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**Are Academic Spin-offs Really Doing Science?**

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## ABSTRACT

Organisations make an indispensable contribution to reproducing functional systems. Can this also be said of organisations with multiple systemic ties? In considering this issue, this paper looks at the example of academic spin-offs. On the basis of qualitative interviews with people involved in founding spin-offs from non-university research institutes in Germany, the authors investigate the extent to which such firms help reproduce the structural characteristics of science. The theoretical yield of this study is the linkage of systems-theoretical and practice-theoretical perspectives.

## ZUSAMMENFASSUNG

Organisationen leisten unverzichtbare Beiträge zur Reproduktion von Funktionssystemen, aber trifft das auch für mehrfach systemisch gebundene Organisationen zu? Der vorliegende Beitrag untersucht diese Frage am Beispiel akademischer Ausgründungen. Auf der Grundlage von qualitativen Interviews mit Personen, die an Firmengründungen aus außeruniversitären Forschungseinrichtungen in Deutschland beteiligt waren, wird gezeigt, inwiefern diese Firmen dazu beitragen, Strukturmerkmale des Wissenschaftssystems zu reproduzieren. Der theoretische Ertrag dieser Analyse besteht in einer Verknüpfung von systemtheoretischen und praxistheoretischen Perspektiven.



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## 1. Introduction

What impact do the advent of new organisations and the transformation of established organisations have on knowledge production? Do the new organisations “permeate” the field of knowledge production? Is knowledge production currently being “corporatised”? How do the growing number of private organisations and new modes of cooperation between private and public research organisations affect the ways in which scientific knowledge is produced (Slaughter/Leslie 1997, Thackray 1998, Gläser 2003)? Do the emergence of new knowledge-producing organisations and the transformation of existing ones encourage dedifferentiation between science and industry (Gibbons et al. 1994, Weingart 2001)? We approach these questions from a somewhat unusual angle. Instead of taking organisations tied to functional systems as the norm, our point of departure is the “intersystemic organisation” (Bode/Brose 2001), i.e., we make no prior decision about the number and intensity of ties between organisations and functional systems. By “intersystemic” we mean organisations “tied” or “bound” to several functional systems. Empirical investigation must decide whether a type of organisation qualifies as “intersystemic” or not. We consider such (multiple) ties as proven where it can be shown that organisational practices are governed by the codes of several functional systems.

Object of the study are academic spin-offs.<sup>1</sup> We take it as given that spin-offs are business enterprises and that they are tied to the economic system. To what extent are academic spin-offs also tied to the system of science? Drawing on current definitions, we describe academic spin-offs as firms founded in direct connection with a transfer of knowledge or technology from public research facilities or universities. This direct relationship is established through patents or persons who transfer to the spin-off.<sup>2</sup> The term itself suggests such academic spin-offs are tied to two functional systems, the economic system and the system of science. The political perspective on this type of organisation hesitates between two different views. From an innovation policy standpoint, it runs counter to the purpose and justification of promoting spin-offs if the new firms are solely tied to the economic system or the system of science. While the coupling of the economy and science

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<sup>1</sup> This paper is based on research projects on academic spin-offs sponsored by the German Federal Ministry for Education and Research (BMBF) and the EU Commission and carried out by the Social Science Research Center Berlin (WZB). Many colleagues took part in the interviews which constitute the corpus of material for these studies as documented in the appendix. On behalf of all staff mentioned by name there, we would like to thank all the interviewees whose names are not mentioned. The second basis for this paper is a similarly designed study on environmental consulting firms in Switzerland (Guggenheim 2005, 2007), which was itself based on ethnographic observations and qualitative interviews.

<sup>2</sup> For similar definitions and quantifying accounts of spin-off activities in the German and European contexts, see Egelin et al. (2003) and Callan (2001). Although quantitative research on spin-offs is quite well developed, the concept of spin-off is still extremely vague. Philippe Mustar has pointed out that since the 1970s, the MIT has produced (depending on definition) 6, 25, or 150 spin-offs per year (Mustar 2003: 522). We will be returning at a later point to this definitional problem, which naturally also affects the sample of spin-offs on which this paper draws (section 5).

is chronically deficient from this perspective, there is reason to hope that the “spin-off” phenomenon can mediate between the two systems, overcoming institutionally consolidated barriers to innovation (Knie/Lengwiler 2008). Ossification is a reproach directed chiefly at institutions in the public research sector. Science, it is claimed, tends to reproduce highly dynamic but closed communication contexts (Wissenschaftsrat 2003, 2007). In view of this criticism, it would be extremely useful in setting up firms if competence and technology could be directly transferred from science to industry via personnel and organisations. However, too little systematic attention has been paid to one implication of this exploitation strategy: What does it mean if a type of organisation with ambivalent ties is established and promoted?

That the question of simple or multiple ties can be clearly answered for the vast majority of parties involved is difficult to reconcile with this innovation policy perspective. Spinning off is understood as an irreversible act of boundary crossing. The ties of research establishments with the system of science are as infrequently called in question as the status of spin-offs by definition as economic organisations. This second perspective is thus premised on a differentiation policy of addressing spin-offs only from the point of view of the commercialisation of public research. On the basis of this premise, there can be no repercussions for the system of science unless the spinning off process develops into a sort of clearance sale: “What will happen to the university once research and teaching are spun off as separate privatized self-contained endeavours?” (Mirowski/Sent 2002: 58). If the entry of private firms into the field of knowledge production is regarded solely from the standpoint of risk, the logical conclusion is that, where possible, spinning off processes are to be handled in a way that has no repercussions on the system of science. From a differentiation policy perspective, there can be no doubt that spin-offs are business enterprises and that these firms have to hold their own in a market environment.

Theoretical clarification of these opposing policy frames is needed but has yet to be attempted. The times are favourable, for a number of recent studies have discovered the problem of ties between organisations and functional systems. While sociology long took an interest only in organisations that could be assigned to functional systems tacitly and exclusively (e.g. schools, courts, churches), more recent investigations have turned to organisations where such assignment is no longer quite so easy. This list includes the post administration, health insurance schemes (Bode/Brose 2001), hospitals (Schmidt 2005a), or environmental service providers (Guggenheim 2005). The question also arises whether and how organisations are bound to functional systems.<sup>3</sup> These links are taken up in the following section (2) before we return to the question of knowledge production (3).

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<sup>3</sup> Cf. Tacke (2001), Schimank (2001), Nassehi (2002). The latest edition of this discussion shows that formulation of the problem is still causing difficulty and is highly controversial. See the reviews by Göbel (2005), Kieserling (2005) and Schwinn (2005) of the paper by Schmidt (2005a) and Schmidt's reply (2005b).

## 2. Problematic Ties between Organisations and Functional Systems

Bode and Brose (2001) have introduced the concept of “intersystemic organisation” to provide an alternative to two unsatisfactory readings of “the advent of organisational society.” The first assumption is that of convergence, with organisations taking over the world not only because they are multiplying and growing in size but also because they are the expression of a renewed and world-embracing process of rationalisation (Meyer/Rowan 1977, Meyer 2005). Supporters of this thesis tend to ignore the question of ties between organisations and functional systems. Diametrically opposed to this diagnosis is the postulate of an organisational society exhibiting not convergence but growing diversity. Organisations in an organisational society are seen as diverging because they now operate only in their own closed worlds by means of specialised codes. This second interpretation more or less tacitly assumes that each organisation is tied to one functional system. Using the concept of the “intersystemic organisation,” Bode and Brose thus tackle a blind spot in the two prevailing readings. They develop the notion of a “multi-referential” type of organisation that mediates between functional systems. We share this view, albeit with the reservation that this mediating role need not be “highly institutionalised” (Bode/Brose 2001: 123, cf. Bode 2003).<sup>4</sup>

The concept of the intersystemic organisation thus allows to reframe the debate on the “advent of the organisational society,” offering an alternative to the positions outlined above, denying primacy to both organisation and functional systems. Organisations either foster global cultural harmonisation or growing diversity because they develop in obedience to the logics of social subsystems, exacerbating their incommensurability. The concept of intersystemic organisation offers a modest counter-concept to these far-reaching interpretations: the two variants declare organisations to be the “vehicles” of an overarching development towards either homogeneity or differentiation. They presuppose that organisations are themselves internally homogeneous. Intersystemic organisations, in contrast, are internally divided and “carry” multi-referential practice.

The concept of intersystemic organisation uses the terminology of systems theory but is not directly compatible with it. Since the “autopoietic turn,” systems theory has operated with a concept of system defined in terms of communication theory. Functional systems are communication systems, and therefore “ties” with organisations are very difficult to define. Instead of having a series of empirical studies on relations between organisations and functional systems to draw on, nothing remains but a sort of standard statement:

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<sup>4</sup>On the contrary, to use a key concept in organisational ecology-oriented entrepreneurship research, it can also suffer from a “liability of newness” (Stinchcombe 1965, Aldrich 2000). We suggest that this justification pressure should also be attributed to the intersystemic position of new organisations. Rao notes that new forms of organisation come into being at the “interfaces of multiple organisational fields” (2002: 335). His study comes very close to the dovetailing of organisational-ecology and systems-theoretical perspectives envisioned in this paper.



organisations are a suitable form of coupling between functional systems. Hence, unlike older versions of systems theory, which tended to see functional systems as containers in which organisations could be fitted, more recent systems theory does indeed foster a concept of multi-referentiality. While the concept of “coupling” which presupposes multi-referential organisations has remained rather fuzzy, the notion that organisations and functional systems are rigidly and unambiguously coupled has somehow survived the autopoietic turn (Schmidt 2005a). As a consequence of this survival, what is “in” the organisation is also held to be “within” the related functional system.<sup>5</sup> While organisations have undoubtedly been important “vehicles” of functional differentiation, there is no reason to take this case as a general rule. Functional differentiation should not be depicted as a co-evolutionary process that proceeded in step at the level of both the organisation and the functional system.<sup>6</sup> Proponents of more recent systems theory would agree with that view, but we claim that too little has been done to clarify, at the level of empirical analysis, what it means to leave more variability to the relationship between functional systems and organisations and the way they co-evolve.

Speaking of variability, there would be no need to turn to the notion of “intersystemic organisations” if it referred to organisations with no ties to any functional systems. This is why the concept of “intermediary organisation” – much more widely used, and not only in systems-theoretical studies – does not serve our purpose. Guided by the concept of “intermediary organisations” numerous studies have investigated the conditions under which organisations become and remain unencumbered. Reference to institutions for knowledge and technology transfer attached to universities, research institutes or their umbrella organisations will suffice for illustrative purposes (Guston 1999, Krücken 2003). But these studies show that, as soon as it comes down to concrete facts, as soon as mediation activities are described, the status of organisations plays at best a secondary role. The focus is on artefacts, classification systems and creole languages that function as “boundary objects.” The structure of structural coupling thus lies outside the organisation. It is not clear what is specific to an intermediary organisation as opposed to intermediary structures that manage without organisation. The difference between intermediary and intersystemic organisations is thus that the first concept relieves organisations from

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<sup>5</sup> And in fact, Schmidt supplies many instances of such “relapses” (Schmidt 2005a). They remain illustrative. We add only one further example to the list of those illustrating how organisations and functional systems are brought into line: “Fully inclusive forms of participation in the industrial societies of the organised modern age make use of the specific, differentiated modes of inclusion that are utilised *in* organisations and procedures *within* functional systems” (Bora 1999: 70; our highlighting).

<sup>6</sup> This was fundamentally called into question by “Organisation und gesellschaftliche Differenzierung” ed. by Veronika Tacke (2001). Since then, “the view has prevailed that functional and organisational systems are ‘loosely coupled’...” (Heinze 2006: 61). It is confusing to find the term “coupling” being applied both between systems and organisations and between systems. In the latter case, “structural coupling” is enabled “via” organisations (Lieckweg 2001). This ambiguity shows that the two uses of the term require greater attention and need to be defined more precisely in the context of empirical studies.

systemic relations whereas studies on intersystemic organisations demonstrate that in this regard organisations are doubly or multiply committed. Any interest in the development of independent communication media, in contrast, is relegated to the background. Turning again to a specific example: deciding in favour of the concept of intersystemic organisation requires proof that academic spin-offs are not uncoupled from functional systems but, on the contrary, doubly bound. It cannot be denied that spin-offs have to hold their own in the market. We now turn to the development of a procedure for ascertaining the extent to which spin-offs are also tied to the system of science, and thus the extent to which they handle market imperatives in a manner specific to science. As we will show, academic spin-offs provide for an intriguing case to explore the nature of these ties. On the other hand, we expect the concept of intersystemic organisations to grasp permanently precarious ways of organising academic spin-offs are involved in.

The next section takes an intermediary step towards that argument. Scaling down the focus to the field of science studies, it gives more detail to our claim. Why is it time to address the issue of intersystemic organisations with regard to this area of research?

### **3. New Production of Knowledge, New Forms of Organisation?**

Two positions currently hold sway in science studies, either admitting only simple ties between organisations and functional systems or questioning the effectiveness of functional systems at the level of organisational practices. This has led to an ultimately unproductive confrontation and hindered empirically meaningful studies on new modes of producing knowledge. Discussion too soon finds itself on the beaten track: either these modes of production confirm differentiation theoretical assumptions, or they question these boundaries. In the first case, this implies that organisations continue to be unambiguously bound to functional systems. In the second case, the assumption in the tradition of laboratory studies is that practice straddles functional system boundaries. In seeking to prove this, however, even the practice-theoretical line of research cannot avoid a preliminary decision about ties between organisation types and functional systems (Guggenheim 2005: 29ff.). In what follows, we employ the concept of “intersystemic organisation” (Bode/Brose 2001) to obviate any such preliminary decision. We show that the concept allows the problem to be formulated with much greater precision – and its operationalisation beyond the case of academic spin-offs.

Attention has been drawn to new forms of knowledge production by, among other things, the realisation that universities and research institutes have been joined by other forms of organisations. The outcome, however, hardly goes beyond uncommented lists of organisations that have entered the scene as producers of knowledge, possibly challenging the status of universities and research institutes as monopolists in knowledge production.

“The number and diversity of institutions devoted to knowledge production and dissemination has increased since 1945. In addition to universities and scientific and professional societies which have themselves multiplied, government research establishments have proliferated, corporate R&D laboratories have become a pre-condition for successful innovation and competition, think-tanks and all sorts of consulting firms and intermediary organisations, such as non-government organisations (NGOs) in the environmental field have emerged and created their own market for knowledge ...” (Gibbons et al. 1994: 10, 141). The realisation that universities and research institutes have lost their monopoly of knowledge production is not quite new (Whitley 1982: 325). It has been accompanied by a second observation: in this situation, universities and research establishments are increasingly opting for a strategy of diversification. In growing measure they are opening their doors to functions that had hitherto been considered alien to the organisation. The conversion of entire national economies to knowledge-intensive products and services has thus not automatically enhanced the growth or importance of universities and research institutes. Much clearer are the two trends mentioned, namely a relative loss of importance and internal diversification.

The current situation is described above all as complex. “New professions have not been accommodated by reduction elsewhere. New schools have been added, making most contemporary universities complex, multipurpose organisations. What is true of the institutions is true of their members. Not only are professors expected to teach and to do research, but they also have come to share a substantial part of the increasingly complex administration of their institutions. Consultancy has also grown rapidly” (Gibbons et al. 1994: 141). Not only complexity is diagnosed but also dedifferentiation. Clearly defined and highly specialised roles are being superseded by communication patterns that cross everyday institutional boundaries. Favoured by the spread of information and communication technologies, networking structures have developed; as a consequence, processes of knowledge production must be described as increasingly “distributed” in the geographical and social sense. “The interactions among these sites of knowledge have set the stage for an explosion in the number of interconnections and possible configurations on knowledge and skill. The outcome can be described as a socially distributed knowledge production system. In this system communication increasingly takes place across existing institutional boundaries. The outcome is a web whose nodes are now strung out across the globe and whose connectivity grows daily” (Gibbons et al. 1994: 10).

Practice theory suggests that every indication of networking is to be interpreted as proof of dedifferentiation. It claims that boundaries between functional systems are blurred and permeable, so that unambiguous (single) ties between organisations and functional systems appear impossible. While systems-theoretical studies often assume the existence of single ties between organisations and functional systems or have shown little interest in organisations which might escape to this rule, practice-theoretical approaches have for the

most part decided to stress the irrelevance of differentiation-theoretical assumptions for organisational practice (Knorr Cetina 1992). Where does the proof get us that functional system codes play no role in organisational practices? While the book by Gibbons and co-authors has provoked a lot of criticism, this question has not yet attracted a lot of attention. Most critics have sought to defend a more general view. More or less connected to the systems-theoretical approach, their scepticism points at any attempt to supply empirical proof of dedifferentiation (Weingart 2001: 197). The practice-theoretical line of argument is indeed problematic because to assert that system differentiation is ineffective presupposes that it exists. But this is not to suggest there are no ties between organisations and functional systems. In our opinion both lines of thought have fallen short to specify the relationship between organisation and functional system. Studies following the practice-theoretical line of research, represented here by texts on the mode 2 of knowledge production, have so far failed to contribute to clarifying simple or multiple ties between organisations and functional systems. Among the weaknesses of these studies is to hint at the problem of ties without spelling it out, let alone addressing it theoretically. Instead, a diffuse picture of dedifferentiation is drawn – as if the boundaries of functional systems no longer played a role for organisations and their complex links. The assumption of generalised heterogeneity has proved a bad precondition for empirical research. If everyone is cooperating in more or less heterogeneous fashion, this cooperation appears strangely shapeless.<sup>7</sup>

On the other side of the debate on new modes of knowledge production, assumptions from differentiation theory are being revived. With particular thoroughness, Peter Weingart has examined the thesis of the new mode of knowledge production. In investigating whether traditional modes of production have been surpassed (Weingart 2001), his point of departure is the concept of “structural coupling” (Luhmann 1997: 92-120). For this purpose he continues a series of studies begun long ago on the external boundaries of science (cf. Weingart 1983). Typical of his procedure is a sweeping historical approach, raising awareness of the contingency of contemporary organisational forms of scientific activity. However, in anticipation it must be said that this historical approach clashes with the systems-theoretical script. Weingart is interested in historical variance and variability only as long as they support the thesis of the progressive differentiation of functional systems. The author is very hesitant when it comes to the contemporary diagnosis of a new mode of knowledge production. The sensitivity towards the genesis and change of

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<sup>7</sup> For an early version of the criticism directed initially against Latour’s (1987) conception of interest-bound, heterogeneous networks, see Shapin (1988). Cf. Shinn and Joerges (2004: 77) for a later version of the same critique, claiming that science studies retreated into micro-sociology, marked by the dominant position of laboratory ethnographies and a rejection of Merton’s (1990/1942) normative integration approach. In this context, any links with macrostructural theory were capped and from then on refused. This situation has not changed to this day. For various versions of this account cf. the special edition of *STI Studies* 2006 (<http://www.sti-studies.de/>) and the millennium edition of the *Yearbook Sociology of the Sciences* (Joerges/Nowotny 2003).

organisational forms demonstrated in his historical account is not consistent; once accepted, the differentiation-theoretical insights are scarcely subjected to stringent empirical investigation. Science, he claims, is not acutely threatened by the imperatives of other systems. There is no danger of knowledge becoming a commodity. “Not only is the boundary preserved, coupling makes it into a prime object of mutual conflicts and reflection” (Weingart 2001: 176). The author fits all his empirical examples to this diagnosis. Closer coupling, he asserts, is not to be confused with processes of dedifferentiation between the economy and science. Empirical evidence in support of this assertion remains rather superficial. He briefly mentions that big companies have given up research because they shy away from costly investment in research infrastructure. In view of the account just given of the success story of industrial research, this requires some explanation. Although intensification of cooperation in research between industry and public research establishments is to be seen as indicative of more “coupling,” he claims that it has ultimately to do with outsourcing risks, thus consolidating unambiguous system affiliation of the organisations involved (Weingart 2001: 190, Buss/Wittke 2001). Weingart also fails to pursue another empirical observation, namely that organisations in the science and economic systems reflect their external worlds within themselves to improve their ability to deal with these worlds (Weingart 2001: 196). At this point the author fails to explain how this finding fits in with his overall argumentation according to which thematisation of the boundary is to be seen as demarcation rather than boundary blurring.<sup>8</sup>

The interpretations of Weingart and Gibbons (et al.) have in common that they leave the relationship between organisation and functional system indeterminate. Even though the threads and representative studies discussed are far from covering the field of science studies, it can be asserted that more demanding organisational theories tend to be marginal. The confrontation between the main lines of research leaves no room for “third ways.” Among some notable exceptions,<sup>9</sup> we would like to mention studies on the diversification of public research facilities (Callon 2003, Larédo/Mustar 2000), which invert the problematic and apply a different theoretical perspective. Their point of departure is the observation that research institutes and universities are no longer engaged only in teaching and research but that other “missions” have developed. For instance, they provide

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<sup>8</sup> If from the perspective of systems theory the question of boundary boundary blurring is accessible to empirical testing at all, then the existing attempts have failed at the stage of operationalisation: “The diversity of a person’s commitments says nothing about the permeability of the system boundary ... However, what results from this pluralisation of roles and the pluralisation of commitments is that more and more subsystems of society can apparently manage without the notion of role and profession-shaped personalities, who with their identity design vouch for the almost complete exclusivity of ties with a single system” (Stichweh 2004: 160). Criticising premature diagnoses of boundary blurring are now common beyond the camp of systems theory, but rarely connected to suggestions about how this issue could be more appropriately operationalised.

<sup>9</sup> Exceptions are Hasse (1996) or Röbbbecke et al. (2002), who rely strongly on preliminary studies by Richard Whitley (1984).

innovation services and contribute to the formulation of new policy areas. The pluralisation of task areas is not discussed in the cited studies as a problem of ties between organisations and functional systems. The point is rather that research establishments are undergoing “hybridisation” and are gaining new strategic capacities by combining old and new tasks. How these “missions” interrelate, how they are held together or kept apart, is of secondary interest to the authors. On the basis of their empirical observations, they conclude that only a limited number of the theoretically conceivable combinations will survive (Callon 2003: 704). There are thus empirical indications about public research establishments that run counter to the notion of converging forms of organisation. However, if this finding is to be couched in positive categories, theoretical presuppositions are indispensable. At the current stage, findings in this line of research lack theoretical precision with regard to functional differentiation.<sup>10</sup> So far, the examination of internal organisational hybridisation in public research facilities is closer to management studies than to social theory. Both in terms of missions and disciplines, the following study covers a broad range of parent organisations. However, it will not enter into detail as to what extent these organisations are internally hybrid as its primary focus is on academic spin-offs. Trying to bring academic spin-offs to the attention of social theory, we do not limit ourselves to look at inter-organisational modes of coordination. We avoid operating with concepts of interorganisational networks as they are usually designed for organisations tied to a single functional system. Instead, investigating the status of spin-offs as intersystemic organisations interpretation of the empirical material is systematically relieved of any assumption of congruence – any notion that spin-offs are unambiguously tied to functional systems. To sum up, the theoretical ambition is to find an alternative to the conceptual strategies of dedifferentiation and redifferentiation that have proved empirically sterile in view of the multiplication and diversity of knowledge-producing organisations.

#### **4. Are Academic Spin-Offs Tied to the System of Science? Empirical Analyses**

Systems theory remote from empirical verification, ethnography bereft of social theoretical ambition – but the concept of intersystemic organisation offers a remedy. Much of what has been said before may be resumed in this simplifying phrase. To test spin-offs for intersystemic alignment, we propose collecting observations on disciplinary relations, on publication practices, and on research orientation. Once more, the dimensions commonly used to describe spin-offs are relegated to the background. Size, legal form, parent discipline, and sector are thus of only secondary interest. Ties to the economic system are

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<sup>10</sup> Notwithstanding this lack of clarification, the number of empirical studies investigating how public research facilities react to the commercialisation of research has increased rapidly. Representative of efforts to see more than mere “responsiveness” (Rosenberg 2003) in these reactions are the studies by Owen-Smith and Powell (2002), Tuunainen (2005), and Shinn and Lamy (2006).

presupposed and not specially investigated. In a first section, we examine where and how the structure of spin-offs relates to the segmentary differentiation of science. To handle this question, a concept of discipline close to everyday usage is employed that assumes that epistemic fields are congruent with the subsystems institutionalised through universities and non-university establishments.<sup>11</sup> Are spin-offs oriented towards the disciplinary differentiation of science? This would be interesting in so far as disciplines are in some cases tailored to professions but certainly not to organisations (4a). Secondly, do spin-offs contribute to the reproduction of the system of science through publications, the key output medium of the system? This medium of communication can be just as concisely determined through embedment in a social practice that has been described as “decentralised” and “anarchical”: publications are validated solely via subsequent publications; whether such follow-up occurs and how it turns out cannot be predicted by participants, or is at least subject to great uncertainty (Gläser 2003: 62). This second section, too, investigates a structural characteristic of science, whose essential attributes – anarchy and decentralisation – run counter to the greater corporatisation of knowledge production (4b). Finally, the issue dealt with in the third section has played an outstanding role in the debate on a second mode of knowledge production. Are spin-offs oriented on the distinction between basic research and applied research? In this instance the criterion is the choice of new projects: Do issues generated within science come to bear, or are problems generated outside science (4c)?

### ***Methods***

The corpus of material on which this paper is based consists in 34 focused interviews with managing directors of spin-offs and representatives of parent institutions (see annex). The guiding principle of our sampling procedure was to identify parent institutes first and then descend to their academic spin-offs. Following this procedure, we succeeded in capturing directly corresponding yet independent perspectives on the development of spin-offs. This was paramount to reach the level of organisational practices both in the generation and in the interpretation of the empirical material.<sup>12</sup> The interview questions presented partly in

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<sup>11</sup> For a more complex concept of discipline, cf. Stichweh (1994).

<sup>12</sup> Interview length varied between 40 and 120 minutes. All interviews quoted are documented in the appendix with information on date of interview and interviewee. Information that could reveal the identity of the firm, the institute, or the respondent have been deleted and replaced by a key statement with recognition value for participants and which gives non-participants insight into the variance of perspectives. In the abbreviations, a letter indicates membership of one of the four “pillars” of the German research landscape. In “F34” or “f22” “F/P” stands for Fraunhofer followed by a chronologically continuous figure. Apart from the Fraunhofer Society, the Helmholtz Association (“H/h”), the Max Planck Society (“M/m”), and the Gottfried Wilhelm Leibniz Association (“W/w”) are represented. Lower-case letters refer to members (mostly managing directors) of spin-offs; upper-case letters stand for representatives of the institutes of origin (mostly management personnel, sometimes supplemented by specialised staff from technology transfer departments).

the original wording and partly in paraphrase included the following: “When you consider the research activities of your spin-off company, how would you describe a typical project or a typical contract? What share does research take in the activities of your firm (e.g., compared with product development)? How would you describe research activities in the spin-off in comparison with those in the parent institute (differences and commonalities)? In what form/how intensively do you cooperate with the parent institute? What role do academic career interests play for scientists employed by the spin-off? To what extent do your research findings contribute to the state of the art in academic research (publications, conference participation)?”

To put it briefly, most of these questions are meant to stimulate comparisons between two particular forms of organisations, namely the spin-off firm and its parent institute. This is precisely how we proceeded to interpret the interviews. In a first step, we identified one key phrase per interview which epitomises what interviewees who are closely familiar with both forms of organisations consider to be distinctive at the level of practices. Key phrases resulting from this first step of interpretation are listed in the annex. Having identified key phrases we are able to map the striking variety of ways both forms of organisations are compared. In comparing practices, some of these key phrases explicitly relate to the basic dimensions of the system of science.

The subsequent step of interpretation consists in re-contextualising the key phrases along three basic dimensions of doing science (derived from systems theory). Reduction (presented as the first step of analysis) and re-contextualisation (second step of analysis) are distinct but not in a strict sense subsequent to each other. For instance, key statements differ with regard to the explicitness of comparison. This is why, in a number of cases, re-contextualisation is needed to understand them as comparative statements. On the other hand, we do not claim that all key statements are, at face value, related to the three basic institutions of the system of science. Before turning to develop on these dimensions, we have to mention a few aspects of selectivity both at the level of sampling and as implied by the interpretive strategy as presented so far. The case studies were compiled to cover as broad a spectrum of parent disciplines as possible. Furthermore, all four pillars of the non-university research landscape in Germany were covered (Fraunhofer Society, Max Planck Society, Helmholtz-Association, Leibniz Association).<sup>13</sup> Spin-offs from universities were left out of account. With respect to firms, too, the study addresses a considerable spectrum. The spin-off companies included in the sample were founded between 1987 and 2001 and employ between 2 and 200 people. However, the present appraisal does not neither take the type or mission of the parent institute nor the size or the age of the spin-off firm as a

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Each case study covers one parent institute and one or more spin-offs. At least two case studies were conducted per “pillar.”

<sup>13</sup> On these four pillars and their role within the German national system of innovation, cf. Meyer-Krahmer (2001).



primary analytical distinction. Neither individual biographies of founders nor firm biographies are the units of analysis. In our effort to understand how and to what extent these firms reproduce important structural characteristics of science, we also downplay differences between disciplinary cultures.<sup>14</sup> The methodological perspective adopted thus allows the demands of systems theory and practice theory to be bracketed. Reversing the onus of proof renders this link indisputable: in order to establish whether organisations are uniquely bound to a system, they are to be examined for multiple systemic ties. This is how we proceed in the subsequent sections. Collecting observations on disciplinary relations, on publication practices, and on research orientation, we will find that academic spin-offs are weakly tied to the system of science in one out of three dimensions.

### *(a) Disciplinary Reference*

In all the spin-off teams under study, there was a least one person with a strong disciplinary background. Before founding of the spin-off companies, such people had occupied positions for a number of years in public research establishments and gave clear indication of specific socialisation in disciplinary cultures. Sometimes, the success of a spin-off project was also attributed to strong disciplinary embedment. What effects do these disciplinary origins have on the spin-off as a type of organisation? Is the disciplinary structure apparent in the structure of the firm, and thus in the distribution of responsibilities and the design of departments?

Only in exceptional cases do departmental structures in larger spin-offs reflect the system of the parent discipline. Where the parent facilities themselves are “non-disciplinary” (like many Fraunhofer institutes) rather than reflecting a system of classical disciplines, disciplinary boundaries play no role in spin-offs, either. In these cases no distinction can be perceived between project management in the parent establishment and the spin-off (f8, f9). Even where spin-offs and parent institutes cooperate for many years and do so, in the view of both parties, on a footing of equality, this does not necessarily prove that this cooperation is subject to an overarching disciplinary system (F19, f21).

Some founders of smaller firms state that they very much appreciate their current job for offering much greater freedom than organised research in big institutes (w51). Spin-offs are often smaller and less “overorganised”.<sup>15</sup> To this criticism of the operational structures of

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<sup>14</sup> We prefer to say “reproduce” rather than “map” in order to stress active performance. In major earlier concepts, like that of the “knowledge-based firm” (Pavitt 1984) or in studies on the “absorptive capacity” of firms (Cohen/Levinthal 1990), this aspect has tended to be treated as a secondary matter.

<sup>15</sup> Many spin-offs in the sample are too small to develop division-of-labour structures (w27). “Because the firm is so small you do practically everything” (w50). If this is to be believed, it applies even for a firm with a staff of 14. In such cases it is difficult to answer the test question whether disciplinary boundaries are effective within firms. There are also reservations as regards larger companies, for ethnographic data are needed over a longer period in order to judge internal dynamics, the development and shift of departmental boundaries in spin-offs.

research, some respondents even add that the spin-off helps conserve disciplinary cultures, whereas the parent institute is blamed for its erosion (w33).<sup>16</sup> On the other hand, it is striking that no one in the sample mentioned spin-offs in connection with interdisciplinarity. Spin-off companies very seldom invoke interdisciplinarity – not even when it really costs nothing and commits them to nothing.<sup>17</sup>

However, disciplinary differentiation is just as rare within spin-offs. Strictly speaking, there is not a single case of a spin-off that defines departments in terms of disciplinary boundaries. The only instance perhaps worth mentioning is a company that was spun-off from a spin-off. For both pragmatic and other reasons, boundary setting in this case served to establish a sort of methods department closely associated with the parent firm (w33). The repeat spin-off can thus be taken as evidence of disciplinary specialisation dynamics. As can be shown over and beyond this example of a second-order spin-off, spin-offs develop substantial organisational dynamics: conversions, mergers, splittings, and acquisitions are to be found in the (correspondingly complex) histories of about half the spin-off firms contained in the sample. In contrast to the case of the repeat spin-off mentioned, most firms treat the variable “discipline” in the following way. Spin-off projects are supported and promoted because they offer an opportunity to raise the profile of a research institute, to pare it into disciplinary shape. Topics that fail to conform with this profile are singled out to be handled by a spin-off (w38, W39). Spin-offs thus relate indirectly to the reproduction of disciplinary structures. Sometimes such amputations are also justified on the grounds that areas of research that had drifted too close to industrial application needed to be hived off. Some institute respondents supported spin-off projects explicitly only to ensure the socially acceptable cushioning of lay-offs. From their point of view, spin-offs are a secondary labour market for failed basic researchers (M56, W55). The radical nature of such statements lies in the assumption that the parent establishments are organised solely along disciplinary lines.

Spin-offs accordingly contribute only indirectly to the segmentary differentiation of the system of science. There is only one firm in the sample whose founders claim a place for themselves in the history of the parent discipline. One of the managing directors refers to himself as a pioneer in new disciplinary developments, pointing out that issues that had led to the founding of the firm were now establishing themselves after a lapse of some ten years as programmatic research topics (w33). The sample offers two further cases in which the founders of firms claim that their companies more or less continue disciplinary research

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<sup>16</sup> We found this pattern of criticism solely in natural science field disciplines. No account can be given of the nature of this disciplinary culture, since this would necessarily breach anonymity. Instead, we refer the reader to the study by Heintz, Merz and Schumacher, which provides a comparative discussion of the essential characteristics of disciplinary culture in two field sciences (Heintz et al. 2004).

<sup>17</sup> Only two of the firms in the sample mention “interdisciplinary teams” on their websites, albeit not in a prominent position. This finding is in strong contrast to the observations gathered by Guggenheim (2005: 137ff.) on environmental service firms.

by other means. They invoke the continuity of the disciplinary order (over and beyond the establishments of origin) in seeking support from the parent institutes (W39). If institute directors show “no commitment” in this regard, they see this as violating their vision of a disciplinary community straddling different forms of organisation (m47). In sum, the evidence presented for the dimension of disciplinary reference is too weak and too unspecific to show a disciplinary structure of spin offs. The importance of disciplinary boundaries for organisational structures and procedures in spin-offs is negligible. The required criterion was consequently not met. The assumption that spin-offs contribute to reproducing this structural characteristic of science must be rejected.

### ***(b) Publication Practice***

Does knowledge production in academic spin-offs primarily find expression in scientific publications? The answer differs from sector to sector. For spin-offs in the field of biotechnology it is affirmative. The corpus confirms what is known from the literature about the publication strategies of firms in this sector. They publish in co-authorship with institute scientists at a high level (m58, M52). “For this purpose we still need the scientific publications and the hard data” (m35). “We only do it to make new developments known, and naturally we have to go into the best scientific journals” (w51). The research literature also reveals that changes have been occurring for some time in the publication practice of public research establishments in these fields, too (MacKenzie et al. 1990). Where this topic crops up in interviews with representatives of parent institutes, respondents hasten to stress that strategies are being developed to safeguard intellectual property. To prevent spin-offs and research cooperation projects operating to the lasting disadvantage of institutes, efforts are being made “to bind know-how to the institute,” without, however passing on to the scientific staff the growing “pressure for exploitation” that makes itself felt, for instance, in certain areas of active substance research (W31). Such strategies find expression in agreements with private cooperation partners: on the one hand, such agreements are considered prerequisite for more publications to appear (and not being held back). On the other hand, publication practice can be coordinated with the often contrary patent interests of the parties. To conclude this excursus on developments in research institutes and return to the publication practices of spin-offs: where spin-offs take a share in the volume of publications in the areas mentioned, this practice presupposes negotiations between the parties. Strictly speaking, publication practice is thus no longer oriented solely on a mode of decentralised and anarchical validation in open scientific communities. Use of the term “strategy” alone, now being employed by institutes in connection with “publication” shows that this form of practice is undergoing transformation.<sup>18</sup>

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<sup>18</sup> It is, for example, evident that the publication practice of spin-offs cannot simply be measured against that of their parent institutes – at least not on the assumption that the latter stands for unadulterated academic publication practice. In our view, an asymmetrical comparison between spin-offs and parent facilities

The publication practice of spin-offs outside the life sciences offers hardly any surprises. Spin-off interviewees state that they publish only occasionally. For people involved in management, this is the case without exception. Also, few employees regularly author scientific papers. For the few spin-offs that regularly issue or participate in scientific publications, a shift in publication practice is apparent: the authors involved are not seeking to establish their personal scientific credentials with a long publication list. On the contrary, in some of the sample we observed that publications are attributed not to individuals but to the firm. Attention is paid to publications where they substantiate the competence of a firm. In some fields, this plays a role in soliciting projects and contracts (h44, w51).

For the individual career, working in a spin-off company is necessarily at the cost of continuous publication. This is confirmed by all respondents.<sup>19</sup> This is almost always said in connection with an irreversible withdrawal from the university system, which does not tolerate such publication gaps below the level of tenured professorships. With the exception of the engineering sciences, a publication gap is an insurmountable obstacle at least to any return to a research institute. In the eyes of hiring committees, an uninterrupted publication list is reliable evidence of suitability for key positions in the academic system. If the question arises whether an applicant “still really wants to engage in research” (h17) it is usually too late. Spin-off founders who consider their individual publication lists to be unbroken are extremely rare. Satisfying the double challenge of building up a firm and cultivating an individual publication list is regarded as impossible or at least improbable.

Spin-offs contribute hardly at all to preserving publication practice as an important structural characteristic of science. Only biotechnology spin-offs publish in any quantities worth mentioning. And in this field publication practices are changing in the parent institutes. Otherwise, spin-offs offer no incentive and no organisational framework for publication.

### ***(c) The Research Concept***

If spin-offs can be described as intersystemic organisations, this should also be evidenced by a specific variation of the research concept. To test this, Guggenheim has proposed considering the generation of new projects: Does the distinction between research and application play a role in the generation of new projects? Is applied research presented as an alternative to basic research? With regard to the question of how new projects are born

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provides less insight than a systematic examination of interactions between spin-offs and parent establishments (Konrad/Truffer 2006, Kutinlahti 2006).

<sup>19</sup> No corporative actors/organisations are really involved in the output medium “publication.” What might seem a trivial insight is in retrospect a major problem for an angry spin-off founder. The individual format of academic publication practice is intolerable: “But this means for me, too, that the academic business is organised *essentially* on egoistic lines: I have to have the publication, I have the problem too, I must be the first author, ... In a firm, I believe, it is less a matter of “me”, although that naturally also plays a role because I want to make a career, but *within* the organisation” (m37).

in environmental service firms, it was found that the distinction between research and application or reference to the subsystems science and industry were not prominent (Guggenheim 2005: 177). What was much more decisive for the development of new projects was the archive or history of projects on which the firm can draw (ibid. 206).

In the corpus of the present study, there are a range of statements about the concept of research along the lines: “Only with a scientific profile can new fields of expertise be successfully developed” (F13). What is “new” is, as in Guggenheim’s study, determined in relation to the project history or project archive of the organisation. For the director of a Fraunhofer institute active in the founding of spin-offs, proof of a “scientific profile” is provided by activities such as those enabled and documented by participation in special research units (F34). This point of view was confirmed with regard to the spin-offs under study: “research” is considered throughout a sort of investment apt to open up new fields. Statements by spin-off employees reflect this insight in that they all draw a distinction between product-related and (research) project-related activities (f09, h43). To judge by employee statements, the majority of spin-offs in the sample are concerned with product development and customer service. Examples range from fully-automatic parking systems to algae-based cosmetic products. Interview statements on these product-related aspects of activities address the vagaries of application. Vice versa, the firm gains perspectives over and beyond its product range through collaboration in research or research contracts. However, we were regularly warned about expecting too much with respect to research intensity: “We don’t claim to be a research facility that has to satisfy customer needs a little on the side” (f11). Couched in positive and less ironic terms: “We are project partners and suppliers for users engaged in research” (W54). Project partners engaged in research are or become customers, so that “research” can be an investment that prevents the firm landing up with too few products and too few customers. Research, it was asserted, was an insurance against the risk of getting stranded in too small a niche (for example, by specialising in a certain type of environmental report) or of becoming dependent on too few customers (e.g., the last chipmakers left in Germany).

All interviewees in academic spin-offs had ideas about the right mix between product and project business. The concept “research” occurs regularly in connection with “projects” and is used as synonymous with a certain form of funding. Unlike product-oriented activities, which, so to speak, are the firm's daily bread, projects need greater legitimation. If one accepts the justification that research projects and cooperation are undertaken to foster the development of fields of expertise, this considerably stretches the concept of research. On the one hand, research is described as a concrete interest in systematic method development, and, on the other, as everything that is not subject to the local logic of product development or which contributes to escaping from such niches (f21). Research is what saves the organisation from blind and random contract canvassing, or what enables and guarantees the consistent development of the firm. This is to prevent chaotic

acquisition of projects. In this sense, spin-offs combine application and research, assuming from their point of view a double reference.

However, the internal view, too, takes account of the enhanced reputation to be gained from engagement in research projects. As a rule, cooperation in research is documented on websites because it increases customer confidence, sending the message that, when in doubt, the know-how concentrated in research establishments can be called on. Even the geographical proximity of large research facilities enhances reputations: “Proximity to a large research facility potentially increases customer trust” (h29). More than half the spin-offs under study point to the outstanding importance of well-networked professorial patrons (f07). “Such contacts, initially we didn’t have any at all, and of course, they were extremely valuable for us!” (h40). It may be attributable to an economy of reputation that behind almost every big biotechnology spin-off there is a Nobel Prize (cf. Stuart et al. 1999). Vice versa we note that, if they can afford it, spin-offs are very picky about the partners with whom they cooperate. Only then to (co)publications “in the best scientific journals” succeed (w51).

The idea that spin-off firms are exclusively market oriented and (in contrast to research) engage only in applied science needs to be relativised in view of the co-existence of and balance required between product and project business. In some cases, this co-existence can be described as a relationship of mutual interdependence. For some spin-offs that have specialised in research instrumentation, the product business provides stimulus for project-bound research (w54, h29, h43). These firms supply, maintain, and renew laboratory infrastructures and measuring equipment for research facilities and firms. They provide mediatory services which in turn presuppose research on instruments and equipment. Their profile resembles the pattern that Joerges and Shinn (2001) have identified for the development of generic technologies: neither does the locus of problem generation coincide with specific contexts of application nor is problem definition a matter of autonomous basic research.

The point of interest for the question of the intersystemic organisation is the double reference to be found in some of the firms: orientation towards research and orientation towards application prove not to be mutually exclusive in the generation of new projects; they are combined. The evidence for this double reference goes beyond the trivial observation that the research orientation of spin-offs is exhausted in their origins and is only occasionally cited for advertising purposes.

## **5. Conclusion**

Finally, in order to assess the explanatory potential of the intersystemic organisation concept, we turn once again to the line of research we have described as practice-

theoretical. The research programme of practice theory has raised awareness of the technical aspects of knowledge production. Technology is constitutive for the production of scientific facts; this is a key finding that has provoked an impressive wave of revision in the history of science: “Science, it was said, stood at the top of a Comtian pyramid of knowledge, with technology at the base; ideas trickled down from the ‘pure’ to the ‘applied,’ technology ‘spun off’ from the enterprise of unfettered inquiry. Spun off, trickled down, or applied: whatever the metaphor, the message was the same. The order of the world put science before technology. Over the last twenty years, work in the history of science and technology has begun to redraw this picture, blurring the boundary between realms, and insisting on a more reciprocal (and more interesting) relation” (Galison 1997: 1127). Over the past decade further research has been undertaken on the basis of this critique, focusing on the technical dimension of experimental practice.

There is no reason to abandon the awareness thus gained for the technical aspects of producing scientific facts, but it is advisable to point science studies in a new direction. One proposal is offered by the present paper: instead of providing repeated criticism of traditional sociology of science’s failure to take due account of technology, a gap in organisation theory ought to be addressed. Instead of demonstrating the importance of technical practice for the production of scientific facts in case after case, studies are needed that address different organisational forms of knowledge production. This programmatic recommendation is on the same theoretical level as the current discussion on relations between organisations and functional systems. There are therefore prospects for restoring theoretical frames of reference that, according to the prevailing view, had meanwhile been lost by practice-theoretical research in the sociology of science.

Shifts in organisational ecologies in the field of knowledge production deserve more attention. This view is fully compatible with the now classical appeal we quote from a founding text of the practice-theoretical programme: “Those who are really doing science are not all at the bench; on the contrary, there are people at the bench because many more are doing the science elsewhere. The time has now come to turn our attention towards these other people” (Latour 1987: 162). We have taken up the motto that science is also done “elsewhere” and developed the concept of the intersystemic organisation: Do academic spin-offs contribute to reproducing key structural characteristics of science? The test criteria were not fully satisfied. With respect to all three dimensions (publication practice, disciplinary reference, and research orientation) only weak indications could be found that spin offs are tied to the system of science. On the basis of the evidence and reservations presented, spin-offs can only to a very limited degree be described as intersystemic organisations that are also bound to the system of science.

Our investigation shows that supporting academic spin-offs (as part of innovation policy) is an extremely contingent process. It has shown that, on the one hand, this type of

organisation takes many forms. On the other hand, it has shown that the “spin-off” is less a clearly defined type of organisation than a principle of fluctuation. This is strikingly illustrated by the processes of spinning-off and conversion. For studies that can draw on a larger sample of case studies, various patterns of intersystemic situations could be identified on the basis of the three structural characteristics. In the context of a nascent policy area, the concept of intersystemic organisation promises theoretically grounded typification.

To judge by the numerous negative accounts given by participants and respondents, they have no such typology on which to draw. Almost all interviewees problematised the categorisation of their firm as a “spin-off.” They denied that the firm in question was a “genuine” spin-off. Sometimes its origins in science are seen as genealogically dubious. One firm in the sample was primarily a subsidiary of a large company “adopted” only after the fact by a research institute, as was reported with a wink (f22). Even when interviews were being organised, interviewees problematised the category of spin-off. The research project has now and again declared units to be spin-offs that claim this title for themselves only in inverted commas. The uncertainties that induce people to keep the category of “spin-off” at arm’s length cannot be easily eliminated, for they cannot be attributed to any common notion of how the spin-off is to be defined as a form of organisation. In the view of one respondent, for example, only firms that have made use of external capital resources should be referred to as spin-offs (H26). But the contrary opinion is also represented. Several interviewees complained that the content and procedure of their work was dictated by outside capital. They asserted that spin-offs deserve the name only if they are self-determined enterprises (h48, h49).

Many of these indications of misattribution assume that spin-offs are transitory phenomena. Do spin offs thus only temporarily mediate between functional systems before committing themselves definitely (or disappear)? We consider this an empirical question, but one that goes beyond the reach of the present study. Our material permits no conclusion on the issue because nobody has observed spin-offs for longer periods. It is therefore with only rudimentary success that spin-offs can be described on the basis of the intersystemic organisation concept as a lastingly precarious form of organisation. Given the status of the discussion on the “advent of the organisational society” described at the outset, this is an unusual finding, for the prevalent readings of the “advent of the organisational society” leave no room for precarious intersystemic alignments that make themselves felt in intra-organisational tensions. It is either assumed that systemic differentiation is intensified through organisations or that a dominant functional system uses the vehicle of the organisation to expand.

Is the system of science at risk of “thoroughgoing organisation” by spin-off activities that prove to be processes of “corporatisation” or pervasive commercialisation? Any such diagnoses presuppose a homogeneous form of organisation. If, in contrast, spin-offs are



classified as organisations with double systemic reference, this suspicion is difficult to confirm. We have drawn on suspicions intrinsic to the organisation itself.<sup>20</sup> The procedure we have used to identify intersystemic organisations has concentrated on critical operations. “Criticism” presupposes that participants within organisations are able to invoke structures that reveal a link to another functional system. We reserve the category of intersystemic organisation for such cases alone. There can therefore be no question of declaring all organisations to be intersystemic. Nor do we deny that there are organisations typical of a given system, in so far as this is not taken to mean organisations that permit only practices that are in complete conformity with the system but rather organisations whose ties with functional systems are not problematised in the manner specified.

What does the concept of intersystemic organisation achieve? In the course of discussing ties between organisations and functional systems, organisations typical of systems were first of all “discovered.” The function of organisations with explicit systemic ties has been convincingly shown: they contribute decisively to imposing communication in conformity with the system. Without such organisations, which provide a level of decision-making and in a certain sense assuming a “policing” role on behalf of societal subsystems, there would probably be no functional systems (Schimank 2001). It has largely come to be recognised that contributions to the reproduction of functional systems can also be made by organisations with multiple ties. The co-existence of organisations typical of systems with intersystemic organisations can be roughly described as follows: on the one hand we have organisations that foster differentiation; on the other we have organisations that accept the consequences and repercussions of intensified differentiation. This comparison implies that intersystemic organisations are not to be considered as atrophied forms of explicitly committed organisations. For the present study we have therefore renounced a comparison between spin-offs and “genuine” research establishments, i.e., establishments tied to one specific system. We put the concept of intersystemic organisation up for renewed discussion – together with a methodological proposal: single tie organisations and intersystemic organisations should be identified by means of the same procedures of investigation. The concept of intersystemic organisation holds promise of a new methodological perspective in that it proposes a reversal of the onus of proof: in order to establish whether organisations are uniquely bound to a system, they are to be tested for multiple systemic ties.

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<sup>20</sup> The precarious state of intersystemic organisations poses a problem not only for social theory. It is also reflected, as we have seen, in empirical observation. Apparently uncertainties about ties also affect parent institutes (Simon et al. 2003). Many of the key upper-case quotes illustrate this. One interviewee, for example, talks about spin-off projects having to be tackled with “stronger market orientation” (H30). How is this comparative to be understood? It becomes even more complicated if the parent facilities are also to be regarded as intersystemic organisations. We illustrate this case with a quote from the director of a Fraunhofer institute: “If the market is declining and competition growing, then these tendencies to cannibalise develop” (F18). For a more comprehensive treatment of constellation and “arrangements” between Fraunhofer spin-offs and their parent institutes see Potthast/Lengwiler (2005).

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## Appendix: Sources/Interviews<sup>21</sup>

### Fraunhofer Society (2 parent institutes)

- f07, “A good scientific publication would take me two weeks,” interviewed by H. Jacobsen, A. Knie & J. Potthast on 7 December 2004.
- f09, “I couldn’t switch to customers or industrial projects in the morning and research projects in the afternoon,” interviewed by M. Lengwiler & J. Potthast on 7 December 2004.
- f11, “We don’t claim to be a research facility that has to satisfy customer needs a little on the side,” interviewed by D. Simon, A. Knie & G. Möll on 10 December 2004.
- F13, “It does not make sense to support a spin-off which ends up as a new institute operating under a different name,” interviewed by A. Knie, D. Simon & G. Möll on 6 January 2005.
- F34, “To eliminate that [impression of being too much concerned about application] I simply set up a collaborative research centre,” interviewed by A. Knie & H. Jacobsen on 30 June 2005.
- F18, “If the market is declining and competition growing, then these cannibalisation tendencies develop,” interviewed by M. Lengwiler & D. Simon on 21 February 2005.
- F19, “On a footing of equality [with the spin-off],” interviewed by Lengwiler, H. Jacobsen & J. Potthast on 22 February 2005.
- f21, “Research topics repeatedly crop up in the direction of developing methods,” interviewed by J. Potthast & H. Jacobsen on 23 February 2005.
- f22, “We were doing that at the Fraunhofer Institute anyway,” interviewed by M. Lengwiler on 23 February 2005.

### Helmholtz Association (3 parent institutes)

- H26, “We’re very stringent with our spin-off definition, we count only capitalised companies,” interviewed by M. Lengwiler & G. Möll on 6 April 2005.
- h40, “Such contacts, initially we didn’t have any at all, and of course, they were extremely valuable for us!” Interviewed by A. Knie, M. Lengwiler & G. Möll on 3 August 2005.

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<sup>21</sup> As stated earlier (see footnote 12), all interviews are documented with information on date of interview and interviewee. Information that could reveal the identity of the firm, the institute, or the respondent have been deleted and replaced by a key statement with recognition value for participants and which gives non-participants insight into the variance of perspectives. In the abbreviations, a letter indicates membership of one of the four “pillars” of the German research landscape. In “F34” or “f22” “F/P” stands for Fraunhofer followed by a chronologically continuous figure. Apart from the Fraunhofer Society, the Helmholtz Association (“H/h”), the Max Planck Society (“M/m”), and the Gottfried Wilhelm Leibniz Association (“W/w”) are represented. Lower-case letters refer to members (mostly managing directors) of spin-offs; upper-case letters stand for representatives of the institutes of origin (mostly management personnel, sometimes supplemented by specialised staff from technology transfer departments). Each case study covers one parent institute and one or more spin-offs. At least two case studies were conducted per “pillar.”

- h48, “All we do is research at the clinical stage contracted out by large pharmaceutical companies,” interviewed by G. Möll & H. Braun-Thürmann on 7 October 2005.
- h49, “Doing research in a scientific context is much about muddling through and getting lost. Obviously, a company cannot rely on processes driven by chance,” interviewed by G. Möll & H. Braun-Thürmann on 7 October 2005.
- h29, “Proximity to a large research facility potentially increases customer trust,” interviewed by M. Lengwiler & D. Simon on 16 June 2005.
- H30, “I’m one of the candidates here that insist we should tackle this with stronger, with much stronger market orientation,” interviewed by M. Lengwiler & D. Simon on 16 June 2005.
- h43, “Apart from the actual project business we have our own products,” interviewed by G. Möll & J. Potthast on 24 August 2005.
- h44, “I see them more as advertising leaflets for the firms that publish these articles,” interviewed by H. Jacobsen & D. Simon on 24 August 2005.
- h17, “I have a publication list of over 60 titles, and I ask myself why I need habilitation on top of that?” interviewed by A. Knie & G. Möll on 21 February 2005.

#### Max Planck Society (2 parent institutes)

- m35, “For this purpose we still need the scientific publications and the hard data,” interviewed by M. Lengwiler & J. Potthast on 7 July 2005.
- m37, “The academic world is much more egoistic: ‘I have to get this publication!’. In a firm, I believe, it has less to do with egos,” interviewed by H. Jacobsen, G. Möll, M. Lengwiler & J. Potthast on 7 July 2005.
- m47, “The institute directors show no commitment,” interviewed by G. Möll on 16 September 2005.
- M56, “People who don’t get anything else can found a firm,” interviewed by H. Jacobsen & H. Braun-Thürmann on 22 December 2005.
- M52, “If we have something [we can exploit commercially] we go first to our own people [the institute’s spin-offs]”, interviewed by D. Simon & H. Braun-Thürmann on 8 December 2005.
- m58, “We are not primarily interested in developing technologies but in being a commercially successful firm engaged in research,” interviewed by H. Braun-Thürmann & J. Potthast on 17 January 2006.

#### Gottfried Wilhelm Leibniz Association (3 parent institutes)

- w27, “Even the janitor here has a doctorate,” interviewed by D. Simon, M. Lengwiler, G. Möll & J. Potthast on 3 May 2005.
- W31, “Private companies have shifted their risks on us. Thus, our organisation is used to carry out research,” interviewed by J. Potthast & G. Möll on 22 June 2005.
- w32, “On the other hand we also do research here,” interviewed by G. Möll on 22 June 2005.

- w33, “We’re a very special spin-off” [as we did not emerge from a parent institute which has encapsulated the idea of spin-off activities], interviewed by J. Potthast & G. Möll on 22 June 2005.
- w38, “Well, since not much at all has happened between me and the institute over the past four years...,” interviewed by J. Potthast & A. Knie on 11 July 2005. [discipline]
- W39, “This spin-off was promoted to dispose of the subject,” interviewed by A. Knie & J. Potthast on 11 July 2005.
- w50, “Because the firm's so small you do practically everything,” interviewed by D. Simon & H. Braun-Thürmann on 3 November 2005.
- w51, “We only do it to make new developments known, and naturally we have to go into the best scientific journals,” interviewed by D. Simon & H. Braun-Thürmann on 3 November 2005.
- w54, “It depends on how you define science. We are concerned with scientific questions, too. We employ scientific methods of screening, but we are obviously engaged in development,” interviewed by J. Potthast & H. Jacobsen on 14 December 2005.
- W55, “Things must get worse so that we have more spin-offs” interviewed by J. Potthast & H. Jacobsen on 14 December 2005.