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THEMA:

Evaluation of Knowledge Transfer:

- **Evaluation Results of the Austrian Technology Transfer Programme TechnoKontakte**
  Eva Buchinger, Petra Wagner
- **Policy Statement des BMWA zur Evaluierung von TechnoKontakte**
  Sepp Mandl
- **Assessing the Impact of Face-to-Face Knowledge Transfer**
  Simone Kimpeler, Steffen Kinkel
- **Zum deutschen BMWA-TOP Programm**
  Götz Fasold
- **Networks of Innovation – Evaluation and Monitoring of Technology Programs based on Social Network Analysis (SNA)**
  Wolfgang Neurath, Harald Katzmair

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Preface

Technology transfer aims at increasing a firm's general disposition for innovation and its research and development capabilities. As immaterial, or soft, components technology gain importance, the term knowledge transfer has been introduced. In the case of firm-to-firm transfer, the intensity of transfer activities in the sense of learning effects is considered particularly high as the involved partners follow the same (business) rationale. Thus, policy initiatives such as Inside UK, TOP in Germany, or TechnoKontakte in Austria aim at engaging particularly SMEs in best practice transfer.

The Platform Research & Technology Policy Evaluation took a closer look at the theme „How to evaluate knowledge transfer? An international comparison of *firm-to-firm* technology transfer programmes", an event hosted by the Austrian Federal Ministry of Economy and Labour on October 14th, 2003.

The design of the event reflected elements of modern evaluation culture: not only evaluators but also responsible policy makers were present and ready to discuss the policy implications with the audience.

First, the findings of the evaluations of Austrian and German transfer programs were presented. Eva Buchinger and Petra Wagner (ARC systems research GmbH) evaluated the impacts of the Austrian TechnoKontakte programme. About at the same time, Simone Kimpeler (FHG ISI) evaluated its German counterpart TOP. Then, Josef Mandl (Austrian Federal Ministry of Economic Affairs and Labour) and Götz Fasold (German Federal Ministry of Economic Affairs and Labour) as relevant policy-makers started the discussion with impulse statements on the potential "maximum" effect of firm-to-firm transfer programmes. All contributions are contained in this edition of the Newsletter.

Beside this subject area, this newsletter includes an article on one of the most important methodological developments in evaluation sciences, social network analysis (SNA). Wolfgang Neurath and Harald Katzmair are describing the application of SNA for monitoring and evaluating technology programs.

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Evaluation Results of the Austrian Technology Transfer Programme TechnoKontakte

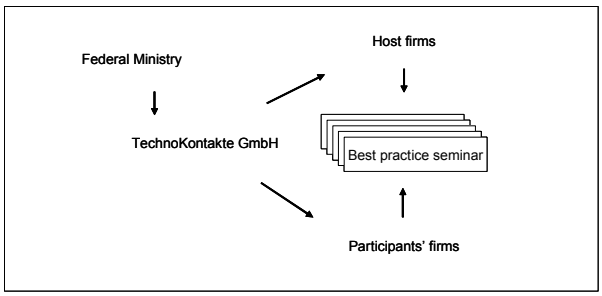
The programme and its goals

The TechnoKontakte programme was started in 1996 with the financial support of the Federal Ministry for Economic Affairs and Labour. It aims to improve the competitive performance of Austrian firms through the transfer of best practice experiences in form of firm-to-firm visits. Knowledge and experience exchange is organized through "hands-on" seminars by technologically leading firms. In one-day, on-site seminars host firms provide an in-depth presentation of a successful technology or management case, discuss their learning processes and "open" their production plant through expert-guided site tours.

A private intermediary - TechnoKontakte GmbH - is responsible for organizing the seminar programme. This includes identifying best practice firms, marketing of the seminars and consulting host firms regarding the seminar design. Presently, around 45 host firms offer 50 seminars for more than 800 participants each year.

The goals of the programme concerning technology transfer are knowledge transfer via seminars at best practice firms and stimulating innovation-related follow-up activities.

Figure 1: Actors of the TechnoKontakte seminar programme



Evaluation objectives and methodology

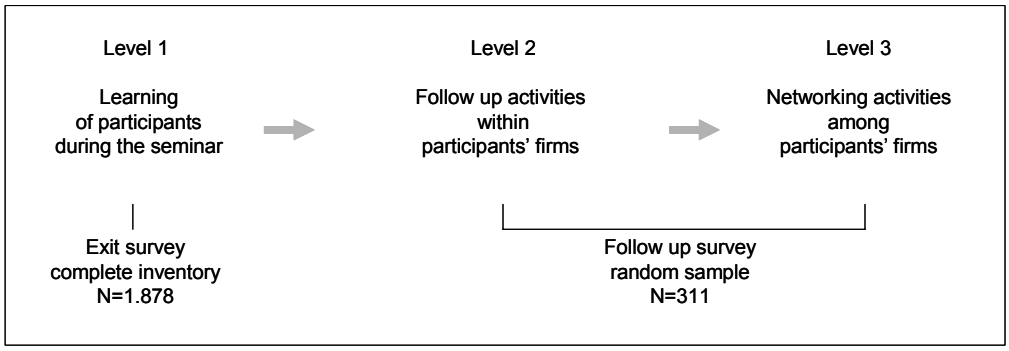
Since the TechnoKontakte programme receives public funding, the Federal Ministry for Economic Affairs and Labour regularly commissions evaluations. The evaluation of the 1999 to 2002 programme period had two main objectives:

- the analysis and assessment of the programme's impact with respect to its goals, and
- the identification and discussion of options for its future development.

In order to categorize the impacts of knowledge transfer, the theory of social systems was used. This approach is particularly fruitful because it distinguishes between organisational and personal knowledge. Organizational and personal knowledge overlaps, but is not congruent. Only a part of organisational members' personal knowledge is used by the organization which implies that new knowledge of organizational members will not automatically become part of organizational knowledge. Therefore, this evaluation distinguishes between impacts on the personal level (seminar participants) and the organizational level (participants' firms). Further, social system theory conceptualizes organisations as operationally closed on the basis of decisions. This implies that "internal" decisions are distinguished from decisions which must be coordinated with the decisions of other organisational systems (inter-organizational

networks). Following the social system theory approach, three impact levels were considered within the evaluation (fig. 2).

Figure 2: Impact levels of the TechnoKontakte program and corresponding data sources



Assessing the impact on these three levels requires quantitative as well as qualitative elements. The primary data source was a regular exit survey (information on seminar performance, participants' firms, and intended follow-up activities). The second data source was a telephone survey among a random sample of participants (innovation-related follow-up and networking activities). Moreover, expert interviews were conducted with policy-makers, technology transfer specialists incl. the programme management, host firms and participating firms.

Survey results: Knowledge gained, knowledge shared

Successful technology transfer depends on a balance of "novelty" and "practical relevance". Therefore, learning of participants during the TechnoKontakte seminars (impact level 1) was identified by asking their assessment of the seminar concerning novelty, practical relevance and intelligibility of the presented best practice experience. Whereas three quarters of the participants are highly satisfied with practical relevance and intelligibility, only one fifth found that "things were really new". This indicates a trade-off between practicability and novelty (which is not surprising). Nevertheless, the overall assessment of the seminar performance was "excellent", the expectations of 80 per cent of the participants were fulfilled, and 94 per cent would also recommend the seminars to others.

Successful technology transfer can be observed through concrete innovation activities within the participants' firm (impact level 2). It was expected that TechnoKontakte seminars would produce a number of innovation-related follow-up activities ranging from informal discussions with colleagues to research and development projects. The survey shows that these expectations are justified.

- The follow-up activity with the least "transactions costs" – internal technology transfer through discussions with colleagues – can be observed in almost all (93 per cent) firms.
- Two thirds of firms adapt their strategy stimulated by the experience of the TechnoKontakte seminar. This is a high value which can be explained by the fact that two third of the participants have management functions.
- One out of two firms (43 per cent) implements technical and/or organizational changes. Although both types are of minor importance from the firm's perspective, they should not be underestimated. Also incremental innovations significantly contribute to firm competitiveness.

- Last but not least, the knowledge gained at the seminar results in research and development projects in 20 per cent of the firms. This is quite an unexpected positive impact of a one-day seminar.

Successful technology transfer can further be observed through innovation-related networking activities among firms (impact level 3) ranging from informal knowledge exchange to research and development collaboration. Analyses show that 41 per cent of the participants are actually able to establish new contacts at TechnoKontakte seminars. New contacts are mainly used to exchange experience (57 per cent of participants), one third leads to business relationships. Again surprisingly positive is the fact that every seventh new contact results in research and development cooperation.

Evaluation results: Success factors and policy recommendations

With respect to goal attainment, i.e. impact on knowledge transfer and innovation stimulation, the TechnoKontakte programme is a successful technology transfer initiative. Moreover, the number of seminars as well as the number of participants is continuously rising. Customer satisfaction with the TechnoKontakte seminars is also generally high: 50 per cent of the participants rank the quality of the seminar as “high”, 37 per cent even as “very high”. Host firms are technological leaders in the participants’ perspective since half of them value the presentations as actual “best practice”, another 43 per cent as “good practice”.

From a technology policy perspective, the programme offers the following benefits: Participants state that it would be difficult to acquire the transferred knowledge without this initiative. The seminars cover a broad range of topics including “soft” (human resources, strategy) as well as “hard” (production, research and development) aspects of innovation. Half of the participating firms are small and medium sized. The programme also offers a service which is quite unique in Austria, namely identifying best practice and organizing firm-to-firm visits. Last but not least, the share of the public finance of the programme has continually decreased.

Overall the programme’s success factors are:

- Learning success: Although the novelty of the presented knowledge is predominantly assessed as good rather than “best” practice, the participants are still highly satisfied because of its practical relevance.
- Diffusion success: Nearly all of the participants transfer their “lessons learned” within their company through discussions with colleagues.
- “Broad” implementation success: Two thirds of the participants report innovation-related follow-up activities as a direct consequence of the best practice seminar. Changes are mostly of minor importance, but nevertheless raise firm competitiveness.
- “Deep” implementation success: Few follow-up activities are of “major” relevance, but lead to substantial changes, particularly in the area of strategy development.
- Networking success: Half of the participants confirm existing contacts or establish new contacts in the seminars. About one fifth gains access to existing networks.
- Adoption success: The prototype of best practice firm-to-firm visits programme was developed in the United Kingdom. TechnoKontakte is a successful adoption innovation, tailored to Austria conditions. The programme turns out to be a market success in terms of rising demand. The intermediary organization TechnoKontakte GmbH successfully selects and wins attractive Austrian firms as best practice hosts.

What are future development options? As TechnoKontakte is a successful initiative in terms of its goals, the basic concept should not be

altered. However, continuous improvement is recommended. This includes that incentives should be placed for the programme management to make quality assurance more transparent and thus more professional. In addition avenues for raising the programme's "leverage effect" should be explored (e.g. through policy instrument portfolios). Broader innovation policy effects may be gained by providing incentives for increased participation by small and medium sized enterprises as well as a stronger focus on structurally weak regions.

Finally, an interesting line of development could be the transfer of the "best practice & firm-to-firm" concept to other "peer-to-peer" areas of public interest. Potential areas of investigation include "best practice & science-to-science" or "best practice & public administration-to-public administration".

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Policy Statement des BMWA zur Evaluierung von TechnoKontakte

TECHNOKONTAKTE: INNOVATIONSSTIMULIERUNG DURCH LERNEN VON DEN BESTEN

Eine der wichtigsten Voraussetzungen für (erfolgreiche) Innovationen in Unternehmen sind deren Veränderungsbewusstsein, Veränderungsbereitschaft und Veränderungsfähigkeit. Wissens- und Technologietransfer, vor allem dessen Hebelwirkung im Sinne auch tatsächliche Mobilisierungswirkungen und in der Folge Innovationen auszulösen ist ein wesentlicher Baustein in diesem Prozess. Vor dem Hintergrund knapper Budgets und der damit verbundenen Forderung nach Effizienz und Additionalität von öffentlichen Maßnahmen wird mehr und mehr auf solche Hebelwirkungen abgestellt. Daran und an der Rolle, die Transferprogramme dieser Art in einem Innovationssystem im Verhältnis zu anderen Maßnahmen spielen, wird ihr Erfolg gemessen.

Das Programm TechnoKontakte zielt darauf ab, im Wege von Firm-to-Firm-Visits Best-Practice-Wissen zu den besuchenden Unternehmen zu transferieren und die Innovationsaktivitäten anzukurbeln und zu erleichtern. Wie die Evaluierungen zeigen- nicht nur von TechnoKontakte, sondern auch von Programmen dieses Typs in anderen Ländern wie TOP in Deutschland oder Insight UK Enterprises (IUKE) -, haben solche Maßnahmen tatsächlich ein hohes Potenzial Veränderungs- und Mobilisierungswirkungen zu erzeugen. Es zeigt sich vielmehr, dass die Ergebnisse hinsichtlich der Zufriedenheit mit dem Programm und den ausgelösten Veränderungsschritten in Unternehmen fast deckungsgleich sind.

Im Konkreten lassen sich folgende Beobachtungen machen:

- TechnoKontakte ist ein zwar ergebnisoffenes und branchenoffenes Programm, das aber als von der Wirtschaft für die Wirtschaft durchgeführt eine hohe Breitenwirkung erzielt (Entwicklung der Anzahl der Seminare und der Teilnehmer) und unterstreicht damit auch die Zufriedenheit der Kunden mit diesem Programm.
- Es löst in hohem Maße Veränderungsbereitschaft der teilnehmenden Unternehmen aus (über 93% der Teilnehmer diskutieren das Ergebnis mit Vorgesetzten und Mitarbeitern im Unternehmen, vgl. auch IUKE: 92%).
- 43% der Teilnehmer unternehmen technische und organisatorische Veränderungen, was auch den guten Hebel bezogen auf Einsatz öffentlicher Mittel unterstreicht und auch bestätigt, dass laut EU-Innobarometer 2002 neue organisatorische Ansätze für fast 50% der Manager Schwerpunkt bei Innovationsbemühungen sind (Zum Vergleich: Für 38% sind es neue Produkte und für 35% neue Prozesse).
- TechnoKontakte ist Auslöser von Folgeprojekten (bis hin zu Neudefinition von Strategie) und damit eine wichtiger komplementäre Maßnahme zu anderen Förderprogrammen.
- TechnoKontakte ist daher insgesamt ein wichtiges Instrument, Unternehmen zu Innovationen zu motivieren bzw. bei innovativen Unternehmen zusätzliche Innovationsmomente auszulösen.

Für die Technologie- und Innovationspolitik lassen sich daher folgende Aspekte ableiten:

- Praxis- und bedarfsorientierte Veranstaltungen lösen Veränderungsprozesse und Weiterentwicklungen bei den teilnehmenden Unternehmen (die Hälfte sind KMU) aus.

- Der hohe Selbstorganisationsgrad durch die Wirtschaft ("gleiche Sprache") erhöht die Hebelwirkung: Unternehmen sehen, dass es sich um nachvollziehbare und umsetzbare "good practice" handelt.
- Die Rolle von TechnoKontakte als Programmträger ist die eines "Moderators und Organisators" eines "Marktplatzes". Entscheidend ist dabei die Qualität des Projektträgers als Multiplikator und Wissenstransporteur.
- Zur Erzielung des Erfolges ist die Gestaltung und Aufbereitung des jeweiligen Themas sehr wichtig.

Darüber hinaus sind noch weitere Potenziale eines solchen Programms erschließbar. Es ist zu überprüfen, ob etwa die Steuerfunktion durch Bündelung von Themen erhöht werden kann. Im Rahmen eines Pilotprojektes des BMWA wird der Versuch unternommen, das Umsetzungspotential durch Steigerung der Hebelwirkung von TechnoKontakte besser auszuschöpfen. Durch ein begleitendes "Coaching" werden jene Unternehmen unterstützt, die sehr konkret eine Veränderung angehen wollen, die aber ohne ein gewisses Maß an "Coaching" die konkreten Schritte nicht oder nur teilweise setzen würden.

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Assessing the Impact of Face-to-Face Knowledge Transfer

TOP – A TECHNOLOGY-ORIENTED VISITS AND INFORMATION PROGRAM

TOP is a technology transfer measure to support networking activities of innovative companies by offering firm visits to executives across the country. One-day visits in selected forerunning companies make up the core of the TOP program. The variety of TOP hosts allows visitors to get on-site information on a broad range of new production and information technologies, organisational concepts and management techniques, following an integrated innovation approach. The innovations are presented in terms of how they were implemented and how they fit into manufacturing as well as organisational concerns. By presenting and discussing their innovations in an open dialogue with interested executives, the hosts receive direct feedback on their innovation activities. Some of them use their events systematically to find fit-ting benchmarking partners. TOP hosts are invited to regional meetings as well as to the annual enterprise meeting (TOP-Unternehmertreffen), hosted by the Federal Minister of Economics and Labour.

The German Federal Ministry of Economics and Labour (BMWA) supports the German Technology Transfer and Visits Program TOP for over 10 years now. The overall objective of the Ministry for supporting TOP is to prompt German firms to increase their innovative ability by face-to-face knowledge transfer. Executing organisation is the “TOP-Team” at the F.A.Z.-Institute. The team is responsible for the topics of the program, selection of TOP host companies, marketing, and organisational support for the hosts. The program is accompanied by an advisory board to support TOP with business contacts and new ideas. The board is made up of six representatives from chambers and business associations such as the Federation of German Industries (BDI), the Association of German Chambers of Industry and Commerce (DIHK), the German Centre for Productivity and Innovation (RKW) and the German Confederation of Skilled Crafts (ZDH).

EVALUATION DESIGN

In spring 2003, the German BMWA commissioned the Fraunhofer Institute for Systems and Innovation Research, ISI, to evaluate the TOP program. A main reason was the upcoming decision whether the financial support for TOP should be prolonged, and if so, which recommendations could be derived to improve the concept or include additional services. Therefore, the main tasks of the evaluation were

- the assessment of the effects and benefits of the program according to its primary goal, to strengthen the innovative abilities of the participating firms, especially small and medium sized enterprises (SMEs),
- recommendations for the future development of the program, based upon the experiences of hosts, visiting firms and selected partners.

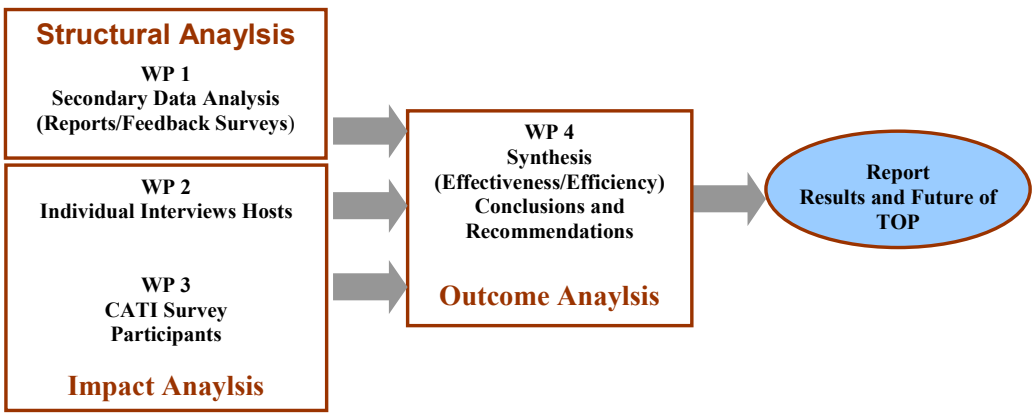
To fulfil these tasks, the evaluation was designed as an aggregated assessment based on five key research questions. As a first step, the key questions, evaluation criteria and main indicators were defined (Table 1).

Table 1 Evaluation Criteria and Indicators

CRITERIA	QUESTIONS	MAIN INDICATOR FIELDS
Coverage	To which extend does TOP reach the German industry?	TOP clientele structure compared to industry structure
Selectivity	Does TOP reach specific regions, firm sizes or sectors of the German industry more or less intensive than others?	TOP clientele characteristics
Degree of Innovation (Contents)	Is TOP's thematic objective to transfer an integrated understanding of innovation implemented adequately?	TOP thematic priorities and firms' selection criteria
Innovation Effects	Does TOP increase the innovative abilities of the firms reached?	Proportion of firms which started innovative action after the visit; mode and extent of adoption of the presented contents
Cost-Effectiveness	Which of the effects of TOP could not have been reached without financial support by the Ministry?	Cost-benefit calculation

The specific pre-conditions of a knowledge transfer program which takes place as a face-to-face interaction implies that the innovation transfer into the industry depends heavily on individual engagement and willingness. All actors, hosts as well as visitors, have to be addressed and attracted to participate in the program. Thus, experiences of participants, hosts and partners in the program drawn from surveys and interviews are the main input for the evaluation. Hence, the task was to examine the balance between policy objectives on the one hand and feasibility of the measures according to market conditions for knowledge transfer activities on the other. Therefore the strategy of the evaluation was based upon three types of analysis: structural, impact, and outcome analysis (Fig.1).

Figure 1: Evaluation Design



In the following sections, a brief presentation of the applied methodologies, work-packages carried out, and main results is given.

STRUCTURAL ANALYSIS

The structural analysis was conducted to assess coverage, selectivity and degree of innovative contents of TOP. Therefore, the development of the program between 1998 and 2001 regarding the clientele and the topics of TOP was analysed. Secondary data provided by the TOP-Team and existing documents like TOP reports and information on other comparable programs were reviewed. According to the different levels of knowledge transfer, three different analytical units were distinguished:

(1) total number of host firms in each year,

(2) total number of TOP events taking place and total number of participants (TOP visits) over all events,

(3) total number of visitors (different persons) and total number of different firms reached.

Coverage

By looking closer at the structural development of these units over time, basic information about the structural characteristics and macroeconomic importance of TOP can be derived. From 1998 to 2001 each year around 120 TOP hosts were offering about 250 events, with about 200 taking place. The structural development of TOP over time shows that the current economic situation has its influence: It has become more difficult to attract hosts and visitors to participate in the program. In 2001 for example, 125 hosts, 241 events with a total number of 2 232 participants were listed, compared to the all time high of 112 hosts, 278 events and 2 466 participants in 1999. Looking closer at the number of participants, 1 647 different persons visited the events, coming from 622 different firms. 400 of these firms are part of the manufacturing sector, representing about 1 per cent of Germanys 40.000 manufacturing enterprises. This is quantitatively approximately the part of the German industry benefiting from TOP. The quota should not be disregarded as low value, but it shows that there is some scope left for widening TOP's industry coverage. If the proportion of events not taking place can be cut down and the medium quantity of participants can be increased, significantly more firms with the given amount of hosts could be reached.

Selectivity

The analysis of clientele characteristics of TOP visits indicates that the coverage of sizes, branches and regions of firms are varying. With just under two-thirds of the firms the majority of the clientele of TOP has less than 1000 employees and can therefore be characterised as "medium sized". As 95 percent of all the companies can be located in this economic sector, it can be stated that the quota of SMEs being reached is below average. In addition some economic branches are predominantly reached as targets, whereas some are less viable targets. The companies not belonging to the metal and electrical industry in particular seem to be rather underrepresented as participants of TOP events.

The distribution of the participating firms also shows, that there are less participants coming from the northern and eastern part of Germany than from the south and west. It became clearly visible that it is quite difficult for the TOP-Team to attract hosts as well as visitors in the economically less active regions. However, when it comes to innovation policy, a stronger involvement of rather weakly represented regions is to be recommended in order to enable the local companies' access to innovative ideas and solutions.

Degree of Innovation (Contents)

The TOP programme claims following a holistic innovation approach. The activities of the last few years over all show the implementation of this approach. The topics of the events range from successful company strategies to group work and

logistics as process innovations, CAD/CAE/CAM as technology innovations and wage models as human resource-related innovations. As regards programme planning and implementation, it is increasingly becoming difficult maintaining this topical variety in the current economic situation. If the holistic approach of TOP is not to be endangered, innovation policy and its goals further on have to rank higher than an exclusive market orientation.

IMPACT ANALYSIS

The second type of analysis was carried out to contribute the experiences of TOP visitors as well as TOP hosts to assess the innovation effects of TOP. 250 Computer Aided Telephone Interviews (CATI surveys) were carried out with TOP visitors from 2001 to get to know whether they transferred or even implemented at least parts of the presented innovations into their own firms after the visits. The CATI sample is representative for all visitors of 2001 and delivers important information about the degree of firm-to-firm knowledge transfer activated by TOP. 45 percent of the visitors of 2001 indicated that some ideas taken from the event were implemented into their everyday work. Almost 20 percent said that an already running in-house project was modified after the visit. 10 percent declared that a new project was set up in their firm following the visit. Thus just 25 percent of the visitors said that the visit had no effects on their own work.

The main factors for the success of the innovation transfer were the “demonstrated feasibility” of the solution (about two-thirds of the answering firms) and the “take-over of implementation know-how” (about 50 percent). The technological and organisational concepts itself were adopted by a smaller, but still noticeable fraction of firms (about 20 percent). This emphasis underlines the importance of the face-to-face character of knowledge transfer within TOP, as executives are learning from each other on the basis of experiences. In addition, the finding that SME’s are in fact learning from large enterprises is very important for the policy objectives of TOP.

In addition to the CATI survey, 20 current TOP hosts were interviewed individually on a qualitative basis regarding their motivation for hosting, expectations, and satisfaction with the organisational support. Criteria for sample selection were size and sector, region, and host engagement (number of visits offered) as well as their type of innovation. As a result, two motivation types for taking over a hosts role were identified: One group named public relations effects as a motive, the other group of hosts expected innovation benefits from discussions with other experts (“bench-marking effects”). In sum, the interviewed hosts were generally speaking satisfied with the organisational support but could imagine further marketing activities and communication strategies.

OUTCOME ANALYSIS

To complete the analysis input, individual interviews with the TOP-Team and members of the advisory board were carried out to learn more about their functions and roles, their requirements and ideas for further improvements of the program.

At the end, the results from desk research, structural analysis and impact analysis based upon surveys of hosts and visitors were put together to analyse the total out-come of the TOP program. The achievement of objectives as well as the organisation and execution were assessed and recommendations for the future of TOP were derived. According to the main tasks of the evaluation, the most important results are in brief (compare Table 2 for the main results regarding all five criteria of the evaluation):

Overall TOP is a successful and effective innovation transfer program that supports the innovative ability of German firms, especially the

small and medium sized enterprises (SMEs) which are an important part of the German national economy. Therefore TOP should be continued with the financial support by the Ministry to guarantee the integrated innovation approach of the program which partially collides with a possible self-financing of the program. Today the financial support enables participant fees of 260 Euro. It is not clearly visible to which amount the fees would rise without national funding (possibly around 415 Euro), since the TOP-Team has no transparent controlling system. It seems to be questionable if then further on more than 2000 participants per year could be reached, which is an essential constraint for an integral mix of topics.

On the other hand, there is still some scope left for widening TOP's industry cover-age. This goal can be reached with the given number of hosts, if the amount of cancellations can be decreased while the number of visitors per event can be increased. Therefore it is necessary to rethink the marketing strategy of TOP. To address specific target groups with special events through different channels of distribution may not only improve the number of participants, but in parallel the coverage of less represented branches and regions (selectivity).

Table 2 Results

RESULTS	RECOMMENDATION
Coverage	
there is some scope left for widening TOP´s industry coverage	to rethink marketing strategy, change of marketing mix
if increase in cancellations could be counterbalanced by increase in number of visitors, the given number of hosts is insufficient	to carry out further investigations in reasons for fluctuations in demand
demand in visits is independent of thematic breadth of supply	
Selectivity	
coverage of branches and regions as well as sizes of firms vary	to address specific target groups with special events (e.g. on regional, sectoral level)
Degree of Innovation	
integrated innovation approach is implemented	to continue with integrated innovation approach despite required market orientation in content development
however, aimed self-financing of program calls for compromises in topic selection	
Innovation Effects	
3/4 of all firms the visitors came from did change something/ implemented innovative elements after the visit	to use this for marketing message (e.g. benefits for SME´s)
main reasons for implementation/ transfer were "demonstrated feasability" and "take-over of implementation know-how"	
SME´s are learning from larger enterprises	
Cost-Effectiveness	
danger of conflict between innovation policy objectives of commissioner and aimed self-financing of program	TOP should be continued...
TOP is a successfully implemented and useful transfer program for the German industry	... with financial support by the Ministry to guarantee the realisation of innovation policy objectives

Based on these main results and the ascertained experiences of partners, hosts and participants, the recommendations for the future development of the TOP program focus on

- the work-out of new controlling instruments to allow deeper analysis of the resulting costs of the program in terms of disposition and effectiveness,
- the extension of data collection to allow on-demand and direct impact assessment, as data access for the evaluation was sometimes too complicated,

the intensification of marketing measures, maybe with additional sponsoring partners for regional or branch-specific activities.

The evaluation results were presented to the BMWA and discussed at a workshop together with the TOP-Team and their board. The findings about the success of TOP induced the Ministry to continue with TOP and its support and the recommendations for further improvement of the program have been taken into account for the current call for tender for the next program period.

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Götz Fasold

Zum deutschen BMWA-TOP Programm

WARUM FÜHRT DAS BMWA EVALUIERUNGEN DURCH?

Der Begriff „Evaluierung“ hat oft einen negativ besetzten Wert: „Wir werden überprüft“, „Wir haben etwas falsch oder schlecht gemacht?“. Insbesondere auch bei Programmen, die wie z.B. TOP bereits lange und nach Ansicht von Auftraggeber und Auftragnehmer erfolgreich laufen.

Für eine Evaluierung von Programmen gibt es aus meiner Sicht eine Reihe guter Gründe:

Eine externe Evaluierung soll oder kann nachweisen, ob die in das jeweilige Programm investierten öffentlichen Gelder richtig angelegt sind. Ist es das richtige Programm? Haben wir den richtigen Ansatz? Gibt es der Wirtschaft neue Impulse und Unterstützung?

Eine positive Bewertung kann für uns als Verwalter dieser öffentlichen Mittel hilfreich sein z.B. in der Diskussion mit dem Parlament bei der Haushaltsaufstellung.

Auch wenn ein Programm von allen Beteiligten als gut befunden wird, kann es immer noch verbessert werden. Wenn bei einem lange laufenden Programm (im Fall von TOP über 10 Jahre) etwa die gleichen Personen tätig sind, schleicht sich eine gewisse „Betriebsblindheit“ ein.

Eine externe Evaluierung durch sachkundige Wissenschaftseinrichtungen kann auf Fakten, die wir einfach übersehen, hinweisen und - noch wichtiger - neue Ideen und Tendenzen aufzeigen, die berücksichtigt werden können.

Am spannendsten sind für uns als Auftraggeber immer die Empfehlungen der Evaluatoren für die weitere Programmfortführung. Im BMWA werden Programme in der Regel über Projektträger abgewickelt. Projektträgerschaften werden in regelmäßigen Abständen (3 – 5 Jahre) neu ausgeschrieben, eine Forderung des Bundesrechnungshofes.

Damit erfolgt auch ein Benchmarking potentieller Projektträger. Auch das führt zu neuen Ideen.

Auch hier ist eine Evaluierung hilfreich, wenn sie uns aufzeigt, was durch den Projektträger verbessert werden kann.

WIE SIEHT DIE PRAXIS AUS?

Die Ergebnisse der TOP Evaluierung lassen sich in die o.g. drei Kategorien einreihen:

Ad 1: Nachweis über die Nützlichkeit des TOP-Programms

Durch die zentralen Aussagen der Evaluierung wie „Das TOP-Programm ist ein, gemessen an der Umsetzung seiner Ziele, sinnvolles uns erfolgreich etabliertes Transferprogramm für die deutsche Wirtschaft und sollte aus diesem Grund fortgesetzt werden“ und „Thematisch ist TOP breit angelegt und verfolgt einen ganzheitlichen Innovationsansatz“ haben wir gute Argumente für eine weitere „Teilfinanzierung“ (zur Zeit rund 18%) dieses Programms. Sowohl gegenüber den Haushältern in unserem Haus wie auch gegenüber den Abgeordneten des Deutschen Bundestages.

Ad 2: Verbesserung des Programms; Berücksichtigung der Empfehlungen

Das Marketing von TOP ist unbestritten erweiterungsbedürftig, um den Bekanntheitsgrad des Programms zu erhöhen. Die Entwicklung der Themen-Palette ist stärker auf jene Themen

ausrichten, die den Unternehmen „unter den Nägeln brennen“. Weiters wäre die regionale Verteilung der Veranstaltungen verbesserungsbedürftig.

Das BMWA war bislang davon überzeugt, dass durch das Programm breite Kreise der deutschen Wirtschaft mit dem TOP-Programm erreicht werden. So gab es bislang über 22.000 Teilnehmer (jährlich 2.200-2.400), wobei sich mit zwei Dritteln ein hoher Anteil aus der mittelständischen Wirtschaft kam.

Die Berechnungen der Evaluierung haben aber jetzt gezeigt, dass mit dem TOP Programm nur etwa ein bis zwei Prozent des deutschen Mittelstandes erreicht werden (dies entspricht 600 bis 700 mittelständische Unternehmen). Hier stellt sich für die Policy-Maker die Frage: „Wollen wir alle erreichen oder soll dieses Programm nur die wirklich Innovativen, die Vorreiter, einbeziehen?“ Darüber diskutieren wir gegenwärtig. Alle einbeziehen ist sicher bei beschränkten Haushaltsmitteln und Humanressourcen nicht machbar. Darüber hinaus stellt sich die Frage nach der Sinnhaftigkeit: Wie groß ist eigentlich der Kreis der „Vorreiter“?

Ad 3: Rolle des Projektträgers

Auch hier lässt sich immer Potenzial für Verbesserungen orten. Konkret werden Themenfindung, die Zusammenarbeit mit den Gastgebern sowie technische Fragen wie Datenpflege, Mitteleinsatz und (wie bereits oben angesprochen) Marketing diskutiert.

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Networks of Innovation - Evaluation and Monitoring of Technology Programs based on Social Network Analysis (SNA)

1. INTRODUCTION

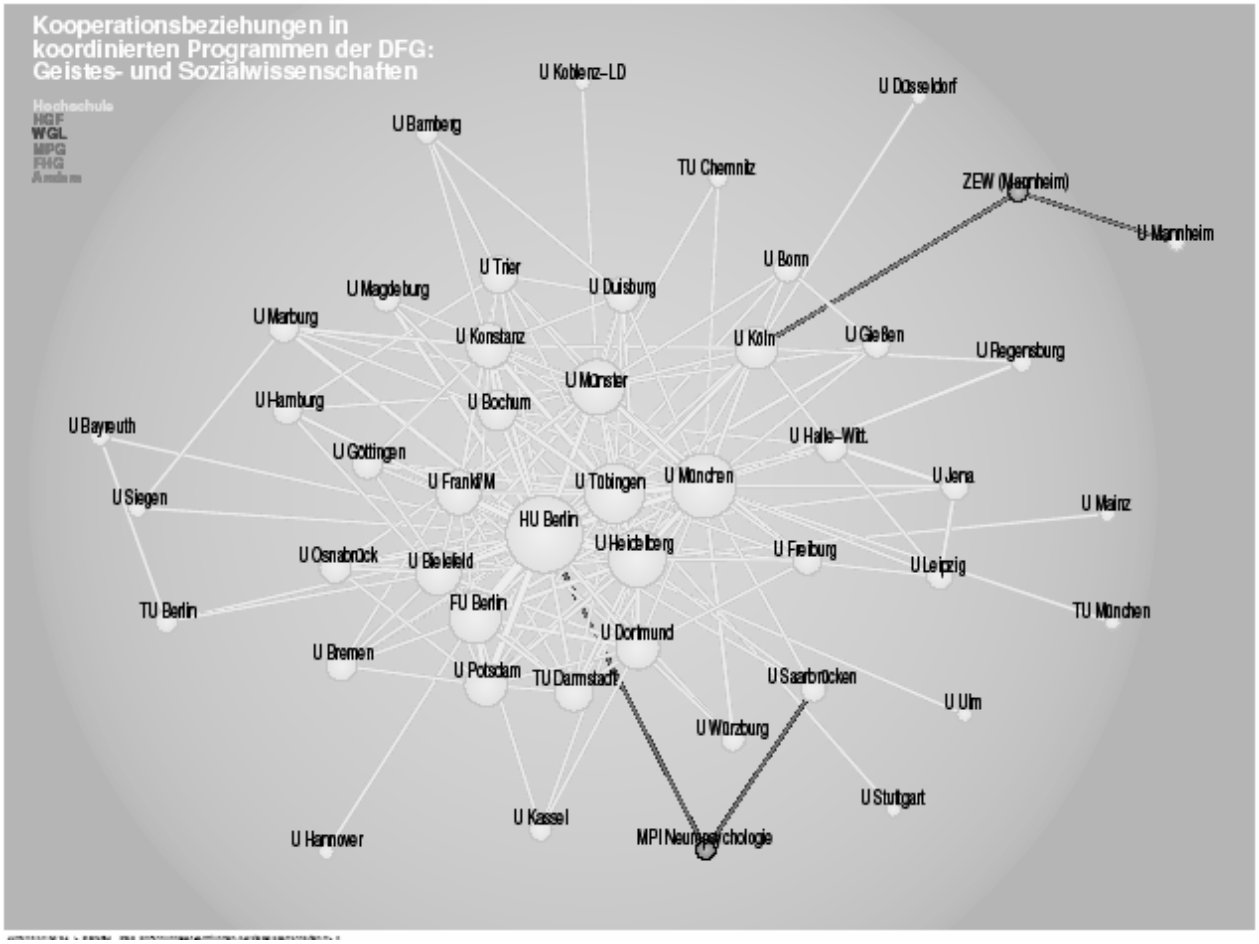
In recent years network research has shown rapid growth. Interdisciplinarity as well as the increasing focus on models with great synthetic strength (complexity theory, new visualization and simulation techniques) have led to major advancements in network theory. As a result of the strong participation of physicists in the research process network research has been restructured and impulses have been drawn from newly established links to these research traditions. Physics, chemistry, biology, computer sciences, chaos theory, ecology and sociology have all contributed to the further development of different branches of network theory e.g. scale-free networks. Social network analysis has focused on revealing the patterns underlying the way people interact. In other words the patterning of people's interaction. It explores the social infrastructure of exchange between sets of actors.

The German Research Foundation (Deutsche Forschungsgemeinschaft - DFG) has developed an instrument that can be used by the protagonists of research and technology politics for strategic planning. Following previous editions in 1997 and 2000, DFG has presented its third report on the distribution of approvals amongst universities and non-university establishments, known as the "DFG ranking".

In comparison to previous editions the scope of the report is significantly broader. It now also incorporates data on the institute the DFG reviewers are affiliated with and on cooperative relationships between establishments in coordinated DFG programmes. Going beyond the DFG, the report also focuses on data on entire third-party funding. Statements regarding the internationality of research are based on figures provided by the German Academic Exchange Service (Deutscher Akademischer Austausch-dienst, DAAD) and the Alexander von Humboldt Foundation (Alexander von Humboldt-Stiftung, AvH) on visiting scholars funded by these bodies. Results of bibliometric analyses round off the picture.

For the first time the cooperation of universities and non-university institutions was studied and visualized by means of SNA. The impressive “maps” enable one to identify those facilities intuitively and immediately, which are connected best within the research network. This way the observer can intuitively identify central players. Social network analysis offers intelligent methods for identifying, visualizing and assessing of innovation networks: Field analysis, identification of strategic actors, support in search processes (logging into networks), dynamic network analysis, innovation potential analysis, equivalence measuring. SNA also offers evaluators a set of excellent indicators which are to be generally tested over the next few years.

Figure 1: Core network of cooperative relationships in "coordinated programmes", funded by DFG from 1999 - 2001: Humanities



Source: DFG, L. Krempel 2003

Technology and innovation policy is undergoing a process of change, as can been seen in the social structure and exchange patterns of the innovation system and in social capital management. Innovation experts argue that not only the input in RT&D is crucial for innovation, but also - and perhaps even more so - the social structure of the network of innovators and the exchange of knowledge in terms of accessibility and speed; in other words the adoption and exchange structure of the innovation system. The advantage of SNA is that it enables us to explore and visualize social structures and helps to generate sustainable social patterns of innovation. With SNA it is possible to detect innovation networks and clusters with a higher potential for innovation than others.

In the past decade there has been a shift in Austrian technology policy towards programs aimed at fostering linkages within the Austrian innovation system. Technology experts have long claimed that the linkages between enterprises, on the one hand, and between the science system and enterprises, on the other, reflect major weaknesses in the Austrian innovation system. These programs should facilitate within a given time modifications in the exchange of knowledge, the use of research and scientific output and the commercialization practices of enterprises. Now the main goal of intervention is not only to stimulate R&D collaboration between university

departments and industry research units in particular, but also to establish innovation networks and long-term linkages between these classes of actors. These programs are supposed to produce an innovative backbone for a network economy. Therefore we need new models, visualization techniques and methods for evaluating these elements of the innovation systems.

2. AREAS OF APPLICATION

Both in terms of methodology and technology network research has very much to offer evaluators in the research, technology and innovation politics. The following diagram gives an overview of the various aspects of evaluation, monitoring and support for strategic decision. The scheme is a based on current research covering innovation on the one hand and network research on the other.

A analysis, support for strategic decision making	
Dimension	Question
A1- Field analysis	Which contexts and structures is an actor, project or scientific discipline embedded in?
A2 - Identification of strategic actors	Which actors, projects or disciplines are prominent, influential or crucial?
A3 - Partner search; Logging into networks	Which structural attributes have (potential) partners, projects or disciplines?
B: Evaluation, Controlling, Monitoring	
Dimension	Question
B1 - Dynamic network analysis	How do networks change over time?
B2 - Measurement of the innovation potential	Which network structure feature more innovation potential than others?
B3 - Market and competition analysis in research or technology fields	Which class of actors, projects or disciplines has similar structural attributes?

2.1 Field analysis

Today the term field or social field in sociology is linked to the work of Pierre Bourdieu who has outlined it in addition to “habitus” and “capital”; “Social field” as one of the central strategical concepts of his sociology. Bourdieuan "field analysis" is a mixture of a technical or methodical procedure and a theory of social conflict and power. Somehow power always plays an organizing role, with the social field specifying the regularities of the "game", the scope and value of the different kinds of capital and the dynamic of social fields, with derivatives from conflicting strategies of "antagonistic classes". Without going into detail, we only want only to outline the general orientation. Without knowledge of the field, to which the actors belong, it's not possible to comprehend their uniqueness and position. The only thing one can say anything about are the effects of field dynamics on the social perception and behaviour of actors, groups or networks.

The origins of "field theory" ("Feldtheorie") in social science are to be found in the work of Kurt Lewin who discovered in field theory (structural psychology, topological psychology, etc.) a perfect heuristic tool for controlling the generation of psychological models in interaction with empirical and experimental research. The unity of person and environment is living space, or anthrosphere, and human behaviour is a function of the environment and the personality. Both - personality and environment - are interdependent

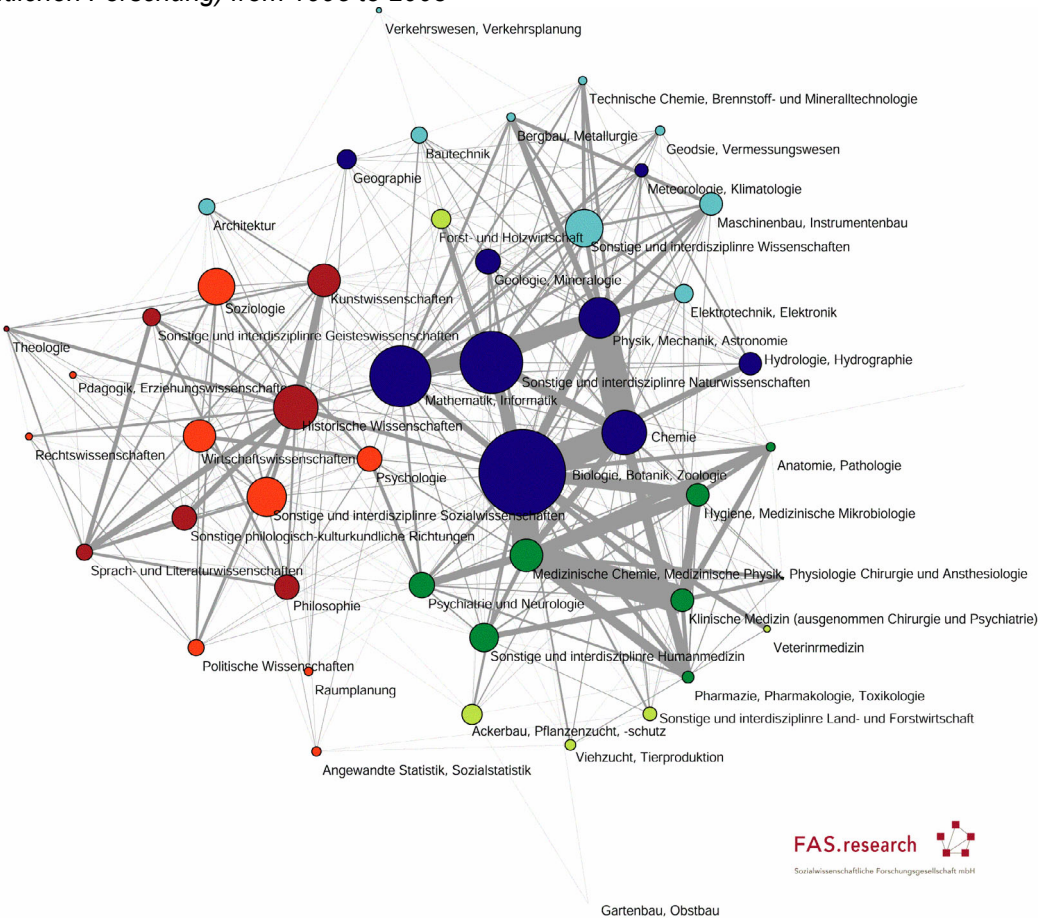
entities. Lewin defines behaviour and personal development as the function of the overall situation ("Gesamtsituation"). The construction of "fields" allows us to explore the environment or context of certain social practices; thus we learn a lot about the structural exposure of the elements of the field.

The possibility of strategic action (and not merely tactical "reaction") requires a clear well-forced position from which a series of actions can be planned within a strategic model. What "field analysis" allows is precisely that: a definition of the position of actors within the context of their partners, competitors or even within a semantic context by visualizing power distribution according to the actors.

SNA makes its own position visible by representing the influence and impact on the field as well as the control possibilities of the individual actors. Within the scientific field this means that the scientific and social infrastructure of the individual actors (universities, research centres, technology parks, and linked-research centres, etc.) become visible and the proximity and distance to all other actors is visualized.

"Field analysis" allows us to determine the density, the fragmentation and the centralization of a network. Dense zones can be differentiated from zones with few nodes and links. Cliques and subgroups are detected.

Figure 2: Network of the research disciplines, funded by FWF (Fonds zur Förderung der wissenschaftlichen Forschung) from 1995 to 2003



Source: FWF, FAS.research 2003

2.2 Strategic actors

Viral marketing and contagious processes (fads, trends, innovations and epidemics) would not be possible without the existence of "hubs" within a network. Networks function because a few actors show a particularly high prominence within a network and their activity ensures that many can be reached within the network. SNA identifies not only the most central but also the strategically most important actors.

Not every actor is equally prominent within the network. The structural importance of an actor can be recognized on the basis of his or her position within the network. Central actors are those who are prominent due to their relations to others. The “stars” are either those who are most involved in relations (centrality) or those who are most often chosen on the basis of assessment (prestige). SNA distinguishes between different centrality indicators. Accordingly, those who on the basis of the degree of relations are most central, are only central in local terms. They serve as local opinion leaders or hubs which reveal a higher activity in certain network regions. This relative significance does not necessarily have to imply global significance.

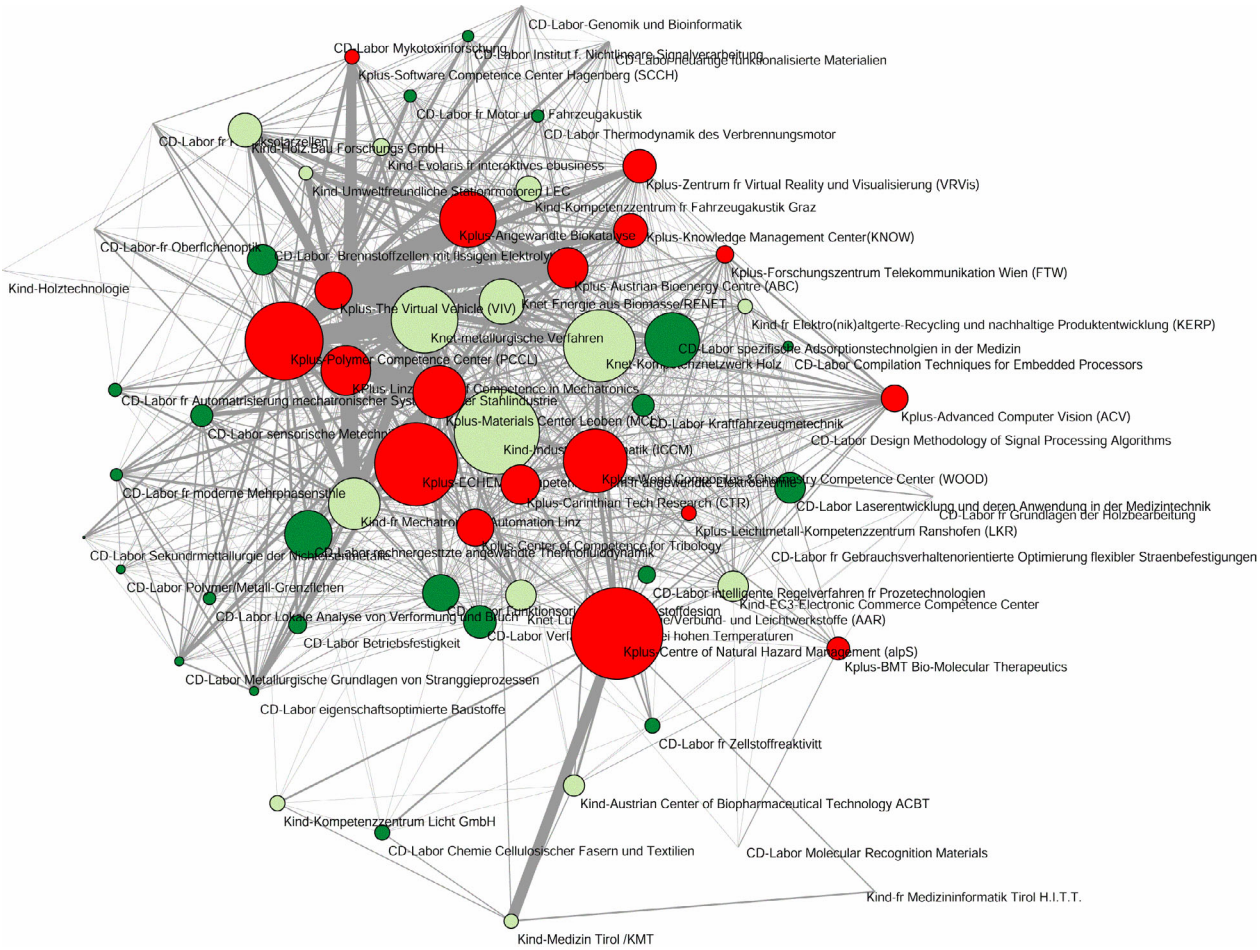
To this end, network analysts have developed two further indicators. Structural autonomy is measured on the basis of the so-called closeness centrality, which can be observed in those who show the shortest distances to all other actors. Given the short (path-) distances to all other actors they are easily accessible for all other actors. Moreover, these actors are very effective in diffusing innovations within the network.

To measure structural control within networks so-called “betweenness-centrality” was developed. Actors who appear most often in the diameter of other actors of the network also show the highest betweenness centrality. They appear as brokers and can thus control transactions within the network.

Eigenvector centrality measures the power distribution within the network by determining primarily the structural embedding of each actor by not ascertaining the number but the value of relations.

The accessibility of different, distant social regions or groups is not just a product of the activity of the "hubs". Exchange of knowledge and innovation is also dependent on those who create bridges between socially homogenous groups. These are the so-called brokers. Brokers organize exchange between entirely different social worlds. They are also usually translators of new cultural codes. As opposed to the "hubs", innovators are often situated on the periphery, i.e., not so much in the centre of the network.

Figure 3: Network of cooperative research institutions: Christian Doppler Gesellschaft, Kplus and Kind/net; June 2003



Source: BMWA, FAS.Research

2.3 . Partner search, logging into networks

Information about the "structural" features of existing and potential partners provides new insights on decision-making processes. Each new partnership can yield opportunities by facilitating access to new knowledge, information or resources of a different kind. So-called "second-step contacts" often have a specific strategic value the knowledge of which can increase the strategy portfolio. To whom you are connected, or better: should be connected, is of course not only a question of excellence or competence, but also a question of social connections and social capital.

2.4 Dynamic network analysis

SNA has modified classical models of diffusion by replacing the typology of persons with the behavior of networks. In the diffusion of innovation the critical mass point can be reached sooner by decreasing the adoption thresholds of strategic actors. The critical mass point marks the moment in diffusion from which the process of diffusion becomes self-sustaining. As regards the conception of transfer programs this has far-reaching implications, since both the moment in

time as well as the target groups can be defined by means of the measure taken. Actors showing a high degree of "betweenness-centrality" are supposed to function as "change agents" in such diffusion-backing measures.

Dynamic network analysis also furnishes the instruments for monitoring processes by documenting the structure and the development of individual networks and entire fields in terms of structural changes over a given period of time.

For individual networks the degree of embedding as well as the position can be determined before embarking upon a research or technology political intervention. It is thus possible to observe defined strategic fields (field analysis) prior to political intervention in the innovation system, allowing structural changes in a field but also documenting the development of forms of cooperation. The question as to whether the network has become more or less balanced as a result of the intervention in the network indicates the innovativeness of the social structure. Dynamic network analysis can capture the functionality of a given network structure in relation to a innovative process or research cycle.

2.5 Diversity and Measuring Innovation Potential

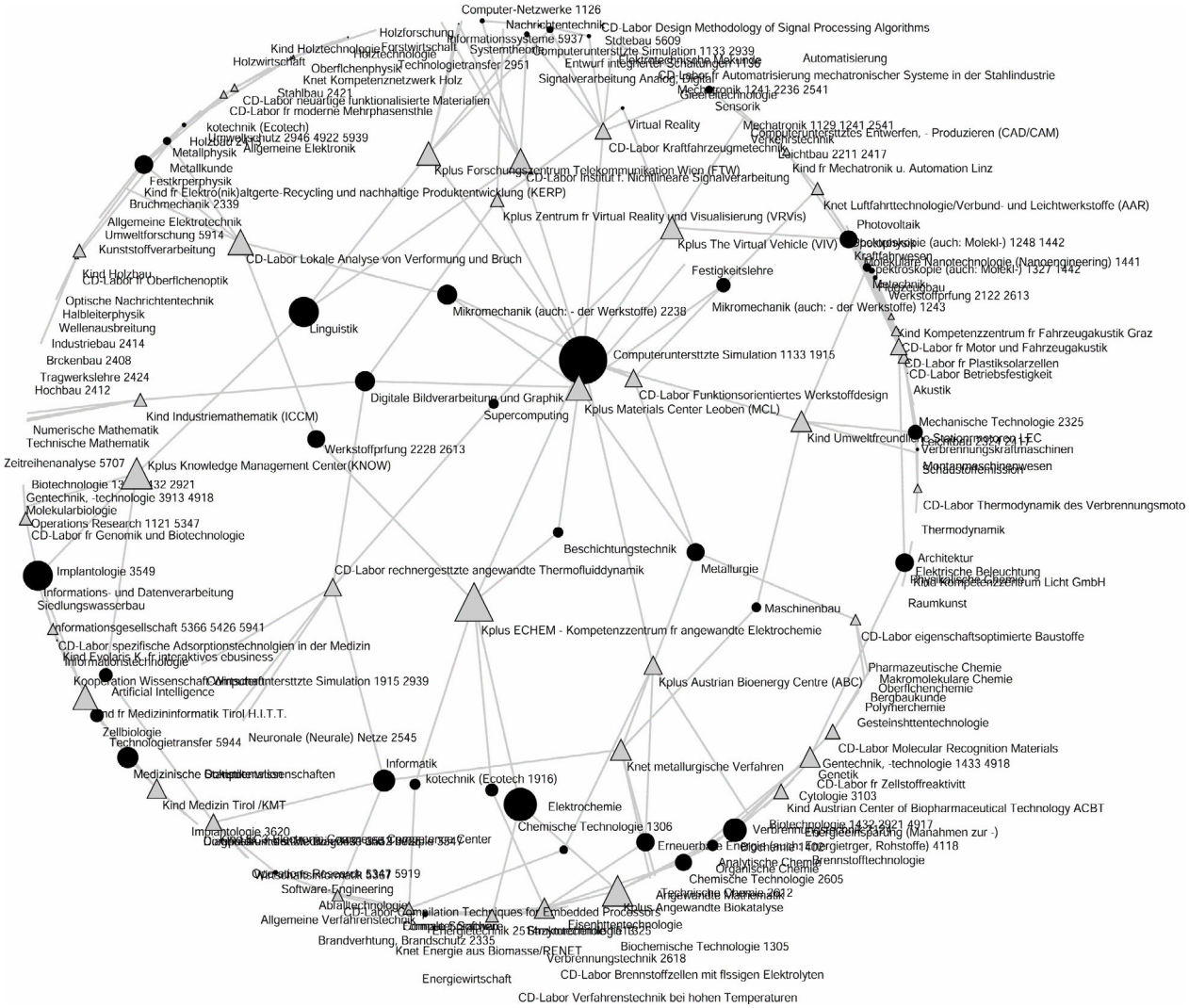
In his studies on the ecology of the advertising sector in London, Gernot Grabher argues that the innovative strength of the British advertising sector could be explained by a culture of diversity. If - according to Grabher - one does not just focus on the usual models of companies in their respective environments (innovative milieu, creativity clusters, regional innovation system, etc.), it is possible to recognize new dimensions of structural prerequisites. Not only does one note the large organizational diversity of individual agencies but also the ability to both facilitate the interaction between very different cultural codes and to deal with the tension between different interests and views (artist and company manager, commissioner, consumer) in a productive arrangement and to ultimately find incentive systems for the transfer and translation of knowledge.

Not just "new economic geography", which combines models, insights and methods of evolutionary economics, urban studies, network models with the tradition of economic geography, can be credited with having discovered the innovative potential of diversity. If one takes seriously Schumpeter's appeal to innovation to implement new combinations, then innovation networks must assimilate at least two features, namely, the productive networking of various actors in a number of respects (link diversity, code diversity, diverse production regimes, etc.) just as the creativity sector in London shows and at the same time maintain the ability of these diversities to prevail in all phases of the innovation process.

Recent research supports the view that teams perform at a higher level when they bring into contact individuals with higher social diversity. In addition, performance also depends on the density of interaction. Therefore diversity indices will help us to advance our measures of innovation potential.

Indicators developed by mathematical ecologists together with information theorists for precisely these purposes lend themselves particularly well to measuring the diversity of networks.

Figure 4 2mode network of cooperative research institutions and research disciplines as ties between them, june 2003



Source: BMWA, FAS.Research

2.6 Market and competition analysis in technology-political fields and clusters

Observation of competition in markets and the social impact of position roles reveals a lot about network processes which no longer can simply be explained by models operating with social cohesion. The structural equivalence of two actors is given in a network when both have a similar profile of lines. Two networks are structurally entirely equivalent when then they are related to all other actors in the network in precisely the same way. Structurally, similar actors can be grouped together to form so-called "blocks" which, depending on the model, have positional attributes or block qualities.

Block model analysis lends itself well for discovering structurally homologous actors and thus also for deciphering the structural conditions of competition.

Further directions

The future development of this research will focus on three subjects. First, the incorporation of models, tools and algorithms from the field of complexity research for dynamizing static networks (simulation modelling); second, testing the different indicators for innovation potential analysis (diversity indicators, balance models and fitness landscape); third, research on organizational structure, innovation capacity in terms of robustness and efficiency. These three dimensions are related to transdisciplinary research based on ecology, general biology, information theory and physics. The application of these transdisciplinary efforts to social topics has created a solid foundation for further research. Thanks to the translatability of the language and models used it will be possible to create a model for innovation development which will enable us to make predictions regarding the emergent characteristics of the system by applying simulation techniques.

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