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# Scenarios of technology and innovation policies in Europe: Investigating future governance<sup>☆</sup>

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## Abstract

In Europe, public research, technology and innovation policies are no longer exclusively in the hands of national authorities: increasingly, national initiatives are supplemented by, or even competing with, regional innovation policies or transnational programmes, in particular the activities of the European Union. At the same time, industrial innovation increasingly occurs within international networks. Are we witnessing a change of governance in European innovation policy? Based on some theoretical assumptions concerning the relationship between the “political systems” and “innovation systems” in Europe, the paper speculates about the future governance of innovation policies, trying to pave ways for empirical analyses. It sketches three scenarios stretching from (1) the idea of an increasingly centralised and dominating European innovation policy arena to (2) the opposite, i.e., a progressive decentralisation and open competition between partly strengthened, partly weakened national or regional innovation systems and finally to (3) the vision of a centrally “mediated” mixture of competition and cooperation between diverse regional innovation cultures and a related governance structure.

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## 1. Introduction

Science, technology and innovations based thereon play a significant role today in the economies of the industrialised countries and are a driving force in their international competition. In the meantime, national and also increasingly regional governments of all these countries pursue, more or less explicitly, “innovation policies,” understood here as the integral of all state initiatives regarding science, education, research, technological development and industrial modernisation. Thus, innovation policy is a broad concept that contains research and technology policy and overlaps with industrial, environmental, labour and social policies. Public innovation policy aims to strengthen the competitiveness of an economy or of selected sectors, in order to increase societal welfare through economic success.

Currently, there is an intensive debate going on about the division of labour in innovation policymaking within Europe. Until the middle of the 1980s, the EU (formerly EC) had a research and technology policy of its own that more or less complemented national policymaking with a transnational dimension. However, this multilayer logic is currently contested through ambitious efforts to create a “European Research Area” [2]. This would give the supranational body European Commission more autonomy to initiate projects and programmes that directly affect national research actors and, in addition, would take coordination of national policies more seriously. The rationale behind this approach is that the ongoing and accelerating process of European economic integration, in combination with the opportunities opened by future enlargement of the European Union and the growing challenges of economic and technological globalisation, functionally leads to an integrated RTD—and even innovation—policy approach in Europe. Ideally, this would optimise the usage and development of critical research and innovation infrastructures in Europe, thereby exploiting the full potential of an integrated Europe. Such a development certainly meant a quantum leap in European governance of research, technology and innovation.

This neo-functionalist understanding of integration, however, faces a competing, disintegrative view, basically stating that the growing pressures from globalisation and the growing divergence of national innovation systems due to enlargement will lead to a re-intensification of competition between national—and even regional—innovation systems. In other words, it is far from certain whether the processes of European innovation policymaking in the course of this decade will experience a new level of intensified integration, or if the national innovation systems will end up in a loose combination of diverse and rather fragmented institutional settings, political arenas, cultures and related functionality.

This paper will not provide systematic and exhaustive answers to such far-reaching questions; neither can it—for obvious reasons—draw on solid empirical data. It should be read as a preliminary outline of a research programme rather than a report on research results already achieved. The paper speculates about the possible dynamics of innovation policies in Europe. To do so in a structured way, it first outlines very briefly some theoretical considerations on the interdependence between, and coevolution of, governance in the European political system on the one hand and the development of national and transnational innovation systems on the other—both stirred up by accelerated internationalisation (Section 2). Based on these theoretical considerations and taking advantage of existing heuristic tools

to structure future-oriented analysis, the paper will then sketch three scenarios (Section 3): (1) an increasingly centralised and dominating European innovation policy arena, a scenario the resembles the ERA vision; (2) the opposite, i.e., a progressive decentralisation and open competition between partly strengthened, partly weakened national or regional innovation systems and related policy arenas; (3) a centrally “mediated” mixture of competition and cooperation between diverse national or regional innovation cultures.

## 2. European political systems and innovation systems stirred by internationalisation

In the following, two analytical systems concepts<sup>1</sup> will be applied—“political system” and “innovation system”—coming from different theoretical angles: the one from American political science, and the other from innovation research, strongly influenced by evolutionary and neo-institutionalist economics. Both system concepts will be used in this paper with a pragmatic intention, thus helping to differentiate between fundamental societal functional areas—in the present case, the political system and the innovation system. The actual ways and mechanisms of policymaking within and between these systems shall be defined as patterns of governance [3]. The topic of the paper, therefore, can also be stated as the speculation about the emergence of new patterns of governance in the field of innovation policy in Europe.

### 2.1. *The EU: a unique political system*

In the course of the 1970s, the term “political system”<sup>2</sup> developed into a generally acknowledged, basic concept of political science [6, pp. 372–374], even in everyday speech. Among the most important elements of the political system of western democracies belong the constitutional legitimisation of political rule, normally expressed as the institutionalisation of the nation state, founded on the rule of law, with its guarantee of basic rights, democratic and parliamentary principles, the separation of powers—and the authorities derived therefrom—a comprehensive catalogue of state guarantees towards society and the economy as well as more or less institutionalised forms of feeding back state actions to (mostly corporatist) socioeconomic interest groups or also “new social movements.”

The system perspective can form an indispensable heuristic aide for the study and description of the growing international competition of the socioeconomic effectiveness of

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<sup>1</sup> As a system, we understand a conglomeration of actors, institutions and processes all functionally bound together, whereby certain characteristic core functions of each form the demarcation criteria against other societal (sub)systems.

<sup>2</sup> Coined in the context of functionalist social science analyses following Talcott Parson’s theorizing and introduced into political science in particular by David Easton [4]. Gabriel Almond—in further developing Easton’s understanding in the framework of comparative policy analysis—defined the political system as that system of interaction appearing in all independent societies which fulfils the functions of integration and adaptation (internally and towards other societies) through the use (or threat) of more or less physical force. The political system is therefore the legitimate system in society which guarantees or transforms order [5].

competing political (especially politico-administrative) systems, since these systems can be understood as “location factors” in the international economic competition, performing at least the functions of market-creating, market-sustaining, market-regulating and market-correcting [7, pp. 42–43]. Regarding the ongoing economic and political integration of European countries, a systemic view may also reveal reciprocal dependencies on the achievements of diverse political systems and some transnational complementarity between them. Therefore, the category “political system” not only shows its capabilities in the classical comparison of political national systems [8], it is also still useful in the analysis of transnationalising innovation policy governance structures.

Analysts agree that until recently, “the study of politics has got stuck in an obsolete mindset that sees nation states and societies as discrete units, which can safely be analysed in isolation from others and in isolation from the basic structures of the international, or global, political economy” [9]. For Western Europe, this process has shown the most obvious consequences. There is no doubt that for half a century now, the integration of more and more European states has shaped a European political system [10], which is still further developing and extending sustainably over and into all participating national political systems—today visible, e.g., as Brussels’ “comitology” and bureaucracy [11]. One can hardly find any “issue area that was the exclusive domain of national policy in 1950 and that has not somehow and to some degree been incorporated within the authoritative purview of the EC/EU” [12].<sup>3</sup>

The debate about the related functions of the regional, national and transnational levels of political systems and the embedded “state functions” (“Staatsfunktionen”)—not only referring to innovation policy—is in full swing, and the spectrum of the remaining or even newly emerged tasks of national policy bodies is still controversial. It is hardly contested that nation states remain indispensable for the present and near future: at least, they function as the “local” guarantors of the rule of law and also as the legitimator for the growing number of transnational political arrangements (see Hirst and Thompson [13, pp. 170–194] and Streeck [14, p. 314]). Even in transnationally intermingled socioeconomic settings, national political authorities continue to fulfil crucial tasks.

## 2.2. *Systems of innovation*

The concept of National “Innovation Systems” was developed by the social scientists (first of all by economists [15–19])<sup>4</sup>, as—with the increasing significance of international hi-tech markets—new explanations for the differing degrees of competitiveness of economies, especially of their “technological competitiveness” and their ability to innovate were sought.

<sup>3</sup> Schmitter developed a table illustrating the historic dynamics of the expansion of the EU authority from 1950 until 2001 (estimates) across a full range of policy issues. The scores of issues closely related with the innovation system (“education & research”; “industry”; “regional development”; “competition”) range somewhat in the middle between “commercial negotiations” at the top and “energy” at the bottom concerning the degree of European integration [12].

<sup>4</sup> Lundvall and Maskell [19] provide a reconstruction of the genesis of the expression “national innovation systems.” They all take as a theme, at least marginally, the interface of markets and political systems (and, in particular, public policies by state governments) as a formative variable of innovation systems.

It was recognised that differing national and regional patterns of technological and/or scientific specialisation and related “innovation cultures,” each rooted in historical origins, characteristic and unique industrial, scientific, state and politico-administrative institutions and interinstitutional networks, crucially affected the ability of economic actors and policy-makers to produce and support successful innovations.<sup>5</sup> Comparative empirical studies demonstrated this even on the level of individual technological developments.<sup>6</sup>

The innovation system of a society encompasses, according to a currently widely accepted understanding, the “biotope” of all those institutions which are engaged in scientific research, the accumulation and diffusion of knowledge, which educate and train the working population, develop technology, produce innovative products and processes, and distribute them; to this belong the relevant regulative bodies (standards, norms, laws), as well as the state investments in appropriate infrastructures. The innovation system extends over schools, universities, research institutions (education and science system), industrial enterprises (economic system), the politico-administrative and intermediary authorities (political system) as well as the formal and informal networks of the actors of these institutions. As a “hybrid system” [26] it represents a section of the society which carries far over into other societal areas, e.g., through education, or through entrepreneurial innovation activities and their socioeconomic effects: the innovation system has a decisive influence on the modernisation processes of a society.

Obviously, each innovation system is different, just as one society is not the same as the other.<sup>7</sup> Sustainable innovation systems develop their special profiles and strengths only slowly, in the course of decades, or even centuries. The historical development and present shape of a “national” system of innovation reflect, to a certain extent, the character of the related political system: centralist nations like France established an innovation system focusing quite clearly on its centrally constituted political system. By contrast, the innovation systems of federally constituted nations like Germany (or the United States) are rooted in relatively strong regional infrastructures, institutions and related governance mechanisms. This heterogeneity is a framework condition for the European integration of innovation systems that cannot be underestimated.

### *2.3. Internationalisation: a secular challenge for political and innovation systems in Europe*

In the transition to the 21st century, though, the national and (regional) innovation systems are experiencing revolutionary shockwaves: the growing pull of internationalising economic

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<sup>5</sup> See Keck [20] for the example of the German innovation system. Although not dealt with exhaustively, in the 1990s, many symptoms and functions of national innovation systems were analysed comparatively, such as national research systems [21,22], enterprise cultures [23] as well as in general the national/regional various “embeddedness of institutions” [24].

<sup>6</sup> So, for example, Jansen [25] for the development of the high-temperature supra-conductor in Germany and Great Britain as well as the example of the biotechnology industries of the United States and Germany.

<sup>7</sup> Amable et al. [27] for instance, differentiate various types of governance (“market-driven”; “government-regulated”; “social democratic”; “meso-corporatist”) and of characteristics (specialisation in science and technology; sectoral specialisation; labour relations/education; financial system; performance; regulatory system; preferred innovation types and innovative sectors).

relationships has mixed up traditional regional or national divisions of labour between industrial enterprises, educational and research institutions as well as administration and politics, and it debased many of their traditional strengths.

While for the last two decades nation states increasingly tended to compete with each other in the field of innovation policy [28,29], strong industrial or financial capital actors have been appearing more frequently on the scene—multinational enterprises, international strategic alliances of national enterprises—who act globally and across the national innovation systems [30]. “Global players” exploit the comparative advantages of the different national infrastructures and policies, but can hardly be influenced by “local” (i.e., so far normally national) political systems, much less controlled [31,32]. Since the 1990s, industrial innovation processes care less and less about national systems and borders [33]. Following developments indicate the growing internationalisation of industrial innovation.<sup>8</sup>

- The volume of cross-border technology transfer via technology-intensive trade, licensing and patents has increased continuously. The share of technology-intensive goods in world trade grew from 9.5% (1970) to 21.5% (1995).
- International strategic technology alliances between companies have doubled since the 1980s [38]. The decline of new cooperations in Europe in the 1990s does not represent a renationalisation, but a saturation: a growing number of transnational mergers has replaced earlier and new alliances in the meantime.
- Finally, multinational corporations have pushed on with the transnational organisation of their research and innovation activities, large European companies conduct more than 22% of their research outside Europe; technical new developments, which originate from the extra-European offshoots of such company groupings have increased between 1985 and 1995 by nearly 150% [39, p. 43]. Non-European large enterprises conduct 12% of their research in Europe (cf. Ref. [40, p. IX].
- Recent studies see in this a new model for transnational research and development (e.g., Refs. [36,40,41]), characterised by stronger interactions, not only on the technology but also the market side: “The motives for establishing R&D units abroad are very much driven by learning from technological excellence and lead markets and dynamic interactions between R&D, marketing and advanced manufacturing” [30].

In sum, corporations, in particular the larger ones, formerly rooted in national systems of innovation, are loosening or relativising their relationships with national infrastructures and innovation policies.

Obviously, this internationalisation has two consequences: first, it raises severe questions about the autonomy and room for manoeuvre left open to national political and innovation systems [42]; second, it might open a window of opportunity for transnational innovation policies in Europe that would exceed the present structure of supranational efforts and that would have implications for the European political system itself. This tension, in fact, is the starting point of the speculation about possible future innovation governance structures in

<sup>8</sup> For details, cf. Ref. [33,34], contributions in Ref. [35] as well as Refs. [36,37].

Europe. Before doing so, some remarks on the current practices on European level are necessary.

#### *2.4. Existing European patterns of innovation policymaking: a governance gap*

On top of the national and regional efforts and in parallel with Europe's economic and political integration, the emergence of an architecture and infrastructures of a European innovation policymaking system can be traced (see, e.g., Refs. [43–45]). Its main pillar is the Framework Programme (FP), the first of which was established in 1984 and concentrated on industrial technologies, information technology, telecommunications and biotechnology. Each subsequent FP has been broader than its predecessor in its scope of technologies and research themes, with correspondingly higher expectations of its impact on the economy and society. In addition to the target dimensions applied already in earlier FPs, the present Fifth FP, covering nearly 15 billion euro, particularly emphasises social objectives that reflect the expectations and concerns of Europe's citizens. As a consequence, the rationales underlying the various Specific Programmes under each FP have become increasingly heterogeneous and even contradictory.

The European Union's innovation policy initiatives are—officially—restricted to and concentrate on the creation of “European added value.” They are supposed to follow the principles of “subsidiarity and European added value.” These principles basically mean that each programme, and indeed its projects, have to be justified through transborder cooperation that would not be effectively managed by national administrations and that promise synergy effects not attainable within national borders. Moreover, community research, technology and innovation programmes and projects claim to contribute to the economy, science and technology in ways that will encourage the harmonious and sustainable development of the community as a whole. This implies that projects should concentrate on areas in which there is expansion and therefore good prospects for growth, community businesses are supposed to become more competitive, and scientific and technological progress is expected to offer a medium- or long-term potential for dissemination and exploitation.<sup>9</sup>

Outside the Framework Programme, the European Commission also developed a number of its own regional innovation policy initiatives. In 1993, for example, a pilot initiative called “Regional Technology Plans (RTP)” was launched which was to initiate the development of a regional innovation policy strategy. The projects in this initiative were to be undertaken in so-called “less-favoured regions.” In terms of process, the commission propagated instead a “consensus-based” approach, where government agencies were to involve a large group of stakeholders to discuss strengths and weaknesses of regional innovation systems, define priorities, and set up (pilot) projects. Many public–private partnerships were established as a result of the RTP projects. Seven regions entered the experimental action and went through what was to become an ongoing S&T policy-planning process. The commission played a

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<sup>9</sup> Compare the criteria as modified by the European Council's Common Position on the 5th FP based on Annex I of the Commission proposal COM(97) 142 final, 30.04.1997.

“mentor role” in the background, the regions themselves were responsible for running the RTP projects (see [Ref. \[46\]](#)).

Finally, there are intergovernmental initiatives like COST (international cooperations in long-term, application-oriented research) and EUREKA, both of which are not institutions of the European Union. In terms of innovation policy, EUREKA is the most important. It has always had a much wider membership than the EU, initially including the European Commission, the then EFTA countries and Turkey and later extending to the current 26 members, including Eastern Europe and Russia. EUREKA was launched in 1985 with the aims to strengthen the competitiveness and productivity of European industry through stimulation of cooperation between companies and research institutes in advanced civilian technologies. The positioning of EUREKA has always been understood to be nearer to the market than the FPs, though there is some overlap. Its policymaking approach is “bottom-up” and (relatively) nonbureaucratic with a very small secretariat.<sup>10</sup>

Despite these transnational efforts—and despite Article 130 of the Maastricht Treaty which explicitly aims at a better coordination of genuine European, national and regional and policy efforts [49]—the innovation policy of the large European member states has not yet taken the step towards a conscious and comprehensive European integration and coordination of their measures. The majority of public initiatives is still mainly developed in national policy arenas, offered by national institutions and addressed to national beneficiaries, borne by the implicit assumption that the research institutes, universities and enterprises involved carry out their innovation activities entirely or for the most part within national boundaries, or at least with a significant relation to the own economy. The EU programmes in support of research and innovation have been increasing in volume and breadth of expertise since the end of the 1980s; their actual reach, however, was limited in the larger EU member states.<sup>11</sup> Other European transnational initiatives like EUREKA or COST occasionally attain an outstanding symbolic position in the concepts of the larger European states, but in practical terms are treated as less prominent. Otherwise, in smaller countries, the instruments of transnational European innovation policy have been regarded for years as a constitutive element of national policy, not least, because large companies with headquarters in small countries are forced to act in international dimensions due to the small domestic market (like Philips in the Netherlands, or Nokia in Finland).

A “governance gap” emerges here: the presently applied “division of labour” in innovation policy between regional, national and EU political levels and institutions is not yet systematically structured and determined. The subsidiarity principle has been working only as quite an abstract rule for practical policy decisions and their implementation. The present distribution of innovation policy responsibilities across the levels may at best be characterised as the result of an emerging strategy between old and newly created institutions. The arising European (innovation) political system still only partly reflects the economic and

<sup>10</sup> For details, see [Refs. \[48,49\]](#).

<sup>11</sup> In Germany, the volume of expenditure of the EU Programmes up till now equaled ca. 4% of the total national expenditure on research and development.

political activities within, between and across the national innovation systems. This situation worsens with new challenges posed by internationalisation outlined above.

Summing up, we can state (1) that political systems are still nationally based, but European integration has brought about a European political system *sui generis* with a multilayered division of labour as for classical state functions; (2) that innovation systems are nationally, regionally or sectorally rooted and have developed in very country-specific manners; (3) that both the political and the innovation systems are stirred up by “globalising” markets as well as by the increasing socioeconomic and political Europeanisation; (4) that in Europe, meanwhile, innovation policy initiatives are pursued in parallel on the national, the transnational and the regional level and this layer structure has left open a governance gap of poor integration and coordination. Just in which directions this gap might develop is the object of the remainder of this paper.

### **3. Potential futures in European innovation policy**

#### *3.1. Heuristic tools*

On a macro-level, i.e., beyond specific policy fields, social scientists have repeatedly attempted to sketch potential “futures” of the ongoing European integration process: Philippe Schmitter, for instance, asking for the future constitutional governance in the European political system, has offered a matrix of two different principles of aggregation—the territorial and the functional [12]: the strongest case of political integration he calls *stato/federatio*; typical elements are definitely fixed territorial boundaries, irreversible membership, an overarching hierarchy of authority and a fixed allocation of competencies among separate institutions within a cumulative division of labour. A *confederatio* “would be a more loosely coupled arrangement in which the identity and role of territorial units would be allowed to vary, while the distribution of functional constituencies and competencies would be rigorously fixed. . . .” In a *consortio*, national authorities of a defined number and identity agree to cooperate with respect to functional tasks that are variable and overlapping; they pool their capacities to act autonomously in fields that they can no longer control at their own level of aggregation. Eventually, the *condominio* would be the loosest way of integration since it allows variation in both territorial and functional constituencies; instead of the present “Eurocracy accumulating organisationally distinct but politically coordinated tasks around a single centre, there would be multiple regional institutions acting autonomously to solve common problems and produce different public goods.”

Schmitter’s models of governance in the EU provide helpful guidance when thinking about future developments of the “constitutional” shape of Europe’s future. The arenas of innovation policy, though, are also shaped by socioeconomic factors and actors, as discussed above. Therefore, a more specific “forward thinking” experiment can provide further insights since it focused explicitly on the relationship between future socioeconomic developments and governance structures, thereby clearly mentioning also the future of science and technology policy in Europe: the “Scenarios Europe 2010” of the EU Commission’s Forward Studies Unit

developed “five possible futures for Europe” [50]. Bertrand et al. built their scenarios on alternative developments of shaping factors and shaping actors of European innovation policies [50], a concept that might also be fruitfully applied to innovation policy scenario building:

- First, one would have to identify the key shaping factors, processes and constitutive elements making up the innovation policy governance structure of the future, such as the dynamics of economic globalisation, the present and upcoming technological regimes governing the dynamics, the competition and related patterns of specialisation of national, regional or sectoral innovation systems (e.g., Ref. [51]) and—last but not least—the potential development of the European political system vis-à-vis national and regional systems (e.g., Ref. [2]). The basic feature of all these factors is that they are important elements of the actors’ environment. Causal or probabilistic effects could be better understood as potentially different reactions of actors to changing environments (economic, technological, political, etc.).
- Second, one would have to define a set of key shaping actors affecting these elements and thus driving the development of innovation policy arenas and related governance structures, such as the actual orientations and strategies of multinational enterprises (“global players”), the specialisation and internationalisation strategies of higher education institutions, of (semi-)public research and technology organisations, of national or regional governmental bodies and—last but not least—European institutions like the European Commission or the European Parliament.

Approaches like Schmitter’s and the “Scenarios Europe 2010” are helpful sources of inspiration when speculating about future developments. In the following, we shall speculate indeed, while doing so, concentrating exclusively on the arenas of innovation policy. What are the patterns or governance in transnational multilevel, multi-actor political systems and in changing innovation systems? In the remaining sections of the paper, three different scenarios will be sketched. They should be read as subjects for debate and as a point of departure for future research. In their present state, the scenarios are still mainly based on political institutional or constitutional design factors which are just one of the elements of innovation policy governance.

### *3.2. Scenario I: concentration and integration of European innovation policies in transnational arenas*

*Shaping factors in the political system:* this scenario corresponds to Schmitter’s “stato/federatio” scenario (while there is no obvious relation to the “Scenarios Europe 2010”). It assumes that the European political system stabilises in bearing a strong transnational governance structure based on generally acknowledged pan-European institutions, with a “European state” and the commission as the government at its core, governing major shares of public budgets, implemented and controlled by presumably centralised transnational bureaucracies. Correspondingly, the political autonomy of the national political systems would decrease. Nation states would hand over many of their responsibilities to centralist

European authorities, in particular, the European Parliament as legislative and the commission as executive bodies. Regional political authorities would probably be less affected by the transnational concentration of power, they might even take advantage of the decline of national powers by simultaneously gaining additional autonomy and accepting direct responsibility vis-à-vis the central European level—“sandwich effect” is a popular characterisation in Europe of this governance model.

*Shaping actors in innovation systems:* quite likely, an increasingly centralised and dominating transnational innovation policy arena would emerge. The shape of national, regional or “sectoral” innovation infrastructures would now depend to a considerable extent on regulatory and investment decisions negotiated in transnational arenas and taken by strong transnational bodies. Consequently, the importance of national innovation policy arenas would fade away. Formerly strong players in national innovation systems would either become marginal or try to establish strategic coalitions or to merge in order to strengthen their negotiating power: research universities, research councils and other basic research institutions would pool their interests in a body like the “European Science Foundation,” but significantly strengthened by comparison with its present role. Industrially oriented contract research organisations like the Fraunhofer Society, TNO, VTT, etc. would amalgamate in a “European Research and Technology Society,” etc.

One can assume that, as a consequence, the diversity of the European landscape of innovation systems, often praised as a crucial source of vitality and innovation power of Europe’s economy, would suffer from this kind of strong centralisation—at least in the sense that long-standing “national styles” of dealing with research, technology and industrial innovation could be leveled out or even disappear. Regional “grass-roots” initiatives, on the other hand, may evolve, driven by strong “local” industrial and political forces, and develop—probably additionally fed by EU regional support programmes—even more richly than in the old national innovation policy settings.

*Evidence and future plausibility:* considering the historic development of the EU’s FPs for research and technological development, their growth in size, thematic breadth and their reach in the various national innovation systems since the mid-1980s, and extrapolating the present trend in a linear way, this scenario does not look too implausible: as a matter of fact, the FPs grew steadily over the years (the First FP, 1984–1987, covered 3.3 billion ECU/euro, the Fifth FP, 1998–2002, will amount to nearly 15 billion euro), often at the cost of national efforts (in relative terms), in smaller member states more clearly than in the bigger ones, and in doing so, a considerable innovation policymaking bureaucracy developed, centralised in Brussels, formally differentiated from national institutions by the subsidiarity principle, but in practice in many cases competing with national policies<sup>12</sup> (as, e.g., in the field of innovation support for SMEs).

On the other hand, there are a couple of reasons which suggest that the concentration and integration scenario will not come true. First of all, the degree of autonomy and the will for survival of important actors—in particular, major research institutions as well as politico-

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<sup>12</sup> See, e.g., the example of the industrially oriented BRITE programme which has been historically reconstructed by Edler [53].

administrative bodies—at national levels should not be underestimated. Secondly, for the time being and quite probably in the near future, too, it will be the national political systems and their democratic institutions which alone can provide the necessary legitimisation of state action—also at transnational levels. It is hardly conceivable that, let us say, a 100 billion euro pan-European public research and innovation budget could be negotiated and decided only on the level of transnational stakeholder networks and by the European Parliament, without any involvement of national and regional “innovation communities.” This legitimacy problem will, thirdly, become even more insurmountable the larger the EU grows: the vast number of organised actors in the innovation policy arenas of possibly 20 member states in the course of the present decade would not allow a unilinear top–down innovation policymaking governance structure.

### 3.3. *Scenario II: decentralisation and regionalisation of innovation policy arenas*

*Shaping factors in the political system:* the opposite scenario corresponds to Schmitter’s “condominio” model and also to the “hundred flowers” scenario of “Europe 2010,” assuming a decentralisation and fragmentation, compared to the status the European political system had already achieved by the late 20th century: after the enlargement of the EU by several central and eastern European countries around the year 2005, this capacious grouping of too many economically, politically, and culturally heterogeneous members states would no longer be able to maintain and further develop a joint political identity and related institutions. The governance of the EU and its commission would progressively be retreating, its transnational institutions would be shrinking, concentrating now on the maintenance of the common European market and related regulation, supported by a certain concentration of foreign policies. The majority of other important fields of public policy, though—like tax, social and innovation policy—would witness a continued heterogeneity of national or regional interests, political targets and strategies. The European polity would be suffering from an absence of coordination and a dismantling of already achieved pan-European regulation in many fields of socioeconomic policy. As a consequence, partly strengthened, partly weakened national or regional political systems and powerful corporatist actors in related policy arenas would compete harder against each other, seeking to increase their political autonomy and—with respect to economic development—to enlarge their share of foreign direct investment. Serious economic and, inevitably, political conflicts between regions or nations would thrive. Some groupings of regions and nations sharing similar interests may establish strategic coalitions seeking to strengthen their economic and political negotiating power against competing groupings within the policy arena of the now emerging “condominio of Europe.”<sup>13</sup>

*Shaping actors in innovation systems:* an overcharging of existing centralised EU policy-making procedures around the year 2005 would lead to a weakening of the genuine European innovation policy institutions (in particular the related Directorates General of the EU

<sup>13</sup> While “varying and overlapping scales of territorial aggregation would interact with varying and overlapping domains of functional competence” [12, p. 138].

Commission), or even their retreat from the EU policy arena. The competition of too many contradictory regional, national or sectoral interests would create an intractable deadlock situation: the European Framework Programmes for research and technological development, suffering from an overload of heterogeneous targets and expectations, would have to be terminated—the Council of Ministers and the European Parliament were unable to agree upon the focus, shape, size and management of the seventh FP (planned for 2006–2010).

Instead, the competition between various national and/or regional innovation policies would increase. Smaller nations that had started to make significant investments in science, innovation and education already in the 1990s (like Finland or Switzerland, the latter still not a member of the EU) attract more and more international investment. The same holds true for some of those regions which—while being part of a nation state—enjoy a high degree of political autonomy; they used to afford and maintain strong innovation infrastructures for many years and would now be keeping abreast with the mentioned smaller nations. They may even establish interregional transborder coalitions for concerted innovation policies, mutually matching local strengths and weaknesses of innovation-related institutions. They may also launch EUREKA-like “bottom-up” interregional industrially oriented innovation support initiatives—imagine, e.g., an “innovation belt” of regions and nations surrounding the Alps, reaching from Bavaria, through Baden-Württemberg (two federal states of Germany), Switzerland (independent), Rhône-Alpes (French region), northern Italian regions like Lombardy to Slovenia (independent).

By contrast, many other regions in Europe might suffer from the new lack of trans-regional and transnational efforts in regional economic and innovation development, thus experiencing a growing gap between economically powerful and weaker parts of the continent. Not only would the EU’s regional initiatives have lost their thrust, but also long-standing and politically well-accepted mechanisms of intra-national compensation between rich and poor regions (as were in force, e.g., in Germany for decades) would be fading away: confronted with the challenges of increased international and global competition, the national governments of the larger EU member states would have agreed with major corporatist actors (leading research organisations, industrial associations, etc.) to now concentrate their public policy efforts on “promising regions” in their national innovation policy arenas. One can assume that in particular, multinational enterprises would gain strong influence by playing their games in this scattered landscape of European innovation systems and related policymaking arenas.

*Evidence and future plausibility:* this scenario is borne by the assumption that the traditional, centralised innovation policy governance mechanisms at the national level—in particular, larger countries struggling with the internationalisation of research and innovation—and at the EU scale—at least after the enlarged membership of the union after 2005—will be overburdened and experience a serious functional breakdown. Since no other integrative governance mechanism is available, strong (inter)regional innovation systems, in particular if effectively interwoven with political systems, would start taking command. European economic history provides evidence of the very strong role that the endogenous dynamics of European regions have always played in economic development and industrial innovation. Many regional innovation systems are older than the nation states they presently belong to. Economically strong regions and related innovation systems, meanwhile, inter-

connected by increasingly international and “virtual” markets, may survive and thrive, even with relatively weak political systems at the national and European transnational levels—but at the socioeconomic cost of the rest of Europe! In essence, this condominium scenario does seem less unlikely than many European policymakers may presently perceive.

### *3.4. Scenario III: centrally “mediated” mixture of competition and cooperation in integrated multilevel innovation policy arenas*

*Shaping factors in the political system:* the third scenario ranges somewhere between the previous two. It corresponds to Schmitter’s “confederatio” or “consortio” scenarios and also to the “shared responsibilities” scenario of “Europe 2010,” assuming a coevolution of regional, national and European policy arenas towards an integration in, more or less, effectively working multilevel, multi-actor systems. All the three levels would undergo a redistribution of tasks, thereby experiencing new functional and informational linkages, vertically and horizontally. Political power and policymaking competencies would not crystallise around one central European institutional core (like in the first scenario), nor would they slip away to some strong but scattered “regional” domains. Instead, power and policymaking competencies would now be distributed throughout the European political system, consistently following the subsidiarity principle: in terms of political agenda setting (regional, national or European thematic arenas), of decision making and regulation (regional, national or European parliaments) and implementation (regional, national or European governmental institutions).

An important precondition is the general acceptance of the enduring coexistence of two, partly competing, overarching political targets: (1) the EU would continue to aim at a sustainable socioeconomic cohesion of all European regions, i.e., political initiatives on all levels would have, in principle, to strive for the establishment of similar conditions of work and living, acceptable for all EU citizens, independent of their place of residence; (2) interested groupings of regional, national or transnational authorities may seize at their own cost transnational strategic initiatives (regulation, funding, etc.) aiming at the creation of attractive and productive conditions for economic investments in “their” parts of Europe or “their” sectors—also if only a restricted number of EU member states are willing to join such efforts. This concept has been entitled “géométrie variable” (in Brussels “Eurospeak”).

Another prerequisite—in particular, for adopting policies of the “géométrie variable” type—is the effective functioning of vertical and horizontal, formal and informal networks of key actors, making use of visible, well-accepted platforms and intermediary institutions facilitating the exchange of strategic information and knowledge, allowing for “mediated contestation” between representatives of conflicting interests. Governments on all three levels may perform mediating functions in a variety of policy fields.

*Shaping actors in innovation systems:* innovation policies initiated and implemented would be based on a mixture of competition and cooperation between diverse but integrated regional or sectoral innovation systems and related policymaking arenas. While regional or national authorities would continue to improve the competitiveness of “local” innovation systems, national and, in particular, transnational institutions like the EU Commission—

instead of running growing and cumbersome own funding programmes—would be in a position to “mediate” between the competitors and to “moderate” their conflicts. Public investment in, and regulation of, research, technology and innovation would originate mainly from regional or national initiatives and sources—but it would have to be concerted and matched with any parallel activities throughout Europe: e.g., core competencies and research portfolios of publicly co-funded research institutions would have to be linked and matched across the continent in order to improve the effectiveness of efforts; national and regional funding schemes would have to be opened for applications from other parts of Europe; a variety of interregional or international, where necessary, as well as centrally developed initiatives, would be disposable, normally following the “géométrie variable” approach.

The mediation of innovation policy would require appropriate arenas for negotiation, institutions and procedures [49]. In today’s political practice, though, hardly any “postnational” arenas have been established hitherto. At best, a few “provisional models” can be identified:

- in Germany, for example, the Federal Government–Federal State–Commission for Education Planning and Research Promotion (BLK), which offers a (conservative) model for aligning the various interests at the interface of regional and national actors;
- on the EU level, CREST (Scientific and Technical Research Committee) of the European Council, which provides a negotiating arena for the various national research policies. As far as general issues are concerned, however, CREST has also hardly progressed beyond the representation of national interests; a “federal system of science” [53] is not yet in sight. New dynamics may, however, be sparked off by the growing involvement of the European Parliament, whose committee for Industry, Foreign Trade, Research and Energy is intervening increasingly in the innovation policy debate.

Contesting and negotiating actors in policy arenas use money, power and information as their main media. Various actors have different shares of these resources at their disposal. One important source of policy mediating authorities is the utilisation of “strategic intelligence”. Strategic intelligence activities may cover, e.g., information gained from exercises like policy-impact evaluation, from science and technology foresight efforts or from technology assessment [54], they may support:

- a more “objective” formulation of diverging perceptions of (even contentious) subjects, offering appropriate indicators and information processing mechanisms; analyses of changing innovation processes, the dynamics of changing research systems, changing functions and likely effects of public policies;
- the organisation of mediation processes and “discourses” between contesting actors (or between representations of their views).

Mediating authorities like the EU Commission—according to this scenario—would systematically facilitate the performance and the use of strategic intelligence, in particular, by linking existing bodies of knowledge (and related institutions) on regional and national levels.

*Evidence and future plausibility:* presently, there does not seem to be much evidence for the realisation of this scenario: in particular, proactive mediation efforts by the EU Commission are still quite rare, although the EU's Maastricht Treaty explicitly requires an improvement of the coordination of the member states' innovation policies, envisaging the EU Commission as a major coordinator. There is, on the other hand, some likelihood that the interest of regions and member states in this "confederatio mode" may soon increase: while they are not ready to give away their power of allocating the lion's share of public investment in innovation, they might, nevertheless, become more interested in a mediation of conflicts among them; the transaction costs of contentious competition between scattered innovation systems may be too high in the long run. In essence, the probability of this scenario will depend on the "policy learning" capabilities of major actors in the European innovation policy arena.

#### 4. Conclusions

In Europe, the functional spectrum and the locations of (innovation) political systems are spreading. This creates a potential for a more integrated innovation policy in Europe, but also for new internal contradictions. The European Union can, with some justification, be described as an institutional structure, which at least forms a basis—albeit fragmented—of a system of "postnational" European innovation policy governance, the characteristics of which are still quite opaque, though, and in need of further research: we see, at the same time, horizontally and vertically interwoven multilevel innovation policymaking arenas; we notice also some already quite sustainable transnational policy structures; but simultaneously, there are also undiminished national "location competition" efforts, and in addition, an increasing number of European regions entering the postnational innovation policy arena as self-confident actors, supported by (partly new) political autonomy and, not least, promoted by the European Commission (among others, by the "Structural Fund" and a regionally oriented innovation policy). So far, there is still a significant governance gap between these levels of innovation policymaking.

Models which assign a crucial role to the Commission of the European Union within a new division of labour between regional, national and global political authorities, have so far not progressed beyond conceptual suggestions (see on this Refs. [43,49,53,55]). Our first scenario—strong centralisation of innovation policy governance—will quite probably fail for many reasons, not least because of the sheer number of member states and the resistance of the remaining more or less strong elements of national political systems and innovation systems, but also as a consequence of an overload of policy complexity.

It is more probable that the second scenario—decentralisation, increased competition of regional actors and finally even disintegration of political and innovation systems—could come true. This scenario bears the strong risk that regions or nations with less-developed innovation capabilities will fall behind, thus widening existing socioeconomic gaps. The envisaged enlargement of the EU within the present decade to include the then more than 20-member states and several hundred more or less autonomous regions may support such a

development—as long as no mechanisms of shared responsibilities have been established, such as depicted in the third scenario.

Although there is no immediate evidence yet, there is some degree of probability that some variation of this third scenario—coevolution of “postnational” political and innovation systems towards centrally mediated policymaking for distributed but interrelated innovation systems—will come into existence. The EU Commission’s recent attempt to facilitate the creation of an integrated “European Research Area” [2] can be interpreted as a step in this direction. Given the institutional diversity across the present regional and national innovation systems, the prospects of this initiative might be better, the more it will be embedded in a governance of “shared responsibilities” between various types of actors and levels of aggregation and hierarchy. Whether such a new governance structure will be robust and sustainable or weak, will depend, not least, on the consciousness and openness of the involved actors and the flexibility of the related institutions of the political systems.

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