0 Introduction

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0.1 Why Analyze Innovation Policies From a Knowledge-Based Perspective?

It is broadly accepted that we have moved (or are moving) to a knowledge-based economy, characterized at least by two main features: that knowledge is a major factor in economic growth, and innovation processes are systemic by nature. It is not surprising that this change in the economic paradigm requires new analytical foundations for innovation policies. One of the purposes of this book is to make suggestions as to what they should include.

Underpinning all the chapters in this book is a conviction of the importance of dynamic and systemic approaches to innovation policy. Nelson (1959)[1] and Arrow (1962)[2] saw innovation and the creation of new knowledge as the emergence and the diffusion of new information, characterized essentially as a public good. The more recent theoretical literature regarded the rationale for innovation policies as being to provide solutions to "market failures". Today, however, knowledge is seen as multidimensional (tacit vs. codified) and open to interpretation. Acknowledging that the creation, coordination and diffusion of knowledge are dynamic and cumulative processes, and that innovation processes result from the coordination of distributed knowledge, renders the "market failure" view of innovation policies obsolete. Innovation policies must be systemic and dynamic.

The first part of the book provides the theoretical background for the later, more empirical contributions. The three chapters in Part 1 present some analytical propositions that emphasise either the systemic dimension (and the notion of "systemic failures") or the role of the nature of knowl-

[1] Nelson R.R. (1959) The simple economics of basic scientific research. Journal of Political Economy, 67: 323-348.

[2] Arrow K.J. (1962) Economic welfare and the allocation of resources for invention, the rate and direction of inventive activity. Princeton University Press, Princeton, 609-625.

edge (in particular tacit vs. codified knowledge). The importance of learning as a knowledge creation process, the coordination of disseminated knowledge and hence the systemic view of the innovation process, and the incentives to produce, diffuse and acquire knowledge are recurring themes in the analysis of different policy actions.

One of the features of the "market failure" approach, based on the concept of Pareto optimality, is that it is a normative approach. The dynamic approaches proposed here are by their very nature not normative, which is one of their main advantages. They offer opportunities for different interpretations and types of analysis. This means that different contexts, i.e. each the institutional and economic systems, can be considered as specific situations, in which history and institutions matter. A dynamic approach emphasizes the importance of analyzing policies in terms of their influence on dynamic processes, and emphasizes the role of policy design. In a dynamic environment, where it is necessary, but far from sufficient, to define policy targets and objectives, policy design becomes critical. The strength of a positive approach is that it enables comparative analysis of different policy designs. Adopting a different analytical approach does not require different policy tools. The same tools can be (and are) used, but they produce different interpretations, targets and results. The contributions in this book explain, based on dynamic arguments, why some classical policy tools, such as incentives to innovate, or public procurement, were successful (or not).

The second and third parts of the book provide some interesting examples of these two types of policy. In Part 2 of the book, three chapters analyse the development or diffusion of a specific technology, developed within the framework of a procurement policy. They explain the success of mission-oriented policies (the development of digital switching systems in the telecommunication sector, the development of high-speed trains, and the diffusion of military technologies), on the basis of the learning abilities of actors, the coordination of innovative activities, and time (the analyses span several decades). The three chapters that constitute Part 3 explore the impact of incentive tools (research and development (R&D) tax credits, R&D cooperative agreements, and university–industry collaboration) on the innovation potential of firms and economic systems (regions).

Consideration of policy objectives and also policy design make the diversity of behaviour of the actors in the innovation systems very relevant. These actors are heterogeneous, particularly in terms of their strategic behaviour and their competences. Also, within a dynamic perspective, these differences are time dependent and subject to reinforcement. Policy design should take account of these actors and exploit their diversity. The originality of the contributions in this part of the book lies in showing that pol-

icy design should be based on a better understanding of the strategic positions of the economic actors.

The chapters in the last part of the book are all based around the question of how is it possible to design an innovation policy that will be applicable throughout Europe, bearing in mind the diversity of opinions in relation to innovation? One chapter analyzes the variety of cooperative agreements, that are entered into by firms, on the basis of their individual strategic positions, and underlines the specificities of government-sponsored R&D partnerships. The second chapter in Part 4 describes why it is important that policy makers design actions that encompass the growing internationalization of research and innovation, but also take account of firms' strategies. The last chapter shows that policy makers should not promote a single "university model", but should exploit the differences in the types of universities to enhance training and research in Europe.

0.2 The Rationales Behind Innovation Policies: Dynamic Approaches

The three chapters in Part 1, which provide the theoretical background to the book, are complementary in at least two respects. First, they all take the neoclassical framework as a starting point for explaining the complexity of the innovation process. However, their positions *vis-à-vis* this framework differ. Metcalfe (Chapter 2) rejects neoclassical theory because it "misreads the nature and the role of competition in modern societies through its failure to realize that capitalism and equilibrium are incompatible concepts and that innovation and enterprise preclude equilibrium". In other words, the model of perfect competition does not reflect modern capitalism, and thus cannot be used as a basis for the design of and justification for policy instruments. Cohendet and Meyer-Krahmer (Chapter 3) consider the neoclassical framework as one particular case within a more general approach based on a knowledge-oriented view of the innovation process. They assume that both these views (the neoclassical and the knowledge-based) identify the same instruments, but that the way they are interpreted, designed and implemented differs. Bach and Matt (Chapter 1) concur with this view, and consider the two frameworks to be complements: the neoclassical approach mainly dealing with the problem of allocation of resources and incentives to innovate, and the evolutionary–structuralist approach focusing on the problem of the creation of resources, and the coordination of learning processes. The allocation and creation of resources are important constituents of the innovation process.

Second, the authors of these three chapters also take the view that approaches focusing on knowledge creation and coordination, and learning processes allow a better understanding of the innovation process and hence of policy specifications. However each chapter develops a particular aspect of innovation. Chapter 1 (Bach and Matt) can be seen as an introduction to the other two chapters in Part 1, in the sense that it analyzes the evolutionary-structuralist framework which encompasses various other approaches: the evolutionary approach, the systemic approach (cf. Metcalfe, Chapter 2) and the knowledge-based approach (cf. Cohendet and Meyer-Krahmer, Chapter 3). Bach and Matt believe that these approaches have strong common features. They all recognize the cognitive ability of individuals and groups of agents. Cognition corresponds to the capability to create new knowledge through changing beliefs, routines, etc. Knowledge is intrinsically linked to the cumulative, irreversible and specific cognitive capacity of agents. Technological development, therefore, is context dependent and varies across firms, regions and countries. The innovation system follows trajectories within a paradigm, and its evolution is guided by diversity and selection processes. The virtuous circle of evolution depends on the cognitive and the coordinating abilities of the actors in the system. Public intervention is mainly justified by the existence of individual and collective "learning failures". It should be aimed at facilitating the development and orientation of the learning abilities in the system. Policy actions should be adapted to the specificities of different contexts (geographical, market-oriented). The authors show how the different instruments are implemented and how they act on the system and compare this with the neoclassical approach. They also underline possible "government failures". This very general picture acknowledges that researchers investigating innovation systems and defending knowledge-based economics emphasize specific aspects of the innovation process.

Metcalfe (Chapter 2) focuses on the systemic view of innovation. He sees competition as an evolutionary process in which innovation plays a central role in explaining the differences between firms, and their competitive advantages. Increasing complementarity between different types of knowledge, and increasing dissimilarity between these bodies of knowledge characterize the innovation process. In other words, the internal and external management of knowledge becomes crucial, and means that innovation needs to be considered in a systemic context. Knowledge must be coordinated and correlated across individuals and organizations. The system of knowledge is constructed around multiple minds, in multiple organizational contexts. The firm, which is embedded in the market process along with customers, suppliers and rivals and in interaction with another set of actors (universities), plays a unique role in this system. An innova-

tion system is defined by its components, by the information flow and the connections between these components and their evolution. The innovation system is a device used to correlate and communicate knowledge, and to coordinate access to complementary knowledge. Public intervention, therefore, should be aimed at facilitating the emergence of an innovation system. It should provide the framework within which the system can organise itself. Policy instruments should both increase innovation opportunities and capabilities, and address areas where there are missing components or connections, or misplaced boundaries. In the absence of such a framework self-organization may fail because different agents in a diversity of organizations have different agendas, and their perceptions of the problems involved are also different. The state could design means for bridging between these different agendas such as collaborative research programmes, incubators, science parks, clusters, technology transfer offices, etc.

Cohendet and Meyer-Krahmer (Chapter 3) base their chapter on developments in the relatively new field of knowledge-based economics. A knowledge-oriented policy (KOP) should take into account the specific characteristics of knowledge. The ways knowledge is assimilated and acquired are as important as the conditions of its production. Markets and organizations can no longer be considered to be the only active players in knowledge production. Knowledge intensive communities are playing an increasingly large part in the process of generation, accumulation and distribution of knowledge. Epistemic communities are groups of people who interact with one another to create new knowledge, and the role of communities of practice is to conduct an activity in which knowledge creation is an unintended spillover (cf. patients' associations). The existence of knowledge intensive communities may help to avoid some of the market failures and learning traps that can arise. These communities are seen as the building blocks of knowledge formation. Learning by communities is the foundation for public policy in a knowledge-based economy. Cohendet and Meyer-Krahmer offer some food for thought in relation to KOPs. For instance, they show that from a KOP perspective, patents, although still a mechanism to protect innovators, can be exploited in other ways. Patents may play a strategic role in some negotiations, be considered as the first sign of a cooperation, or be used as a signalling device. Strong patents may hamper the diffusion and production of knowledge. In some cases of excessive fragmentation of the protected knowledge, no agent, or group of agents, may be able to assemble all the pieces necessary to develop the next step in an innovation (this is especially true in the case of biotechnology). The role of a KOP is to enable the construction of a cognitive web that allows different communities to communicate effectively. States should encourage the association of scientific research and lay knowledge

through KOPs that promote "hybrid forums" that bring together in an innovative way the insights of both communities. This requires the creation of a cognitive architecture, the establishment of common rules and procedures, and the construction of interfaces. The value of lay knowledge must be acknowledged in public policy. From a knowledge-based perspective, policy makers should pay attention to the co-evolution of the absorptive and the emission capacities of the different communities of actors.

0.3 New Technology Procurement: Knowledge Creation, Diffusion and Coordination

The second part of the book focuses on specific technologies developed within the frame of a procurement policy. Chapter 4 (Llerena and Schenk) analyzes the development of high-speed trains in Germany. Chapter 5 (Llerena, Matt and Trenti) compares the outcome of the public programmes for digital switching systems in France and Italy, and Chapter 6 (Avadikyan, Cohendet and Dupouet) focuses on the diffusion of military technologies. All three technologies are very costly to develop; standard industrial methods cannot be used; their development involves a very small number of firms; and a single user (a public authority) purchases the final product. These three chapters underline that the success of technology development or diffusion depends on the abilities of actors to create knowledge, and on actions being coordinated.

In Chapter 4, Llerena and Schenk explore the impact of learning in the competition between the Wheel/Rail technology (ICE train) and the MagLev technology (the Transrapid) and look more generally at how learning occurs in these types of technological development. There is frequently a first phase of exploration in which the performance of a variety of technological options is investigated. As a result some options are eliminated and the selected one(s) enter the exploitation phase in which the performance of the chosen option is enhanced. Exploration and exploitation may occur in an experimental setting that reflects the representativeness of the real environment. The learning environment may be strategic and involve trade-offs (cost of experimentation vs. representativeness of results). The authors also highlight that "doing" (practice) is important when learning is taking place in an unstable environment. They demonstrate how the ICE technology had an advantage in that it had similarities with the existing system and could use the existing rail network. The innovation was incremental and was located within established technological boundaries that allowed a rapid learning curve. The degree of predictabil-

ity of the outcome and the rapid commercial exploitation of the ICE allowed learning based on real experience. All these advantages kept development costs down and allowed rapid diffusion. The ICE technology benefited from first mover advantage. Finally, the lead user Deutsche Bahn (DB) was extremely committed to this development and its support was crucial in providing commercial credibility. The development of the Transrapid was experienced many difficulties and its implementation was delayed. The MagLev technology, which it used was a breakthrough technology and required a full sequence of learning, and exploration of various options, which was long and costly. There was no compatibility with the existing network. The development of the Transrapid depended on the implementation of a new high-speed network. There was no lead user involved in its development and DB's position in relation to this technology was unclear. The Transrapid was never able to demonstrate its technical feasibility or economic viability; it did not have credibility.

Chapter 5 compares Italian and French procurement policy in relation to the development of digital switching systems in the telecommunications sector. The chapter describes how the coordination of various actors impacts on the success of mission-oriented programmes. In large technological programmes, the policy maker has a clear vision of the technological goals to be achieved and the institutional proximity between the policy maker and the firms involved is substantial. The companies concerned are characterized by significant initial knowledge, coordination skills and learning abilities. In programmes such as these, the coordination mode is dependent on the technological competences of the policy maker. If these are high, then the preferred mode will be vertical coordination. The success of the digital switching system in France was in part due to CNET (the National Centre of Telecommunication Studies) a powerful research centre, working closely with the policy maker. It allowed vertical coordination of two technological options and facilitated cross-fertilization. The breakthrough technology was thus initially well supported and the learning effects were positive. In 1975, changes in the political system had significant implications: CNET lost its leading role; the breakthrough technology lost its priority; and the telecommunications industry was reorganized (emergence of a duopoly). Eventually, the superiority of the new technology became evident and the incremental innovator was pushed out of the market. These political decisions increased costs and development time. Nevertheless, France was the first country to introduce a digital switching system based on time-division technology. Italy's policy was unsuccessful because there was no institution in Italy similar to CNET, and no horizontal coordination between the firms. This lack of coordination was very destructive given that there were both complementarities between firms and

also a shortage of high skilled personnel. There were three technological options and the experimentation phase was lengthy. Finally an Italian firm collaborated with an American company and there was a pooling of national resources, which resulted in the emergence of a new digital system based on a modular architecture. Although a viable technology was eventually developed, the coordination failures during the first phase had entailed tremendous costs – both financially and in terms of time.

In Chapter 6, Avadikyan, Cohendet and Dupouet look at the diffusion of military technology since the end of World War II and highlight the shift from a spin-off to a spin-in paradigm. They show that the relationships between military and civil technologies depend on the nature of the technology, the industrial organization and the nature of user networks. The authors describe the opportunities and constraints to diffusion along these dimensions. The dual nature of the enabling technologies gives spin-in a particular relevance: it facilitated linkages between the military and civil sectors and the creation of a virtuous circle of innovation. The military usually has sufficient resources to generate breakthrough technologies, whose diffusion is linked to their more or less generic nature and to their degree of maturity. Military projects to develop new products or systems that can be diffused to the civil sector usually require capabilities necessary to combine diverse technologies that exploit a variety of knowledge bases. The diffusion of military technologies depends also on the existence of organizational forms favouring knowledge circulation: often military projects are extremely complex and many firms do not have the right organization to promote diffusion. The knowledge developed within highly integrated and very specialized companies, or within a very small and hierarchical network, does not circulate outside the military sphere. The need for secrecy and the existence of a limited number of users are also not conducive to interaction. More recently, however, large military groups have begun to sub-contract to civil and military SMEs and this may enable greater knowledge diffusion. The main obstacles to diffusion can be summarized as follows. The reduction in basic research expenditure by the military reduces the possibilities for radical innovations. Defence firms increasingly have to rely on the civil sector for technological developments and scientific research (outsourcing to universities). Although military firms have to maintain a high absorptive capacity to exploit this externally developed knowledge, this does not necessarily include the ability to diffuse the knowledge. Secondly, there is a big difference in the life cycles of defence and civil products. Military products generally have long life cycles and high functionality resulting in very different dynamics in terms of competencies between the sectors. The reform of DGA (Délégation Générale de l'Armée) in 1996 has positively influenced the diffusion of tech-

nology in France from the military to the civil sector by encouraging public-private partnerships, enabling intensive cooperation in all phases of the military product life cycle, and encouraging the development of technologies that are applicable more widely.

0.4 The Impact of Incentives Tools on Systemic and Learning Failures

Part 3 focuses on how traditional incentives (tax credits, university–industry relations) may improve the learning abilities of firms and reduce coordination failures. The first chapter in this part (Chapter 7, Héraud and Lévy) analyzes the French CIFRE[3] system. This system facilitates university–industry coordination, and aims to increase knowledge transfer between the two worlds by supporting doctoral studies that are conducted partly within a company. The authors construct a typology of regions that details the different innovative actors involved and their propensity to collaborate. The next chapter (Chapter 8, Lhuillery) provides an in-depth study of the specificities of the national Research and Development Tax Incentives (RDTI). It focuses on the different targets and efficiency of these instruments. The third chapter in this part (Chapter 9, Bach and Matt) uses a method developed by BETA, to evaluate the economic benefits generated by actors participating in public R&D cooperative programmes. The authors highlight the influence of university–industry interaction and how partnerships can be designed to increase the economic performance of both firms and academic actors, and enhance the benefits to SMEs of these collaborations.

The French CIFRE system described in Chapter 7 by Héraud and Lévy is shown to be an important research training device that links the scientific and the industrial spheres. The PhD students, working in companies as part of their doctoral study, in recombining different types of knowledge and competences create new knowledge. The CIFRE system has proved to be an effective way of promoting collective learning, and the development of science-based activities in firms. It facilitates the coordination of different type of actors and reduces learning failures in the economic system. The chapter examines the regional systems of innovation within the French system. The authors use the CIFRE system, KIBS (Knowledge Intensive Business Services), and classical indicators such as scientific and technological density, to empirically define a regional system of innovation

[3] CIFRE : Convention Industrielle de Formation par la Recherche

(RSI). RSI should encompass a complete and balanced set of interconnected innovative actors. The authors demonstrate that in France, which is a centralized country, few RSI exist. Some regions are specialized in the production of academic knowledge; others are characterized by a network of efficient companies; some have neither of these features. Regions contribute to the development of a national system of innovation, but are not themselves autonomous systems with relevant competences and links. The CIFRE system is undoubtedly improving the learning abilities of firms encouraging connections with universities, but will not, on its own, ensure the formation of a RSI.

In Chapter 8, Lhuillery provides a detailed comparative study of various national RDTI systems. In summarizing these national schemes, he concludes that such incentive schemes are becoming more and more common in R&D intensive countries and are not restricted only to the OECD countries. Even though RDTI systems are being more widely used they are not sufficient to significantly increase R&D investment. There are three major fiscal mechanisms that sustain firms' R&D investment: accelerated depreciation, special allowances for R&D investments, and R&D tax credits (RDTC). Lhuillery defines four types of RDTC systems: volume mechanisms, incremental mechanisms, a combination of the two, or the firm choosing its preferred system. He underlines that definition of the tax base is imperative to protect the system from becoming subject to opportunistic behaviour from firms. He details the elements that a fiscal innovation policy should encompass, i.e. he describes how R&D activities are defined and computed in various countries. Some countries have extended the tax credit system to include the costs of innovation. Since corporate R&D expenditure is not limited to in-house R&D some countries include external R&D services, R&D cooperative agreements, R&D within a group, and international financial flows. To ensure the efficiency of innovative fiscal tools certain regulations are necessary. Imposing a ceiling on tax credits, smoothing tax credits and punishing firms for reducing their R&D spending are among such provisions. Some tax credit systems include incentives targeted at specific firms: small and new companies, and companies with few financial resources; specialist firms and high-tech firms located in specific regions (federal systems). The author analyzes RDTI in comparison to other R&D policy tools and tax incentives and to corporate taxation in general. He shows for instance that in France firms taking advantage of RDTI are less likely to receive direct R&D subsidies. He also underlines the existence in some countries of tax incentive mechanisms devoted to fostering technology diffusion, acquisition, transfer and training. RDTI, then although they are exploited in different ways in different countries, are not sufficient to promote innovation: direct R&D support is also

needed. Achieving the right balance, and positive interaction between different R&D tools in innovation policy, has still to be accomplished.

Chapter 9 by Bach and Matt sets out to analyze how the coordination of different types of actors in publicly funded cooperative arrangements influences the learning activities of actors, and thus their economic performance. The chapter underlines how SMEs benefit from public R&D cooperative programmes. The chapter opens with a description of the BETA evaluation method, its relevance, its main methodological features and the different studies that have been performed based on this method. The BETA method evaluates the direct and indirect economic effects generated by the actors participating in public R&D programmes. Direct effects are those directly related to the objectives defined at the beginning of the project. The nature of the direct effect will depend on the type of public policy (procurement vs. diffusion). Indirect effects are those benefits that accrue that were not initially defined as being objectives. These benefits include transfer of knowledge within the company, and application of what has been learned through the project to other activities within the firm. Indirect effects cover such aspects as: technological and organizational learning, networking, reputation, management, increased competences, etc. The originality of the BETA evaluation method is that it enables an in-depth analysis of how participation in a public programme affects the learning processes of the actors. In this chapter the authors focus on the outcome of public R&D cooperative programmes and analyze how the design of the partnership influences the performance of participating organizations and the economic performance of SMEs in particular. They find that collaborations that combine scientific knowledge with technological competence induce higher economic performance and speed up the innovation process. The combination of users and producers or particular scientific disciplines with specific industrial sectors, or the combination of different sectors, produces distinct impacts on the innovative performances of the participating actors. SMEs face particular barriers and constraints that mean that they do not perform as well as large companies. The extent of the benefits they derive depends on their organization, for instance whether they belong to a group, whether they are independent firms or start ups, etc.).

0.5 The Relevance of R&D Strategic Management in Policy Design

The three chapters in Part 4 underline the importance in designing policy of the R&D strategies of the various actors it is aimed at. Policy makers

must be aware of the behaviours and strategies within the economic system in deciding the objectives of their policy actions. Chapter 10 by Matt and Wolff underlines that the strategic importance assigned to a particular R&D activity will influence the kind of agreement that firms will enter into. Publicly financed cooperative R&D agreements are generally related to peripheral activities and the policy framework should include specific incentives, coordination modes and types of learning. Chapter 11 by Edler and Meyer-Krahmer analyzes the increasing internationalization of multinational companies' (MNC) R&D activities. It underlines the different reasons why firms internationalize their R&D, based on their corporate strategies, and raises some issues for European policies. In the final chapter, (Chapter 12), Mailhot and Schaeffer highlight the need for universities to implement strategic management of their three missions. The authors emphasize that the new challenge for policy should be to exploit the diversity of universities rather than imposing a single model.

In Chapter 10, Matt and Wolff theoretically analyze the organizational specificities of alliances sponsored by the European Commission and compare them with an ideal type of agreement entirely financed by partners. They use a tri-dimensional grid of analysis that explores the incentives to cooperate, the learning that occurs within an agreement, and how the coordination is arranged. The analysis is based on a review of the literature on strategic alliances and on empirical information gathered during interviews with participants in the Brite–Euram programme (cf. Chapter 9). The specificity of Brite–Euram projects is related to the existence of subsidies and with the requirement to reveal public information. These types of projects act as signalling strategies and allow new technological options in peripheral activities to be explored. Spontaneous agreements on the other hand, are entirely financed by the partners and their main objective is to develop strategic knowledge close to their key competences, and which is often kept secret. Publicly funded partnerships generate mainly unilateral learning and thus redeployable knowledge whereas spontaneous agreements are characterized by the creation of non-redeployable specific assets. In Brite–Euram, the presence of pre-defined rules and the existence of an arbitrator facilitate the coordination of partners and reduce opportunistic behaviour, but also impose certain rigidities in terms of learning. In spontaneous alliances the rules must be created: this generates some flexibility, but increases the risks of opportunism and the danger of premature endings. In terms of policy, knowledge complementarity should be the primary aim, with cost-sharing issues taking second place. The promotion of networks is an appropriate way to increase the coordination of complementarities, but should not become the main objective of firms. As these types of agreements differ in strategic terms, they should be seen as com-

plements and not potential substitutes. The State should not hesitate over subsidizing projects that firms would have implemented without public support in order to develop key competences, but should emphasize that the overriding objective is to sustain the exploration of new technological options.

Chapter 11 sets out to show that despite obvious trends towards internationalization in the R&D performed by MNC, national policy makers have not devised appropriate tools. Edler and Meyer-Krahmer underline the variety of contexts that apply in different countries and draw lessons for national and European policy makers. The growing internationalization in science and technology takes place in three dimensions: the international exploitation of nationally generated knowledge, international science and technology collaborations, and the generation of knowledge. A complex mix of motives and the role played by lead markets underlie this increasing phenomenon. In Europe, the pattern of internationalization is not uniform, but in terms of hosting international R&D the role of Europe is decreasing. The strategic motives of MNC to invest in R&D abroad include knowledge exploitation (the knowledge is generated at home, but exploited abroad to meet local market requirements); knowledge augmentation (the international arena is used to create new knowledge by employing scientists participating in international networks.); and other factors such as vertical cooperation, following competitors, research costs, public RTD policy, etc. Edler and Meyer-Krahmer highlight that policy makers have been slow to respond to the growing internationalisation of innovation. Five major initiatives can be identified: attraction of foreign scientists, attraction and integration of foreign industrial R&D, improvement of access to foreign knowledge and lead markets, targeted learning from practice abroad, and support for international networking. As a consequence of this in-depth study, Europe and its individual nation states should orient their policies to take account of the strategic motives of firms to locate their R&D abroad. European policies should identify possible lead markets (pharmaceuticals, communications, fuel cell technology, etc.) to attract foreign companies. Direct policy measures should not be discriminatory and should facilitate cooperation between foreign companies keen to exploit a lead market and partners or lead users. One of the greatest challenges will be to render countries scientifically or technologically attractive. This could be achieved by encouraging scientific excellence for instance, or by maintaining a wide scope of scientific and technological competences. Attracting the prime players to a market may attract followers; facilitating vertical cooperation may also be an attractor. In sum, European policies should aim at establishing the market and knowledge generation conditions that will

attract foreign companies and take account of their different strategic behaviours.

Chapter 12 (Mailhot and Schaeffer) highlights the convergence of scientific policies and the emergence of a unique university model: the entrepreneurial university. The authors show that this global model is disconnected from the real world in which different types of universities co-exist within one country, and in which the academic system differs between countries. They provide management and policy recommendations and argue that policies should exploit the existing diversity among universities. The first part of the chapter describes how the missions of universities have evolved in line with various socio-economic constraints on their research orientation. Since the 1990s, academic research has been determined by social and economic needs and is evaluated in terms of its contribution to national objectives. An entrepreneurial university model has emerged as a result of the pressure imposed by science and technology policies. Pressures to make money from in-house research are forcing universities to increase their interdisciplinarity, to establish new links with industry and to adopt active intellectual property rights (IPR) policies. To cope with these new challenges universities need to implement strategic management, i.e. to manage the conflicts induced by the contradictions that emerge among their different missions. Universities must develop strategies taking account of their own particular constraints, opportunities, competences, value system and declared objectives. It is thus impractical to impose the same set of objectives on all universities: realistic objectives will take account of a university's specific assets. In other words applying a unique model increases the gap between those universities that fit within the entrepreneurial model, and those that do not. Current policies are not aimed at exploiting the existing diversity of universities: the challenge for policy is to take advantage of this variety. If the aim is to foster knowledge diffusion, then different kinds of universities will fulfil different roles. The entrepreneurial university should be in the best position to develop innovations with companies, while training-oriented universities could play a more societal role. The presence of a university in a region may have an impact on the population in terms of financial inputs and taxes, and may foster urban and network (of students, academics and industry) developments. In designing policy, policy makers, should have a greater appreciation of how the presence of a university affects the economic environment, and also take into consideration the different strategies of universities.

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