A Theoretical Examination of the Cases: Why Coping Is Often Difficult and Defective

Uwe Schimank and Andreas Stucke

If there is one thing all the preceding case studies make unequivocally clear, it is that effective coping with trouble is not at all easy. Most of the cases are not success stories. Even those cases where the research actors could finally get rid of their trouble to a considerable extent, or were at least able to significantly reduce the damage done to their research conditions, show nevertheless that coping requires great effort – see the molecular biologists in the case presented by Hasse and Gill, the laboratory endangered by disassociation from the CNRS in the case presented by Musselin and Vilkas, the first laboratory in Wolf's study of the East German Academy of Sciences (AdW), or many of the professors in Schimank's case. Often, good luck is also a vital element of successful coping, as, for instance, the nuclear physicists in the Berlin case presented by Gläser et al. illustrate. And not only Mayntz's case of the AdW reminds us of the very real possibility of fruitless coping. In all cases there are examples of actors who simply had to suffer their trouble – the third institute in Wolf's case, for instance, or the biomedical researchers in Braun's case who could no longer acquire the resources they needed. Weyer's case of the German aerospace research institutes, finally, points out that even successful coping may often provide merely temporary relief, which may already contain the seeds of future trouble.

Of course, as Krauss's case of French agricultural research demonstrates, sometimes trouble is only staged. Or, as in the case of the research group from the Parisian laboratory of the CNRS presented by Musselin and Vilkas, what seems to be trouble may be an initial misperception of a situation that turns out, in fact, to be a good opportunity. But most often the trouble is real, and coping with it is difficult. Admittedly, this is a rather trivial finding. But as such it offers an uncontroversial starting point for further analysis. As we

stated already in the introductory chapter, we are not interested in investigating the manifold potential causes of trouble in this analysis. Here, a reference to the case studies will have to suffice. We take trouble, or at least the real possibility of trouble, as given and ask, what happens then?

Three principal reactions to trouble are possible: trying to *prevent* trouble which has not happened yet; trying to *cope* with already existing trouble if one perceives an opportunity to reduce the damage done; or, if neither of these alternatives seems feasible, helpless *suffering* of trouble, perhaps made bearable by waiting for better times. Whereas the first two reactions are usually difficult, demanding appropriate skills, social influence, knowledge, and resources, the third is easy because it is a passive reaction. Helpless suffering can be equated with failure if the extraordinary – and improbable – stroke of good luck does not come along. The success of waiting depends on other actors, who cannot necessarily be expected to behave as one would hope. The nuclear researchers in Berlin described by Gläser et al. had, indeed, good reason to hope that the political constellation in the Berlin government might change again to their advantage, or that the federal government might press the Berlin government to issue the operating license for the research reactor. But by no means could the researchers be sure of either development. In contrast, prevention as well as coping imply that actors facing trouble take their fate into their own hands. Since our case studies provide examples of all three kinds of reactions, we can put coping into perspective by comparing its difficulties with those of the other two reactions.

We would like to focus our analysis on one particular group of factors which very often make coping difficult: the factors associated with the circumstance that coping takes place in a constellation consisting of a plurality of research actors facing trouble and the political actors who caused that trouble. As we also asserted in the outline, such a constellation has three dimensions: the horizontal juxtaposition of different research actors on the same level of action, the vertical arrangement of different levels of research actors, and the relations of the research actors to the relevant political actors. For example, in Stucke's case the institutes constituting a big science center are actors facing trouble on one level of action, while the big science center itself faces trouble on a different level; both the institutes and the center each have specific relations to the Federal Ministry for Research and Technology on the political level. What we primarily want to know is how this *horizontal and vertical structure of the constellations of research actors as well as their*

relations to political actors determine the set of coping alternatives. Which alternatives are possible at all in a given constellation, and how difficult are they to achieve?

In addition, we will explore the relative effectiveness of different kinds of coping. We have chosen cases in which one particular type of trouble is shared by a plurality of research actors[1] in order to emphasize that our point of reference for assessing effectiveness is not the isolated actor – at whatever level of action – affected by trouble, but the group of actors jointly facing a particular type of trouble, i.e. the *population in trouble*. Consequently, the overall effectiveness of coping refers to this population's ability to maintain its research conditions in spite of political disturbances.[2] It is certainly not totally unconvincing to suspect, in a first rough guess based on the cases, that the easier a particular reaction to trouble is to accomplish, the lower its overall effectiveness will be. Let us take, for the moment, just the two extremes: Helpless suffering is very easy to accomplish, but has a rather low overall effectiveness; in contrast, prevention of trouble has a high overall effectiveness, but seems to be very difficult to accomplish. The various types of coping now to be considered (see Figure 1) are located between these two poles (which, as we indicated in the introductory chapter, are *not* coping). We will elaborate on these coping strategies, which range from getting rid of trouble to a variety of ways of adapting to it.

As we stated in the introductory chapter, coping with trouble is an analytical perspective which belongs to the political sociology of science. Therefore, we can benefit from many concepts and models already developed within political sociology and political science. Our reflections here will be based upon a number of general theories about collective and corporate political action, and upon elements from sociological theories of social differentiation and organization theory. Combining analytical tools from these theories with

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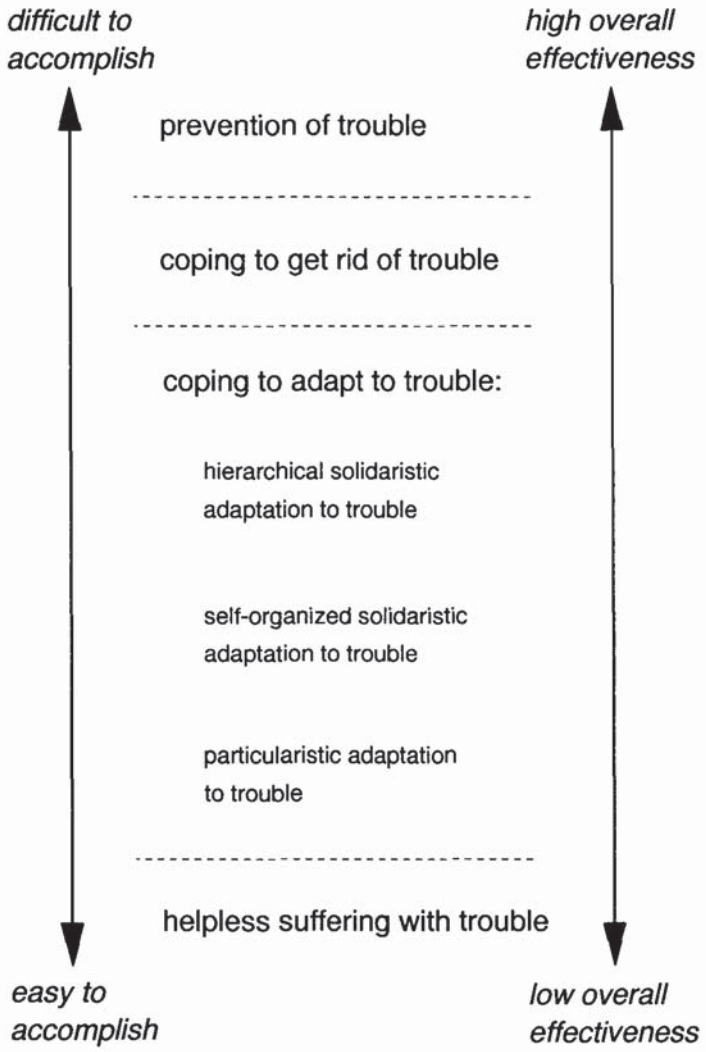
1 This plurality may be the organizational subunits or the individual researchers of only one research institute.

2 Applied here in a very strict sense, effectiveness must be distinguished from an improvement in a particular research actor's situation, the research system's situation or the situation of the society in general. It may certainly be that what is good for the population in trouble is bad for some of its members, for the research system, or for society. As we stated in the introductory chapter, our concept of trouble is strictly related to the point of view of the research actors affected; consequently, the same applies to the effectiveness of coping.

Figure 1: Possible Reactions to Trouble



insights from our cases, we will construct a middle-range theory about coping and its effects. Since there is no general theory of coping with trouble in political sociology or political science, we cannot simply specify such a theory for our topic of the coping of research actors. Instead, we have to apply and link elements from the existing toolboxes of the theoretical perspectives to our empirical subject. On the one hand, there is no alternative to this way of inductive theorizing "from below." We have to extract our theoretical insights from the cases because, with no comprehensive general theory of coping with trouble at hand, theorizing deductively "from above" is impossible. But a pure theoretical incrementalism, on the other hand, would not yield more than a fragmented, incoherent store of propositions. Therefore, before we examine the cases, we will lay a foundation by asking more generally what types of political influence research actors can exert. How research actors try to cope obviously depends critically on the type and degree of influence they have on those political actors who produce their trouble. Thus, a framework for our examination of the cases is made up of some peculiar features of the research system which crucially determine the possibilities of coping with trouble.

In Section 1, we will look at the political influence of research actors, showing that while their collective influence is rather weak, many have individual opportunities to articulate their interests and, sometimes, to achieve their goals. This finding explains our overall impression from the case studies that coping is most often a particularistic adaptation to trouble. In contrast, the occasions when research actors can successfully prevent trouble or get rid of it are quite rare. In Section 2, we will concentrate on the specific factors which make it so difficult to prevent anticipated trouble or to eliminate actual trouble. In addition, we will describe the exceptional circumstances under which both reactions may be successful. In Section 3, we will turn to those coping reactions which, if successful, only bring about an adaptation to trouble. We will focus on how much more difficult it is to achieve solidaristic adaptation to trouble – be it hierarchically imposed or self-organized – than particularistic adaptation and explain why the latter exhibits a low overall effectiveness.

Our goal, therefore, is to draw some general conclusions about coping with trouble as a constellation phenomenon. Reviewing the case studies in this volume and, occasionally, cases cited elsewhere, we will try to identify

patterns of coping.[3] This theoretical strategy presupposes that there are no simple two-factor causal relations between coping activities and *single* structural or dynamic features of the relevant actor constellations. The diversity and complexity of the case studies suggest that it makes no sense analytically to study the effects of single determinants – such as the degree of self-organization of troubled actors – on coping activities. No elegant laws stating "if x, then y" or "the more x, the more y" can be formulated. Consequently, we will not arrive at easy recipes for successful coping, either. For us as social scientists, though, it does not suffice to assemble an assortment of cases without drawing at least some tentative conclusions that might apply to future cases. Two reductions of historical complexity must be achieved by generalizations in the social sciences: The multitude of concrete past events as well as the uncertainty of concrete future events must be reduced to a smaller number of well-conceived abstract patterns. Even if these patterns do not exhibit the simple structure of two-factor causal relations, the analytical reduction of complexity contributes to a better understanding of social reality.

1 The Weak Political Influence of Research Actors

Theories of societal differentiation point out the curious fact that the research system is distinguished from other societal subsystems by being primarily its own public (Stichweh 1988). Whereas a doctor, a teacher or a company executive – the central actors of the health care, the educational and the economic systems respectively – works for his patients, his pupils or his customers, a researcher works for other researchers, who read his books and articles and then quote him in their own publications, thereby providing him with a scientific reputation. This feature of scientific research, strange when compared to other societal subsystems, derives from the character of its product. Scientific research produces bits of true knowledge. But truth, as the guiding principle of research work, is *orientationally closed* to the concerns of non-researchers. The scientific value of a "piece" of research work is never depen-

3 Rather than attempting to provide an all-inclusive catalogue of the many valuable insights into coping with trouble offered in the case studies, we will selectively choose those we need for our present argument.

dent upon its societal usefulness, whereas the medical value of a new treatment for a particular illness or the educational value of a new pedagogical principle will naturally be tied to its efficacy in healing patients or educating pupils. Health, or education, as the guiding principle of a doctor, or a teacher, relates to the concerns of patients, or pupils; profit-making, as the guiding principle of a corporate executive, relates to the concerns of customers. The performance of the systems of health care, education or corporate business would be meaningless without counterparts outside. Medical, educational or economic action is intrinsically oriented towards reaching beyond the boundaries of these subsystems. Research action, on the other hand, is intrinsically enclosed within the research system. Other concerns remain extrinsic to this logic of action, even if occasionally particular researchers or, on an institutionalized basis, whole disciplines such as the medical or engineering sciences bridge the gap to other societal subsystems.

As long as scientific research was an inexpensive, small-scale affair, usually conducted by wealthy amateurs or promoted by even wealthier patrons, the closed circles of researchers working on the same topics were rather self-sufficient. But as research grew more and more expensive and developed into a profession during the last century, the research system became strongly dependent on its societal environment for financial resources. Research facilities became much more complex and costly, and researchers had to earn a living from their research. With this resource dependency, the major potential for trouble came into being. Although specific causes of trouble do not concern us here, we nevertheless have to inspect briefly the general vulnerability of research actors to political trouble. This is necessary if we are to understand the weak political influence of research actors.

Basic research which is not oriented toward any potential applications has a particularly difficult time legitimizing its resource needs. Why should anybody not involved in the self-sufficient communication circles of specialized researchers want to finance such a hobby? Although a work of art is just as useless as the results of this kind of basic research, the artist's patron can at least enjoy the intrinsic aesthetic qualities of the works produced with the help of his money. Thus, an artist still works for a public which does not only consist of other experts like himself. Despite its uselessness, there is a societal demand for his kind of work because it fulfills certain needs of at least some members of society who are not artists themselves. In contrast, those who

do pure basic research without any prospects of applications can offer nothing in return for the growing amount of money they demand from society.

On the surface, this legitimation problem does not exist for the researchers involved in applied research, or in basic research promising applications at some point in the future. But a closer look reveals that they have this problem, too – though it is admittedly less critical for them. In periods of prosperity, it is not that difficult for these research actors to find other societal actors – especially in government and industry – whose interest in particular applications of their research activities is so strong that they will be willing to finance the research. But whenever these other actors' funds become scarce, promotion of research tends to be one of the first budget items to be cut back. This tendency to reduce the support for research activities grows if it takes longer and longer for applications to materialize and, especially, if it becomes doubtful that applications will emerge at all. As funds become scarce, the time horizon of actors shrinks, and their risk-aversion grows. Suddenly, the promotion of research activities – even of applied research – can appear to be a investment in a luxury good that will not pay off for decades, and that is now unaffordable because of the many serious, pressing problems requiring immediate attention.

Frequently, research actors have to face not only resource cutbacks, but also strong demands to make themselves more immediately useful. Thus, for the money they still do allot to research, the financial sponsors insist upon a quicker and better "return" on their investment. Not content to confine themselves to general demands, the sponsors try to intervene directly in specific research decisions – especially when it comes to choosing research topics. Under these circumstances, the scientific interests of researchers may be confronted with divergent extrascientific interests.

Thus, trouble is inherent to the peculiar character of the product of scientific research. Basic research without potential applications is vulnerable to resource trouble. In a weaker sense, this also holds true for applied research which, in addition, often has to face the trouble of being instrumentalized for extrascientific interests. The smaller the circle of actual or potential sponsors is for a particular research project, the bigger the researcher's trouble is. To take the extreme case, if there is only one sponsor, the researcher has no exit option at all and is thus completely dependent. The *state-financed* research institutes upon which our cases have focussed get a substantial, often predominant share of their funding as institutional financing from government. The

higher the share of institutional financing a research institute has, the more dependent it is upon the sponsoring government agency for resources.[4] Project grants are the institute's other main source of funding. If their share of an institute's financing is high, the institute's dependency on the government agency will be more relaxed; its susceptibility to the insecurity of the grant market, however, will increase correspondingly. Whether this is preferable for a research institute depends on the degree of competition within this market and on the institute's competitive strength. As a sponsor's allocative flexibility is higher with project grants than with institutional financing, the former can also be better used for a short-term instrumentalization of researchers. Thus, financing by means of project grants always implies – in addition to the basic insecurity of the grant market – the trouble of instrumentalization. Project grants like those provided by the German Research Foundation, which are not linked to a specification of research topics by the grant-giver, are the exception. A sponsor providing institutional financing usually has the prerogative, however, to participate in decisions about the institutional set-up of a research institute – i.e. its basic organizational structure, its research program, and the recruitment of its directors. At the very least, the sponsor has the right to veto an institute's decisions on such matters; at the most, the sponsor bears the sole responsibility for these decisions. The trouble of institutional restructuring, therefore, is another potential consequence of a research institute's institutional financing by government.

The researchers' narrow-mindedness, resulting from the differentiation of the research system within modern society, leads to their being indifferent not only about the societal usefulness of scientific truths, but also about the risks scientific research may inadvertently pose to society at large. Truth is orientationally closed to the risks of its production or application. Therefore, the political regulation of types of research which may be dangerous to society is necessary. While legal instruments are the principal means used to

4 A special constellation exists if a research institute's institutional financing comes from more than one government agency. In Germany, this is the case for most extrauniversity state-financed research institutes which are jointly financed by the federal government and the states. This situation is a mixed blessing for the institutes (Hohn/ Schimank 1990). While joint financing may help an institute to defend its autonomy against instrumentalization by letting it play the government agencies off against one another when they disagree, it often results in a situation where the stingiest government agency determines how much the institute will receive from all the others.

control these negative externalities of research, the resource dependency of state-financed research institutes upon government agencies also gives government considerable leverage. Because financial resources might be withdrawn if an institute breaks the law, the regulations serve to reinforce the research institutes' obedience doubly: The loss of resources may have even more massive and long-lasting repercussions than legal sanctions. Government agencies can even use financial incentives and disincentives to discourage or eliminate research behavior which is not (yet) legally forbidden or to foster the development of research behavior which is not (yet) legally prescribed. Thus, the trouble originating from political regulation of research, an inevitable consequence of the differentiation of the research system, affects state-financed research institutes most strongly.

In sum, from the point of view of theories of societal differentiation, a peculiar characteristic of the product of scientific research – the orientational closure of truth to all aspects of societal usefulness or riskiness – causes its high vulnerability to the different kinds of trouble political actors can generate. If this vulnerability was counterbalanced by a respectively high degree of *political influence of research actors*, these actors would not have a serious problem. Research actors would be able to defend themselves against political actors, and could prevent trouble most of the time, or nip it in the bud. But if research actors' political influence is actually low, their possibilities of coping are greatly restricted. Therefore, we will now examine how research actors are able to collectively influence political actors.

1.1 The Low Obstructive Capacity of Research Actors

A general finding from political science which we can start with is that the degree of political influence social actors have varies strongly with their ability to obstruct processes of societal reproduction, either by withholding services perceived as indispensable by others or by hindering other actors from performing such services (Offe 1969). Research actors' *obstructive capacity*, however, is very low. At first sight, one might imagine that research actors are highly influential because they provide other societal subsystems with a growing stock of knowledge which is functionally required by those systems to maintain and improve the systemic level of performance and, thereby, to contribute to the reproduction of society. To withhold or to threat-

en to withhold this supply of scientific knowledge would seem to be a powerful weapon research actors could wield in political conflicts. As has become especially apparent since the technocracy debates in the 1960s, the scientification of modern society is indeed very high, and it is still growing (Schelsky 1961; Bell 1973; Kreibich 1986; Böhme/ Stehr 1987; Stehr/ Ericson 1992). This fact is also appreciated by societal actors in general and political actors in particular. Nevertheless, the latter do not refrain from causing trouble for research actors again and again. The estimation of the high societal usefulness of research manifests itself, interestingly enough, in the trouble arising out of political attempts to redirect research according to extrascientific criteria. Somehow, modern society's irrefutable dependence upon scientific research does not supply research actors with the type and degree of influence which organization theory, for instance, demonstrates for intraorganizational groups controlling critical uncertainties of organizational performance (Pennings et al. 1969; Hickson et al. 1971; Hinings et al. 1974). Why are research actors not as influential as, say, the repairmen in a production plant upon whom everybody else depends because they alone can ensure or restore the smooth working of the assembly lines (Crozier 1963)?

The more alternative suppliers of these indispensable services there are, the less influence an actor will be able to mobilize by offering his special services (Emerson 1962). The particular scientific knowledge a societal actor – a firm, for instance – needs can very often be provided by more than one researcher or research institute. It is only in some very specialized fields of research that one research actor may temporarily have a monopoly on the supply of knowledge. Political actors often deliberately promote the emergence of alternative suppliers of certain scientific knowledge in order to reduce potential dependencies of customers. Of course, even a plurality of suppliers can organize themselves to prevent their being subjected to a "divide and conquer" strategy by the customers. One of the reasons this happens rarely among research actors – others will become clear later – is that even a successful solidaristic organization of research actors would not help very much. The deeper cause of their low obstructive capacity lies not in their social fragmentation, but in the peculiar character of scientific truths.

It is true that in an increasingly science-based society, a growing number of societal actors perceive being provided with scientific knowledge to be a critical functional prerequisite for attaining their goals. But this remains an estimation of the long-term relationship between the research system and

actors from other societal subsystems. In the short run, almost anybody can do without new scientific knowledge. Many years can elapse before actors in other societal subsystems notice that they have been receiving a suboptimal supply of useful research results – by then, though, it is usually too late. A general strike by all researchers would not leave a trace for a long time, whereas a strike by doctors, teachers, or garbage collectors would hurt many people immediately. Most societal actors – especially the political actors – are well aware of the immense long-term damage research actors can do to society by not producing knowledge. A threat in this direction, however, endows the researchers with hardly any political influence; those involved in basic research with distant – and maybe even doubtful – potential applications have the least influence of all. The short time framework within which societal actors pressed by an overload of urgent demands and interests almost always act obstructs their view of the future. To put it in drastic terms, if caring for one's long-term survival critically reduces one's chances of short-term survival, one cannot but act according to the maxim "First things first!" and hope for good luck in the future. This applies even more to political actors than to other actors. Thus, although research actors do provide important services to many other societal actors, this gives research actors no significant influence on political actors.

On the contrary, research actors are heavily dependent on political actors who act toward them as benevolent and trusting sponsors and protectors. When they invest money into research, the sponsors deviate considerably from the usual logic of political action in two respects. Firstly, financing research is almost always a high-risk investment. Most research, even if it is already quite focussed toward a particular application, fails to satisfy the extrascientific world's expectations. Thus, some of the funds are inevitably "wasted." This does not fit into the "politics of blame avoidance" (Weaver 1986) usually pursued by political actors. Financing research makes a political actor very vulnerable to delegitimation, because societal groups will inevitably justify their own demands for money from the state by pointing out how much tax money is wasted on research. Secondly, even if a considerable return on investment is yielded by the financing of particular research activities, a long time usually elapses before this return becomes visible. Political parties and party politicians, in particular, forced to present quick successes to the public in order to be reelected, tend to pass this orientation on to the ministries, too.

Although these considerations would lead us to believe that it is improbable that any political actor would ever invest in research, they do it all the time. There are ministries responsible for financing research, and politicians dedicated to furthering the cause of research policy. The various reasons for this surprising confidence of political actors in research are of no concern here. What is important, however, is that their benevolence is limited in two ways. Whenever the state's financial resources become scarce, the ministry in charge of research comes under pressure from the ministry of finance, and from other ministries competing for these resources, to cut back "luxurious" expenditures for "useless" research, or to induce a reorientation of research toward more useful goals. And whenever societal risks of particular research activities become visible, the ministry is pressured to introduce regulations in order to reduce the risks. To some degree, the ministry can act as a buffer for the research system against the trouble originating from other political actors, such as the ministry of finance (Stucke 1993). Nevertheless, the very political actors whom research actors need as their benevolent sponsors and protectors are also the ones who have to implement the measures which cause trouble. Sometimes they do this reluctantly because they are forced to by another political actor; sometimes they want to do it to achieve their own ends. The sponsorship and protection from these political actors thus breaks down just when research actors are most desperately in need of sponsorship and protection.

Lacking an effective obstructive capacity and support from benevolent political actors, research actors are left with *persuasion* as their most powerful means of exercising political influence. *Direct persuasion* occurs when a research actor facing trouble tries to change the minds of the respective political actors by convincing them that their actions which caused the trouble were unwise or unjust. *Indirect persuasion* happens when a research actor mobilizes influential allies to take a stand in opposition to the political actors. Persuasion, thus, consists of bringing forward arguments that will convince either the political actors or the potential allies. The political actors have to be convinced that what they are doing is not in their own best interest, or that it is not in keeping with their own moral principles; or other actors have to be convinced that they, too, will suffer from what the political actors are doing to the research actors.

Of course, the principal problem with all kinds of persuasion is that one must be able to find convincing arguments. While they may well harm a

research actor's self-interests, the measures implemented by a political actor will probably be fair and wise from the latter's point of view. Thoroughly convinced of his opinion on this matter, the political actor will probably be unshakable. Moreover, even if one does come up with convincing arguments, they can only be persuasive if the actors to whom one is appealing are willing to listen and to reflect critically upon their own point of view. If they have immutable prejudices, because strong self-interests compel them to see things in a particular way, it will be very difficult – and often virtually impossible – to persuade them with arguments that do not fit into their frame of mind. This applies especially when the arguments are not airtight.

1.2 The Low Capacity of Research Actors for Coordinated Collective Action

The research actors thus have no guarantee whatsoever that their attempts at persuasion will impress political actors at all; and even if persuasion has an impact, it remains to be seen how strong it will be. Persuasion is clearly a second-best means of political influence upon which research actors fall back because they lack the much better means of an effective obstructive capacity. But for persuasion to work at all, it is very important that the arguments put forward are presented as the unanimous point of view of all affected research actors. Each dissenting opinion among the arguers increases skepticism exponentially among the political decision makers to be persuaded.[5] If the decision makers are already somewhat skeptical, giving their skepticism even the slightest reinforcement may make any attempts at persuasion entirely futile.

Only if all the affected research actors speak with one voice do they have a chance to be listened to attentively by the political actors. This often requires an effective *capacity of research actors for coordinated collective action*. But looking at the research system from the perspectives of organization theory and of interest-group theory, one detects that this capacity, too, is largely lacking.

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5 Scientists in many countries experienced this firsthand in the debates about the safety of nuclear energy (Nowotny 1979; Nelkin 1987). A few dissenters sufficed to shatter the public credibility of nuclear physicists.

Most kinds of research organizations, universities and state-financed research institutes outside of the universities exhibit a comparatively *weak hierarchy*. The main reason for this is that most of these research organizations have a relatively weak influence on their individual researchers' scientific careers (Luhmann 1990: 679-680). A scientist's career is mainly determined by the reputation he acquires within his scientific community. This reputation is the researcher's major "social capital" (Bourdieu 1975) on the "academic market place" (Caplow/ McGee 1958). In other words, researchers are primarily "cosmopolitans," not "locals" (Gouldner/ Newcomb 1958). Of course, the research organization to which a researcher belongs shapes his opportunities to acquire a reputation by the amount of resources and time it provides him for research, and by the degree of autonomy it leaves him in his choice of research topics. But this means that research organizations are, from the point of view of their individual researchers, merely opportunity contexts within which they do *their own* work. Research organizations are the means for their individual researchers' goal attainment. The best expression of this individualism of research work is the fact that publications are attributed to an author, not to his research organization. All researchers share such an egocentric view of their research organization. Even the directors at the top of a research organization take this view, or at least have to concede it to their researchers. Thus, a research organization is seen and used by its individual members mainly as a "common pool resource" (Ostrom 1992) which they have to divide among themselves, with each one trying to acquire the most for himself.

This peculiar social structure of research organizations is a consequence of their prevailing internal structure of interdependence between different research activities. Research organizations exhibit a high degree of *pooled interdependence,* which is the most loosely-knit type of task interdependence (Thompson 1967: 54-55). Pooled interdependence means that there are no direct unilateral or reciprocal dependencies among researchers or research groups with regard to their research results. None of them needs the results of any other researcher or research group within the research organization to continue his or its own work.[6] In many scientific disciplines, an individual

6 This does not exclude that the work of others within the organization is often inspiring to a researcher. But such inspirations, while they may certainly be helpful, are not necessarily vital to one's work.

researcher still does his own work independently from his colleagues within the same research organization. At most, a few younger researchers form a small group around a professor or experienced researcher.

In other disciplines, especially in certain areas of the natural, medical, and engineering sciences, the advent of "big science" has led to groups taking the place of the individual researcher. Sometimes, as in particle physics, the cooperation of very large groups of researchers is necessary. However, these groups do not make up the whole research organization, since large groups tend to be parts of very large organizations. Thus, "big science" has not altered the picture fundamentally. Research organizations still tend to exhibit pooled interdependence among groups; only within groups is there sequential or reciprocal interdependence. The egocentric view of individual researchers is partly transcended by or embedded within a group-centered view, and the research organization itself becomes the means of the various groups' goal attainment. The research organization is still seen from a particularistic point of view.

Within this pooled interdependence, researchers or research groups are dependent upon each other only in terms of each one's contribution to the research organization's standing, which is an aggregate result of their individual reputations.[7] The organization's standing, in turn, determines the amount of the "common pool resource" to be divided among its members. But even this type of pooled interdependence is often quite loose. If attractive exit options exist for individual researchers, they can leave a research organization whose standing is declining because too many of its researchers or research groups have performed poorly. Thus, research organizations are extremely fragmented, "loosely coupled" (Weick 1976) organizations.[8]

As corporate actors, however, research organizations are not only weakened "from below" by the particularistic way their individual researchers or research groups view and use them. In addition, state-financed research orga-

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7 This also means that the research organization and its leaders are quite dependent upon the research performance and reputation of the individual members. Institute directors thus have to respect their individual researchers' or research groups' egocentric or group-centered view of the organization.

8 This is most obvious at universities, whose internal division into departments and chairs has the purely enumerative character of a catalog of unconnected specialties. But a closer look reveals that the same situation prevails at many research institutes outside of the universities, despite the much more narrow focus of their research programs.

nizations are also weakened "from above." As already mentioned, the ministry providing a research organization's institutional financing usually acquires rights to participate in important organizational decisions. Therefore, as instruments of coordinated collective action against political actors, research organizations are strongly impaired. The respective political actors will exercise their right to participate in a research organization's decision-making process if this is necessary to obstruct collective action directed against the political actors themselves. Because the individual researchers or research groups cannot simply switch from their particularistic use of the research organization to a mode of action which will allow the organization to become a strong corporate actor representing their common interests, they clearly face a dilemma. When their determination to preserve their opportunities to exploit the research organization for their own particularistic goals prevails, they welcome a weak hierarchy. When, for a while, their well-being depends on an increase in the organization's political influence, they welcome a strong hierarchy because that might be necessary to save them collectively. But if it does save them, which is by no means certain, each individual researcher (or group) might have lost his (or its) autonomy – a price that might turn out to be too high.

Another kind of corporate actor capable of coordinating collective action against political actors is an interest association. Interest associations are voluntary organizations of individual or sometimes corporate actors with common interests. Usually, interest associations are polyarchic organizations. Those at the top are elected by the majority vote of all members. The elected leaders will probably try to influence political actors, but their scope of action will be partially circumscribed by the extent to which they are able to impose sacrifices on the association's members without having to consult them on every decision. Do the elected leaders have enough *generalized support* at their disposal to arrive at such decisions even against the wishes of some or all of their members?[9] This generalized support is so important because it expands the interest association's bargaining capacity in negotiations with political actors. With adequate generalized support, the interests of some members can be sacrificed in order to realize important interests of the major-

9 For the distinction between generalized or "diffuse" support and specific support see Easton (1965).

ity of members; or some narrow-minded short-term interests of all members can be sacrificed in order to realize their vital long-term interests.

There are interest associations within the research system, although this kind of corporate actor is much less common than in other societal subsystems. This fact itself already raises suspicions about the strength of interest associations within the research system. Indeed, those that do exist are usually weak polyarchic organizations which are unable to impose serious sacrifices on their members. Interest associations within the research system are weak because they need a very high level of consensus among their members, which strongly restricts their leaders' bargaining capacity in negotiations with political actors. The "logic of membership" forcefully impedes the "logic of influence" (Schmitter/ Streeck 1981). The high level of consensus is needed because persuasion, which is the only kind of political influence these interest associations can exert, tends to suffer irreparably from even minor dissent, as we explained above. Under these circumstances, interest associations within the research system can only articulate demands and make bargains for Pareto-superior changes. No member shall suffer; instead, as many members as possible shall profit from the bargains struck with the political actors. Indeed, no member shall even fall behind the others too much. Therefore, not only absolute losses have to be avoided, but relative losses must also be kept within strict limits.[10] Only if these conditions are fulfilled will political demands get the unanimous consensus of the interest association's members. This requirement sharply reduces the set of alternatives for coordinated collective action. Interest associations within the research system are thus often forced into totally unrealistic bargaining positions. But this means that they have nothing to offer or to promise which might move political actors to make concessions.

Another cause of the improbability of coordinated collective action of research actors is that many of them have good chances to realize their interests on their own. This is also a consequence of the low task interdependence of scientific research – within as well as between research organizations. The fragmentation of research activities allows most research actors – individual researchers such as university professors as well as research groups or research institutes – to behave as independent entrepreneurs pursuing only their own interests without restrictions imposed by task interdependencies with

10 Relative losses can provoke envy, which in turn may give rise to dissent.

other research actors. This entrepreneurship operates mainly on the market for separately budgeted funds, which are granted by political actors – either directly or via their financing of specialized agencies for research promotion such as the German Research Foundation – or by firms and other customers in the market for contract research. Of course, there is competition on this market. But, nevertheless, many research actors can hope to realize at least a substantial part of their interests by independent entrepreneurship. For them, the possible additional benefits of coordinated collective action are often smaller than their own additional effort required for participation. Thus, they refrain from it and stick to entrepreneurship. Even the research actors who would benefit from coordinated collective action have to estimate carefully whether enough fellow actors will come to the same conclusion, because the success of coordinated collective action depends on a critical mass of participants. Obviously, this may result in a mutually reinforcing discouragement: Ego does not participate in coordinated collective action because he expects that Alter Ego will not participate, and vice versa.

All in all, the low political influence of research actors is *overdetermined* because it results from two independent causal factors, each of which alone would already be sufficient: the low obstructive capacity of research actors, resulting from the peculiar character of scientific truths, and the research actors' inability to launch coordinated collective action, resulting from the peculiar character of task interdependence in scientific research. Moreover, the research actors' perception of these effects of both factors reinforces the second one even more. Actors are more inclined to join in coordinated collective action if they perceive that the respective corporate actors possess effective capacities for political influence. No one engages in a hopeless struggle.

As we asserted at the beginning, these general reflections about the political influence of research actors are meant to lay the foundation for our theoretical analysis of coping with trouble, which rests on the assumption that a research actor's possibilities for coping are decisively shaped by its political influence. Guided by this assumption, we will now turn to the cases.

2 The Improbability of Preventing or Getting Rid of Trouble

Obviously, the weak political influence of research actors strongly reduces their chances to prevent or get rid of trouble. Our cases reflect this correlation, first of all, in that only a few actually exhibit instances of an attempt to prevent or eliminate trouble – and only some of these were even partially successful. In Schimank's case, the advocates of the German universities demanded from government that university research be compensated for the losses of general university funds. This pressure politics was utterly unsuccessful. As Mayntz shows, the East German AdW's attempts to survive as an institution were equally futile. On the other hand, the two French case studies by Krauss and by Musselin and Vilkas show how anticipated trouble was sometimes prevented by INRA or the CNRS. In the period following the events examined by Hasse and Gill, the community of German genetic researchers was also quite successful in pressing government to reduce the legal regulations of their research significantly.

2.1 Consequences of a Low Obstructive Capacity

Each of the cases of an unsuccessful attempt to prevent or get rid of trouble, and every case in which such reactions to trouble were not even tried, illustrates the various features of the research actors' low political influence outlined above. In none of the cases did the research actors have a significant *obstructive capacity*, which is plausible as structurally determined from our theoretical framework. Because of their chronic inability to influence political actors by obstruction, research actors have to rely on less effective kinds of social influence.

To counteract some kinds of trouble, certain research actors can insist that *formal rights* granted them by the state be protected – for instance, the German professors' autonomy with regard to choosing their research topics. This right is even constitutionally guaranteed. Its observance by political actors keeps them from ordering professors to do particular kinds of research or work on particular research topics. However, the political actors can often change such rights if they seem to be hindering the realization of political goals. In this respect, the German professors' autonomy, which is based on a law that is very difficult to amend, is a rare exception.

A more promising way to influence the political actors who have caused trouble is *social exchange*. Research actors are sometimes in a position to offer the political actors something in return for their refraining from or discontinuing measures which will cause trouble. For instance, research institutes may promise to redirect their type of research according to the wishes of political actors if the latter agree to revoke plans to cut back the institutes' budgets. As in Braun's case of the British biomedical research community, the political actors may even propose such a bargain to the research actors.

But neither formal rights nor opportunities for social exchange are readily at hand for research actors. Most often, they have nothing to fall back on but *persuasion*. Persuasion, be it direct or indirect, will be attempted in almost all situations of trouble. Some of our cases exemplify the types of arguments used and the kinds of allies sought after. In Schimank's case, the advocates of the German universities not only tried to convince the government that its responsibility for the country's future demanded an increase of general university funds, but they also presented the same arguments to the general public and to special interest groups such as business associations and trade unions. In this way, the advocates made an appeal to the long-term interests of government and societal groups. In the cases presented by Hasse and Gill and by Gläser et al., the genetic researchers and the nuclear researchers tried to assure the protest groups and the general public that genetic engineering and the research reactors did not pose a threat to their well-being. This was a primarily cognitive argument, which tried to eliminate what the research actors perceived as a judgmental error on the part of the public. Mayntz's case exemplifies a strong moral plea. The feared dissolution of the East German Academy was declared by some of its members to be another proof of an unjust and merciless conquest of East Germany by the West Germans.

As these examples suggest, such attempts at persuasion often bear no fruit. Particularly Stucke's case of the German big science centers indicates that persuasion is sometimes used even though the research actors are well aware from the beginning that it will be ineffectual. Such consciously fruitless prevention or coping activities can be interpreted as "symbolic politics" (Edelman 1964) by which the normative expectations of the individual members of the respective research organization or interest association regarding how their leaders should act in such a situation are fulfilled. In such cases, persuasion with arguments sure to be ignored is just an habitualized "standard operating procedure" (Nelson/ Winter 1982) for dealing with trouble situations, which

follows a "logic of appropriateness" rather than a "logic of consequentiality" (March/ Olsen 1989).

A special difficulty of certain situations in which persuasive attempts are made is illustrated by Hasse and Gill in their study of the German genetic researchers. Sometimes different actors whose support is needed have to be persuaded by mutually incompatible arguments. What persuades one actor dissuades the other, and vice versa. If the research actors do not meticulously separate these different audiences, it becomes apparent to everyone that the persuasive efforts are ridden with contradictions,[11] which destroys their convincing power. Thus, if different actors whose support is needed can only be reached by mutually incompatible arguments, this fact must be carefully concealed. Care has to be taken to prevent an actor from hearing arguments not directed at him. If this cannot be accomplished, as with the German genetic researchers, persuasion becomes very difficult.

Sometimes, though, persuasion is successful. Mutual trust between research actors and political actors seems to be an important supportive element of successful persuasion. As mutual trust generally increases with the density of contacts, it is not surprising that the French cases presented by Krauss and by Musselin and Vilkas exhibit several instances of successful persuasion. Political and scientific elites are much closer to each other in France than, for instance, in Germany.

In sum, research actors are often not very influential, so they are unable to prevent or get rid of trouble. In certain situations, however, they do not need to defend their interests themselves because they coincide with the interests of other, highly influential actors. This is indicated by recent developments in the case presented by Hasse and Gill. The genetic researchers from state-financed institutes had *powerful allies* in the big pharmaceutical and chemical firms, whose research was also restricted by the regulations of genetic engineering. These allies were able to press the federal government to remove quite a number of the legal restrictions of genetic research; researchers from the universities and the Max Planck Society profited from this, too. Such a coincidence of interests occurs when what is at stake is an indivisible good, so that there is no competition among the negatively affected actors. Regulative trouble often meets this condition whereas resource trouble usually does not.

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11 See Goffman (1956) for this requirement of "impression management."

Finally, there is the phenomenon of *"mock trouble"* detected by Krauss in the case of the INRA in France. "Mock trouble" is a mere show for the public and the political opposition[12] by which the political actors can symbolically display their determination to take a hard line with obstinate research actors without actually doing them any real harm.[13] This kind of "mock trouble" is staged by both sides – research actors and political actors – for a third group of political actors. This collaboration presupposes that the institutes are well-informed about the politicians' situation and in close contact with them – a constellation which is characteristic for France, as already mentioned. Another kind of "mock trouble" which happens even more frequently is the staging of trouble by the research actors for the political actors. This amounts to a dramatic rhetorical exaggeration of the potential or actual suffering of research actors resulting from certain political interventions. Of course, this is done to keep political actors from intervening further. If it works, this is the most elegant way of preventing real trouble. At least the research actors can hope that loud protests will deter the political actors from implementing measures which would increase the trouble even more. Stucke's case may be interpreted partly in this way. Thus, by complaining bitterly about actual financial cutbacks, the German big science centers hoped to keep the federal research ministry from pondering even harsher measures, especially the dissolution of whole centers.

2.2 Difficulties of Coordinated Collective Action

All these makeshift attempts to influence the political actors can hardly compensate for the research actors' low obstructive capacity. The research actors' *capacity for coordinated collective action* is a further important prerequisite for the prevention or elimination of trouble. This kind of solidarity does not necessarily imply that the research actors will transcend their narrow self-interests for the welfare of some collectivity to which they all belong. While such altruistic solidarity involving an actor making sacrifices for the collective

12 See the comparable phenomenon of "mock bureaucracy" described by Gouldner (1954: 182-187, 216-217).

13 This is one of the most common strategies of "politics as symbolic action" (Edelman 1964).

good may sometimes occur, instrumental solidarity in keeping with the research actors' particularistic view of the research organization will be more common. According to the familiar maxim that there is strength in numbers, research actors may simply realize that their self-interests could best be furthered by coordinated collective action.

As we already pointed out, this assessment is obvious neither to individual researchers nor to research institutes. While research actors are well aware that their trouble is of such great magnitude that collective action is necessary if the trouble is to be prevented or eliminated, they also realize that particularistic coping by each research actor individually will often result in an adequate – albeit small-scale – adaptation to the trouble. Such a piecemeal solution is sufficient for some researchers. As we explained, this applies primarily to those research actors for whom particularistic coping is the better bargain because solidaristic coping's added benefits are smaller than the added effort it requires. It also applies to the many research actors who are not harmed much by the trouble, or even profit from it. Such researchers, who are actually winners – or at least not losers –, can be found in all the case studies. For instance, in Schimank's case there were some professors whose research was not very resource-demanding and others who benefitted from the ministries' policy of redistribution of general university funds. Another example, in the case presented by Musselin and Vilkas, is the research group of the CNRS laboratory that perceived the move away from Paris not to be trouble but, actually, a good opportunity. For the first laboratory in Wolf's case, dissolution of the East German AdW presented no trouble at all. In Stucke's case, too, some big science centers were exempted from the resource cutbacks, as were some institutes at centers generally faced with trouble. Finally, in the case presented by Gläser et al., some of the users of neutron beams who could do their research in other laboratories were not seriously affected by the trouble facing the research reactors in Berlin and Munich.

For these two reasons, the troubled population of research actors is often divided into two segments: those who prefer solidaristic coping, and those who prefer the particularistic approach. The larger the second segment is or appears to be, the less mobilization for coordinated collective action will occur aimed at preventing or getting rid of trouble. Some political actors who are aware of this weakness exploit it, employing the strategy of *"divide and conquer"* (Baumgartner et al. 1978) to break down the potential for solidaristic coping; others at least welcome such side-effects of their measures if

they arise. In Schimank's case, government actors knew that the professors who profited from the redistribution of general university funds would hardly be inclined to join solidaristic coping activities. Such side-effects of "divide and conquer" would have been even more important for a suppression of solidaristic coping in Mayntz's case if there had not been a widespread preoccupation within the AdW with reforming its internal structure. This focus of attention kept the members of the AdW from using the Academy as an instrument of coordinated collective action. But even if they had, the government's declared intention to ensure that scientifically qualified institutes and research groups of the East German AdW should survive the Academy's dissolution probably would have contributed to inhibiting effective collective protests. When the situation of the AdW became critical, but before its fate was sealed, the institutes expecting to be among the survivors would have begun to care less for the Academy's fate and to concentrate, instead, on their own future prospects. The institutes which hoped, but were not sure, that they would be among the survivors would have concentrated all their efforts on improving their own chances, increasingly neglecting the possibility of surviving within the Academy. The institutes, however, which considered their chances to survive on their own to be low and which had not already given in to helpless suffering would have tried the hardest to mobilize collective action for the rescue of the AdW as a whole because this was their last chance to ensure their own survival. This hypothetical scenario shows a pattern of solidaristic coping frequently resorted to by actors who estimate their chances of particularistic coping to be rather low. To put it drastically, this kind of instrumental solidarity is often rooted in desperation. If political actors succeed in giving just a few troubled actors a ray of hope, this can suffice to stifle effective solidaristic coping.

Still, even if a research actor concludes that coordinated collective action would serve its interests best, two potential problems remain. The first is the familiar phenomenon of free-riding (Olson 1965). If an actor expects that a sufficient number of others will engage in coordinated collective action to prevent or get rid of trouble, and if this actor stands to profit from their potential success, it will be tempted to refrain from participation; but if many actors think this way, nothing will happen. This does not occur very often, though, because a research actor already begins to doubt the feasibility of its participation in collective action when it considers how unlikely it is that enough others will actually participate. This insecurity of attaining the necessary

"critical mass" (Marwell/ Oliver 1993) arises partly from the perception that some of the others are not strongly affected by the trouble, and that most of the others have opportunities to help themselves at least to some extent.

Thus, the probability that coordinated collective action will prevent or get rid of trouble is rather low. If collective action arises at all, it manifests itself very often via interest associations expressing Pareto-superior demands without sufficient scope for bargaining with the political actors. In Schimank's case, to give just one example, the West German Rectors' Conference (WRK) was forced to demand nothing less than full-blown compensation for the resource losses of professors, although everybody knew that government actors were neither willing nor able to meet this demand. As outlined above, interest associations within the research system *lack autonomy* because their members will not give it to them. An instructive example is found in Weyer's study of space research in Germany: The aeronautics research institutes founded an intentionally weak interest association because they each feared losing their institutional autonomy. Interest associations are unable to disregard the interests of even small minorities of their members in order to represent the interests of the whole population facing trouble. The leadership of the WRK had to respect the vote taken among all members regarding every important decision. Formally, majority decisions are taken; but informally, a total consensus is aimed for because decisions are not binding for those who disagree. The members of the Association of National Research Centers (AGF), a relevant actor in Stucke's case, guard their autonomy so jealously that they do not endow their interest association with any significant decision-making authority whatsoever. Instead, each big science center tries to lobby for its interests on its own, often openly against other big science centers. Coordinated collective action supported by many – or even all – of them happens only rarely and spontaneously, and it is not initiated by the AGF.

When hierarchically structured research institutes – or other corporate actors which are not of an associational character, like the funding agencies in Braun's case – are the potential initiators of coordinated collective action on behalf of their individual members or clients, other problems occur. Such institutes usually have much more autonomy in relation to their members than polyarchic interest associations.[14] This gives them greater leeway when bar-

14 German universities in particular lack this hierarchical structure. In this sense, German universities resemble the interest associations just mentioned more than they resemble

gaining with political actors and enables them to participate effectively in collective action, but it may also cause them to diverge widely from their members' interests. Such a divergence may result from the fact that trouble is often *level-specific* in at least three respects.

Firstly, even if we assume here for simplicity's sake that the interests of a research institute as a corporate actor are merely the sum of all its individual members' interests, its interests are nevertheless broader than those of each individual researcher. The same holds true, of course, for the relation between departments of an institute and the institute as a whole. Higher-level interests are always more inclusive than lower-level interests: It can be in the higher-level actor's interest to sacrifice the interests of some of its members in order to protect the interests of other members. Examples for this type of sacrifice can be found in the case of the CNRS in France presented by Musselin and Vilkas or in Stucke's case of the big science centers in Germany.

Secondly, in addition to having more inclusive interests than each individual member, institutes as corporate actors have interests of their own which go beyond the aggregate interests of their members. Each corporate actor is interested in its own continued existence and growth, the preservation or expansion of its domain, and the maintenance of its autonomy (Scharpf 1989: 45-46; Schimank 1992: 263-264). These interests coincide sometimes, but by no means always, with the interests of the respective lower-level actors. Thus, in the case presented by Gläser et al., the interests of the Hahn-Meitner Institute converged with those of its constituent institutes and of the researchers who needed the research reactor because atomic research was still an important element of this big science center's corporate identity. But, as Stucke's case shows, the situation was quite different in many of the other big science centers. There, the interests of the individual researchers and institutes working in research areas that were no longer scientifically promising and were not in government demand were not shared by the centers' directors, whose primary concern was the standing of their own center compared to others and its reputation at the federal research ministry. Another example is the Max Planck Society, which as a group of research institutes has to defend its autonomy in the face of political actors' attempts to intervene in the selection of research topics. In periods of resource scarcity, each institute of the Max Planck Society may very well be interested in acquiring as much separately

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research institutes.

budgeted funds as possible from federal or state ministries although this implies the danger of weakening the group's autonomy. Mayntz's case is perhaps the clearest example for a strong divergence of interests between levels. The individual researchers and institutes of the AdW whose research performance was excellent had no strong interest in the AdW's preservation, whereas the AdW, in turn, did not share their interests in finding new and better institutional niches for their research activities.

Thirdly, as outlined above, state-financed research institutes have to act to a certain degree as agents of their political principals. Thus, unfortunately, the research actors with the best connections to the political actors – which we have shown to be helpful for the prevention or elimination of trouble – are frequently obliged to implement the political measures which cause the trouble. This applies certainly to the leadership of the German big science centers in Stucke's case, to the director of INRA in Krauss's case, and to the directors of the CNRS in the case presented by Musselin and Vilkas.

Accordingly, research institutes as corporate actors are not always an obedient instrument of their members' coordinated collective action. Even if institutes represent their members' interests to political actors, they may do it only half-heartedly for the reasons just mentioned. The members, in turn, reflecting upon this, will often refrain from any attempt to push their institute towards coordinated collective action to prevent or get rid of trouble.

All in all, the chances for coordinated collective action as a means of political influence to prevent or get rid of trouble are small. Moreover, even if such action is actually taken, its success is still extremely dependent upon the political actors' action space. They must be able to retract or discontinue the measures which caused the trouble to the research actors. The extent to which the relevant political actors are forced to act as they do by circumstances they cannot change determines just how futile attempts to prevent or get rid of the trouble can become. The action space of the political actors who caused the trouble, in turn, is determined by the extent to which other actors can narrow it down. Foreign states may apply considerable pressure on political actors, as Weyer shows in the case of the prohibition of German rocket research after World War II. Public opinion and protest groups can also attract political actors' attention, as the two cases of regulatory trouble presented by Gläser et al. and by Hasse and Gill emphasize. By forcing budget cuts on the political actors responsible for research policy, the ministry of finance can impose serious constraints, as the cases of the professors and the biomedi-

cal researchers described by Schimank and by Braun illustrate. Other policy concerns – in Schimank's case, for instance, educational policy making it impossible to restrict the number of students admitted to the universities – may dominate research policy.

From our first examination of the cases, we can conclude that the conditions necessary for preventing or eliminating trouble are seldom fulfilled. Our general considerations about the research actors' low political influence originating in their inadequate capacity to obstruct processes of societal reproduction and to engage in coordinated collective action are confirmed by the cases. But if such a political mode of coping is possible only under exceptional circumstances – some of which could be detected in the cases – how *do* research actors usually cope? Which alternative reactions to trouble, apart from helpless suffering, remain open to them? With this question in mind, we shall review the cases again.

3 Adaptation to Trouble and Its Shortcomings

Whenever trouble cannot be prevented or got rid of, coping can be nothing more than a "response to irreversible loss."[15] Research actors' adaptive reactions to worsened research conditions go in two main directions: accommodating themselves to their worsened research conditions, or searching for a way to escape from their trouble.

Efforts to accommodate aim at making the best of a bad situation. In a situation of resource trouble, research actors may economize, either by proportional cutbacks, by queuing resource demands according to their temporal order, or by putting greater emphasis on a rank-ordering according to substantial priority. Research actors may deal with regulative trouble or trouble from extrascientific interventions in their research program by being obedient and, at the same time, working toward a step-by-step shift in their research topics and methods. Research actors may handle trouble from institutional restructuration by gradually learning how to pursue their own research interests under

15 As Fritz W. Scharpf put it in a discussion at the conference on "Coping with Trouble" in November 1992 at the Max-Planck-Institut für Gesellschaftsforschung in Cologne.

their new institutional conditions. There is sometimes only a thin line between such accommodating efforts and helpless suffering.

Searching for a way to escape from a troublesome situation is a very different means of adaptive coping. Individual researchers may leave their present institute for one that is trouble-free, or at least seems to have less trouble. Such an exit option is usually not available to research institutes. But they can try to find new sources for funding in situations of resource trouble – an option also open to individual researchers. Research actors can react to regulative trouble by secretly trying to get around the regulations, and they can counteract trouble from extrascientific interventions into their research program by pretending to conform to these expectations while actually trying to continue research according to intrascientific priorities. Confronted with trouble from institutional restructuring, research actors can use, for instance, networking strategies to find themselves a new niche that is trouble-free. All of these possible strategies of adaptive coping are illustrated in our cases.

3.1 Conditions for Solidaristic Adaptation to Trouble

Adaptive coping can be particularistic in character, but it may also be solidaristic. This latter type of coping can either be hierarchically enforced upon actors facing trouble, or it can be self-organized by them. The advantages of *solidaristic adaptation* over particularistic adaptation are obvious. Solidarity makes it possible for relatively better-off research actors to help ones that are worse off; at the very least, ruinous competition among actors vying for the scarce opportunities to escape from their troublesome situation can be prevented. Nevertheless, in our cases there are not many examples for solidaristic coping. Although it is easier to accomplish than the prevention or elimination of trouble, it is still too difficult in most situations.

Hierarchically enforced solidaristic adaptation to trouble is something quite common in other societal sectors – in industrial firms, for instance, where the managers decide which departments shall suffer to what degree from necessary budget cuts so that the firm as a whole suffers least. No matter what kind of trouble is facing a research institute – resource cuts, submission to political regulations, or imposed research topics – the hierarchical leaders' capacity to enforce a differential allocation of the trouble within the collectivity will depend on the strength of their authority. As already men-

tioned, interest associations within the research system usually do not possess such authority over their members. Within research organizations – particularly within universities – strong polyarchical elements and professional solidarity can interfere with the leaders' authority. Thus, there are several reasons why a president or dean at a German university will be quite reluctant to impose a differential allocation of trouble on the professors, the main one being that he is often bound by the mutual attitude of cooperativeness described in Schimank's case. On many of the relevant issues, moreover, the dean or president cannot decide alone, but must heed the majority vote of the respective group of professors. This differs greatly from the situation in American universities, for instance, where the deans and presidents possess greater authority and the stage is thus set for hierarchically enforced solidaristic adaptation to trouble.

For hierarchically enforced adaptive coping to be successful, the hierarchical leaders must be willing to use their power for a differential allocation of trouble. That such assertiveness is often lacking stems not only from factors common to all kinds of hierarchies, such as the superiors' fear of conflicts and of taking the responsibility for allocative decisions that may be wrong, but from a special factor peculiar to the professional socialization of researchers and, hence, the research system: the academic's conviction that neither professors nor their counterparts in extrauniversity institutes should be subject to hierarchical orders from someone who is their professional equal. This widespread attitude may keep a university president, a dean, or a director of a research institute from effectively using his power, as is explicitly mentioned, for instance, by Musselin and Vilkas in the case of the CNRS in France.

Coping that takes the form of solidaristic adaptation to trouble will therefore tend to be *self-organized* rather than hierarchically ordered. Even adaptation that formally appears to be hierarchically enforced is often de facto self-organized. Self-organization in this context means that a plurality of actors faced with trouble assemble into a solidaristically coping collectivity. Self-organized solidaristic adaptation to trouble does not come about "from above" but "from below." Since this does not require a hierarchy, it is easier to achieve. At its minimum, self-organized solidaristic adaptation to trouble is nothing more than an implicit mutual nonaggression pact resulting from an attitude of cooperativeness, as exemplified by Schimank's case of the German professors mentioned above. This adaptation requires neither binding agree-

ments among those involved, nor even an explicit communication of the intention to respect the others' interests. All that is necessary is *continual mutual observation,* so that everybody knows about everybody else's moves. If this is guaranteed, risk-averse actors whose primary concern is to avoid others dumping their trouble on them, and conflict-averse actors who shy away from the stress of conflicts with colleagues, will jointly bring about such an implicit mutual nonaggression pact.

Mutual observation requires mutual visibility of the actors involved, which confines the size of the respective collectivity. The multilevel structure of actors within the research system sometimes makes such visibility quite easy. The vertical architecture of the actor constellation at the German universities, for instance, produces visibility by decomposing the multitude of individual professors into small units of mutual observation. Professors within faculties, faculties represented by their deans within universities, and universities represented by their presidents within the WRK: On each level, the actors can survey what the others are doing. Thus, nobody can expect to be able to cheat the others secretly, and nobody has to fear that he might be secretly cheated by the others. The more the higher-level actors depend on their lower-level members' acceptance, the better an overall coordination of a great number of individual researchers can be achieved, as the universal mutual nonaggression pact within the German university sector demonstrates.

For explicit agreements to result from bargaining, the number of actors within a unit of communication has to be much smaller than the number of actors within a unit of mutual observation. Weyer's case contains examples of self-organized networking among research institutes trying to cope solidaristically with their common trouble. These institutes agreed upon goals whose realization would make each of them better off. This is a comparatively simple situation for solidaristic self-organization. Explicit agreements are even more necessary, but much more difficult to reach, if solidaristic adaptation to trouble is to achieve a differential treatment of the actors involved. In most situations, many different allocations of trouble within a collectivity are possible in the sense that many winning coalitions meeting the demands of institutionalized decision rules could be formed. Which coalition actually results depends on diverse factors shaping the actors' interests and opportunities. Such winning coalitions are able to exploit the losers by shifting their own burden of trouble onto them. But again, because of this very multitude of possible winning coalitions, such exploitative moves are frequently not initiated.

Thus, each coalition of exploiters would be highly unstable, because someone now belonging to it might be a loser if a new coalition is formed tomorrow. Even to suggest forming a certain coalition of exploiters harbors the risk that others might decide to form a coalition themselves to which one might not belong. Only if some factors, such as strong cleavages established for other reasons, sharply limit the number of possible winning coalitions of exploiters can such a coalition actually be established.

Thus, if a differential treatment of actors facing trouble is achieved at all, it tends to go in the opposite direction. The better-off actors help the worse-off ones.[16] The Fraunhofer Society (FhG) in Germany, for example, had a very hard time just surviving in the 1950s and early 1960s (Hohn/ Schimank 1990: 181-211). Financial resources from contract research were very scarce and unevenly distributed. Some institutes were not able to cover their own costs for a long time, while others took in much more than they needed for themselves. To survive as a group, the FhG redistributed resources from the comparatively well-off to the worse-off institutes. The better-off institutes approved of the redistribution, perceiving that they, too, would profit from the preservation of the group as a whole. In addition, there was the implicit understanding that a sort of mutual insurance was established. The institutes now helping the others would have a right to call upon them for help in future if they needed it.

Solidaristic adaptation to trouble, therefore, tends to be self-organized. When it is, it usually results in a proportional allocation of trouble among the affected actors. Thus, solidaristic coping often stabilizes the status quo of the distribution of research conditions among the troubled research actors. When solidaristic coping is involved, the trouble does not result in an escalation of the fights among research actors for the maintenance and improvement of each one's research conditions – although political actors often want to trigger just that, as the government actors in Schimank's and Braun's cases explicitly declared. But a crucial prerequisite of solidaristic adaptation to trouble is that the affected actors are able to mutually observe each other,

16 One might interpret this as an exploitation of the former by the latter. But the better-off actors differ from the winning coalitions just discussed in that they agree to help the others, often without having to be persuaded to do so. Sometimes a large majority of actors decide to help a small group of worse-off actors which would not have been able to press for this help.

so that deviations from the attitude of cooperativeness can be detected and sanctioned. Often this condition is not fulfilled, so that only a *particularistic adaptation* to trouble is possible – the kind of coping least difficult to accomplish because it requires neither hierarchical authorities, mutual trust, communication among actors, nor even mutual observation.

3.2 Particularistic Adaptation as the Prevalent Reaction to Trouble

The majority of instances of coping cited in the cases must be categorized as particularistic adaptation to trouble: the competition of researchers for separately budgeted funds in Schimank's and Braun's cases; the strategies of the institutes and research groups endangered by disassociation from the CNRS in the case presented by Musselin and Vilkas, by dissolution in Wolf's case, by resource cutbacks in Stucke's and Weyer's cases, and by restrictions of their research methods in the cases presented by Hasse and Gill, and Gläser et al.; finally, the exit of individual researchers from troubled institutes reported in many of the cases. In game-theoretical terms, particularistic coping is a *game against nature*: against other actors whom one regards as causal forces which one cannot influence strategically.

Very often the allocation of trouble among actors trying to cope particularistically results in a skirmish akin to the Hobbesian war of everybody against everybody else – although, of course, particularistic coping does not take place within a "state of nature." These struggles to grasp scarce opportunities to reduce one's own damage from trouble occur whenever these opportunities are available to many other actors facing trouble as well,[17] as is the case with separately budgeted funds, or with research facilities like the research reactors for the groups of users of neutron beams in Gläser et al.'s case. Under such circumstances, particularistic adaptation to trouble quickly develops into a ruinous competition for coping opportunities. Some actors confronted with trouble will come out of this sooner or later without any opportunity to cope. They will have been reduced to helpless suffering. These are the absolute losers of particularistic coping. Most other actors will find – and take advantage of – opportunities to cope, but the competition will exact an ever-

17 See, again, Ostrom's concept of a "common pool resource" (Ostrom 1992).

increasing price. These actors are, therefore, relative losers. Thus, if coping opportunities are available collectively, almost everybody involved in particularistic adaptation to trouble will lose.

Sometimes, though, particularistic coping can rely on discrete coping opportunities, each of which is exclusively available to one particular actor facing trouble. In such cases, the actors can avoid the additional losses resulting from ruinous competition. For example, many of the methods employed by professors to cope with the time pressure of an increasing teaching load do not interfere with each other.[18] If one professor reduces the quality of his teaching, this does not stop another professor from doing the same, whereas one professor's gain of separately budgeted funds is another's loss. Similarly, many strategies used to cope with regulatory trouble identified in the cases presented by Hasse and Gill, and by Gläser et al., are available exclusively to the actors faced with that particular trouble. For instance, if one group of researchers tries to secretly circumvent the legal restrictions of genetic research, that does not deprive another group of the same opportunity – as long as this tactic does not become so evident that government agencies detect it and react with stricter controls.

The widespread use of particularistic coping is not only due to the comparative ease with which it can be accomplished, but also to the research actors' prevalent *weakness of will*. Actors engaged in any kind of solidaristic adaptation to trouble or in the solidaristic elimination or prevention of trouble will repeatedly pass by situational opportunities for their own particularistic adaptation to trouble. These opportunities are temptations to openly or secretly abandon the solidarity achieved – the bigger one's troubles are, the more tempting the opportunities look. "High cost situations" (Latsis 1972) are bad times for solidarity. Each actor, moreover, knows that this weakness of will is not confined to himself, but that the others are afflicted with it, too. Thus, each research actor has to take into account not only his own weakness of will, but everybody else's, the latter reinforcing the former. The others' assumed or proven weakness of will not only necessitates one's own grasping of opportunities for particularistic coping, but also serves as a ready excuse for it. Thus, even just a few situational opportunities for particularistic coping

18 As long as their aggregate effects are not so conspicuous that the ministry responsible for the universities is prompted to interfere by instituting a stricter monitoring of teaching.

can forcefully undermine solidaristic coping[19] – as if it were not difficult enough to achieve for so many other reasons.[20]

Particularistic adaptation to trouble is possible on any *level of action* – from the lowest level of individual researchers up to the highest level of interest associations which deal directly with political actors. Stucke's case illustrates this. Just as an individual researcher working in one of the German big science centers may cope on his own with the resource cutbacks as they affect him, any of the centers may do the same even if other centers are affected by the same resource cutbacks and even if an attempt at a solidaristic removal of trouble has been made. Nevertheless, as already mentioned, the particularism of higher-level actors has a broader scope because they have to aggregate the interests of a plurality of lower-level actors. Higher-level actors able to observe each other and communicate with each other are not easily swayed by the particularism of their individual members. In this way, higher-level actors serve an important order-preserving function against the disruptive effects of individual particularistic coping.

Sometimes, though, higher-level actors deliberately allow for particularistic coping on the lower level of action or even promote it. This happens whenever it is in their interest to foster "healthy" competition among lower-level actors because it will make them more compliant or increase the quality of the lower-level actors' performance, especially by eliminating poor perform-

19 In game-theoretical terms, the actors' weakness of will constitutes a Prisoner's Dilemma game in which each actor strongly discounts the future so that no "evolution of cooperation" (Axelrod 1984) – i.e. mutual trust in each other's firmness against temptations to grasp situational opportunities of particularistic coping – can occur.

20 However, a certain number of opportunities for particularistic coping may also stabilize solidaristic coping. These opportunities may give the actors facing trouble a little leeway for coming to terms with their weakness of will, which would otherwise destroy their solidarity altogether. To continue in the game-theoretical vein, this means that the game has a certain tolerance for what are called "trembling hand" phenomena (Holler/ Illing 1991: 106-107). Schimank's case might illustrate this. Only because the German professors were able to cope with their resource troubles particularistically by the acquisition of separately budgeted funds were they not tempted to destroy the self-organized solidaristic adaptation to trouble in the intrauniversity nonredistributive allocation of general university funds. But although this case demonstrates a mutually reinforcing coexistence of solidaristic and particularistic coping, it nevertheless points to the strong tendency of coping efforts towards a particularistic adaptation to trouble. This tendency has to be paid tribute to if solidaristic coping shall be maintained over time.

ers. Funding agencies occasionally try to use shrinking budgets in this way, as Braun's case shows. In the same manner, research institutes may stimulate the competition for resources among their departments or research groups, as is evident from the case study of the CNRS.

Quite often, however, higher-level actors try to initiate action by the lower-level actors which the latter can view as being solidaristic adaptation to trouble. Higher-level actors may do this because it is in the interest of the whole population of troubled lower-level actors to avoid ruinous competition. This goal of higher-level actors is frequently not at all easy to realize, as has been elaborated upon above. Solidarity can seldom be ordered or arrived at simply by incentives. For example, it is almost impossible for research institutes in trouble to prevent their best researchers from leaving for better jobs. Thus, attempts by higher-level actors to keep lower-level actors away from particularistic coping are often futile. Still, higher-level actors can at least sometimes cope solidaristically among themselves and thus tame the particularism of the respective lower-level actors somewhat.

Another factor which further reinforces tendencies of lower-level actors toward particularistic adaptation is the exceptional character of big trouble, which demands high sacrifices from many affected actors. The smaller the trouble is, the better particularistic coping works for an affected actor. But comparatively small trouble may happen frequently enough for actors to learn how to cope with it over time. Schimank's case of the German professors and Braun's case of the biomedical researchers illustrate this. Thus, particularistic coping is routinized to some extent. In contrast, actors are usually not prepared for the rare occasions of big trouble, when only solidaristic coping together with other affected actors might help them effectively. They have neither acquired adequate skills nor learned to rely on established social mechanisms which might promote solidaristic coping. Mayntz's case depicts such helplessness, which leaves no option but particularistic coping. Since big trouble is often accompanied by a strong time pressure, there is almost no chance to build up solidarity on the spot.

All in all, there is a weighty tendency towards particularistic adaptation to trouble on each level of action; the lower the level of action, the stronger this tendency is. All other kinds of coping, not to mention prevention, are much more difficult – and often impossible – to accomplish. But particularistic adaptation, although it may be advantageous to some of the actors in

trouble, has only a comparatively *low overall effectiveness* for the whole population of these actors. Its defects are manifold and often interconnected.

First of all, by definition, particularistic adaptation to trouble does not eliminate its causes. It can be likened to treating only the symptoms of an illness. The pain vanishes, but the illness gets worse, unnoticed, until a point is reached when a cure is no longer possible. For example, if researchers' work is thwarted by restrictive regulations in one country, and they leave to do their research in another, less restrictive country, this may solve their problems for the time being. But what is to stop this other country from adopting similarly restrictive regulations? Of course, researchers might move into a third country, and so on. However, sooner or later there will be no more feasible exit options. Then particularistic adaptation to trouble will have come to a standstill, and the whole trajectory of coping turns out to be a dead-end street. Moreover, by the time the researchers notice this, their trouble has multiplied and is, hence, all the more difficult to cope with. As long as the restrictive regulations prevail in only one country, researchers may use the other countries as points of reference to indicate to the political actors how unreasonable their measures are. But if similar legislation is enacted everywhere, this argument becomes much less persuasive. It is not surprising, therefore, that in the cases studied by Hasse and Gill and by Gläser et al. not only the research institutes – which have no exit option – but also researchers and research groups were persistently trying to get rid of the trouble. That German genetic researchers can now work again under less stiff regulations is due to the fact that they did not confine their coping to particularistic adaptation.

More generally, when they opt for particularistic adaptation to trouble, actors run the risk that their coping, as successful as it may be in the short run, may even intensify their trouble in the long run. Weyer's case is an instructive example of how serious the *shortsightedness* of particularistic coping can be. When the institutes coped with the scarcity of resources at the state level by accepting generous funding from the federal government, they incurred a debt: Sooner or later, the rescuer wanted a reward. Thus, this kind of particularistic adaptation almost inevitably brought about the future trouble of becoming the object of instrumentalization by the federal government. This example points out that it might be very useful to systematically

investigate which kinds of potential future trouble are inherent in the different kinds of particularistic coping.[21]

Another example of the shortsightedness of a particularistic adaptation to trouble demonstrates how it is often coupled with certain other serious defects resulting from "unhealthy" competition. If research actors, such as the German professors in Schimank's case, react to resource cutbacks by increased efforts to acquire resources from other sources, this quickly results in an escalating competition among them. This shifts more and more intellectual energy and working time from research work to resource acquisition, with decreasing – and increasingly insecure – returns. This is the first reason why competition beyond a certain point is no longer "healthy." Secondly, the insecurity as well as the time pressure associated with increased efforts to acquire resources furthers a preference for conventional, uncontroversial research topics and approaches, as Braun's case shows. Thus, beyond a certain point, increased competition strengthens the research orthodoxies, which is detrimental to the long-term innovativeness of the respective research areas. If research actors have adopted particularistic adaptation to trouble as their way of coping, they drift helplessly into a situation where competition becomes ineffective. This is, moreover, associated with increasingly sharp conflicts among the research actors. These conflicts emerge from the process of escalating competition as well as from its result, an increasing inequality of research possibilities.

As several of the cases show, some researchers, research groups, or research institutes are actually better off after their coping efforts, while most are worse off. Wolf's case demonstrates aptly that the research actors who are successful with their particularistic adaptation are not necessarily those whose research performance is superior. Other factors – such as political skills and connections, belonging to the established research orthodoxy, or the good luck that one's research area appears to be more promising with regard to its societal usefulness – are often equally or even more important than the quality of one's research work. Thus, because factors which have nothing to

21 Even an attempted prevention of trouble may produce future trouble, as the case presented by Hasse and Gill shows. The genetic researchers who wanted to prevent public distrust by openly discussing possible risks of their research and, later, by advising government to establish certain regulations ended up having to cope with heightened public distrust and extremely bureaucratic handling of the regulations.

do with research performance gain weight in a situation of increased competition, particularistic adaptation to trouble, again, makes research more ineffective.

Sooner or later, these negative effects of "unhealthy" competition are suboptimal from the point of view of the respective *political actors*, too. It is true that what is trouble to the research actors is often the desired result of political actors' measures to increase research performance or to direct research by initiating more competition. The difficulty often neglected, however, by political actors is that it is not at all easy for them to keep competition within "healthy" limits once it has started. This is partly because the point at which competition becomes counterproductive is not discernible until it has been passed. Only then do the negative effects mentioned materialize; only then are they taken seriously by the political actors, who always suspect – and not without reason – that research actors' laments about their troublesome situation are totally exaggerated. But if the political actors finally realize that the competition they stimulated has gone too far, they often lack adequate means to reduce it again.

Another suboptimal feature of particularistic adaptation to trouble from the point of view of political actors is sometimes the *anarchic character* of this kind of coping on the aggregate level. By definition, all kinds of solidaristic coping and solidaristic attempts to prevent trouble achieve some degree of intentional coordination of action among the actors affected by the respective trouble. This coordination brings about a strong reduction of the set of relevant alternative action possibilities. For instance, efforts to get rid of trouble converge into a few clear-cut options of collective action that otherwise would be a chaotic variety of independently pursued actions by a multitude of actors in trouble. Even self-organized solidaristic adaptation to trouble – such as a mutual nonaggression pact among the respective actors – has a recognizable pattern which allows political actors to calculate the endogenous dynamics and their aggregate effects. Such a calculation is a prerequisite of a purposeful political intervention. Obviously, however, the more independently acting actors there are to be taken into account, the more difficult this calculation becomes. Admittedly, sometimes political actors deliberately create an anarchic confusion of particularistic adaptations to pit the research actors against each other so that everyone's resistance to political interventions will be broken by exhaustion after a while. But this is not what political actors usually intend to achieve. Instead, their aim is usually to bargain with the

research actors. This, however, is only possible with a small number of actors; the multitude of actors affected by some trouble is therefore required to bring about a solidaristic collective coordination of their actions.

Consequently, particularistic adaptation to trouble is often harmful not only to the research actors but, in the long run, to the political actors as well. Compared with other societal sectors, the research system exhibits a rather *defective trouble management*. Political actors are confronted with a highly fragmented multitude of research actors. It is not unusual for the level of the individual researcher coping by himself according to his own situational opportunities and individual interests to have a significant and disturbing impact on political interventions. But, as we spelled out at the beginning of this chapter, these defects of trouble management are unavoidable within the peculiar structural framework of the research system, which, in turn, is strongly determined by the character of research work. Thus, the catalog of dysfunctions of the prevailing particularistic adaptation to trouble presented here should not be misunderstood as a naive plea for more solidarity among research actors. Although this would benefit them as well as the political actors, such a plea would be in vain. This insight, in turn, amounts to the diagnosis of a growing political crisis of the research system in contemporary societies – if, that is, we are correct in our estimation (elaborated in the introductory chapter) that all kinds of trouble will intensify in future. Under these circumstances, the predominant pattern of coping by a particularistic adaptation to trouble will become increasingly defective.

There seems to be only one way out of this escalation of trouble. If political actors perceive that their measures which cause trouble for the research actors are becoming harmful for themselves, they may refrain from or discontinue measures which are – or would be – troublesome. This would amount to a political recognition of the politically dysfunctional aggregate effects of particularistic coping. For instance, referring to Schimank's and Braun's cases, if political actors intend to improve the overall research performance by increasing the competition for separately budgeted funds, they may discover after a while that they have overdone it and caused serious trouble to the good researchers whom they wanted to promote. They may find that they have initiated ruinous competition among researchers, which indeed has eliminated bad research, but has also harmed good research because the good researchers have become too occupied with resource acquisition and had to neglect research activities. This perception would give political actors the chance to

correct their measures. Whether they are willing and able to do so depends on many other factors, though. Thus, even this way out of the crisis is anything but certain. The research actors' main problem – their incapacity to rescue themselves from trouble – persists. Since no ready solution is in sight, trouble will probably intensify in the near future.

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