recently, the concept of "open innovation" has become an increasingly popular tool of fostering academia-industry linkages and commercialization of R&D results (see Box 6).

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[26] Creating Spin-Off: Designing Entrepreneurship Conducive Universities, by Elco van Burg http://cms.ieis.tue.nl/Beta/Files/abstract per cent20Elco per cent20van per cent20Burg.pdf.

Box 6. The Responsible Partnering Project: Open innovation to foster R&D cooperation in Europe

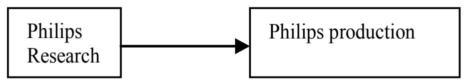
Responsible Partnering is a project that was launched in 2004 in order to create a code of conduct to foster efficient cooperation between innovative companies and public research in Europe. This code of conduct is the result of collaboration between a number of European universities' and research associations.

The objective of the project is to promote research joint ventures between public research organizations and private companies through a new model of "open innovation". As opposed to the traditional model of company-owned applied research, the "open innovation" approach encourages companies to collaborate in research with external institutions, in particular public organizations. Through this, innovative companies benefit from access to research resources of public institutions and their research workers acquire additional knowledge and skills. The "open innovation" model encourages patenting and licensing out of research results, including the inventions, which would have remained unused under the traditional model of innovation.

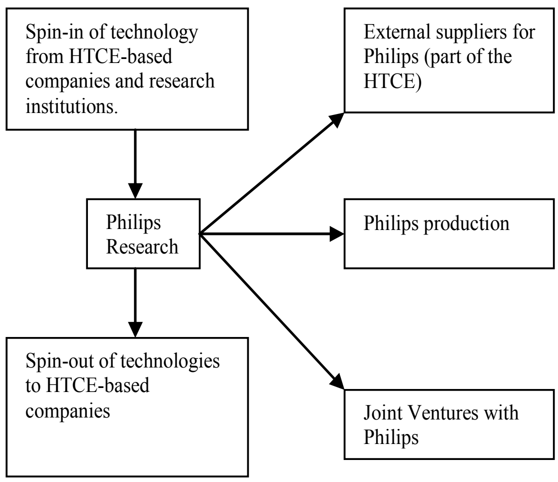
One of the examples of successfully implemented open innovation is Philips' R&D centre and the High Tech Campus Eindhoven (HTCE) situated in Eindhoven (Netherlands). The Philips' system of open innovation combines collaboration with public research institutions and operation of a technopark with incubation and business facilities.

In 2009, the technopark of HTCE housed over 90 innovation-based companies and institutions employing 8000 people. Philips has created an environment promoting interaction, networking and knowledge-sharing, leading to joint projects and joint ventures among the HTCE-based companies. While there is no formalized agreement to share technology among those companies, the technology exchange occurs naturally, inspired by the synergies benefiting all stakeholders. The open model used by Philips can be schematically summarized as follows:

Closed Innovation model:



Open Innovation model:



Shared facilities and technology help the networking and exchange of ideas among the campus-based companies.

Along the same lines, collaboration with public research institutes plays an important part in the open innovation model fostered by Philips. In 2007, this company was taking part in about 100 projects in European and national R&D programmes involving about 16 per cent of its full-time research staff. At the same time, Philips Research had 900 partnership links with some 550 different partners, 48 per cent of which were public research organizations. The implementation of research projects involved about 35 university professors as part-time research workers and consultants.

According to Jan van den Biesen, Philips Vice-President and Director of Public R&D Programmes, over the last two decades, the open innovation strategy and, in particular, its collaboration with public research institutions, has paved the way to astonishing growth of Philips innovation potential.

The Responsible Partnering framework is an example of good practice which could be useful to policy makers, in particular, in EMEs who seek to foster linkages between academia and industry and to raise the effectiveness of both public and private R&D.

Sources:
Responsible Partnering Joining Forces in a World of Open Innovation: Guidelines for Collaborative Research and Knowledge Transfer between Science and Industry, 2009, Responsible Partnering;
Responsible Partnering between Research and Business, Special conference, Lisbon, December 2007, Responsible Partnering;
http://www.responsible-partnering.org/;
http://www.hightechcampus.nl.

B. Cooperation in education

56. In the modern economy, university and private sector cooperation in education helps to adapt the curriculum to the evolving needs of the economy. To achieve this, a participation of employers in the development and implementation of educational plans as well as the development of the educational and career advisory systems by universities are instrumental. In addition to that, technology transfer is facilitated through training the R&D staff in business management and commercialization.

57. Closer collaboration of companies and universities in the framework of integrated incubators and science parks creates beneficial side effects facilitating the students' access to innovative firms and their adaptation to corporate culture, and increasing their chances to obtain a job offer or establish their own company.

58. According to the final report of the Expert group for the European Commission "Entrepreneurship in higher education especially within non-business studies" delivered in 2008, in the 2000s the entrepreneurial education and training was insufficient in many of EU countries, in particular, in the new members States of the European Union. The report noted that the engineering and sciences faculties often lacked qualified personnel and as a rule did not set up training programs on entrepreneurship.[27]

59. Recently, however, there has been an increase in the number, scope and level of higher education courses that focus on entrepreneurship both in the old and new EU member States[28]. Inter alia, these programmes aim at facilitating communication between research workers and business managers. The curricula include issues on technology, business management, entrepreneurship and IT, and emphasize practical know-how through established links with private business or university-based commercial operations. The final objective of training is encouraging students to set up their own ventures. To achieve this, programmes use such tools as mentoring and coaching, and business plan competition. An example of successful entrepreneurship training programme in the new EU member States is presented in Box 7.

Box 7. Teaching business in Poland for non-business majors

The nation-wide program aimed at fostering entrepreneurship in non-business higher education institutions was started in Poland in 2004 by the Academy of Entrepreneurship and Management as a pilot project funded by the European Commission and the Ministry of Science and Higher Education. One of the outputs of the project was an adapted textbook and other study materials (including a website containing study cases and background information for lecturers), which appeared in 2006 as a training-for-trainer toolkit. As a result, during the period of 2006 - 2008 as many as 20 academics were trained as lecturers in entrepreneurship, and entrepreneurship classes became a significant part of the curricula in a number of polytechnic institutes, universities and agricultural schools. Over the same period, the entrepreneurship programmes became operational in as many as 30 of tertiary education institutions, while over 1000 students were trained in entrepreneurship.

Sources: http://www.kozminski.edu.pl.

[27] European Commission," Entrepreneurship in higher education especially within non-business studies", Final Report of the expert group, March 2008.

[28] UNECE, Enhancing the Innovative Performance of Firms, Policy Options and Practical Instruments, Geneva, 2009, p. 73.

60. In some cases, training in entrepreneurship becomes one of the objectives of business incubators. In Ukraine, for example, the Kharkov Business Incubator established in 1998 organizes business education seminars for scientists and engineers. During the first ten years of operation these seminars were attended by more than 2000 students.[29] Along the same lines, in Armenia the Enterprise Incubator Foundation (EIF) advises the university on the curriculum and organizes management and business classes for EIF clients (including students and postgraduates, managers and technical staff, as well as professionals and other experts with technical background) at the training centre jointly operated with Yerevan State University. [30]

C. Mobility of research personnel

61. One of the effective tools of strengthened private sector - university cooperation is the intensified employment of research workers in industry (the so called ‘personnel pooling’). Academic scientists get positions inside the private sector, either as consultants, founders of companies or members of their boards. Facilitating technology transfers, such arrangements have an additional advantage for universities of shifting a part of the financial cost of research (salaries) to the private sector. At the same time, this helps companies reduce their development costs and acquire a certain ‘scientific legitimacy’ versus the results of their R&D that substantiates their demands at financial and investment markets.

62. In 2006, the European Commission acknowledged the importance of scientists’ intersectoral mobility between academia and industry and developed practical recommendations to foster it. Among the good practices one can note the establishment of ‘research hotels’ for research workers from industry, who enrol in research institutions to refresh their knowledge and get updated on the new developments at universities. At the same time, research institutions encourage outside consultancy work. At the Massachusetts Institute of Technology (MIT, United States) the employment contract covers 9 months per year, while the rest of the year can be used for outside consultancy. MIT provides incentives to academics, whose activities enable the Institute to obtain considerable income from research contracts: it relieves those who earn for the Institute more than USD 2 million from teaching responsibilities, and those who earn more than USD 4 million – from administrative responsibilities. [31]

63. On the industry side, some companies encourage the cooperation between their own scientists and academia. For example, the energy company Schlumberger, France, offers between Euro 25 000 to Euro 100 000 to company workers for research and consultancy work outside of the company. These activities are seen to generate closer collaboration with academia and a positive return on investment to the company. A longer-term mobility occurs when universities employ top managers from the private sector to adapt their management to the newest managerial techniques. [32]

D. Institutional support to commercialization.

64. Innovation support institutions are public, private or public-private organizations that provide support to entrepreneurs in establishing spin-off companies, commercializing

[29] http://www.novekolo.info/en/ , official website of the Ukrainian Business Incubators and Innovation Centre Association (UBICA).
[30] http://www.eif-it.com/index.php.
[31] “Mobility of researchers between academia and Industry, 12 Practical recommendations”, 2006, European Commission.
[32] Ibid.

their innovations, bringing them to the market and finding financial solutions.[33] Among such institutions one notes training and consulting centres, technology transfer centres, incubators and pre-incubators, seed capital funds, technology parks and clusters. The services that they usually provide to academic entrepreneurs are coaching and consulting on managerial, legal and administrative matters. The ‘technology transfer offices’ (TTOs) established within universities focus on finding partners for commercialization, private investors as well as on licensing of the patents owned.

65. In the context of the issues addressed in the present note, business incubators and science or technology parks are particularly relevant.

1. Business incubators

66. A business incubator is an institution, be it privately or publicly owned, that provides physical space and a number of services to start-ups, helping them through the earlier stages of their development. The incubation process may also include coaching and mentoring of managers, advice on financing and marketing issues, as well as facilitation of networking with industry experts. The expected outcome of business incubation is for a start up to reach a revenue-generating stage, when it is ready to attract external investment for future development. To be efficient, business incubators need to define clear goals in order to monitor and guarantee their sustainability in the long run.

[33] UNECE, Enhancing the Innovative Performance of Firms, Policy Options and Practical Instruments, Geneva, 2009, pp. 75-79.

Box 8. Main Characteristics of Business Incubators in Europe

A survey conducted in 2006 in 25 EU countries identified the following main characteristics of European business incubators:

- Number of full time employees. The average number of employees in an incubator is six and the median number is four. Half of the existing business incubators are run by small staff of one to three employees and 90 per cent of them employ less than 10 people.

- Number of tenant start-up firms. The average number of tenant start-up firms in an incubator is 25 and the median number is 18. A large majority of incubators support less than 30 tenant firms.

- Sponsorship. As much as 48 per cent of the existing incubators are publicly sponsored, 12 per cent are privately sponsored and 38 per cent have mixed sponsorship. As much as 70 per cent of business incubators are non-profit institutions while 30 per cent work for profit.

- Location. The bulk of incubator tenant firms (76 per cent) are based at the incubator facilities. The rest are located off-site in rented space or in industrial or science parks. The minimum incubator space required for efficient operation is estimated at around 3,000m².

- Business services offered. As much as 70 per cent of the incubators offer all or most of services and business support required to start ups. As much as 50 per cent of incubators also hire external business service providers. In addition to business services proper, many business incubators assist tenant firms to raise early stage external finance.

- Public sources of support. Start ups obtain public support both through the incubator itself and independently. According to the survey, as much as 64 per cent of incubator-based SMEs enjoyed support from the national programs for SMEs; 58 - 59 per cent from regional development agencies and national programs for innovative firms and 45 per cent of those benefited from support of local authorities.

- Entry and exit. Most of incubators (73 per cent) apply standardized entry criteria and procedures. As much as 43 per cent of them use such criteria for exit. It is generally considered that tenant firms should not need more than four years in the incubator to graduate (some firms graduate earlier). The survival rate of firms reared in the incubator environment is estimated at some 80-90 per cent, which is significantly higher than the average survival rate for start-up firms operating in an open market environment.

Sources:
Goddard, J. G. and Chouk, H. (2006), "*First findings from the Survey of European Business Incubators*";
Centre for Strategy & Evaluation Services (CSES) for the European Commission's Enterprise DG, 2002. Report: *Benchmarking of Business Incubators*.

67. Some key features of business incubators in Europe are summarized in Box 8, while Box 9 presents a successful incubator in the former Yugoslav Republic of Macedonia.

Box 9. The Youth Entrepreneurial Service Incubator in the Former Yugoslav Republic of Macedonia

The Youth Entrepreneurial Service (YES) Incubator was established in 2007 and has its premises near the Skopje airport, in the vicinity of the highways Skopje-Belgrade and Skopje-Athens. Currently the YES Incubator hosts 16 client companies employing 44 people.

At pre-incubation stage, the incubator consults the would-be entrepreneurs and assists them in compiling business plans.

At incubation stage, the incubator offers to entrepreneurs fully equipped offices at affordable rents, free or low cost business consulting (administrative, financial, marketing and legal), matchmaking with potential customers and suppliers, financial support (credit lines up to Euros 15 thousand), and possibility of obtaining grants (up to Euros 1.5 thousand).

Success Story:

One of the companies developed within the incubator is **Broker Inc**. Established in 2008, this company specializes in on-line investment and in 2009 it employed six IT engineers, three marketing experts and two graphic designers. In 2009, Broker Inc won the national competition part of the World Summit Award for e-business and commerce and will now compete on the global level.

Sources:
http://www.ecabit.org/, network of business incubators and technology parks in Eastern Europe and central Asia;
http://www.infodev.org, special program jointly created by the World Bank to help information sharing among small innovative companies;
http://www.idisc.net/en/Incubator.122.html, InfoDev website promoting incubators actions.

2. Science Parks

68. Science parks, which are sometimes called research parks or technology parks (technoparks), are organizations, the main aim of which is to increase the wealth of the community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions.[34]

69. Compared to business incubators, science and technology parks tend to be larger in size, often spanning large territories and housing various entities from corporate, government, and university laboratories to private companies. Science parks do not necessarily offer a full range of business support services but some of them may host a business incubator for early stage innovation-based ventures. Typically, however, science and technology parks provide services to companies at post-incubator stages of their life cycle or provide a launch pad for companies that are "spun out" from a university or company.

70. Main features of science parks are summarized in Box 10.

[34] See the full definition of science parks suggested by the International Association of Science Parks in the glossary.

Box 10. Main Characteristics of Science Parks

A survey conducted by the International Association of Science Parks (IASP) in 2007 among its members (including parks from all over the world) has identified the following main characteristics of science and technology parks:

- Location. Science and technology parks are situated mostly in urban environment, and 36 per cent of the parks were located on a University campus or adjacent to one.
- Territory occupied by the park. As much as 45 per cent of the parks had relatively small territories (less than 200,000 square metres). On the other hand, 33 per cent of the parks had territories exceeding 600,000 square metres, of which 22 per cent occupied territories over 1 million square metres.
- Number of resident companies. As much as 58 per cent of parks reported having hosted 100 resident companies or less; and 23 per cent - more than 200 companies. Middle-size parks (101 to 200 companies) represented 19 per cent of the total number.
- Ownership. Publicly-owned science and technology parks prevailed (54 per cent of the total), while 16 per cent of parks were entirely private and 30 per cent reported mixed (public-private) ownership.
- Government support. Most science parks received public financial support of some sort. The most widespread forms of such support were grants (45.4 per cent of parks); subsidies (40.3 per cent of parks); tax incentives (27.3 per cent of parks) and subsidized loans from governments and public administrations of different levels: national, regional and local (20.8 per cent of parks).

Source:
International Association of Science Parks, http://www.iasp.ws/;
Statistics available at http://www.iasp.ws/.

71. In the University-based science parks (business incubators) up to 40 per cent of tenant companies are spin-offs or start-ups, while a significant number of academics participate in tenant business operations as directors, partners or mentors. The science park generates income for the university and at the same time benefits the local economy though the use of its inputs.[35] An example of university-based incubator operational in Serbia is presented in Box 11.

[35] Allen, John (2007), Third Generation Science Parks, published by Manchester Science.

Box 11. Business Technology Incubator of Belgrade University: An example of a university-integrated incubator

The Business Technology Incubator of Technical Faculties of the Belgrade University was established in 2006 as a partnership between four technical faculties of that University, the Municipality of Palilula and an NGO. The Organization for Security and Cooperation in Europe (OSCE) sponsored the project through a transfer of technical competencies (information on good practices and business advice) and some financial support (Euro 12,000 in 2007).

The goal of the incubator is two-fold: to foster spin-offs and improve the conditions for the commercialization of R&D results obtained in the university; and to encourage and support young and educated people in starting up their own business in high-technology industries and prevent them from emigration.

The incubator is working in parallel on pre-incubation and incubation phases.

- At pre-incubation phase the incubator trains final grade students and young graduates of technical faculties in the modalities of starting their own business; it also facilitates the commercialization in the final stages of a research process.

- At incubation phase the incubator supports innovative start-ups though legal, accounting, training, mentoring and other advisory services.

During the four years of its operation the incubator developed a toolkit on legal, accounting and financial services for start-ups and trained 250 students on matters related to starting one's own business. It has had 11 registered tenants – new small enterprises, which have developed and commercialized 5 innovations. Over that period, as many as 20 new jobs appeared in the incubator itself and in the tenant companies.

Success Story: One of the incubator-based start-ups - **Teleskin Ltd** was founded in 2007. This company is a producer of hardware and software solutions for biophysical skin diagnosis, focusing in particular on early diagnosis of skin cancer. Having increased the number of employees to 8, Teleskin Ltd plans to establish a network of early diagnosis centers throughout Serbia.

Sources: http://www.ecabit.org/; http://www.infodev.org; http://www.idisc.net/en/Incubator.309.html.

72. In the context of science parks, the enhanced industry-science linkages take the form of:

- establishment of joint research laboratories;
- opening of park facilities to outside users from industry;
- development or joint development of pilot plants or demonstration laboratories, open to industry;
- liaison with university technology transfer offices;
- professional development and training for practitioners from the industry, including training based on advanced technologies; and

- internship programmes and assisted job search for graduating students.[36]

73. In EMEs, science or technoparks are a relatively new phenomenon and in many aspects their founders have to adjust their objectives to the realities of the local economy. In the first half of 2000s, in Armenia, Viasphere Technopark (VT) founded in 2001 and centrally located in the capital of the country, housed 11 tenant companies specializing in information and communication technologies. Over that period, the technopark facilitated the creation of more than 400 jobs in the ICT sector.[37] In the mid-2000s, in Kazakhstan technoparks are reported to have been relatively small ventures housing between 16 and 46 enterprises, not all of which were commercially active. On average, technoparks in Kazakhstan employed some 200 to 300 people. With the exception of few pharmaceutical companies, technopark-based firms operated mostly in traditional manufacturing industries and agriculture, and largely serviced the local market. Many tenant firms faced cash flow problems and regarded lower rents as an important benefit. In 2009, in the absence of own financial means, the lack of Government funding was the major problem of technopark-based start-ups. Overall, so far technoparks in Kazakhstan have operated rather as business incubators for firms in traditional sectors. Their transformation into centres promoting innovation-based start-ups would require a more targeted support for this kind of firms[38].

74. Recent developments in the area of science parks in the Russian Federation are presented in Box 12.

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[36] UNECE, Enhancing the Innovative Performance of Firms, Policy Options and Practical Instruments, Geneva, 2009, p. 47.

[37] http://www.viasphere.com/partners/inctech.htm.

[38] Radosevic, Slavo and Myrzakhmet, Marat (2006), “Between Vision and Reality: Promoting Innovation through Technoparks in Kazakhstan”, UCL Centre for Slavonic and East European Studies, Economics Working Paper No. 66;
Presentation by Mr. A, Betekbaev, President of Engineering and Technology Transfer Centre (ETTC)of the Republic of Kazakhstan at the International Conference “Ways and means of attracting external finance for new innovative enterprises”, 21-22 May 2009, Astana, Kazakhstan. http://www.unece.org/ceci/ppt_presentations/2009/eed/Betekbaev_r.pdf.
http://www.sodbi.kz/php/modules.php?name=main&menu_id=0&lm_img_flag=0; http://www.idisc.net/en/Incubator.36.html.

Box 12. Technoparks and Science cities in Russia

According to different estimates, in the late 2000s there were 40 to 60 technoparks in Russia, among which about 8 to 10 are considered to have been fully operational and successful (e.g. industrial parks established at Moscow State University Lomonosov, Moscow State Technical University of Electronic Technology (Zelenograd), Tomsk State University of Control Systems and Radio Electronics, Moscow Power Engineering Institute (MEI), and several others). In 2006, the Ministry of Economic Development of the Russian Federation approved the programme "Establishment of High Technology Parks", which called for launching pilot technoparks in seven regions of the country. Most of the funds for the project were to be allocated from the federal and regional budgets (in 2007, the overall public financial support to technoparks amounted to Euro 38 mn). Reportedly, one of the major problems of technoparks in the Russian Federation is their detachment from universities and research centres.

The Skolkovo Project:

Inspired by the ‘Silicon Valley’, a large high-tech area in the United States, the Skolkovo project aims at establishing an innovation center focused on energy efficiency, information technology, telecommunications, biotechnology and nuclear technology in the vicinity of Moscow. It is hoped that its operation will contribute to the diversification of Russian economy and reduce its reliance on fuels and other raw material.

The project is expected to benefit from strong international support and partnerships with foreign high-tech companies (at the time of writing, cooperation agreements were negotiated with the Finnish telecommunication company Nokia and the US network developer Cisco Systems). A preliminary agreement reached with the Massachusetts Institute of Technology (MIT) stipulated its involvement in the inter-university academic center where 2000 students would study.

With the objective of encouraging private investment, a special legal regime for the Skolkovo center is due to be developed by the end of 2010. The innovation hub will have its own tax and customs services, and patent authority. Tax exemptions as well as privileged conditions for public tender participation are envisaged for companies and individuals participating in Skolkovo activities.

Sources:
Order of the Russian Federation Government of 10.03.06 № 328-p.
I. Semenova, Current issues in the process of technopark establishment in the Russian Federation (in Russian), St-Petersburg University Journal, Geographical section, 2009, No.3, p. 132-138;
http://www.gazeta.ru/business/2010/05/28/3375812.shtml.

75. According to a recent study, there is a direct correlation between the speed of firms’ growth inside a science park and its proximity to a university, implying that the geographical closeness generates more collaboration between science parks and universities. The study also shows that the science park-based companies outperform the average firms in their sectors in terms of revenues, quantity of new products developed and

number of registered patents.[39] This attests to the effectiveness of science parks in terms of R&D commercialization and innovation development but also underlines the importance of geographical proximity and clustering.

VIII. Conclusions

76. The information presented in the note suggests a certain gap between the innovation potential of most of emerging market economies and that of developed market economies. Despite a good tradition of higher education in natural sciences, advanced position in certain research areas as well as a strong corps of well-trained scientists, former centrally planned economies lag behind the OECD countries in terms of number of researchers, enrolment in tertiary education and levels of R&D expenditures per inhabitant. This gap, other conditions being equal, limits the stock of innovations to be commercialized.

77. However, the differences between these two groups of economies go beyond the indicators measuring such inputs in the innovation process. Emerging markets economies also lag behind in the efficiency of the conversion of these inputs into commercialized innovations.

78. The general business environment, which is often characterized by heavy administrative burden on enterprises, violations of property rights and corruption, creates poor incentives for entrepreneurship and the commercialization of research.

79. A major obstacle to innovation and commercialization seems to be the insufficient communication and collaboration between the scientific community and industry. The absence of closer links between science and industry is a significant shortcoming since, in modern economies, the linear model of innovation is ineffective and interaction between innovation stakeholders is a key to success. In addition, weak links between industry and science, regulatory hurdles and unclear property rights restrain private investment in R&D and result in disproportionately low patenting of inventions by universities and research institutions. Linkages between industry and science need to be strengthened to ensure that research activity anticipates and takes advantage of market needs.

80. Fostering technology transfer (through licensing or sale of IP rights) from universities to private companies would facilitate the collaboration between the scientific community and companies. The establishment of technology transfer offices in universities could contribute to this endeavour. Not less important could be measures encouraging academic entrepreneurship. To foster spin-offs, universities should have coherent policies regarding the ownership of patents, which provide financial incentives for successful researchers. These incentives could be incorporated in an agreement between the research institution and the inventor to share revenues generated by the patented invention.

81. To ensure a more effective commercialization, stakeholders in emerging market economies need to encourage industry-science linkages. The ways and means of achieving this include developing cooperation in R&D through open innovation projects or research joint ventures. The business community should be more actively involved in advising on university curricula, and on available and future job opportunities. At the same time, curricula in scientific subjects should include courses on entrepreneurship training. The mobility of personnel between research institutions and private companies could also contribute to their productive cooperation.

[39] D. Siegel, P. Westhead, M. Wright, 2003, Assessing the impact of university science parks on research productivity: exploratory firm-level evidence from the United Kingdom. International Journal of Industrial Organization 21(9) :1,357-69.

82. The financing needs of innovation-based SMEs and spin-offs can be met through a variety of sources, which reflect the changing needs of innovative companies at different stages of development. Specialised financial intermediaries, such as business angels and venture capital firms, have emerged in developed market economies to address the specific financing challenges of innovative companies. However, these forms of financing are not yet well developed in emerging market economies and should benefit from public support.

83. Governments should facilitate the development of national business angel networks and their links with research institutions and universities. Regulations should encourage also the involvement of venture capital companies in early-stage financing, including through hybrid public-private funds. Governments should facilitate closer collaboration between different types of investors to ensure the continuity of financing, which would match the needs of start-ups at different stages of their life cycle. Corporate venture capital investment should also be promoted, as it can help to bridge the financing gap caused by the lack of development of financial markets. Public grants should be used as seed capital, especially in emerging markets, where alternative sources of private financing may be particularly scarce.

84. The international experience shows that high-tech SMEs grow and mature faster when effective innovation support institutions are in place. Business incubators and science parks, which are pivotal at the early stage of SME development, should be established with due regard to the peculiarities of the local economy. In particular, science parks, having the advantage of proximity to universities, enable to reap the synergic effect of clustering small innovation-based enterprises, public research institutions, and larger companies.

85. Encouraging innovation and commercialization of R&D results should be an important part of the Government policy in the areas of science, education, intellectual property and entrepreneurship. This effort can be instrumental in fostering the competitive market economy of the twenty-first century.

ANNEX 1. Disclosure of Inventions

Invention disclosure is a document that provides information on the inventor or inventors, the nature of the invention, the circumstances leading to the invention and related subsequent activities. It provides the basis for determining patentability and the technical information for drafting a patent application.

Submitting a disclosure is the first formal step towards obtaining proper intellectual property protection through a university or R&D institution. In the absence of a technology transfer unit, a university could have a committee responsible for receiving and processing disclosures of potentially patentable inventions.

The key information on the disclosure form should include:

- invention title;
- names of the inventors;
- description of the invention;
- sponsorship, if any;
- design date and date put into practice;
- publication dates, existing or projected, if any.

The written description of the invention should be as complete and accurate as possible to allow a patent professional to comprehend the invention and assess its patentability. The disclosure should be understood, witnessed and signed by a non-inventor. Inventors are strongly encouraged to submit invention disclosures early in the invention development process.

It is advisable for universities and R&D institutions to develop and adopt participation agreements or patent and copyright agreements to govern disclosures.

Intellectual property disclosures are normally considered confidential by the institution, so it will instruct the members of the Technology Transfer Unit or Disclosure Committee and experts involved accordingly.

Source: Guidelines on Developing Intellectual Property Policy for Universities and R&D Organizations", WIPO, 2002.

ANNEX 2. Major Channels and Forms of Industry-Science Collaboration

Cooperation in R&D and patenting	Joint R&D projects Exchange of information on R&D results Sponsoring of research by the private sector Joint patenting
Publications	Companies' scientific publications used in academic research Academic publications used in corporate research Joint publications
Participation in relevant events	Participation in conferences Participation in fairs
Mobility of workers	Hiring of graduates by private companies Moves of scientists from public knowledge institutes to industry Moves of managers and research personnel from industry to public knowledge institutes Mobility of personnel among public knowledge institutions Training of students and post graduates in private companies Holding double positions in academia and industry Temporary exchange of personnel
Informal contacts	Networks based on friendship Alumni societies Other boards
Sharing of facilities	Shared laboratories Common use of equipment Sharing of R&D and office space (science parks)
Cooperation in education	Training or retraining sponsored by the private sector Private sector participation in developing the university curriculum Financing of students' education by the private sector Financing of PhD students by the private sector
Commercialization infrastructure	Organization of university-based science parks and business incubators

Source: Reginald Brennenraedts, Rudi Bekkers & Bart Verspagen, Eindhoven Centre for Innovation Studies, The different channels of university-industry knowledge transfer: Empirical evidence from Biomedical Engineering, 2006, p. 4.

Annex 3. Glossary

Assignment is a transfer (sale) of ownership of intellectual property rights from one entity (assignor) to another (assignee). Assignable intellectual property rights include copyright, patent or trademark registration as well as the rights to pursue protection or enforcement of any of those IP rights domestically or in other jurisdictions.

Business Incubator is a company or facility that assists new companies at earlier stages of their development. Business incubators usually provide to start-ups physical space, business support services and often access to finance. The incubation process may also include coaching, mentoring, assistance in market analysis, as well as facilitated networking and contacts with industry experts and other entrepreneurs. The expected outcome of a start-up incubation is the stage of revenue-generating company or the stage when the start-up is considered attractive by outside investors.

Confidentiality agreement is an agreement between a company and an employee of a university or R&D institution, according to which the latter is bound not to release the company's confidential information unless expressly permitted by the company. In the same way, when applied to information on invention belonging to an employee of a university or R&D institution, the objective is to prevent the commercial use by a third party of such information without permission and protect the patentability of the invention.

European patent application is a patent application filed under the European Patent Convention (see below).

European Patent Convention (EPC) is an agreement among 36 countries aimed at harmonizing the patent law, and patent application rules and procedures. The EPC established a single European patent which is effective in all member-countries of the Convention.

Infringement is the violation of Intellectual Property Rights. Anyone who makes, uses, sells, places on sale, or imports a claimed invention is guilty of infringement.

Intellectual Property (IP) refers to property that is a result of some intellectual effort and enjoys legal protection. Examples of Intellectual Property include patents, trademarks, copyright and design protection.

International Patent Application is a patent application filed under the Patent Co-operation Treaty (PCT) in any of the member countries of the World Intellectual Property Organization (WIPO). The patent thus filed will be valid in up to 104 countries.

Invention disclosure is a document that provides information on the inventor or inventors, the nature of the invention, the circumstances leading to the invention and related subsequent activities. It forms the basis for deciding on patentability and communicates technical information for drafting a patent application. Such a disclosure is the first signal to the university that an invention has been made. This document is also used to report on intellectual property that cannot be patented but is protected by other means such as copyright.

License represents a permission of the owner of a patented invention ('licensor') granted to a third party ('licensee') to use the invention in specified geographical areas against a fee to be paid to the licensor ('royalties'). The amount of royalties usually represents a percentage of revenues obtained through the use of a patented invention.

Merit-based grants are a form of financing provided by public agencies, under which enterprises obtain financing unconditionally, i.e. the grant need not be repaid if the enterprise is not successful.

Material transfer agreement regulates the transfer of proprietary tangible property that is coming to a university or R&D institution from industrial and other sources, or the reverse.

Patent is a set of exclusive rights granted by a state (national government) to an inventor (the patentee or patent holder) for a limited period of time in order to prevent others from making, using, selling, or distributing the patented invention without patent holder's permission.

Patent Cooperation Treaty (PCT) is an international agreement regulating the filing of patent applications which would have effect in many countries. The treaty simplifies the process of filing patent applications, delays the expenses associated with applying for patent protection in foreign countries, and allows the inventor more time to assess invention's commercial viability. Under the PCT, an inventor can file a single international patent application in one language with one patent office in order to simultaneously seek protection for an invention in the PCT member countries.

Patent prosecution is a process of interaction between applicants and a patent office with regard to a patent, or an application for a patent. Broadly, patent prosecution can be split into pre-grant prosecution, which involves negotiation with a patent office for the grant of a patent, and post-grant prosecution, which covers the post-grant amendment and opposition. The respective **fees** paid to the patent representative or attorney can be also split into those referring to pre-grant prosecution (involving fees for negotiating with a patent office) and post-grant prosecution (involving fees for post-grant amendment and opposition).

Science Park, which is often called a **technopark**, is an organization managed by specialized professionals, the main aim of which is to increase the wealth of the community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a science park encourages the exchange of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities.

Service agreement is a contract between the university or R&D institution and a company, in which the former agrees to perform certain tasks, such as evaluation, field testing or clinical trials, using protocols specified by the company or developed by the university, to meet criteria and data requirements set by the company.

Spin-offs are generally small, new firms established by research workers in universities or other research organizations with the objective of transforming the outputs of R&D into new marketable products or processes. Examples of spin-offs also include companies that license technology from a public institution.

Start-ups are newly created companies, often in high technology sectors. Typically, they experience uncertainty regarding their sources of financing and the choice of appropriate business model.

Technology transfer is the process, by which a technology, expertise, know-how or facilities developed by one individual, enterprise or organization, is transferred to another individual, enterprise or organization. Effective technology transfer results in commercialization of a new product or service or in the improvement of an existing product or process, and may occur from country to country, from industry to industry or from research laboratory to an existing or new business. It may be facilitated by financial or other types of assistance provided by government agencies at national, regional or local levels.