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## **On the Roles and Rationales of European STI Policies**

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**299/2007**

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WIFO Working Papers, No. 299  
August 2007

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## **Abstract:**

EU enlargement has increased the diversity of the European Union in a substantial way, in particular with respect to its capacities in the fields of science, technology and innovation (STI). The shares of both gross and business sector expenditures on R&D in GDP are increasingly diverging following EU enlargement pointing at quite different levels of technological opportunities and absorptive capacity. Against this background, this paper tries to disentangle the rationales for STI policies at an EU level. Starting from the different policy rationales we assign different STI policy fields to levels of governance. Our discussion suggests that the European Union plays two quite distinct roles in EU STI policy. The first role is closely related to the assignment of policy competences and establishes the fields where the EU should act as policy maker and program owner. But this alone is likely not enough when it comes to the managing and coordination of complex horizontal policy fields such as STI policy. Here the second role of the European Commission comes into place. This second role is not related to policy making but to the "right" to fuel discussions to find coordinated solutions. This role is essentially political and relates to the job to stimulate activities in areas where the Commission has no mandate (due to missing clear rationales) to act alone.

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## 1. Introduction

EU enlargement has increased the economic diversity of the European Union substantially, also with respect to capacities in the fields of science, technology and innovation (STI). The increasing disparities have (re)kindled (old) debates on the role and scope of EU policy intervention in general and on the appropriations of the EU budget for the 2007-2013 period in particular. The conflicts of interest revolved mainly around the size of the budget, but also on the composition of funding and – within the single chapters of funding- around the content of programmes. In a nutshell, the net paying Member States aim to limit the redistributive role of EU funds and strive for more excellence in European STI performance. The net recipient countries in turn insist on Article 2 of the Treaty on the European Union which states that cohesion is one of the core objectives of the European Union.

In the net donor Member States politicians gain in popularity when alluding to supposedly "costly, non-transparent and inefficient European bureaucracy" ("Eurocracy") and governance. On the other hand there are proposals which emphasise the role of STI for growth and call for a stronger concentration of EU spending on STI (e.g. Saphir et al. 2003). In fact, the innovation policy agenda of the EU has grown substantially in the last decades. Since the 1986 Single European Act STI policy is a policy priority at the European level<sup>1</sup>. The Single European Act has established competencies for a common STI policy at the EU level, and gave the Commission a procedure for implementing multi-annual Framework Programmes (FPs). Since then STI policy in Europe has become a multi-level policy area (cf. Borrás 2003). The ratification of the Maastricht Treaty in 1992 provided an even stronger base for STI policy at the European level, as it gave the Commission competences to take initiatives to ensure coordination between Member States' and EU activities in STI. These competencies were put into practice using the "Open Method of Coordination" (OMC), and are seen also in the ambitious goal to establish a European Research Area (ERA). The OMC (launched at the Lisbon Summit in 2000) is based on benchmarking, monitoring and spreading of best practice. The ambitious efforts to create ERA aim at realising efficiency gains through the utilization of synergies between research infrastructures in different Member States. It is believed that less dispersion and overlap in national research programmes help to better exploit Europe's scientific and technological potential. If successful, ERA gives the European Commission more autonomy to initiate projects and programmes that affect national STI players – research organisations, industry, national funding agencies or user groups. This creates some overlap with national competencies and policy making. Even if a large part of STI policy is still pursued at the national level and Member States pay close attention to retaining their individual

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<sup>1</sup> Although early pan-European research cooperation in science and technology were in place, e.g. COST (Co-operation in the field of Science and Technical Research) since the mid 1970s or ESPRIT (European Strategic Programme for Research and Development in Information Technology Programme) since the earlier 1980s.

decision-making powers (Banchoff, 2002), budgets and competencies become increasingly dispersed and complex. Thus extensive coordination efforts horizontally across the various Commission services and countries and vertically across the different territorial governance levels in the European Union are necessary. However, any argument in favour of a coordinating role of the EU citing the complexity of European STI policies would put the cart in front of the horse. Such arguments give the EU a role but do not provide a genuine rationale for STI policies at the EU level.

Against this background it seems important to discuss and (re)define the rationales and roles of European STI-policy. In which fields should the EU set the policy agenda, pursue active policy making or maintain coordinating tasks only and what aspects of STI-policy should remain within the exclusive authority of national policy makers?

## **2. Rationales for supranational STI policy**

While there is much literature on the rationales of government intervention to foster innovation, technological development and science, not that much is known from an economic perspective on the rationales for a supranational STI policy.

### **2.1 Rationales for government intervention**

The conventional rationales for government intervention in STI are derived from either market failure arguments or from system failure arguments. Market failure arguments are based on traditional neoclassical welfare economics and are related primarily to the fact that appropriability problems, uncertainty and risk, asymmetric information problems in financing as well as economies of scale lead to a suboptimal level of innovative activities. Government action in the form of innovation policy should then establish an optimal level of innovative investment. This can be achieved by public investment in STI, or subsidizing STI activities of private firms. The argument of system failures takes into account that knowledge generation and technological change is essentially a learning process that takes place in networks of knowledge. Missing coordination between actors reduces the diffusion of knowledge and hence leads to a suboptimal innovation performance. System failures are related to missing bridges between organisations, related to dysfunctional institutions and provide a different set of rationales for public intervention in the area of innovation policy. While the two approaches have a quite different theoretical background, the experience of the last decade is that they come up with quite similar policy recommendations.

### **2.2 STI policy in multilayer policies**

The rationales for national government intervention apply of course also to supranational STI policy. However, there is also an additional set of requirements that supranational STI policy

needs to fulfil. The main criterion to assign policy competences to supranational institutions such as the EU is that outcome of this assignment must have positive effects. Thus the main rationale for supranational STI policies is that they enable national systems to take on tasks collectively that these systems would not have been able to tackle independently, attempting to avoid duplication or under-provision of innovative activities and to foster policy learning between different national STI systems.

The question of what and how much of public goods provision should be centralised in the European Union is subject to the subsidiarity principle. The precept is that public policy and its implementation should be assigned to the lowest level of government with the capacity to achieve the given objective. This principle ensures that constant checks are made as to whether supranational policy intervention is justified. There is a close relationship between the subsidiarity principle and the economic theory of federalism, the main task of which is to define the assignment of allocative responsibilities to decentralised government levels<sup>2</sup>. Key to the Economic Theory of Federalism is the decentralisation theorem, a normative proposition which states that there is a presumption in favour of the decentralised provision of public goods (such as STI) with localised effects. The criteria for the centralization or decentralization are related to (i) the heterogeneity of preferences, (ii) the existence of economies of scale, (iii) the internalisation of external effects and (iv) policy learning. Let us discuss these arguments in some detail with regard to STI policy:

1. A high *diversity of regional preferences* leads to a strong case in favour of decentralisation (Oates 1972) as smaller units can better account for the preference of its constituencies. With STI policy this is primarily related to regional sectoral specialisation and regional innovation systems. However, the size of the jurisdiction is a decisive factor in evaluating heterogeneity as well as realising economics of scale. Therefore, the larger the jurisdiction, the more responsibilities should be assigned to the lower level.
2. The realisation of *economies of scale* is a main decisive factor for the assignment to a central level of decision-making. The argument of "creating critical masses" is key to the EU's self-conception on appropriate cases for supranational policy intervention. It may very well be the case that innovation projects are not divisible into small enough pieces to warrant minimum efficient scales of operation. In case of physical indivisibility of respective technical infrastructure, single countries may rate the necessary technical or capital equipment as unaffordable. If only the cross-country pooling of financial resources makes the respective project feasible, the subsidiarity principle is fully satisfied, i.e. there is full project additionality with respect to EU policy intervention. The Airbus story gives a good example in this respect. The scale argument is closely related to 'mission oriented' STI policies: Advances in research, technology and innovation are instrumental to the

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<sup>2</sup> Chapter 2 in this book spells out the basics of fiscal federalism. See also Oates (1972, 1999), Breuss and Eller (2004), Alesina et al. (2001), Inman and Rubinfeld (1998), Pitlik (2006).

solution of a number of societal problems. In the field of defence, for instance, the Joint Strike Fighter has been justified – among others - by alluding to both, critical masses and priority setting.

3. It is well known that STI has substantial interregional spillover effects introducing a coordination argument in favour of centralised decision-making. A primary example for the internationalisation of external effects is related to *global public goods* (GPGs). GPGs are public goods whose benefits reach across borders, generations and population groups (Kaul et al., 1999). GPGs cover issues that range across the whole spectrum of the sustainable development agenda, from the global environment, international financial stability and market efficiency, to health, scientific knowledge, peace, security and humanitarian rights. With global public bads the rationale for transnational policy intervention is straightforward: if the prevention of global public bads corresponds to national needs and self-interest, then coordinated action among states is required to escape from the prisoner's dilemma scenario. This dilemma originates from the non-excludability of GPGs nullifying incentives for any state to act positively, but rather to wait in hope for others to take the initiative. Although the joint payoff of the countries would be higher by cooperating, each one has an individual incentive to cheat (Gardiner and Le Goulven, 2001). Scotchmer (2005, p. 347) argues that the dearth of international efforts to coordinate public spending on STI on global public goods led to an inefficient shift from public sponsorship of research towards the private sector via intellectual property rights (IPR) policies. Stiglitz (1999) goes even further and argues that the global public goods nature of knowledge calls for supranational government intervention. An example for externalities are cross border STI activities. On the one hand there may be a risk of wasteful locational policy competition when governments are willing to subsidise inflow of STI activities (Lundin et al., 2004, p.20). Here, supranational policies can help to avoid wasteful rent seeking behaviour. On the other hand a problem may arise with regard to cross-border STI collaborations. If most countries restrict the use of subsidies and tax-credits to domestic STI, the leakage of public funds can be considered to be minimal (cf. the contribution of van der Horst et al. in this book). However, restricting the choice of collaboration partners to domestic partners may lead to suboptimal outcomes, especially for smaller member states and with regard to scientific research. In this case the limitations to use public funds for domestic partners may inhibit the exploitation of beneficial cross-border externalities.
4. The fourth argument is the policy learning issue. It is closely related to the externality issue, and is close to the concept of interjurisdictional competition. Policy learning requires decentralisation (or the ability by the central player to set locally different policies) and at the same time an arena where the experiences with different policies can be shared. The open method of coordination can be considered to be a tool for policy learning at the national level, coordinated by the EU. Most policy learning initiatives in the different EU programmes are related to policy learning at the regional level or at the level of very

specific innovation policies. In the field of STI policy the European Commission has a role in promoting an European innovation policy agenda. In fact, the Commission tries to lead the European policy discussion by presenting Communications, and by trying to facilitate the transnational exchange of knowledge and to support mutual (policy) learning by establishing and promoting respective networks.

The Union's choice on what and how much should be centralised is essentially subject to a basic trade-off arising from economies of scale or externalities and the costs of harmonising policies in light of the heterogeneity of preferences in a Union of countries and regions. The arguments in favour of supranational European STI policies emphasise the internationalisation of STI, the increase of positive externalities through transnational spillovers, and the provision of transnational public goods. In fact, "policies where economies of scale and / or externalities are predominant should be allocated at the union level, or even at the world level" (Alesina et al. 2005: 276). This makes clear that the subsidiarity principle is vindicated for innovation policies with an exclusive national and regional orientation. However, there are more policy alternatives than complete centralization or decentralization of competences. For example, the existence of interregional spillovers does not necessarily require the concentration of competences upward to the central level. An intermediate solution is mutual cooperation between nation states.

### **2.3 The assignment of policy domains in theory**

Let us now summarize in a stylized taxonomy the assignment of STI policy domains to the EU level, the national or regional level and to mutual cooperation based on the dichotomy between heterogeneity of preferences and spillovers/scale effects. Table 1 shows that policy fields where scale effects and spillovers are low should be allocated to a national or a sub-national level. This is likely to be the case for innovation and development activities that have an exclusive regional or national focus or for SME innovation policies. In contrast, policy fields that have a low heterogeneity of preferences and high spillovers and/or scale effects should be allocated at a supranational level (EU or mutual cooperation). A primary example for this is research that has high fixed costs, high uncertainty and provides results that have the potential to be beneficial to all member states (global public good character). The need to assign this policy area to the EU is weakened if cooperation among the Member States is credible. CERN is a primary example of mutual cooperation. Credible cooperation is weakened – even if the preferences are quite homogeneous - once the benefits of common actions are 'non-excludable in consumption', i.e. once some form of free-riding becomes a possibility. The textbook example is research in vaccine for communicable diseases. In this case it is appropriate to assign the policy competences to a supranational level.

Coordination projects that promote policy learning on the national/regional scale could also be classified in this area, as they provide platforms for policy learning. However, as policy learning platforms do not assign competences in STI policy, these initiatives are better

located in the upper right quadrant, i.e. they should be implemented at a central level. Here high spillover effects and potential scale effects compete with a high heterogeneity of preferences. These policy fields are politically highly contested. Some supranational governance in one or the other form is clearly needed for policy issues that fall in this quadrant in order to reduce negative externalities or to take advantage from positive externalities and scale effects. Thus policy coordination is more difficult and much more important than for policy domains that fall in the other quadrants. Policy areas that fall in this quadrant are inherently political as the preference heterogeneity is usually revealed through the political process. From a normative perspective the overall welfare effects of centralised and decentralised provision of the policy need to be assessed in detail using the compensation principle. In this instance the compensation principle would argue in favour of centralisation if and only if the welfare gains are large enough to compensate the losers.

Table 1: A simple taxonomy for the assignment of policy domains

		Heterogeneity of Preferences	
		low	high
<b>spillovers and scale effects</b>	<b>High</b>	EU / mutual cooperation  e.g. promotion of scientific research on global public goods, research that has large scale economies (e.g. energy fusion), IPRs (except for language issues)	EU / mutual cooperation / national / regional (according to the possibilities of mutual cooperation and the compensation principle)  e.g. policy coordination and learning at the European level, regulations (e.g. state aid)
	<b>Low</b>	national/regional  e.g. regional innovation policies with exclusive regional focus; SME innovation policies	national/regional  e.g. sectoral/regional innovation policies, where specialization patterns are important

The above taxonomy is closely related to Pelkmans' (2006) functional test for subsidiarity (see the contribution of Ederveen et al. in chapter 2 of this book). Pelkmans argues that even if the assignment of the policy issue is to the EU level, not all powers need to be located at the EU level. His test is of course functional and does not take into account aspects of policy learning and government failure, nor complex and complicated decision making at the central level. In light of such imperfections Pelkmans argues that "the decision ought to be political, precisely because of the sensitivity at the level of local/regional preferences which are often only sufficiently revealed once clarity is provided about the repercussions" (Pelkmans 2006: 9). This issue is taken into account in table 1.

### 3. STI policy and subsidiarity in practice

In order to apply the ideas presented in section 2 to EU STI policy we use the latest Communication of the European Commission "Putting knowledge into practice: A broad-

based innovation strategy for the EU". This Communication provides a snapshot on a number of topics in STI policy which are discussed at the European level. This choice is motivated by the fact that European STI policy cannot be reduced to the Framework Programmes for Research and technological development or to the Competitiveness and Innovation Programme (CIP). Regulations to foster the Single Market play also an important role in innovation policy (e.g. state aid regulations). The high visibility of R&D and innovation activities at the Community level may lead to an overestimation of the actual amount of resources available at the European level. This pragmatic limitation of our discussion to issues mentioned in the latest Communication is not really a limitation, as the Communication intends to set the ground for a broad based innovation strategy and thus mentions the most important policy areas which are necessary for the formulation and implementation of a European innovation policy.

Using the Communication as a starting point enables us to consider the actual distribution of policy competences. This distribution is not necessarily the optimal one selected by a benevolent government. The distribution emerged from a "competitive" political process between governments and their administrations at the European and the national level. From the public choice literature it is well known that Leviathan governments strive for competencies and resources and pursue own interests that may be in contrast with the public interest (see the contribution of Ederveen et al. in chapter 2 of this book). Secondly, the allocation of tasks as such is driven by perceived problems and challenges, i.e. worries on European competitiveness have motivated policy responses at national and European level for a long time.

The topics raised in the Communication are very broad. The Communication mentions education, skill formation, mobility of researchers, the working of the internal market, regulation, standardization, IPR, cluster policies, transnational cooperation, knowledge transfer, cohesion policy, financing of innovation (e.g. risk sharing facilities, state aid guidelines, tax incentives), public procurement, the creation of innovation friendly markets and governance issues. Thus it is clear that the Commission sees a European innovation policy as a broad horizontal collection of initiatives that cut across different policy fields which are under the auspices of different services (ministries) at the European (national) level.

### **3.1 How are policy responsibilities assigned in the Communication "Putting knowledge into practice: A broad-based innovation strategy for the EU"?**

As starting point let us concentrate on the policy agenda for the near future put forward under point 5: A Roadmap for more innovative Europe in the Communication (EC 2006a pp 16). Here the Commission proposes ten actions, which correspond closely to the innovation strategy put forward in the Communication. Table 2 presents these actions and the proposed division of labour for each action. The column "topic" states the overarching topic under which each of the 10 actions fall. The column "competence" describes the primary policy

competence for the topic as presented in the Communication. The column "responsibility" indicates who is responsible for the implementation of the specific activities proposed. The last two columns outline which activities are to be implemented either at community level or in the member states

Table 2: The allocation of competences in the 10 actions put forward in the Communication from the Commission: "Putting knowledge into practice: A broad-based innovation strategy for the EU"

Action	Topic	Competence	Responsibility		Type of Activity	
			COM	MS	COM	MS
1	Increase share of public expenditure devoted to education. Implement Communication "Delivering on the Modernisation Agenda for Universities"	MS	X	X	Invites member states to act by proposing recommendations	Should implement recommendations
2	European Institute of Technology	EU(MS)	X	X	Put forward proposal	Decide on proposal
3	Create an open, single, and competitive European labour market for researchers	EU/MS	X	X		
4	Promote knowledge transfer between universities and other public research organisations and industry	MS (EU)	X		Communication including voluntary guidelines for actions of MS and concerned stakeholders (non-binding recommendation)	
5	Cohesion policy to be mobilised in support of regional innovation	MS		X		Earmark ambitious proportion to be invested in innovation
6	New framework for State Aid	EU/MS	X	X	Adopted on 22nd November 2006	Reorient State aid budgets to target these objectives
7	IPR Strategy	EU/MS	X		Will present a new patent strategy and prepare a more comprehensive IPR strategy	
8	Improve framework for the development of new digital products, services and business models	EU/MS	X		Initiative on "copyright levies"	
9	Innovation friendly lead markets	MS/EU	X		Prepare comprehensive lead market strategy	
10	Public Procurement	MS/EU	X		Handbook on pre-commercial and commercial procurement.	

Source: own elaborations on EC 2006a.

Take for example action 4. This action refers to knowledge transfer between universities and other public research organizations and industries. This policy field is generally considered to be a competence of the single member states. In fact, action 4 consists of the drafting of an

Communication by the Commission that includes voluntary guidelines for member states and concerned stakeholders. The responsibility for drafting the Communication (and thus to realize action 4) is exclusively at EU level. This example illustrates that the Commission of the European Union does not see itself not only as policy making entity covering policy fields where it has a clear mandate but also as policy facilitator and policy coordinator with the "right" to initiate policy discussions in policy fields where it has no clear mandate to act. As actions 1, 2, 4, 9 and 10 show, there are a number of actions, where the Commission will be active without having a clear policy mandate.

The proposed actions vary considerably in "intensity" and range from finalising decision processes on issues which have been discussed for some time (e.g. the European Institute of Technology (EIT), or a framework for State aid), keeping some projects going (reform in the education sector) to the start up of new policy initiatives. The role Member States have to play varies. Only in five of the ten actions Member States have to deliver results. In particular they are supposed to implement the recommendation on higher education systems, to decide on the EIT, to earmark a substantial share of structural funds for innovation, to implement the new state aid framework and to create a more competitive labour market for researchers. However, in most of these actions the Commission has no direct competences to force Member States to take actions. This is especially the case in education systems, which are under exclusive competence of the single Member States. Thus, in this policy fields the actions of the Commission are limited to coming up with communications, strategies, and other recommendations and suggestions to shape national STI policies. This shows that an important role of the Commission in the EU STI policy is not related to the funding of research nor the implementation of innovation-friendly regulation but to act as catalyst and coordinator for an EU STI policy.

The ten actions outlined in the Communication have mostly a short term perspective. It seems that the intention of the Communication serves two different purposes beside the formulation of an innovation strategy, namely first to remind the Member States to pursue reforms in areas where the European Commission has no competences to implement policies – especially in the area of higher education and second to inform Member States and the interested public about the next steps the Commission plans to undertake. If the Communication is taken seriously it would entail substantial changes for national and regional STI policies. In fact, by publishing Communications,, handbooks, strategies etc. the attention is directed towards specific policy areas that are considered to be important from the side of the Commission. However, the ten actions put forward are far less demanding than the policy lines which motivate action in the Communication itself – except perhaps when it comes to higher education policy and the establishment of the European Institute of Technology, which are politically and economically quite controversial. We proceed to evaluate the proposals by using a broader definition of policy fields.

### 3.2 Assigning the responsibility for broad policy fields

With the Communication "Putting knowledge into practice: A broad-based innovation strategy for the EU" the Commission tries to harmonize efforts to create a more innovative Europe. While all themes touched upon are important, importance as such is not a rationale for shifting competences to the EU level. The starting point for this paper was the attempt to find theoretical rationales for the assignment of responsibilities for policy fields to either the European, national or regional level. The main rationales for the delegation of competencies to the European level were externalities and scale economies while heterogeneous preferences were considered a strong argument to make decisions at the national or regional level.

We now try to apply these principles to the broad policy areas mentioned in the Communication from the Commission. This is summarised in Table 3.

Table 3: Policy assignments in EU STI policy

No	Topic	Responsibility for designing		Responsibility for implementing		Rationales for COM Involvement			Heterogeneity of Preference
		COM	MS	COM	MS	cross-border externalities	scale	policy externalities	
1	Education		X		X				X
2	Public funding of Research	X	X		X	X		X	X
	Research with GPG character and/or cross-border externalities	X	X	X	X	X		X	X (low)
	Research with scale effects	X	X	X	X		X		X (low)
	European Institute of technology	X <sup>1,2</sup>		X <sup>1,2</sup>		X <sup>1,2</sup>	X <sup>1</sup>		X <sup>1</sup> X <sup>2</sup>
3	Mobility of researcher	X	X	X	X	X		X	X
4	Knowledge transfer		X		X				X
5	Cohesion policy	X			X			X	X
6	Financing of innovation		X		X				X
	Financing of innovation: state aid guidelines	X			X			X	X
7	IPR policy	X		X			X	X	X (low but language issues)
8	Regulation (single market)	X	X	X	X		X	X	X
9	Lead markets								X
	if GPG character and/or cross-border externalities	X		X	X	X			X
10	Public Procurement	X			X			X	X

Notes: <sup>1</sup> if the EIT is realized as institution for research fields with substantial scale effects and there is no voluntary cooperation among member states, <sup>2</sup> if the EIT is realized as funding agency.

Let us begin with the first topic, higher education. It is well known that European higher education systems are quite different. The relevant economic research does not show that there is a large role for EU involvement in the designing or implementation of policies due to cross-border externalities or scale effects (e.g. Breuss and Eller 2004, Thissen and Ederveen 2006). However, as the politics of the reform of the higher education system are quite complex, it might well be that the Commission has a role to play as facilitator of policy learning. Thus the role of the EU in education and higher education policy should be restricted to the issuing of non-binding recommendations and as facilitator of policy learning<sup>3</sup>.

The second topic is the funding of research. In contrast to education, research can have direct cross-border externalities and substantial scale economies, hence opening up national finance for foreign researchers would be a straightforward approach. However, there are not many indications that public funding of research needs to be centralised unless the research topics have a global public good character or the research projects have substantial cross-border externalities. There is considerable evidence for international cross-border spillovers of public and private research whose impact is closely related to the openness and the size of the countries (e.g. Keller 2004). This suggests clearly a role for the EU in financing R&D in the Single Market. As science is itself a global public good this suggests that the establishment of the European Research Council is a step in the right direction of creating a European funding agency for scientific research. The main instrument to finance R&D at the EU level are the framework programmes. The research priorities selected in the current 7th framework programme largely fulfil the criteria for direct involvement of the European Commission, because (i) the nine thematic priorities of the cooperation programme<sup>4</sup> as well as the programmes ideas and people relating to the European Research Council and the mobility of researchers essentially reflect issues which are related to EU-wide public goods or are directed towards issues with large potential external effects for the EU (for more detail see e.g. Hölzl 2006 and van der Horst et al. 2006).

An important role of the European Commission is to provide incentives to increase R&D spending in the single member states, as spillover effects would benefit all EU countries. But the heterogeneity in preferences results in slow progress and reluctant decision taking. This makes the task to facilitate mutual cooperation among Member States and to monitor

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<sup>3</sup> However, as long as higher education is provided by the state as public good there arises an incentive problem when European Single Market regulations are stretched in a way to prohibit discriminatory actions against students from other countries. The incentive to invest in higher education may thus be weakened in the target country when a large fraction of the students are foreigners and they may also be weaker in the originating country as students can study abroad. In order to re-establish the incentives some form of cross-country redistribution would be required or a fee based system of higher education finance that is based on the costs of higher education.

<sup>4</sup> The nine thematic priorities are: (1) health, (2) food, agriculture and biotechnology, (3) ICT, (4) nanosciences, nanotechnologies, materials and new production technologies, (5) energy, (6) environment (including Climate Change), (7) transport (including Aeronautics), (8) Socio-economic sciences and the humanities, and (9) Security and Space.

progress on the goals agreed without having the possibility to create binding agreements or using disciplinary devices to inhibit free-riding behaviour a very difficult one. In our view this establishes a clear role for the European Union to be active primarily in funding scientific research and to implement mission oriented research programmes that are relevant for all member states due to scale effects or cross-border externalities. However, not all R&D and knowledge generation fulfils the criteria of economies of scale and EU-wide externalities. Knowledge is sometimes localised in character. This is likely to lead to substantial differences in preferences what and how to fund (e.g. Hölzl 2006). These differences in preferences are also related to the specialization patterns. This heterogeneity implies that public funding of R&D should be performed both at the level of Member States and EU-level. Following the logic of the Pelkmans' functional test of subsidiarity a failure to reach an agreement by voluntary cooperation strengthens the case for a centralisation of science, technology, and innovation funding but only for research fields that have substantial cross border externalities and/or scale effects. For localised network-oriented innovation policy the case for centralization is very weak, and limited to initiatives that foster policy learning and voluntary cooperation among countries and regions.

From a subsidiarity position the establishment of the proposed European Institute of Technology (EIT) is controversial. The proposal by the European Commission presents four possible options to establish the EIT. At the one hand of the spectrum is the option to establish the EIT as centralized institute with one location, at the other end of the spectrum is the option to establish the EIT as a funding agency (EC 2006b). A detailed assessment requires information on the selection of research fields and the option selected. For example, if the EIT is established following the preferred model of the European Commission, then from a subsidiarity perspective the EIT is justified only for research fields that have substantial EU-wide economies of scale. This assessment is based on the fact that there are not much rationales to centralize EU-wide capacity building, except when substantial scale economies and EU-wide externalities exist. The decision about where to locate the EIT (or its centres) leads to a high heterogeneity of preferences, as at least some of the benefits of the EIT have a clear local character. Therefore, the literature that looks at EU innovation policy from a subsidiarity perspective is very sceptical about the usefulness of centralizing R&D capacity building (e.g. van der Horst 2006, Hölzl 2006). This implies that establishing the EIT as science and research funding agency (option 4 in EC (2006b)) would receive a more favourable assessment of the EIT from a subsidiarity perspective.

The mobility of researchers (topic 3) is already an important part of EU R&D policy and performed via the programme "People" in the FP7. The aim is to foster the diffusion of knowledge within the EU. This is an integral ingredient for any strategy to create a European Research area, which aims at creating a single European "market" for research. Thus externality effects give a clear rationale for EU support of researcher mobility.

Topic 4 concerns the knowledge transfer. While knowledge transfer between universities and public and private research institutions on the one hand and industry and society on the other hand is clearly an important element for any innovation policy strategy, the often localised character of these spillovers and the largely missing scale economies do not establish a general rationale for assigning general competences to the EU.

The heterogeneity of interests shows up in a particularly clear way in the case of Cohesion policy (topic 6). The European Commission aims to make structural interventions targeted more toward the strategic priorities of the Lisbon agenda. Expenditures for research, technology and innovation averaged to 5.5 % of the total Structural Funds support from 2000 to 2006. Therefore the R&D and innovation related expenditures in the structural funds are a relevant part of EU innovation policy. However, Cohesion policy is a special policy field, as the rationales for decision making at the EU level are not primarily related to EU-wide scale effects or knowledge spillovers. It is primarily motivated by redistribution arguments. The redistribution programmes at the EU level are closely tied to the belief that the geography of economics activity matters, and that agglomeration externalities benefit economic activity close to the center. A second justification is that redistribution is necessary in some cases to prevent costly unilateral actions by single member states. The aim of cohesion policy is to create a more equal playing field by fostering the convergence of less favoured member states and regions within the EU. However, this argument is not entirely persuasive as redistribution can stand in the way of needed regional adjustment and have a structure-preserving instead of a structure-changing effect. This suggests that the rationales for a European locational redistribution policy is stronger when there are substantial barriers to labour mobility (Casella 2005). The rationale behind the expenditures for research and innovation in the Structural Funds is regional/national R&D capacity building. Therefore, the decision-making about how to allocate the resources needs to be allocated at the regional/national level. The main challenge of research-oriented Cohesion policy is to assist adapting local policies and institutions in order to aid re-emergence and enhancement of workable and national innovation systems and focus on activities that reflect and reinforce the comparative advantages of regions and countries (Midelfart-Knarvik and Overman 2002). In fact, the evaluation of the Structural Funds suggests that science parks and technopolies that are not connected to existing regional networks and regional competitive strengths are not functional and become 'cathedrals in the desert' (von Tunzelmann and Nassehi, 2004). This clearly shows that any attempt to centralise network-oriented innovation policies that have a clear regional/national orientation beyond the regional and national level is very unlikely to enhance efficiency.

The funding of innovation (topic 6), is closely related to the funding of research and science (topic 2), knowledge transfer (4) and to the use of R&D measures in cohesion policy (topic 5). Therefore, the arguments from before are valid: substantial EU-wide scale economies or EU-wide externalities need to be present in order to justify EU action. As example let us consider innovation policy for SMEs. While there are good arguments and rationales for an innovation

policy for SMEs, it is also clear that the funding of innovation projects of SMEs or provision of public risk finance should be primarily a national issue. There is not much evidence that SMEs generate substantial externalities (Holtz-Eakin 2000) nor that scale effects are important (van der Horst et al. 2006). However, there is clearly a role for EU action with regard to indirect policies related to the regulation or policies affecting SMEs. Policy learning plays an important role, but regulatory issues which affect the Single Market and economic integration are of primary importance. For example consider R&D tax incentives. The establishment of discriminatory R&D tax incentives will lead to suboptimal outcomes when foreign partners are disadvantaged. In this case EU intervention is justified, in order to guarantee that R&D tax incentives are designed in a non-discriminatory way.

The Single market between EU member states is one of the first principles upon which the EU has been built. National regulations often erect costly barriers to trade. This is especially true for services and therefore also for R&D services. Here the goals of subsidiarity may conflict with creating new legislation at the EU level: The rationales to transfer regulatory authority to Brussels is not always very strong. In our view here priority should be given to the creation of the Single Market in R&D services. It should thus be a priority to delegate competencies to the European level in policy fields where a common legal framework reduces trade barriers, regulatory burdens and creates a single regulators framework instead of 25 different legal frameworks. This applies to all issues connected with the establishment of the Single Market and in particular also to the policy domains of intellectual property rights (topic 7), standardisation, competition policy, rules for state aid (topic 8) or public procurement (topic 10). These issues are also directly or indirectly relevant for innovation policy. Let us start with IPR policy. European coordination is still missing for patents, while for the most other formal methods to protect intellectual property European regulations exist. In the case of patents scale economies clearly suggest that the establishment of a Community patent would be in line with the subsidiarity principle (cf. the contribution of van der Horst et al. in this book). A Community patent would reduce costs of patent filing and patent litigation substantially. Until now conflicting preferences on the use of translations – which is an important cost component of European patenting – made an agreement between member states impossible.

On the one hand the regulation of state aid is an important element of competition policy at the EU level. On the other hand public support of private research is an important element of innovation policy. The new guidelines for State aid relax the constraints on the provision of public risk capital to SMEs. The drafting of the guidelines should be allocated at the EU level, so that the regulation is the same in all Member States. But given the arguments regarding the public funding of research and innovation and innovation policy for SMEs, from a subsidiarity perspective the creation of risk capital instruments should remain a national task.

The last topic are lead markets. Lead markets are a quite new concept in EU innovation policy but they cover quite some space in the Communication "Putting knowledge into

action". Lead markets initiatives aim at creating innovation-friendly markets in a targeted way. The goal is to facilitate the creation of markets for innovative products and services in promising areas. There is some controversy about whether lead market strategies are an appropriate policy instrument for the EU – or for national governments – i.e. whether policy is successful in picking winners. However, the integration of research funding, regulatory action and persuasion (policy learning) shows that this concept provides a fresh way of looking at mission-oriented and cluster policies that goes beyond funding research. In the case that lead market strategies are oriented towards areas which have a global public good character and substantial cross-border externalities, such as eco innovations, for instance, the discussion of the policy fields regulation and funding of research have shown that there are rationales to allocate policy competences to the EU level, especially if no voluntary agreement between the member states is likely. These rationales are not related to the concept of a lead market strategy as such, therefore, for lead market strategies that do not have a GPG character or substantial cross-border externalities no case for the allocation of policy making competences at the EU level can be established.

#### **4. Conclusion**

For a number of different policy areas in STI policy it is possible to find rationales to assign competences to the EU level. However, these rationales arise in a strong form only for a small subset of policy issues. This suggests that a division of labour in STI policy is necessary. However, there is a danger that the different responsibilities become blurred if too many levels of government are involved in a policy area. In the case of STI policy it is difficult to allocate competences exclusively to one level. Thus the boundaries have to be carefully crafted in order to facilitate a coordinated interplay between the European Union and the Member States and regions.

Our discussion suggests that the EU plays two quite distinct roles in EU STI policy. First, the Union should act as policy maker, regulator and/or program owner in those policy domains where there are clear and justifiable rationales for doing so. This requires an explicit allocation of policy competences. But this alone is likely not enough when it comes to managing and coordinating complex horizontal policy fields such as STI policy. Here the second role of the European Union as an institution with the "right" to fuel discussions (e.g. through the open method of coordination) to find coordinated solutions and to monitor the Member States progress on the agreed goals. A primary example for this role is to encourage Member State to increase STI spending by committing themselves to the Lisbon targets. This role is essentially political. It relates to the job to stimulate activities in areas where the Commission as "guardian of the treaties" has no clear mandate to act, due to missing rationales from a subsidiarity perspective.

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