Mission impossible? Institutional barriers to the diffusion of the 'third academic mission' at German universities

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Abstract: The intensification of university-industry relations and the role universities play in a knowledge society are widely discussed. Some even argue that economic development through technology transfer has become a 'third academic mission' on a par with universities' traditional missions of teaching and research. Institutional barriers to the diffusion of that mission, however, are largely ignored. With the aid of some conceptual and theoretical tools from research in organisational analysis the paper focuses on these barriers. Empirical evidence is drawn from a study on technology transfer offices at German universities.

Keywords: Technology transfer; universities; third academic mission; transfer offices; diffusion; institutional barriers.

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1 Introduction

Scientific collaboration and networking do not take place only among industrial organisations. In a knowledge society, the linkages between industry and universities play an ever more central role. In particular, economic development through technology transfer between universities and industry is of ever increasing importance. This worldwide trend is reflected in a multitude of linkages between industry and academia, as well as in political programs aiming at facilitating technology transfer. In addition, scholarly discussion on the changing role of universities in a knowledge society has

intensified. Social scientists like Henry Etzkowitz, Andrew Webster, and Peter Healey, for example, argue that economic development through technology transfer has become a 'third academic mission' [1]. According to this view, the societal functions of universities are no longer solely research and teaching – the two traditional missions of the university. Direct contributions to economic development are no longer limited to the collaborative efforts of individual researchers, but have become an institutional mission of the university.

The view that economic development through technology transfer has become one of the primary missions for universities has strong normative implications. Not surprisingly, this position has provoked an intense scholarly and political debate, focusing on the risks and benefits of the 'third academic mission' [2]. It is striking, though, that both advocates and critics of the 'third academic mission' seem to take the unproblematic diffusion of that mission for granted. Institutional barriers to its diffusion are, generally, ignored. Therefore, the central aim of this paper is to focus squarely on possible institutional barriers. Instead of asking normatively, 'Is the third academic mission desirable?', we will first ask empirically 'Do universities assume a third academic mission?', and, if not, 'What are the institutional barriers to the diffusion of that mission?'. Empirical evidence will be drawn from a study on technology transfer offices at German universities. Our empirical findings will be analysed with the aid of some conceptual and theoretical tools from research in organisational analysis. Our main objective is to focus on transfer offices and universities as organisational entities being embedded in wider institutional contexts. Though the empirical focus is on the German case, the overall theoretical perspective of this paper allows for a more nuanced view of possible institutional barriers to the diffusion of the 'third academic mission' and changing university-industry relations in general.

In this paper we will first give a brief outline of the historical and institutional background of technology transfer and related offices at German universities (see Section 2). We will then describe the research methodology and data sample of our study (see Section 3). Having done that, the five main findings will be presented and analysed (see Sections 4.1, 4.2, 4.3, 4.4, 4.5). These findings depict the most critical institutional barriers to the diffusion of the 'third academic mission' within the organisational setting of German universities. The paper concludes with a summary and an outline of some research perspectives.

2 Historical and institutional background

German universities have actively taken part in technology transfer since at least the late 19th century. Strong ties between academia and industry were especially fruitful in chemistry. Medicine, physics, and engineering also had exposed strong ties between different constituencies, which facilitated a series of remarkable scientific and technological innovations. Two major specifications need to be made, however. The Berlin University, founded by Wilhelm von Humboldt in 1809/1810, was the role model for the German university system as such. It was highly influenced by German idealist philosophy of that time (e.g., Hegel, Fichte, Schleiermacher). The ideal was one of a remote, socially disembedded community of students and professors, happily bound together in a unity of teaching and research. The status of the natural sciences within that institutional setting had been ambiguous: theoretical advancements had been widely

recognised, while empirical research and industrial applications were considerably lower in status. The study of engineering received much less recognition. Engineering had been taught at polytechnic schools, which had, despite their increase in status in the 1870s, a far lower status than did universities. A second specification has to be made with regard to the character of the ties between academia and industry. They were not institutionalised whatsoever. The transfer process had been limited to the directly involved partners in academia and industry. The very ingredients of technology transfer as a 'third academic mission' – organisational infrastructure, university's active involvement, political programs– were absent during this early stage of academic transfer activities in Germany.

The situation changed dramatically during the 1970s. Triggered by the widespread perception that German technology lagged behind that of the USA, efforts were made to facilitate cooperation between different partners in technological innovation. The relatively slow flow from basic research to industrial applications caused concern among policy makers. As a result, technology transfer from universities was no longer seen merely as an informal process between individual researchers and industrialists, but rather as an organised activity needing institutional support. Technology transfer increasingly involved the university as a whole, rather than solely transfer-oriented individuals. This shift manifested itself in a variety of newly created political programs and organisations.

One major outcome of these efforts was the creation of technology transfer offices at German universities. These offices – located within academia but closely bound to the economic realm – seemed to be the most appropriate tool for overcoming the divide between universities and industry. Early pilot projects began in the mid to late 1970s (1976 Bochum; 1978 Tübingen; 1979 Technical University Berlin). During the 1980s the institutionalisation of transfer offices gained considerable momentum. This rapid institutionalisation process concluded in the 1990s with nearly all German universities having their own transfer office.

3 Research methodology and data sample [3]

Our research methodology consisted of interviews based on guidelines. With this, we complemented the bulk of research on technology transfer which is based on standardised questionnaires. While the latter are best at gathering and analysing large amounts of data, the methodology we employed can better come to terms with ambiguous and open responses. Through this strategy, we were able to corroborate findings from questionnaire-based studies. The method also allows us to add further insights into a complex issue. The control problem in interviews was tackled in two ways: firstly, in order to minimise the risks of idealised or strategic responses we asked different interview partners about one and the same subject. Secondly, we tried to validate our interview findings through written documents (statistical yearbooks, reports, related studies and the like). The interviews were recorded and transcribed. Later, we created analytical categories according to our guidelines and research hypotheses. Through this we were able to decompose, analyse, and interpret our interview material in a systematic and non-random way.

The data sample included all universities, their transfer offices and the related local Chambers of Industry and Commerce in North Rhine-Westfalia. Fourteen of North

Rhine-Westfalia's 15 universities are public, as are the overwhelming majority of German universities. The group of public universities consists of eight traditional and well-established universities, five ex-polytechnic schools that had achieved full university status in the 1970s, and one open (off-campus) university. In addition, North Rhine-Westfalia's single private university was included in the data sample (see Figure 1).

Figure 1 Universities in North Rhine-Westfalia

Note that we did not include polytechnic schools in our sample. The pursuit of transfer activities has been an integral part of these tertiary educational institutions ever since. German universities, in spite of their heterogeneity, share an institutional identity that has traditionally been very different from polytechnic schools. North Rhine-Westfalia hosts Germany's largest and most diversified university infrastructure. North Rhine-Westfalia is Germany's most populous state (1999: 17.9 million), and it includes the industrial Ruhr as well as the Rhine area (with the state's capital Düsseldorf, and the former German capital Bonn). The variety of universities ranges from universities created around engineering disciplines to those which exhibit a particular strength in the humanities. Several universities founded in the 1960s and 1970s as a response to the 'massification' of higher education in Germany complement the rather heterogeneous picture.

Germany's educational system is federative in character. This being the case, the analysis of North Rhine-Westfalia's universities should not be mistaken for a general account of German universities. Yet, basic tenets of Germany's universities do not vary significantly across the different states. This is due to the common and regionally unbounded heritage of many of Germany's universities ('von Humboldt') as well as to general, consensus-oriented features of a federalist policy-making system.

Between November 1998 and April 1999 we interviewed 41 representatives from the universities (the heads of the university administration or their deputies), the universities' transfer offices, and the local economy. Besides these main constituencies, we also conducted interviews within North Rhine-Westfalia's ministry for science and education, and with two independent transfer-related organisations. Thus our data sample makes possible some interesting insights into technology transfer and related offices at German universities. The main findings will be presented in the following five Sections (4.1, 4.2, 4.3, 4.4, 4.5). We will give empirical evidence on the limited success of the diffusion of the 'third academic mission', and will interpret these findings from the perspective of research in organisational theory. This allows for general insights into the organisational preconditions of and obstacles to networking and collaboration between industry and academia.

4 Main findings

4.1 The legal environment

A first and major obstacle to technology transfer becoming a 'third academic mission' lies in the legal environment of German universities. The regulatory framework within which universities operate provides insufficient support for the promotion of technology transfer. Many of our interviewees regard that framework as a 'corset' too rigid to foster technology transfer. From their standpoint, the transfer of personnel in particular, between academia and industry is cumbersome, inflexible and sometimes even impossible primarily due to legal obstacles. German universities are mainly public institutions, and professors at these institutions are civil servants. They operate under a restrictive regulatory framework, which hardly allows for pursuing part-time or timely limited activities outside academia. These shortcomings as well as the difficulties in overcoming them have been widely discussed. A comparative study on technology transfer systems in Germany and the USA, for example, concludes that "in Germany, the environment for professional mobility is unfavourable, so technology transfer through the movement of individual researchers is less significant than it is in the United States" [4]. However, since nothing less than fundamental changes in the legal structure of public institutions and the legal definition of civil servants is required, one cannot expect the underlying puzzle to be solved in the short term.

Our analysis has brought to our attention an additional problem in the legal environment of universities, one which has figured less prominently in current debates. In contrast to other university systems within and outside Europe, the title to all potentially patentable inventions belongs to the researcher if he or she is a civil servant. Since all professors and many researchers work under this premise, the university has very few incentives to promote technology transfer. The title belongs to those who often lack the time and knowledge to actively engage in patenting and licensing. During our interviews,

representatives of the university administration and representatives from technology transfer offices consistently mentioned this double-edged problem – few incentives to tackle the problem institutionally, lack of time and knowledge to deal with it individually – as a major obstacle to effectively promoting technology transfer. This often neglected problem has been addressed only recently. Firstly, in 1997 and 1998 private limited liability companies were founded at two universities from our sample. These companies allow for the commercialisation of academic research and development, and the university is the main partner of both companies. Secondly, different political programs have been designed to assist in the patenting and licensing process which often remains opaque and cumbersome for professors and researchers. In order to get that assistance, they have to hand over a share of the revenues to the university (25% in North Rhine-Westfalia). These two very different solutions to legal impediments – the individual foundation of private companies as well as political programs facilitating patenting and licensing – each have their merits. However, they cannot substitute for removing these impediments to transfer by shifting at least part of the title to the universities. Once universities are entitled to patenting and licensing, they are given a clear incentive to foster technology transfer and provide for professional administrative assistance by transfer offices. This goes hand in hand with the necessary upgrading of transfer offices. Transfer offices often lack institutional support from their universities and a professional infrastructure. Before focusing on the latter problem (see Section 4.5), in the next three Sections (4.2, 4.3, 4.4) we will focus on the main reasons for the lack of institutional support: transfer offices are mainly a political role model; the institutional identity of German universities does not easily embrace technology transfer as a 'third academic mission'; and technology transfer requires a high degree of trust which is granted to persons, not to mediating offices.

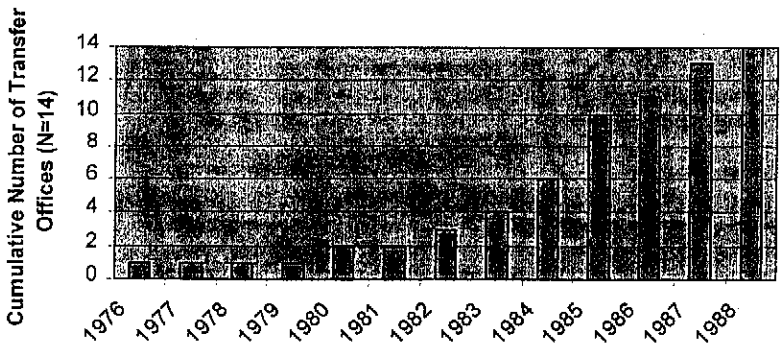
4.2 Transfer offices as a political role model

While the legal environment is not very supportive of transfer activities, the political environment is all the more supportive. This holds particularly true for the institutionalisation process of transfer offices. Having studied official documents from North Rhine-Westfalia's government and its Ministry for science and research, we identified a strong political commitment to technology transfer and to related offices. In these documents, the rapid transfer of scientific results into the economic realm is seen as a crucial factor in the modernisation of the state's economy. The necessity for modernisation is due to North Rhine-Westfalia's traditional industrial base with its heavy emphasis on coal and steel especially in the Ruhr. The state's large and diversified university infrastructure came increasingly to be seen as an important asset in that process, potentially taking part in restructuring traditional industries and giving way to new, typically knowledge-intensive industries and services. Alas, the transfer of knowledge and technology between universities and industry seemed to be underdeveloped. A 'transfer gap' between the potential supply from universities and the potential demand from industry was widely perceived.

The 'missing link' was identified in transfer offices, aiming at bridging the 'transfer gap' by disseminating information and bringing transfer-interested partners together. Following the political analysis outlined above, institutionalised transfer through transfer offices became a political role model. As a result, political programs and initiatives were set up and universities were given budgetary incentives in order to actively stimulate the

creation of technology transfer offices. Beginning with a pilot project in 1976 at the Ruhr-University of Bochum, other universities followed, eventually leading to the institutionalisation of transfer offices at all public universities in North Rhine-Westfalia. After a little more than a decade, in 1988, what had begun with an innovative pilot project, had become completely institutionalised (see Figure 2).

Figure 2 Institutionalisation of transfer offices at public universities in North Rhine-Westfalia



This was seen as a major political success. With the help of our interviews we can give a more fine-grained account of that process. Since the political initiatives helping to create transfer offices were not always met with an equally strong commitment from the universities and industry, what at first sight seemed to be as an unequivocal success story needs to be seen in a different light.

When asked about the process of institutionalisation, interviewees at ten of the 14 public universities claimed that either the state's government or its Ministry for science and research was the driving-force. In only three instances was the motivation located within the universities: twice from the administration and once from transfer-oriented professors. Local and regional industry played hardly any role at all. In only one case was industry's demand visible, but that demand was not considered to be a primary source of motivation. Though the state's government and its Ministry for science and research did not directly impose the creation of transfer offices on the universities, strong political pressures to comply were perceived by many interviewees. The perceived pressure on the side of the universities was met with a widespread lack of interest on the part of the possible transfer partners. While many universities in the 1970s and 1980s met the external governmental expectation with the creation of transfer offices, transfer-oriented professors and industry mostly did not perceive the necessity for a new organisational unit. On the contrary, some even feared that an additional bureaucratic layer would stifle well-established informal transfer activities. The institutionalisation of transfer offices, to put it differently, in large part neither emerged from within the universities, nor was it a response to industry's demand. Transfer offices were mainly a political role model. As a result, the rapid institutionalisation process was much more problematic than at first sight. Though the process hardly met open resistance, it lacked the required support from

all relevant actors outside the political realm. The early lack of support is reflected in the rather precarious infrastructure of transfer offices (see Section 4.5) as well as in the institutional identity of universities (Section 4.3) and in the overwhelming use of informal transfer mechanisms (Section 4.4). Before focusing on these aspects, we will discuss the results of this section with the help of some tools from sociological organisational analysis.

From the point of view of organisational analysis the problematic aspects of the process of rapid institutionalisation are not at all surprising. They may be thought of as a typical example of what John Meyer and Brian Rowan call the loose coupling between the formal structure and the activity structure of an organisation [5]. According to their neo-institutionalist perspective, organisations need to be understood as embedded within broader social contexts. They are bound to these contexts through material resources and legitimation. Both are granted by conforming to the expectations of the organisational contexts. The conformity is reflected in the formal structure of an organisation, which serves as a kind of display window for external parties. The formal structure is only loosely coupled to the activity structure of an organisation. This serves to buffer the organisation from external pressures. Applied to our case it is obvious that universities' behaviour could only be understood by their dependency on the state's government, which actively promoted technology transfer and the institutionalisation of transfer offices as role models. Universities conformed to these expectations by creating a new and externally visible sub-unit, the transfer office, which is part of the formal structure. Transfer offices served as a display window towards the universities' political environment. They effectively guaranteed external legitimation and resources without heavily altering the organisations' activity structure. With formal structures established, 'business as usual' can proceed. 'Business as usual' implies two things in this instance: institutional inertia as regards technology transfer as a 'third academic mission' on the part of the university as an organisation; and the reliance on informal, non-institutionalised transfer mechanisms by those who are actively involved in technology transfer. In the following two sections we will elaborate on both aspects.

4.3 Institutional identity

As we have tried to illustrate in Section 4.2, the role of universities in the process of institutionalising transfer offices was mostly ambiguous. Though they all complied with the underlying political will, this process was not always accompanied by a strong commitment or even enthusiasm. As a result, many transfer offices experienced a lack of institutional support (see also Section 4.5). This is somewhat surprising, given the fact that all our interviewees representing the universities stressed the growing importance of technology transfer. Why is it that this perceived importance was infrequently transformed into policies supportive of transfer offices? Part of the answer lies in personal animosities between the provost and the head of the transfer office (one case), and in the early fear on the part of the administration of losing centralised control to a new organisational sub-unit (two cases). However, these cases are far from representative. They cannot account for the more widespread experience of ambivalence. When studying the transcripts of the interviews we became aware of a factor which was also relevant to universities' level of support for their transfer offices. We detected a strong and commonly shared institutional identity. That identity is not easily compatible with the idea that economic development through technology transfer should be at the

very core of what a university is about. It is difficult to give a quantitative assessment of the identity concept shared by our interviewees at the top levels of the administration. Remarks concerning the institutional identity were made at various points during the interviews. However, these responses make up a clear and consistent picture, one which may help to explain the puzzle of why universities seem to take technology transfer seriously, yet do not assign centrality to it.

Over the course of our interviews it became apparent to us that the ideals of Wilhelm von Humboldt (see also Section 2) remain deeply entrenched in contemporary German universities. The very essence of von Humboldt's university concept – the unity of teaching and research; social disembeddedness and autonomy; a non-utilitarian approach to higher education as opposed to purely vocational training – are still part of the commonly shared understanding of what it means to be a university. In other words, these ideals shape the institutional identity of universities. Von Humboldt's concept is by no means to be taken as an accurate description of what universities actually are in an era of mass education. Our interviewees were extremely clear and forthright on this point. But referring to von Humboldt's ideals serves as a strong benchmark that helps to evaluate both the current state of the art and future trends in German academia. This became most obvious in the vigorous rejection of the 'Humboldt is dead' statement made by Germany's former minister for education, science, research and technology. All of the heads of the university administration who commented on that notion disagreed openly with the minister's 'provocation', as one interviewee called it. Invoking von Humboldt's ideals also serves as a strong demarcation line, separating universities from polytechnic schools in an unambiguous fashion. Attempts at redirecting universities towards a stronger emphasis on vocational training and practical knowledge would alter their traditionally superior status in higher education. Though this underlying fear of degradation was not openly expressed, we found hints of it in both our interviews and in policy-oriented documents. In addition, we found numerous, though scattered remarks on the centrality of teaching and education as the core missions of universities. We did not get answers which implied the necessity to expand universities' missions – towards economic development through technology transfer for example. Instead, when problematising current limitations our interviewees mostly focused on the disjunction of von Humboldt's ideal of the unity of teaching and research in an era of mass education.

It was surprising for us to see how strongly the label 'von Humboldt' still shapes the institutional identity of German universities. We neither noticed the emergence of a fragmented and patchwork-like 'postmodern' identity, nor could we detect a far developed 'entrepreneurial' definition of what it means to be a university. We interpret the identity concept associated with von Humboldt as an organisational myth [6]. A myth, on the one hand, implies that the organisational reality is far away from being the embodiment of the underlying ideals. On the other hand, a myth lies at the very heart of the social fabric of an organisation. It provides its members with meaning through reference to a commonly shared identity. The 'von Humboldt' myth, in the case of German universities, is obviously both: far away from their organisational realities while at the same time constituting their chosen frame of reference. Organisational psychologists would call this a 'cognitive scheme' [7]. Cognitive schemes do not reflect organisational activities, but they serve as a selective filter of expectations in the organisation's environment. In this, 'von Humboldt' can be seen as a major institutional barrier to the diffusion of the 'third academic mission' within German academia. The 'third academic mission' [1], 'the entrepreneurial university' [8], 'academic capitalism'

Slaughter and Leslie [2] and other buzzwords of current science policy are myths or cognitive schemes as well. But at least until now they have been less influential than the 'von Humboldt' myth in defining the institutional identity of German universities. And as long as the orientation towards von Humboldt's ideals is at the centre of universities' very identity, market-driven approaches to academia will have to pass through this institutional bottleneck.

4.4 *Personalised transfer*

Complementary to universities' reluctance to embrace the 'third academic mission', individuals actively pursuing technology transfer continue to rely heavily on a personalised, informal pattern of transfer. This holds true for both industry and for academic researchers. The creation of transfer offices has hardly altered this robust pattern. By far the biggest share of the total sum of transfer projects is achieved through informal links. Compared to this, the share of those being mediated through transfer offices is much smaller. Unfortunately, precise data on the relation between direct, informally achieved transfer projects and mediated, institutionalised transfer projects are not available. Though far from being validated, our interviewees roughly estimated a ratio of nine informal projects to every formal one. This general finding parallels previous research on the structure of academic technology transfer in Germany [4]. In addition to this research, our interviews with representatives from universities, transfer offices, and industry are revealing with regard to the underlying reasons of the heavy reliance on personalised transfer patterns.

According to our analysis, technology transfer first and foremost requires a high degree of trust between those involved. This is particularly clear in the case of the industry side of transfer partnerships. Industry grants trust to individuals or to research units, sometimes even to organisational departments, but not to science or to universities as institutions. On the contrary, science and universities are widely perceived as 'too aloof' and 'too little economic' to deal with bottom line economic issues. Also academic researchers typically trust their concrete industrial partners without stretching that trust too far. Instead of a mere 'information gap', most of our interviewees perceived an underlying 'cultural gap' between universities and industry. This led to a high degree of uncertainty and even distrust which was only ever overcome by trust in individual persons. The cultural gap was widely expressed in terms of institutional differences. Stereotypes between 'those in the ivory tower' and 'those only interested in short-term results' were frequently expressed. They seemed to undermine the credibility of those popular science policy concepts that neglect the reality of institutional boundaries [9]. Though this might be true in some cases, one should not over-generalise these concepts. For the case we analysed, institutional boundaries between universities and industry, as well as their related cultural properties, were still heavily entrenched in the perceptions of all relevant actors. Furthermore, these boundaries shape behavioural patterns in confrontations between institutional contexts. Thus those who nevertheless engage in technology transfer cannot do so on the basis of institutional trust. In such a situation of generalised uncertainty and even distrust, only trust in individual persons reduces the underlying uncertainties when dealing with a different institutional context.

Since interactions between academic researchers and industrialists are fraught with uncertainty on both sides, personalised modes of interaction are a prerequisite for effective transfer. It is quite clear that organisational units like transfer offices can

only play a very limited role in reducing these uncertainties. Transfer offices were designed under the assumption that information is the key problem in technology transfer (see Section 4.2), and they do a great deal in reducing the 'information gap' (see Section 4.5). But they apparently fail to compensate for the lack of trust and the perceived 'cultural gap' between different institutional contexts. Our findings with regard to the necessity of personalised relations of trust is corroborated by organisational network analysis. While sociologist Mark Granovetter has long stressed the relevance of personal ties in economic life, Walter Powell has focused on the centrality of informal network structures in organisational networks, which require mutual trust [10]. Due to widely perceived institutional differences between universities and industry, it is clear that technology transfer is an even more uncertain endeavour for all actors involved than interactions between different industrial firms, which can at least tacitly agree on mutual expectations and behavioural patterns. Personalised trust in the case of technology transfer is all the more necessary. Our findings on the nature and relevance of trust in transfer relations are also instructive for answering the following questions, which currently figure prominently in general debates on the future of technology transfer and transfer offices: could technically mediated communication through the internet reduce the apparent gap in technology transfer? Will the internet provide new opportunities for transfer offices?

We certainly believe that the internet is a very useful tool in technology transfer. It helps, for example, to make information available and transparent by setting up research data banks. In addition, it serves as a broker for internships and Master's theses. However, facilitating technology transfer through the internet is limited because it is basically a solution for information problems. Since our data show that a serious 'cultural gap' between universities and industry underlies the 'information gap', we remain sceptical about the internet's overall problem-solving capacity. Following our analysis, some of the interviewees' advice to use internet communication in order to reduce personal contacts and personalised transfer structures in general could prove counterproductive. Internet communication, which is mainly anonymous, may not create the required trust among potential transfer partners. It falls short of remedying the peculiarities of technology transfer between academic and industrial partners, many of which lie in social uncertainties and perceived institutional differences. Trust-building through personalised interaction is a solution for these problems. It can hardly be replaced by the internet, which can provide information but not trust.

4.5 Profile, status and degree of professionalisation

The characteristics of technology transfer at German universities discussed above – legal obstacles, transfer offices as a political role model, universities' institutional identity, personalised transfer – have left their marks on the profile and status of transfer offices. Our analysis of the task structure of transfer offices at universities in North Rhine-Westfalia shows rather diverse results. The activities range from assisting start-up companies to university's public relations, and from advice on public funding to extended vocational training. Advice on patenting and licensing plays a role, too. Due to the legal obstacles in Germany we discussed in Section 4.1, however, this last aspect is not as central as in other university systems [4,9]. Nearly all representatives from transfer offices (12 out of 14) give advice on creating a start-up company and advice on public funding. The former is given especially high priority (six cases), but the latter is also

prioritised (three cases). All other activities were mentioned as priorities in only one case each at maximum. Giving priority to start-ups is strongly influenced by governmental programs. The strong ties of transfer offices to their political environment is reflected in this. But the embeddedness of transfer offices in their university environment can also be reconstructed. The concrete task structure depends heavily on local circumstances, and does not follow textbook recipes on what transfer offices should be all about. Some of them, for example, take part in activities which, like university's public relations, only remotely resemble tasks of an organisational sub-unit specialising in technology transfer. An optimistic reading could interpret the heterogeneous task structure as an indicator for a context-sensitive approach, which is generally seen as superior because of its flexibility and adaptability. Following our analysis, however, this structure indicates that transfer offices experience a relatively low status within universities and that many of them are in need of a more professional infrastructure. Before focusing on the latter, we will briefly outline our results on the clientele of transfer offices.

Our analysis of the academic clientele reveals both remarkable similarities and notable differences as regards the overall pattern of academic transfer activities. This pattern was analysed by distinguishing between three different subgroups: engineering and computer sciences, natural sciences, and social sciences/humanities. The overall pattern of academic transfer activities included all engineering and computer sciences departments. However, a rather heterogeneous picture is given by the natural sciences. While some like chemistry are heavily involved, others, for example physics, display weaker transfer activities. Not surprisingly, the social sciences and humanities scored lowest in this regard. But here one also needs to distinguish between stronger (e.g., psychology) and weaker (e.g., philosophy) involvements. In discussing disciplinary differences, several interviewees noted: "The more technical, the more transfer-oriented". This intuitive rule of thumb matched with our aggregate data. Keeping in mind that by far the largest share of transfer activities is personalised and not mediated through transfer offices (see Section 4.4), it is interesting to know whether the general pattern summarised above is reflected in the academic clientele of transfer offices. According to our data this is not the case. The sequence in transfer activities between our three subgroups seems also to hold true for transfer offices. Nevertheless, their clientele seems to deviate from the general pattern. As one of our interviewees stated: "Professors who have contacts with industry do not make use of us. And those who do not have these contacts turn to us." This reveals an important difference. While traditionally transfer-oriented fields, particularly in engineering, rely on informal ties to industrial partners, a wide share of all the others turn to transfer offices in order to get advice and support, and in the hopes of finding an industrial partner. Transfer offices are actively involved in assisting interdisciplinary projects, which sometimes – in projects on technical communication for example – are even bridging the gap between engineering and the humanities. Furthermore, those professors and researchers working in fields and disciplines which are traditionally less transfer-oriented and who therefore cannot rely on related knowledge and contacts make regular use of transfer offices. And finally, transfer offices play an important role in fostering entrepreneurship. They are often contacted by graduate students and graduates endeavouring to create a start-up company, and who therefore need legal, financial and organisational advice.

Some interesting, consistent patterns were also revealed with regard to the industrial clientele contacting transfer offices. Eight out of 14 cities in which the universities in our data sample are located are marked by an industrial structure based on small and

medium-sized enterprises (SMEs). Here, transfer offices mostly deal with local and regional SMEs. Transfer offices in cities with industrial structures dominated by large enterprises, on the other hand, were much less embedded in their immediate economic environment. In these six cases their industrial contacts are more often with firms beyond the local and regional level. In addition, mediating transfer projects is less important than on average. Instead, they mainly focus on other tasks like start-up advice, public relations and administering external grants. The literal absence of contacts to large enterprises is not due to their strong internal R&D capacities, which would make university-industry linkages less necessary. On the contrary, many large firms maintain strong links with their local universities. But these links are direct ones with professors and their research groups. Our findings on the industrial clientele parallels the findings on the academic clientele: in both cases, transfer offices are approached by those who neither have the knowledge nor the contacts for effectively exploiting university-industry relations. Thus a disproportionate number of clients are recruited from academic researchers with no ties to industrial firms and – though to a far lesser extent – from SMEs lacking established patterns of cooperation with academic partners.

To sum up the findings presented above, transfer offices display a heterogeneous task structure and they deal with an academic clientele with little or no industry contacts. To put it differently: neither are the core functions well defined, nor do transfer offices deal with the central academic players in the field. This profile is problematic because it engenders a relatively low status within their organisational contexts. Transfer offices are in continuous need of resources and legitimation, which has to be granted mainly by the universities in which they are embedded. The request for more personnel was a common complaint in nearly all interviews conducted at transfer offices. According to our analysis, however, transfer offices are not only in need of more personnel. A higher degree of professionalisation seems to be indispensable. Transfer offices should define their core functions and their related task structures more exclusively than they have in the past. In addition, they need to hire specially trained personnel with business related skills and experiences. In the past transfer offices recruited a heterogeneous group of people with highly diversified, but mostly academic expertise ranging from the humanities to engineering. Business experiences are hardly to be found. Further, the heads of these units do not by any means form a homogeneous group, though their background is mainly academic or in academic administration. Following a brief but instructive survey of American universities, this resembles the American picture in the initial phase. As the field of technology transfer has matured, a stronger emphasis has been put on "hiring professionals with business experience and a technical background, rather than the primarily academic/research/administration experience which has dominated the recruitment of the technology transfer personnel in the past" [11]. It is obvious that in the long run transfer offices should be evolving in such a way in order to effectively work as bridging institutions between academia and industry. Yet there remains a long way to go for transfer offices at German universities.

It is reasonable to assume that professionalisation also has to take place beyond the level of individual personnel selection. Organisational sociologists Paul DiMaggio and Walter Powell have convincingly argued for the importance of the role of inter-organisational cooperation [12]. Professionalisation is seen as a critical mechanism in the construction of an organisational field. Applying this insight to our case, this implies fostering initiatives aiming at closer coordination and the common definition of standards and procedures with regard to technology transfer from universities. We found

many such initiatives, though they tended to occur at a regional level. With some remarkable exceptions, the participation in professional activities seems to be less at the national and especially at the international (for example EU) level. These activities which help to create a distinct organisational field and an identifiable mission around units focusing on technology transfer from universities are of paramount importance. They could be essential in the definition of legitimate tasks and problem-solving technologies, which in turn could upgrade their status within academia.

5 Conclusions

The insight into the necessity of organisational units facilitating the transfer of knowledge between academia and industry does not necessarily lead to the creation of effective bridging institutions. Our organisational analysis pointed out five factors that can be seen as main obstacles preventing transfer offices from playing a more active role in the transfer of knowledge and technology. The legal environment of German universities is not giving them sufficient incentives to exploit the academic transfer potential
(Section 4.1). Transfer offices diffused as a political role model are lacking the requisite support of all relevant actors outside the political realm (Section 4.2). The institutional identity of German universities is still strongly shaped by von Humboldt's ideals, which do not easily mesh with the demand for a more active role in technology transfer (Section 4.3). As a consequence of these three factors, transfer activities remain somewhat marginal and are not perceived as an integral part of the universities' core functions. In addition, we found that personalised modes of interaction are a prerequisite for the effective pursuit of transfer between universities and industry. In this regard, organisational units like transfer offices can only play a very limited role, and they cannot substitute for direct contacts between transfer partners (Section 4.4). All these factors have left a strong mark on the profile, status, and degree of professionalisation of the institutionalised transfer. Transfer offices display a rather heterogeneous, unspecific and 'untechnical' profile. Their status, as a consequence, remains relatively low, and it could be upgraded only by stronger professionalisation (Section 4.5).

Our organisational analysis has shown that universities are best understood as entities which are embedded in larger institutional environments and which due to historically developed practices and identity concepts display a remarkable amount of institutional inertia. They customarily cope with heterogeneous, rapidly changing, and sometimes even contradictory expectations, without transforming these expectations directly into institutional change. To name only the three most prominent movements confronted by German universities during the last two decades: the demand for a greater inclusion of women in faculty positions; the demand for more consideration for the adverse environmental effects of science and technology; and the demand for a more active role in technology transfer. None of these expectations led to dramatic changes, and all of them were transformed into typical organisational responses: the creation of representatives and offices. These responses are not intended at fostering institutional change. On the contrary, they allow universities to adapt to broader societal expectations without risking too much institutional change.

Concluding that transfer offices are rather a reflection of institutional inertia than of institutional change is not necessarily the end of the story. In the long run, though not

designed as such, they may serve as agents of change. Burton Clark has shown in his intriguing study of the transformation of five European universities into 'entrepreneurial universities' that a common organisational culture was at the heart of each of these transformation processes [8]. Agents of change were required to create such a culture, in which the university's altered identity was envisioned and the performance of entrepreneurial activities was encouraged. Transfer offices are of paramount importance for the diffusion of the idea that technology transfer is an important and desirable academic activity. They symbolise its relevance and actively promote its diffusion. In this, they extend the traditional academic focus on research and teaching. And in this, they take part in the creation of a common organisational culture, in which transfer activities, much like research and teaching, are an integral part of what faculty are expected to do. Transfer offices can be a catalyst in the diffusion of an idea which, if taken seriously, would alter academia's institutional identity and practices. And triggering institutional change within German universities will undoubtedly transform transfer offices too, supposedly towards more professional and upgraded units.

However, this view of an as yet distant future is rather speculative. At present, popular concepts like 'transfer as a third academic mission' [1], which appeal to both researchers and policymakers, need to be treated with considerable caution. They should not be taken for a general description of academia's current institutional identity and practices, since these are bound to specific conditions, which, at least in the case we analysed, are not in place. Systematic cross-national studies would be useful in investigating the institutional conditions in which universities and their linkages to industry are embedded. We suspect that such studies will reveal a much greater variation than current science policy concepts seem to assume. One will likely find not only a broad trend towards closer linkages between universities and industry, but also historical legacies, path dependencies, institutional inertia and resistance to change. In this paper, we have attempted to highlight these often neglected forces with the aid of some conceptual and theoretical tools from organisational analysis. Thus we view this research as a counterbalance to current models of rapid institutional change in university-industry relations, one that paves the way for a less dramatic, but perhaps more realistic picture.

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References and Notes

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3 For a complete project report (in German) see www.bomes.uni-bielefeld.de/kruecken/lfp

4 Abramson, H.N., Encarnação, J., Reid, P.P. and Schmoch, U. (Eds) (1997) *Technology Transfer Systems in the United States and Germany. Lessons and Perspectives*, National Academy Press, Washington, DC, p.348. Obviously, the different legal structures in Germany and the USA reflect broader cultural characteristics. The authors, for example, suggest that the "cultural environment in Germany is characterised by a limited entrepreneurial spirit. This situation is due to a low-risk mentality on the individual and societal levels" (pp.347–8). Though this might be true, these issues are beyond the scope of this paper.

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