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Project Group Science Policy Studies*

Production of Knowledge Revisited: The Impact of Academic Spin-Offs on Public Research Performance in Europe (PROKNOW)

Abbreviated description of the research project
funded by the European Commission

P 2006-102

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In the office of the WZB president
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Abstract

The EU-funded project *Production of Knowledge Revisited: The Impact of Academic Spin-Offs on Public Research Performance in Europe (PROKNOW)* aims at analysing the interactions between public research institutions and academic spin-offs focussing on the impact of entrepreneurial activities on the academic research system. Based upon approaches in organisational sociology, science policy studies and science studies and analysing the gains and losses of spin-off activities for public research institutions, PROKNOW examines the relevance of public and private forms of knowledge in innovative processes of knowledge production. Academic spin-offs often epitomise innovative forms of knowledge production and are thus an exemplary topic to study innovation processes in the interaction of science, economy and society. PROKNOW proposes a European-wide comparison of research institutions in seven countries, including the three biggest research systems, Germany, France and the UK, and the – often considered to be innovative – systems of the Netherlands, Switzerland and Finland, and the associated candidate country Bulgaria. Institutionally, PROKNOW analyses different forms of public sector research institutions, university and extra-university institutions. In terms of economic sectors, the project focuses on life sciences, information sciences and nanotechnology. Thus, PROKNOW can help provide the institutional and organisational conditions for a profitable interaction between public research institutions and academic spin-offs.

Zusammenfasssung

Das Eu-geförderte Projekt *Production of Knowledge Revisited: The Impact of Academic Spin-Offs on Public Research Performance in Europe (PROKNOW)* analysiert Interaktionen zwischen öffentlichen Forschungseinrichtungen und deren akademischen Ausgründungen („Spin-offs“) und hat dabei die Folgen der unternehmerischen Aktivitäten auf das akademische Forschungssystem im Fokus. Auf der Grundlage von Ansätzen aus der Organisationssoziologie und der neueren Wissenschaftsforschung fragt das Projekt nach Gewinnen und Verlusten von Spin-off-Aktivitäten für öffentliche Forschungseinrichtungen und leistet damit einen Beitrag zur Erforschung zum Verhältnis öffentlicher und privater Wissensformen in innovativen Prozessen der Wissensproduktion. Anhand von akademischen Ausgründungen lassen sich Innovationsprozesse als Interaktion von Wissenschaft, Wirtschaft und Gesellschaft in exemplarischer Weise untersuchen. PROKNOW wird einen europaweiten Vergleich der Forschungseinrichtungen in sieben Ländern unternehmen. Ausgewählt wurden die drei größten Forschungssysteme, Deutschland, Frankreich und Großbritannien sowie die vielfach als innovativ eingeschätzten Systeme der Niederlande, der Schweiz und Finnlands und des EU-Beitrittskandidaten Bulgarien, die jeweils für avancierte Ansätze stehen. Dabei wird PROKNOW verschiedene Formen von öffentlichen Forschungseinrichtungen, universitäre und außeruniversitäre Einrichtungen analysieren. Das Projekt wird sich auf die Bereiche Biowissenschaften, Informations- und Nanotechnologien konzentrieren. Damit kann PROKNOW dazu beitragen, die institutionellen und organisatorischen Rahmenbedingungen für eine fruchtbare Interaktion von öffentlichen Forschungseinrichtungen und akademischen Spin-offs zu optimieren.

Contents

1. Science policy objectives of the project

The production of scientific knowledge is a key economic resource of the modern knowledge-based European society. However, given the significance of this strategic resource, we still know comparably little about the functionalities and work practices of highly differentiated research systems. There are still relatively few empirical findings about the supposed interactions and interdependencies between different, public and private, actors in the innovation process. Also, the consequences of more interactive forms of innovation for public research systems and science policy regimes have not been adequately reflected.

The project PROKNOW[*] therefore aims at analysing the interactions between public research institutions and academic spin-offs in order to assess the impact of entrepreneurial activities on the academic research system. Analysing the gains and losses of spin-off activities for public research institutions, PROKNOW examines the relevance of public and private forms of knowledge in innovative processes of knowledge production. Recent research has pointed out that entrepreneurial or spin-off activities of public research institutions epitomise innovative forms of knowledge production and are thus an exemplary topic for the study of innovation processes in the interaction of science, economy and society. PROKNOW draws on these studies but takes a different approach. It not only focuses on the university or higher education sector, but examines the complete public research system, including the extra-university research sector (such as big science institutions or academies). Moreover, in contrast to research concerned with the founding and prospering conditions for spin-offs, this project shifts the focus back to public research institutions and studies the multiple impacts and consequences of entrepreneurial activities on public sector institutions. Finally, on a theoretical level, the project refers to approaches at the crossroads of science policy studies, science studies, and organisational studies, which differ from the economic approaches prevalent in the literature.

Science policy is still struggling with the problem of how to improve the transfer processes at the interface of science-industry relations. How can the production of socially

[*] PROKNOW is co-ordinated by Dagmar Simon and Andreas Knie (WZB), "*Project Group Science Policy Studies*". Within the *WZB*, the Project Group is part of the office of the WZB president. Partners in the project are *OFCE-DRIC* (Observatoire Français des Conjonctures Economiques); *SPRU* (Science and Technology Policy Research), University of Sussex, United Kingdom; *VTT* Technical Research Centre of Finland; The Center for Higher Education Policy Studies (*UT/CHEPS*) of the University of Twente, the Netherlands; The Institute of Sociology at the Bulgarian Academy of Sciences *IS-BAS;* The Centre for Innovation Research in the Utility Sector (CIRUS) within the Swiss Federal Institute for Environmental Science and Technology, *EAWAG.*

and economically relevant knowledge in academic research institutions be accelerated, and the quality of knowledge production improved, without restricting the relatively autonomous governance structures of the public research system? Commercial spin-off-activities by university and extra-university research institutions are highly interesting phenomena because, in these cases, public research institutions leave their own reference system in order to submit the results of their endeavours to the commercial logic of profitability. Current research on academic spin-offs has usually focused on their relevance for the labour market and on their founding conditions. During the years of the new economy boom, entrepreneurial activities have reached a peak, thus raising expectations that were often disappointed after 2001, both in terms of the number of formation of companies and of workplaces generated. Analogous to conventional start-ups, the number of newly founded spin-offs has declined throughout Europe since 2001. Thus, the economic potential of spin-offs has recently been reassessed and deemed more moderate.

PROKNOW principally focuses on the effects and repercussions of academic spin-offs on public research institutions (higher education and extra-university institutions acting as parent organisations). The actual effects of spin-offs on the orientation, positioning, and capacities of public research institutions are hardly known. Some scattered evidence is offered in the growing system of research assessments, as in evaluations, rankings or ratings that include spin-offs as part of their indicators. However, this information remains incoherent and far from a systematic assessment of the role of spin-offs for the processes of quality assurance and control.

The topic of PROKNOW is also relevant on a general science policy level. Academic spin-offs offer an empirical phenomenon to study the interfaces and crossovers between the public and private research sectors. In this boundary context, scientific and economic orientations and reference systems are linked together in an experimental form and for a limited time horizon. The interactions between public and private organisations offer concrete insights into the otherwise mostly anonymous processes of diffusion and validation of scientific knowledge. By founding spin-offs, the parenting research institutions voluntarily launch a self-organised, non-scientific process of validation. Thus, the examination of spin-offs and their interactions with public research institutions from a sociological and science studies perspective opens a new “window” to examine the changing research and validation practices.

2. Research questions and hypotheses

The foremost goal of the project is to examine the positive and negative effects of entrepreneurial activities on the parenting institutions. Regarding the positive effects, the project analyses the extent to which spin-offs contribute to enlarging the capacities and sharpening the profile of public institutions, thereby increasing their competitiveness on the academic market. We hypothesise that the extension of the "value chain of knowledge" towards concrete opportunities of application can enable valuable feedback processes for the academic system of knowledge production. By reflecting, the product quality of research results, the scope of a scientific project can be enlarged. The pure existence of spin-offs as new distribution channels might feed back on the conception of research questions and project designs. Thus, the self-referential discursive loops and the conventionality codes of scientific research practices can be amplified, if not broken through, by the interaction with entrepreneurial organisations, without the need for external intervention and restriction of the autonomy of academic institutions.

As to the negative effects, the main question is to what extent spin-offs harm public institutions by privatising research and thus extracting competences and capacities from universities and extra-university research institutions? We hypothesise that intense interaction with private partners can lead to risks for academic institutions. Changing the reference system can negatively affect everyday research practices. A quick entrepreneurial success of spin-offs, for example, bears the danger of a "pull effect" and of a loss of scientific competences from the public to the private side if there is no strong "knowledge retention". Researchers can be attracted by entrepreneurial opportunities – not least the earning opportunities – with the result that they subordinate their activities to short-sighted economic commercialisation logic. Also, in a gender perspective, spin-off-activities can raise problems. As entrepreneurial activities are often based upon informal male networks, an institutional focus on spin-off-activities can reinforce existing gender hierarchies and obstruct the career perspectives of women in research institutions.

3. Operational goal: Development of a typology

The analysis of positive and negative effects enables us to reassess the spin-off activities in science policy discourse between the two radical interpretations: a profit or a threat to the academic system. In particular, the analysis will be carried out in four steps.

First, the partners will identify successful fields of academic spin-offs (according to national-specific circumstances) and the corresponding public research institutions (interacting with successful spin-offs). Second, the interactions between spin-offs and public research institutions (as chosen in the first step) will be identified and assessed. Third, the general performance quality of the public research institutions (as identified in the first step) will be analysed. And, finally, the spin-off-interactions of public research institutions will be compared with their general performance, analysing and appraising the relevance of spin-off-activities and interactions for the performance of public research institutions (repercussions as profit or loss for performance of institution).
This four-step analysis aims at PROKNOW's central question: What impact does the continuing relation between parenting organisations and spin-offs have on the research quality in the public sector institution? The results of this analysis should be integrated into a typology of more or less successful parent organisations. The typology will be based on the patterns of interaction and the particular benefits and losses for parenting organisations gained by these interactions. The typology of parenting organisations is not a national typology per se. It is based upon characteristics of the interaction between the two actors that are not necessarily country-specific. However, the analysis should test to what extent such circumstances still indirectly determine the quality of the interaction. This test is carried out in two steps. First, a national comparison will reveal to what extent nation-specific science policy arrangements have an impact on shaping the relations between spin-offs and parent organisations. Second, a comparison of factors across national contexts (or factors overlapping several national cases), such as organisational cultures or scientific disciplines, will be used as an alternate hypothesis to test the limits of the assumption the country-specific institutions would have on the interactions between research institutions and spin-offs. The development of this typology will be the subject of an international workshop. Based on the systematic analyses of the gains and losses for public research institutions, the project also aims to develop a system of indicators to assess and measure the influence of spin-off-

cooperation on public research institutions. Finally, the project's results will include a consideration of the consequences for science policy actors. These considerations will be summed up in science policy recommendations on the national as well as the EU level.

4. National case studies on patterns of interaction

The aims of PROKNOW will be achieved by carrying out case studies on parent institutions of spin-offs in seven European countries. These studies will describe the internal structure and practice as well as parts of the environment of the organisations. In terms of research sectors, the project will concentrate the analysis on life sciences, information sciences and nanotechnology. Each case of the project follows the same structure. The cases consist of the parent institutions and the cluster of successful spin-off firms founded by the parent institutions.

The number of parent institutions to be analysed in each participating country of PROKNOW differs according to the size of the organisations. In general, the standard number should be between three and five cases. If possible, the national samples should include universities and extra-university institutions in order to compare different forms of public sector research organisations.

Each case study focuses both on the performance of the parent institutions and the patterns of interaction with their fostered spin-off firms. Based on this analysis of the interaction, the relevance of the quality of interactions for the performance of public science institutions will be assessed. These analyses aim at identifying different patterns of interaction between parent institutions and their spin-offs and at building up typologies of more or less successful practices.

5. Definition of National Innovation Systems

The National Innovation Systems (NIS) approach represents an analytical framework for technology- and information-based innovation processes stressing the contribution of people, enterprises and institutions. In a post-Schumpeter sense, the NIS approach understands innovation as a complex set of relationships, interactions and knowledge

transfers between actors in a system. In the analytical framework of PROKNOW, the flow of information and knowledge (also via personnel mobility) between enterprises, universities and public research institutes is particularly crucial for the understanding of NIS. Based upon a review of the relevant NIS research, the following paragraphs outline the basic characteristics of the national innovation systems of the seven countries examined in the PROKNOW project.

Germany

In Germany, the public research system is divided into two sectors, both similar in size: the university and the extra-university sector. The predominant part of the university sector is decentralised and under the authority of the *Bundesländer*. The extra-university sector consists of a heterogeneous setting of basic and applied research institutions, including the *Max-Planck-Gesellschaft*, the *Fraunhofer-Gesellschaft*, the *Helmholtz-Gemeinschaft Deutscher Forschungszentren* and the *Leibniz-Gemeinschaft*. Under these institutional conditions, regional differences (most importantly the difference between the “Alte Bundesländer” in West Germany and the “Neue Bundesländer” in East Germany, but also the division between north and south Germany) as well as the institutional pillar of the public research sector is traditionally strong in the German NIS. In the private sector, the innovation system is dominated by the strong export-oriented industrial sector and its high and advanced technological research activities (often delegated to SME's). The private sector innovation system is highly intensive (for example with an internationally high rate of patents) and focuses on the life science sector, the automobile industry and information and communication technologies.

France

The public sector part of the French NIS is marked by an institutional divide between a university and a non-university research system, similar to the research system in Germany. Essentially, the latter includes the centralised CNRS, research units from the Grandes Écoles and thematic-oriented research institutions (such as CEA, INRA, INRIA, INSERM etc.). The differences in the regulation of these public research institutions are reflected in a variety of science-industry relations and a comparable variety of types of academic spin-offs. Moreover, due to historical reasons, academic spin-offs cannot count on an established entrepreneurial culture at public institutions. For a long time, France was characterised by a philosophy of encouraging national industrial champions (the ‘Grandes Programmes’ philosophy) underlined by the overlapping in-

volvement of French engineers both in the government administration and the management of large corporations. As such, entrepreneurship in the traditional form (academic as well as non-academic) is rather weak in France, and the research system as a whole is quite disconnected from industry. This inheritance has produced a crucial divide between the world of science and the world of industry – a divide still existing, despite renewed policy efforts to bridge the rift. A series of public measures are emerging with the aim of encouraging the mobility of individuals (academics) from public research institutions towards industry, including a sustainable effort to support the development of science-parks in the vicinity of most French universities.

United Kingdom

In the U.K., the public research sector is mainly dominated by the universities. Universities and associated bodies receive around 45 per cent of the Government's budget for science, engineering and technology (2003/04), whereas defence and defence related R&D receives 30 per cent (still an internationally high figure) and contract research in government departments receives 25 per cent. Government policy on research is centralised in the Office of Science and Technology, which is part of the Department of Trade and Industry and cooperates with the Research Councils for allocating funding. Thus, the U.K. has a long tradition in promoting entrepreneurial activities at universities; reaching back to the change in laws on intellectual property rights in 1985, enabling universities to commercialise their intellectual properties. The Labour government in particular has tried to promote an "*entrepreneurial culture*" at universities and research institutions; thus a comparably large part of policy instruments have been on an educational level. Initiatives to promote the interactions between science and industry and the founding of academic spin-offs are therefore numerous.

Finland

The public research sector in Finland follows the dual model. Universities are responsible for higher education and basic research whereas various state-owned research institutes carry out applied research. The latter includes such institutes as the VTT Technical Research Centre of Finland, Agrifood Research Finland and the Geological Survey of Finland. Since the mid 1990s, universities and public research organisations have been increasingly seen as an essential catalyst of economic development and competitiveness-based knowledge and innovation. The two most important ministries are the Ministry of Education and the Ministry of Trade and Industry. In this context,

universities and other public research organisations are being urged to redefine their goals and missions. Furthermore, a number of public funding and incubator schemes have been launched and the new services for commercialising academic research and generating academic spin-offs are being strengthened. Industrial R&D is dominated by the traditionally important forest industry (with clusters of chemical industries) and by the growing sector of high tech industries (mainly information and communication technology). The VTT acts as a bridging institution between research activities in the industrial and the university sector.

Netherlands

The Netherlands have a long tradition in entrepreneurial activities within the public research system. *The Technology Foundation* (STW) for example was founded in 1981 with a two-fold mission: to finance and stimulate high-quality scientific research, and to promote the utilisation of research results. Among the various programmes implemented by STW to fulfil these goals, the *Open Technology Programme* (OTP) is the most important as an instrument stimulating technology transfer via patent applications and spin-offs. In the 1990s, the Interdepartementale Commissie Economische Structuurversterking (ICES) initiated various investment impulses in the knowledge infrastructure known as KIS-1 and 2, and the more recent BSIK-programme. The BSIK programme has several objectives, the most important being to stimulate fundamentally strategic and industrial research, and to initiate long-term research collaborations and networks between public and private research organisations. Other important programmes and initiatives include the Innovation Subsidy (IS) for collaboration projects, the Innovation Oriented Research Programmes (IOPs), and the Leading Technological Institutes (TTIs), established in 1997, which form largely virtual hubs between public research institutes, universities and the business sector. Programmes that concern stimulating entrepreneurship among scientists more specifically include a number of TechnoStarter and TechnoPartner initiatives as well as another interesting Dutch policy initiative, the Valorisation Grant, based on the US Small Business Innovation Research programme.

Switzerland

The Swiss Science and Technology system is marked by its high productivity. Switzerland is regularly among the world's top five or top three countries with regard to scientific publications, citations and patents per capita. Its *Federal Technical University* (ETH) ranks among the world's 20 most productive universities and is one of Europe's leading research institutes. However, the past 15 years of economic history have been marked by a virtual stagnation. The traditionally strong link between the technical universities and Swiss industry has been weakened over the years. This has been interpreted as a sign for the need to improve knowledge transfer between universities and industry.

As a consequence, a broad range of activities has been set up in order to foster collaborative research in general and for promoting academic spin offs in particular. In the latter realm about 37 centres for technology transfer are currently operating in universities, in the ETH domain and at the universities of applied sciences (Fachhochschulen). Furthermore, student courses on entrepreneurship, business plan development or fundraising have been strongly reinforced over the past few years. In 2003 an association of 25 transfer institutions was founded under the name of the *Swiss Technology Transfer Association* (swiTT). Furthermore, considerable energy and resources have been invested to set up collaborative research projects between academia and industry through the *Commission on Technology and Innovation* (KTI).

Bulgaria

With the collapse of the communist regime in the 1990s and its centralised system of scientific and technological research, the Bulgarian research potential was preserved in the institutes of the Bulgarian Academy of Sciences and the universities, which in the early 1990s established themselves as autonomous institutions. However, they endured hard times because of lowered government funding, lack of industrial demand and ageing staff. With the dismantling of the DSO, the socialist industrial corporation for research and development, the previous science-industry relationships were nearly completely destroyed. During the 1990s, the integration of Bulgarian research institutions within European scientific and R&D networks was often the only way that these institutions could retain their human resources and research infrastructure. However, this was also a period of massive 'unwitting' creation of spin-offs, since a number of talented researchers established their own private high-tech ventures, some of them willing to maintaining contacts with their parent research institutions. Recent years

were marked by several national policy initiatives, inspired by the EU Lisbon strategy, aiming at improving the country's science and research base and promoting the collaboration with newly emerging innovative businesses. It was finally recognised that the country's innovative potential has been reduced significantly. The decline in relationships between universities and public research laboratories is considered an important setback, inherited from the transition period. A new law for scientific research was passed by the Parliament in late 2003, which established the National Fund for Scientific Research making special provisions for improving the relationship between science and industry.

The Bulgarian research system is structured along four axes: universities against research institutes of the Academy of Sciences and the industrial applied research institutes, classical university against applied higher education institutions, public vs. private universities (private universities emerged in the 1990s), and regional research system in the capital, Sofia vs. other regional centres of research institutions - tension between the capital and other regions is a heritage from the over-centralised socialist society.

6. Relevance of the topic

The central question of PROKNOW focuses on the repercussions of academic spin-offs on the capacities of public research institutions. With this focus, we aim to enhance the understanding of the cooperation between public and private institutions related to knowledge production and commercialisation.

Spin-offs can be seen as an example for the increasing relevance of scientific knowledge for the current development of European societies. The expectation is that spin-offs will increase the utilisation of publicly produced knowledge and thus improve the innovation capacities of the European economy. Spin-offs serve as an important link for the interaction between institutions of public law and commercial organisations in the process of knowledge production and transfer. At the same time, they are seen as a model organisation in which new forms of knowledge production (as indicated in the concept of a mode-2 knowledge production or the triple helix innovation model) are being practiced. Analysing the interactions between spin-offs and their parent institutions, including their repercussions on the performance of public research institutions,

thus implies an important contribution to a differentiated understanding of a knowledge-based society. From the perspective of the sociology of knowledge, spin-offs indicate an amplification within the reference frame of science. The capacities of research institutions are not only evaluated by self-regulated mechanisms within the scientific system, but – mediated through the economic success of entrepreneurial ventures – also by the usability and commercial potential of research results within the economic system.

PROKNOW addresses, for example, the question of how public and private knowledge production forms interact. In particular, this rarely posed question will be raised in a way that an increased commercial orientation of public research institutions feeds back on the development of its research capacities. What consequences do extensive spin-off activities have on the performance of the parent institutions? What do these activities mean for the self-image of scientists in public research institutions? What is the reference system, with which they interpret their own work? Are entrepreneurial research institutions better in overcoming the linear model of knowledge production and generating new forms of integrating basic and applied research? Or do spin-off-activities confirm the linear form of knowledge production, distributing the basic research tasks to public research institutions and the applied tasks to spin-offs? In other words: Do extensive spin-off-activities bear the risk of an increased division of labour between public institutions and private organisations? Does the enlarged reference frame of public research institutions lead to a snail-shell-effect by implying a restricted understanding of research in public institutions?

The focus of the analysis lies on the meaning of the respective formal and informal arrangements with which the interactions between spin-offs and parent institutions is structured. These arrangements consist of formal and informal communication practices as well as cultural aspects (organisational Leitbilder, norms and values such as sincerity and trust). With this approach, our project concentrates upon one of three of the core concerns of the Priority 7 work programme. The first point to be addressed is the question of how institutional and organisational conditions for the production of knowledge relate to each other and what characteristics this knowledge has. We assume that different institutional arrangements produce different forms of knowledge and that this can lead to respective differences in the capacities of research organisations. The analysis aims at assessing the forms of interaction between spin-offs and

their parent institutions, in particular with respect to the positive and negative effects for the parent institutions. The results of this analysis will lead to practical recommendations for the management of scientific organisations. Thus, the project offers research institutions better opportunities to increase their potential for reflexive self-perception.

Secondly, PROKNOW contributes to an extended understanding of the prospects and risks of collaborations between publicly and privately organised research activities. Spin-offs also represent a form of privatisation of public knowledge. By examining the positive and negative feedback of spin-offs on public research institutions, PROKNOW also critically tests the limits of the productive input of public institutions in entrepreneurial activities. The project thus explores the boundaries that a public research institution should not exceed if it wants to remain an institution for the benefit of the public.

The third point PROKNOW refers to is the question of the relevance of different knowledge types for the innovation capacities of institutions. A public institution engaging in spin-off activities does not only initiate a transfer of codified knowledge as in the licensing of patent rights. Another important component of spin-off activities is the transfer of personal and often tacit knowledge, because spin-offs often include the transfer of individual scientists from public institutions to private enterprises. Therefore, the analysis of the interactions between spin-offs and parent institutions also offers insights into the characteristics and the social and economic relevance of tacit knowledge. At the same time, the project offers the chance to identify forms of interaction between public and private partners that allow for a further utilisation of tacit knowledge forms within the parenting institution.

7. Potential Impact

The present project also contributes to a sound scientific basis for evaluating spin-off activities at the level of research institutions. It therefore joins the recent efforts in standardising the evaluation of research and education activity at the European level. Based upon the proposed multi-national analysis, the project will define the above mentioned set of “good practices” for spin-off activities of public research institutions. In a second step, this set of good practices will be formalised into a framework that can be used for the further development and refinement of indicators of science-industry relations.

PROKNOW presents an innovative view of processes of knowledge production at the interface of public research institutions and private enterprises, thus enhancing the theoretical understanding as well as the policies of evaluation and support for these forms of knowledge production. The strategic impact of the project is based upon the perception that in most European states the prevailing policies to support academic spin-offs, a crucial mediator between public and private institutions of knowledge production, have narrowly focused on economic goals (technology transfer and job creation) and that recent research has shown the limited success of this approach. Other benefits of spin-off activities, for example, those located within the public research system, have hardly been examined and will be the main research focus of this project. Furthermore, the project aims at an in depth examination of spin-off policies, not only focusing on potential benefits, but also considering potential threats for parenting institutions.

In general, the strategic benefit of PROKNOW consists of a comprehensive understanding of the effects of spin-off activities on national innovation systems. In particular, we will propose a “second generation” of policies for evaluating and promoting spin-off activities, more responsive to wider framework of science and innovation policy goals. Against this background, we expect impacts at the level of research institutions, national science policy and in structuring the emergent European Research Area (ERA).

PROKNOW’s results will help public research institutions to better understand the role and importance as well as the risks of spin-off processes for their own core competencies. These insights will transcend the comparably narrow, market-oriented policies for spin-off promotion currently prevalent through the analysis of the profits and risks of entrepreneurial activities for the parenting institutions. Thus, the project will specify the instruments for an integrated management of the interface of public research institutions and private knowledge producers: contract research, patenting, co-operations with industry, shared labour markets, job rotations, continued education and so on. The results of the project will enable public research institutions to better decide to what extent spin-offs are relevant to them as a long-term source of funding; for networking with actors outside academia; for the development of new job opportunities for their own staff, or as mere marketing and communication instruments. The project aims to elaborate the different functionalities of spin-offs for their parenting institutions and to

relate these functions to the institutes' structural characteristics. Based on these results, more comprehensive management guidelines for research institutions will be elaborated within this project.

On the level of national science policies, PROKNOW will broaden knowledge about adequate instruments to evaluate and promote academic spin-offs. Spin-offs are not always a very effective means for directly strengthening the innovativeness and competitiveness of a national economy; neither will labour market effects be very important. However, indirect effects (such as impacts on public research institutions studied in PROKNOW) might be considerable and have been overlooked in recent research. In order to develop tailor-made approaches, the project will suggest a number of concrete policy measures geared towards specific forms of spin-offs.

Also, the ERA should profit from the results of PROKNOW. There is a considerable added value by carrying out this project on the EU level. Current research suggests a high diversity of spin-off activities at the level of the member states. By setting up a comparative framework, the relevance of different institutional settings may be compared and different development paths for institutionalising knowledge and technology transfer identified. Based upon this comparison, the project will define a set of "good practices" for spin-off activities reflecting the needs of public research institutions (the set of "good practices" is part of the above-mentioned management guidelines for research institutions). This set of good practices will be valid for the whole ERA, including research systems beyond the nations examined in the case studies of this project. By analysing different national styles of spin-off support, the project will facilitate knowledge transfer processes among the EU member states. Also on the European level, the project will help to determine whether the different national styles of spin-off activities are converging, and to what extent they are creating a "European" type of spin-off activities, which differ from the American model for entrepreneurial universities.

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