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Final Report

Field research of public R&D teams in the South Moravian Region (2010)

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RIS3
Regional Innovation Strategy of South Moravian Region

Final Report

Field research of public R&D teams in the South Moravian Region (2010)

Client: South Moravian Innovation Centre
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List of abbreviations

AR	Applied research
CAS	Czech Academy of Sciences
BA	Business Angels
TTO MU	Technology Transfer Office of Masaryk University
4–7FP	4th to 7th EU Framework programme for science and research
JIC	South Moravian Innovation Centre
SMR	South Moravian Region
SME	Small and medium enterprises
MNC	Multi-national company
PGS	Doctoral students
FDI	Foreign direct investment
RIS	Regional Innovation Strategies
ROP	Regional Operational Programme
TT	Technology transfer
TTO BUT	Technology Transfer Office of the Brno University of Technology
BR	Basic research
SS	Secondary school

Definitions of selected terms

Business Angels (BA)
„Godfathers" of businesspersons, or affluent individuals who are willing to use their capital to invest in interesting ideas and firms

Excellence centres
Units or organisational structures that are involved in scientific research and the development of superb world-class technologies based on measurable scientific phenomena (which also includes educational activities). The role of excellence centres is to bring together theoretical and applied research in the natural, social and economic sciences and to employ multidisciplinary approaches as much as possible throughout

Innovation
Realisation of a new, or substantially improved, product (goods or services), process, marketing or organisational method

radical innovations
Innovations that introduce brand new knowledge (most often new technology)

incremental innovations
Step-by-step innovations consisting of new combinations of existing knowledge, or the use of existing knowledge in new contexts for different purposes; they consist in the realisation of partial and gradual changes

Innovative entrepreneurship
Includes business activities that focus on the continuous realisation of innovations. Innovative entrepreneurship can be characterised by the use of progressive knowledge in all activities and elements of a business, thus achieving high levels of added value in products

Cluster
Geographical agglomeration of firms and institutions within a certain business sector that have vertical relationships (as in between a client and a contractor) and horizontal relationships (in terms of shared customers, technologies, sales channels, key competences, etc.)

Innovation system
"… the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies." (Freeman, 1987)

Business park
Integrated location that has been defined in the mandatory part of an approved zoning plan of a large territorial unit or an approved zoning plan of a municipality as a territory on which are primarily erected buildings for industrial production, trade or the provision of services, or as a territory for future building development for industrial production, trade or services. The term "business park" may also refer to a territory where buildings for industrial production, trade and services may be built pursuant to legally valid planning permissions. The term can also refer to a location that, pursuant to zoning documentation or legally valid zoning permission, is intended for the construction of a business park. Furthermore, an industrial zone that has all qualities of a business park may be referred to as such.

Pre-seed capital
Capital investment that enables the financing of additional research that is necessary prior to introducing a new product onto the market, or prior to producing a prototype, model, etc. The company itself has not yet been founded.

Production network
No final product is manufactured in one company (i.e. "under one roof"). Should a final product represent a certain added value, it should be noted that this added value has been created by numerous companies at numerous locations, irrespective of national borders. Production networks (otherwise known as "value chains") refer to a network of companies whose added value contribute to the final product.

Venture Capital
Generally speaking, the term refers to all types of capital. In Europe, this term is sometimes identical to development capital, which is the most common type in the Czech Republic. Pursuant to a definition offered by the Czech Statistics Office, venture capital, in the narrower sense of meaning, includes private capital investments into the foundation and launch stages of a company (seed and start-up) as well as capital investments into the expansion stage, in exchange for agreed private equity. Venture capital, in the broader sense of meaning, also includes other forms of capital investments, such as replacement, buy-out or buy-in.

Seed capital
Capital investment that enables the commencement of a business plan (i.e. to set up a company), focusing on financing research and development.

Start-up capital
The process of financing a company during the foundation stage (usually until the company manages to market its product).

Spin-off [company]
The literature so far has failed to agree upon a clear definition of this term; generally speaking, however, it is used to refer to a company founded for the purpose of commercialising intellectual property originating at a university or other public-sphere research institution. However, private company spin-offs also exist.

Technological platforms
Associations of businesses, research institutions and financial institutions, national public administration authorities, user and consumer associations that take part in research, development and innovations in those business sectors of particular strategic importance, both at national levels as well as on the pan-European level.

Technology transfer
Process that enables the outputs of science, research and development to be "moved", whereby technology, knowledge and/or information conceived in a single organisation, in one sector or for one particular purpose is applied in another organisation, a different sector or for a different purpose.

Triple Helix
This term is used to refer to the coordination of activities of the (local) public authorities, companies and the academia, so as to improve conditions for the development of the local knowledge economy.

Science park
This term has been used in the Czech Republic since 1990; generally speaking, it may refer to all kinds of parks, represented by three subcategories: (i) science park (centre), (ii) technology park (centre), (iii) business and innovation centre. It is an institution that uses its know-how to create the conditions to dynamically develop innovative companies, transfer technologies and to provide education in the area of innovative entrepreneurship.

Research
Systematic creative activity the purpose of which is to expand knowledge, including that of humankind, a culture or society, by employing methods that enable acquired knowledge to be confirmed, updated or overturned, undertaken as:

basic research
Activities at the theoretical or experimental level(s) the purpose of which is especially to acquire new knowledge on the basic principles of phenomena or observable facts, where these activities are not primarily focused on any use in practice

applied research
Activities at the theoretical or experimental level(s) the purpose of which is especially to acquire new knowledge and skills for the purpose of developing new , or substantially improved, products, processes or services

Development (experimental development)
Process of acquiring, connecting together, forming and using current scientific, technological, business and other knowledge and skills in order to design new, or substantially improved products, processes or services

Knowledge economy
Economy, where the key competitive advantage of individuals, companies and regions is (their) ability to create, acquire and use (for their economic benefit) newly acquired knowledge.

Executive Summary

In order to fulfil the goals of the international project known as Centrope_tt and as part of the preparation for updating the Regional Innovative Strategy of the South Moravian Region, the Berman Group was approached to take part in a survey of public-sphere science and research institutions in the South Moravian Region. **The main goal of the survey was to acquire more in-depth, primarily qualitative knowledge of the conditions of, and barriers to, (i) the development of research in public-sphere science and research instutions in the South Moravian Region and (ii) the transfer of research outputs to everyday practice**.

Specialisation

According to researchers interviewed, **the basic precondition for the development of applied research and TT is top-quality basic research**, where the **relevant reference level with respect to global competition and the nature of the science would be the global excellence level**. Although it is not to be expected that most local research teams would achieve these levels of global excellence, the intention of achieving such standards should, logically, be the goal of most teams involved in those branches of science focused on by research activities in SMR.

The base specialisation of the research sphere in SMR is the sector of molecular biology, including closely related branches and applied fields. Within this network of research activities is concentrated a critical volume of resources (including cooperation networks and partnerships with companies) necessary for a substantial development of research towards global excellence. **Basic research in molecular biology and its closely related branches represents a key source of new knowledge within the framework of the regional innovation system of South Moravia. It is a great stimulus to applied research, both within biology studies and outside of them, thus creating attractive conditions for the development of innovative entrepreneurship in several business sectors at a time.** Aside from this key specialisation of research activities in SMR, very high quality was, to a lesser extent, also documented in the sectors of **material research**, **instrumentation production**, **mechanical engineering, electrical engineering and IT**.

Based on the information acquired in the survey, it seems that it would be extremely difficult, if not impossible, to catch up with the world leaders in these braches of science. However, as human society develops it stimulates the **development of new research topics, quite often of an interdisciplinary nature that require unique combinations of established branches of science. New opportunities arise in these branches, in which case the achievement of global excellence may be noticeably easier**. With respect to the aforesaid, it is important to point out the existence of developing **interdisciplinary ties** among the aforementioned specialisations of the research environment in SMR, **and the fact that they produce unique technologies** (see Chapter 3.7). **This is proof of the fact that global excellence is indeed achievable in the context of research activities in SMR. The challenge behind setting up said support systems is to achieve as many such cases as possible and to support the benefits of these cases for the economic development of the region**.

Barriers to the development of excellent research

In terms of educating young people is to take up careers in branches of science that are the most demanding in terms of knowledge, the main barriers are as follows:

- The system of doctoral study programmes in the Czech Republic, where the average quality of graduates significantly lags behind their potential.
- The low interest in technical and natural sciences among secondary school leavers, as a result of which, with respect to demographic developments, it is expected that the talent pool in research and development will soon decrease significantly. This will hamper, if not render impossible, the "renewal of talent" in research and development (and elsewhere), not to mention any progress.
- The image of an academic career combined with the actual conditions offered to young people discourage many young talents not just from an "academic career" itself, but for some even acts as a deterrent to pursuing PhD. studies.

The consequence common to the aforementioned barriers is a significantly small pool of talent (as compared with countries with the same population) from which to recruit future researchers.

As for experienced researchers who have already learned to work within the system under the defined conditions and to obtain the resources they need, the most notable problems in developing research are as follows:

- **The large ratio of "unproductive" activities that need to be carried out by team leaders, which often corresponds to one third or sometimes even one half of their workload.** These activities consist, in particular, in paperwork connected to teaching activities, preparing applications and managing individual projects, etc. This results in them having very little time and energy for research, the conceptual development of their teams or for TT. It is a key obstacle (barrier) since it is experienced by the largest number of research team leaders.
- **Salaries fail utterly to reflect the labour market situation of highly qualified experts.** Under the current system, experts are "expected" to take on a great deal of work (high quality research, teaching activities, etc.) for very little money, while at the same time, their secondary activities, which in many cases provide the main, or at least highly significant, source of personal income, are "tolerated". The main consequence of this is that fewer hours are devoted to research activities compared with average researchers abroad, where salaries reflect much better the situation in the local labour market for highly qualified experts.
- **Unstable system of financing.** Ongoing changes in the system of financing and uncertainties regarding the period following termination of the Operational Programme Research and Development for Innovations represent, according to most respondents, considerable problems for the strategic planning of both teams and research activities. There is a relatively significant risk that established teams will not survive. When established teams are lost, it has fatal consequences for the quality of research and its further development.

Last but not least, **the Czech Republic is not an attractive option for foreign researchers (and not just the best) as a place to stay for longer periods.** One of the main reasons is that salaries do not reflect the situation on the labour market. On the other hand, most respondents pointed out that **salaries are not the decisive factor with respect to the attractiveness of individual research institutions** within the framework of global labour market competitiveness. **Particularly important (especially to foreign researchers) is that institutions offer interesting and high quality work, good-quality support facilities as well as the image and international reputation of the team and the institution as a whole**.

Can such barriers be removed at the regional level?

Although many of the aforementioned problems exist at the national level and though it is true an effective solution must be sought with respect to central government, there does exist space for numerous solutions at the regional level, some of which are now being implemented. Pursuant to findings from the field survey, which are described in detail in the present report, we recommend the following:

- **Realisation of the SOMOPRO programme should continue**. Resources should be increased only if attempts to re-integrate and attract really superb researchers are successful. Attention should also be paid to verifying and assessing the benefits arising from the supported researchers, especially for the institutions they work at.
- **The Somopro programme model (part of reintegration) should also be applied to researchers from EU countries**. There are many expats working at leading research institutions in the EU (especially the United Kingdom, Germany, France, the Netherlands, etc). The survey repeatedly recorded an interest in applying the Somopra model with respect to these researchers, where in most cases they were referred to as potential leaders of future key teams at the respective institutions.
- **The system of support services for long-term stays of top foreign researchers and their families in SMR should be developed**. With regard to foreign researchers, this system of support services should be coordinated with other activities aimed at improving the attractiveness of SMR (or Brno, for that matter) for long-term stays of foreign researchers.
- **Talented doctoral students should continue to be supported through additional scholarships; additional resources should be sought for this instrument.** In our opinion, an opportunity in this regard might be a fund to which companies located in the region (or even companies from other regions that have close relations with SMR-based companies) would contribute on a voluntary basis. Private and public resources could be shared and used for additional scholarships, e.g. using **the mechanism of cost sharing with respect to additional scholarships for students signed up by companies** that contribute to the system.
- **A joint marketing strategy should be prepared and implemented, so as to present Brno and SMR as natural locations for top-quality science, research and technology**. This is participation-based preparation process. Of key importance is consensus on target groups, the messages and their forms, budgeting and implementation spanning several years.
- **Implementation of a new instrument – "young researchers start-up grants".** This should involve a limited number of multi-year research grants (about five for approx. 5–7-years amounting to approx. CZK 1.5 – 2 million per year) for top young researchers from all over the world. Specialisation would be highly selective, in relation to excellence within local science branches of key importance. The purpose of this initiative is to broaden the area from which future top team are recruited. In terms of excellence, we recommend particular attention be paid to interdisciplinary teams which have relations with branches of science that are, globally speaking, in their initial stages. The achievement of global excellence is most likely in such cases. Local resources (the regional authority, the City of Brno) and locally administered external resources (ROP, global grants for individual operational programmes) should strive to exploit this potential.

Barriers to technology transfer (TT)

With regard to impetus for TT, there exist factors on the part of demand *(pull)*, in which case businesses are interested in making use of the outcomes of research, and factors on the part of supply *(push)*, in which case the authors of research outcomes are themselves interested in putting such outcomes to practical use. **Our field survey revealed that interest in participating in research and development on the part of companies-respondents was conspicuously limited**. In terms of such cooperation, companies are interested in specific services that have nothing in common with research and development.

The aforementioned limited demand from companies for participation in research and development is a consequence of the combined causes outlined below:

- The main leaders of the Czech economy are local branches or subsidiaries of large multinational companies (MNC) that have their own research and development capacities abroad. If they do locate some of their R&D institutions in the Czech Republic, these activities consist in the last stages of the internal R&D value chain that does not require any significant input from research.
- Numerous companies are not parts of MNC structures, but they strongly depend on local branches and structures of MNC. They need them as their clients/customers. However, these companies focus mainly on the job-order production of products with relatively low added value, i.e. products whose design and specifications are provided by customers themselves. Logically, this results in low demand for innovations and is reflected in the scant interest in R&D cooperation with universities.

Although the extent of the demand for cooperation on the part of companies may be sufficient, its contents are dominated by the need for various services, not by research as such. This is the reason why a **significant barrier to TT development is the disparity between demand and supply**, since researchers from public-sphere research and development institutions focus on research and not services, even though realisation of the latter, to a limited extent, would involve a significant improvement of their low base salaries provided by public-sphere R&D institutions.

The survey showed the following barriers to TT development on the part of research institutions and their employees/teams *(supply)*:

- **Insufficient preparedness of internal procedures and TT-related assistance tools** at universities and research departments of CAS. Although the related procedures and internal services may be developed on paper, the vast majority of respondents stated that they still fall far behind the required functionality and quality.
- **A critical lack of experienced experts in managing and implementing support activities in the area of TT**.
- **The relatively low involvement of people with qualities that would favour entrepreneurship**.

How to support TT development in the South Moravian Region?

Considering the aforementioned barriers to TT development in SMR and other findings from the field survey, we recommend the following:

- **To consider the possibility for initiating and facilitating effective discussion** among the top representatives of (i) regional and local self-government, (ii) local universities and other research institutions and (iii) leading local businesses and/or their representatives (Chamber of Commerce, etc.). **The purpose of any discussion would be to find out what steps need to be taken in order to speed up the process of introducing effective procedures and assistance services for TT support at academic institutions**.

- **Based on the progress and outcomes of the aforementioned discussion, to prepare the tools of the current version of the Regional Innovation Strategy of the South Moravian Region that will, as far as possible, facilitate and enable implementation of internal changes within local research and development institutions.** These tools and activities will:

  - » **ensure and improve availability of the best qualified experts who have experience managing and implementing support activities in the area of TT**
  - » **improve knowledge and encourage inspiration among managers of research institutions and their departments with respect to (i) TT assistance tools and (ii) the conditions and issues that represent the key agenda for private-sector managers**
  - » **facilitate coordination for the development of assistance services at individual research and development teams/institutions, so as to make maximum use of potential synergies, including ensuring the effective use of support resources.** With respect to the above, we recognise a need to initiate a discussion to assess **the types of activities and TT support tools that should be provided by individual institutions on an internal basis, as well as how to improve the quality and effectiveness of their provision at the regional level**.
  - » **make it easier to obtain public resources for funding the necessary changes to internal procedures and assistance tools employed by local academic institutions**

- **To continue building the mix of activities and tools used to overcome the insufficient demand for innovations and the supply-demand disparity with respect to cooperation between companies and local R&D teams/institutions.** In this regard, we recommend the following:

  Expanding the innovation voucher model to include foreign companies. This step should be supported by suitable promotional activities (linked to the general marketing strategy, which is to present SMR as a centre of top-quality research and development). Furthermore, the value of each voucher should be increased to make it relevant for companies from Germany, Austria or other countries where price levels are significantly higher). If no resources are found for this measure, then we believe expansion to include Poland, Slovakia and Hungary would be worthwhile, as researchers who responded in the survey have numerous contacts with companies from these countries.

  To assess the need for, the form and circumstances of the foundation of a regional "proof of concept" fund. This tool should not compete against the Technology Agency of the Czech Republic. Although, considering circumstances in the Czech Republic, it might initially be expected to take the form of a subsidy fund (with participation), we recommend considering a switch to the return fund model in future, where a small number of successful projects would pay (in full or part) the costs of unsuccessful projects. In the long-term, the latter is more suitable with respect to demands on public resources and success working to motivate all participants.

  To consider the possibility for supporting the activities of independent technology scouts who would provide active marketing and represent local research and development institutions. This line of business is relatively rare in the Czech Republic. In our opinion, it might be beneficial to initiate a system under which institutions interested in professional representation and/or good-quality marketing in commercialising research outputs would be offered professional assistance consisting in the recruitment and (partial) remuneration of suitable candidates. These businesspersons could become independent over time and they would bring to the marketplace good contacts and information on the commercial potential of local academic institutions. Put more simply**, this would be a special incubation programme for businesses that provide the services of independent technology scouts.**

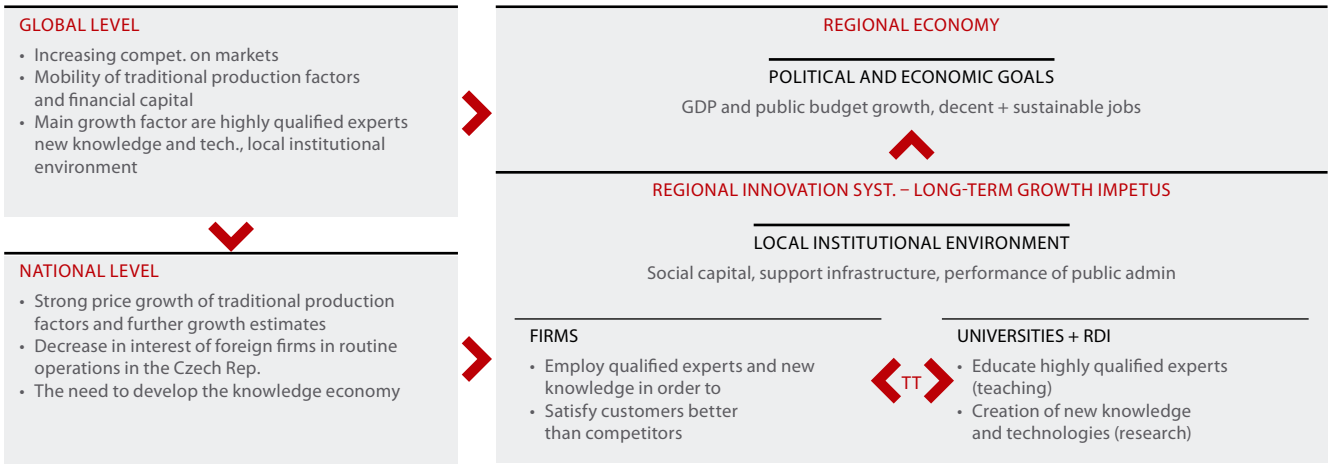
» I. INTRODUCTION

A survey among science and research teams and institutions from the South Moravian Region was conducted in cooperation with the Berman Group – služby ekonomického rozvoje, s.r.o., as part of realising the Centrope_tt project[1] and preparation for the upcoming implementation period of the Regional Innovation Strategy of the South Moravian Region. **The main goal of the survey was to acquire more in depth, especially qualitative, information on the applicable conditions and barriers**

1. **to the development of research in public-sphere science and research institutions in SMR**
2. **to the transfer of research outputs into practice.**

There are several reasons for in-depth evaluation of this issue. Firstly, **the importance of academic institutions for the socio-economic development of countries and their regions has been increasing steadily**. This coincides with an increase in the importance of (i) new knowledge and technologies and (ii) top experts as primary sources for developing the knowledge economy (see Fig. 1). With respect to ever-increasing global market competition and the mobility of traditional production factors (raw materials, land, work force, etc.), outputs produced by universities and other research institutions have become the "key raw materials" for the competitive advantage of companies and, consequently, regional and national economies.

Fig. 1: Importance of cooperation and TT between academic institutions and companies for developing local economies



Source: author

Secondly, the scope and structure of research at universities and research institutions in Brno represent a significant potential for growth and development, not just of the region itself. If, due to the loss of competitive advantage in terms of low input prices (salaries, energy, etc.) the Czech Republic is forced to confront the challenge of shifting to a knowledge economy, it is, in fact, **the high concentration of research capacity in Brno that represents the key potential for the SMR with respect to long-term economic development**.

However, the mere fact that new knowledge is created (even though it may be published in the most prestigious magazines and journals) or that numerous of the very best students are taught does not guarantee the use of this potential for economic growth. **Outputs produced by universities are "just an offer" of resources; the use of such resources to generate profit and create jobs is for companies to decide**. Specifically, their ability to succeed on global market is thanks to (in part) the knowledge and personnel offered by local academic institutions. In other words, the very nature and success of (i) the commercial utilisation of newly conceived know-how and (ii) the process of educating graduates to be top experts are the decisive factors with respect to the actual contribution made by the outputs of academic institutions for local and regional economic growth. This is the reason why our field survey focused on interactions between academia and the business sector in the region, i.e. two worlds that have previously been relatively distant from each other.

1 Field survey is implemented as a pilot project within the Centrope_tt project. The reason for its realization was low rate of accomplishment of the online R&D institutions survey after the finalization of online mapping. Therefore, there arose a need for learn more about these institutions, establish personal contacts with scientists and support one of the aims of the project – sustainability of current information about R&D institutions. A partial goal of this research is to gain a better understanding of barriers to technology transfer in one of Centrope regions and try to formulate a tool that can be used also to strengthen Centrope as the „knowledge region".

In particular, it means that attention is concentrated in the first instance on the issue of technology transfer and cooperation between research teams and companies. However, in the context of the significance of basic research for applied research and commercialisation activities, emphasis is also placed on the conditions for, and barriers to, the development of research teams and their key research activities. **Considering the main goal of the survey, it may seem as if its authors overly focus on the application and commercialisation of research outputs and that they over emphasise the need to develop the "third role" of universities. We shall note at this early stage that we consider the issue of TT development and the third role of universities in general to run in parallel and not to compete with their hitherto dominant roles in the area of research and development.**

The report is structured as follows: 1) the most important findings and recommendations are summarised; 2) the course of entire survey and its data processing methodology are described in a separate chapter; 3) the results are then set out in the main chapter. This chapter is divided into six sub-chapters, where each is focused on a particular area of TT barriers, HR issues in research and development or evaluating the recorded demand for tools considered as part of preparations for the updated Regional Innovation Strategy for the South Moravian Region. The final chapter offers a synthesis of findings, plus recommendations in the area of state aid and assistance.

» II. METHODOLOGY

Researchers were visited by consultants from the Berman Group, which has long experience (both in the Czech Republic and abroad) conducting surveys in a business environment. Although academic institutions differ considerably from companies in numerous aspects, the company employed a field survey methodology that has been well established and effective. The purpose of this methodology, which was partially adapted for use in researching a new subject in the Czech context, is to obtain "soft data" on how an environment operates (its related conditions and barriers), which affects the decision-making processes in participants (who, in this particular case, are researchers, not managers).

During most of the invterviews, consultants were accompanied by an employee of the client, i.e. the South Moravian Innovation Centre, or the South Moravian Centre for International Mobility. Almost all interviews were conducted with researchers who are leaders of research teams ("principal investigators"); they took 60 to 90 minutes and were focused on (i) the scope, issues and achievements of the respective research activities, (ii) goals with respect to developing the team, or the entire institution as such, (iii) cooperation with companies and other institutions, (iv) HR issues and financing issues, etc. During the second part of the interview, the researcher-respondent was made familiar with the rough objectives of the assistance tools and other activities and were asked to share their views about the potential benefits of these tools.

The purpose of these visits was to assess and describe the situation of research teams in the region with respect to transferring knowledge to companies and to channel this data to the creators and authors of the Regional Innovation Strategy for the South Moravian Region. The conclusions will be used in the process of preparing tailor-made assistance tools for particular development needs as expressed by local research institutions, or individual teams. Moreover, the intention behind this survey was to launch a more persistent dialogue across the academic, public and private sectors, in order to assess how to (i) improve efficiency of the transfer of knowledge from academic institutions to companies, (ii) keep developing cooperation between companies and academic institutions in the region, and (iii) how to increase the motivation of companies to finance research and teaching at local universities and other research institutions.

> The research cannot be regarded as a statistically accurate investigation. Participating researchers were not chosen at random, their responses are considered as honest, and even though interview transcripts were sent for authorisation the data collected was not verified. The tool employed to collect data was only loosely standardised and included a number of open questions. In order to carry out basic statistical processing, some answers were standardised. One has to bear these conditions in mind while working with the data contained in this report. Whenever possible, the exact numbers of researchers answering a particular question are given and the proportion of the sample they represent is specified, so as to avoid misinterpretation.

For the purpose of the survey interviews, 140 researchers were chosen from academic institutions in SMR. Moreover, 30 researchers representing Prague-based institutions were approached for the purpose of comparing certain regional specifics. Researchers from SMR were selected by JIC based on a combination of scientometric indicators and recommendations from directors of acdacemic institutions. Researchers from Prague were selected based on outcomes from the interviews conducted in South Moravia in such a way as to mirror the professional structure of the institutions visited in the South Moravian Region. Besides visiting those researchers whose work receives the greatest number of citations, the purpose of the initiative was to visit researchers who are active in the area of transferring knowledge into the private business sector. It should be noted that there is no significant relationship between these two areas, which indicates the need for intermediators between the academic and business sectors.

Interviews took place between mid-February and the end of April 2010. A total of 90 researchers from SMR and 20 researchers from Prague were visited. The professional structure of respondents was as follows2: Brno: biology and medicine – 22, electrical engineering and instrumentation – 18, physics, metallic material research and mechanical engineering – 17, chemistry and non-metallic material research – 16, IT – 13, other – 4. Prague: biology and medicine – 5, electrical engineering and instrumentation – 3, physics, metallic material research and mechanical engineering – 4, chemistry and non-metallic material research – 3, IT – 5. This classification is somewhat ambiguous, however, as many researchers are involved in a range of topics, and some interdisciplinary areas cannot be categorised. Considering the relative heterogeneous sample of researchers and their respective fields, the survey results are presented as a whole, not by individual specialisations. Taking into account the specifics of the various branches of science, we point out significant differences in each of the fields.

A questionnaire was prepared and drawn up as a source material for the interviews. It included six groups of open questions and several tables for basic quantitative data on the participating institutions, or on their research teams. The questionnaire was not submitted to respondents; rather it served as a supporting document during interviews. The interviews were informal and the order of the questions listed in the questionnaire did not always conform to the order of questions as asked. Information acquired during interviews were processed in Microsoft Word format and returned to respondents for authorisation.

2 Individual branches of science are categorised earlier in Chapter 3.6.

Conclusions presented in this report are mostly based on the so-called content analysis methodology. Interview transcripts were coded by the questioners who conducted the interview. Then they were subjected to cumulative frequency analyses of terms, topics and contexts. The latter were conducted by one of the chief analysts and summarised. Subsequently, these findings were authorised by the questioners. Moreover, workshops were held throughout the survey process where trends were discussed and explained and efforts were made in order to generalise. These activities were very hard and complex, and so the accuracy of the results should not be compared with statistical surveys or opinion polls.

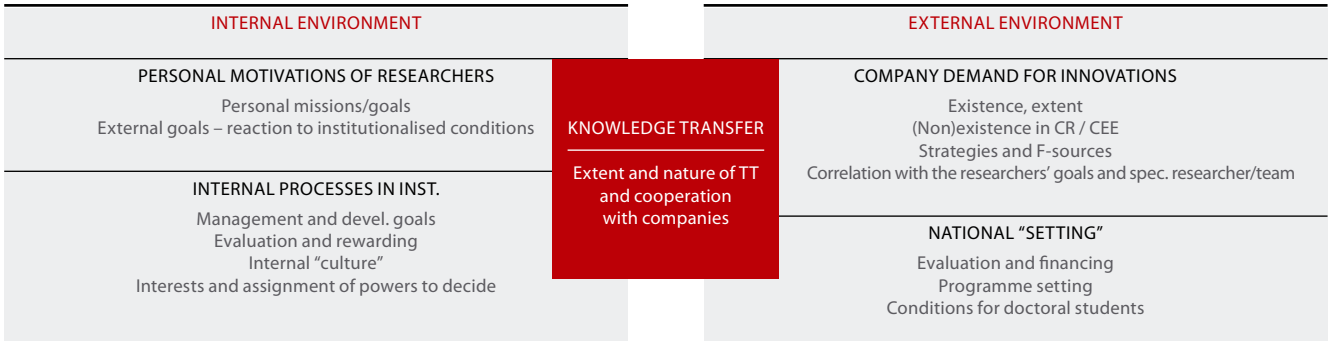
All respondents are highly intelligent experts with intensive practical experience in research and development, knowledge of the system and opinions formed thanks to long years of personal experience. Conversely, consultants who conducted the interview are experts in regional economic development and their knowledge about internal matters of research and development in Czech public institutions is rather superficial. Readers of this report who are familiar with these issues will certainly encounter passages or even conclusions with which they, unlike us (its authors) will find it impossible to identify.

On the other hand, our "non-biased approach" enables us to present conclusions that might be new and somewhat provocative and which therefore may contribute to creating the regional dynamics necessary for implementing and realising desirable changes. The spectrum of personalities, attitudes, opinions and relations with the private sector is so varied and incumbent on such highly diverse factors that any attempt here to introduce a generally valid typology must be treated as illustrative or paradigmatic, rather than a realistic depiction. Typologies outlined below are therefore purposefully assigned and motivated by attempts to ensure that complex TT issues are given greater clarity. They are based on the responses of researchers that could not be verified effectively. When reading following parts of this report we should keep the aforesaid in mind.

» III. RESEARCH RESULTS

The survey essentially focuses on barriers to research excellence and the benefits accrued by the activities of participating research teams (and their respective institutions) for the economic development of the region. This is why particular attention is paid to the transfer (and barriers to such transferral) of accummulated knowledge into practice (hereinafter referred to as TT). We focus on knowlege transfer between research institutions and companies. However, the role of public sphere institutions in the process is not ignored (especially hospitals, regulatory bodies, etc.). Considering the methodological problems with the process of mapping the extent and type of "channels" used in the process of TT (see the methodology chapter), it was not a purpose of this report to quantify the current extent of TT in SMR. Particular attention is paid to assessing the issue of TT as a complex system (see Fig. 2) resulting from the mutual influence of many forces both from within and without institutions that conceive new knowledge.

Fig. 2: Main groups of factors affecting the system of TT in the South Moravian Region



Source: authors

Since **the goal of the survey is to find opportunities to continually improve the environment for top research in the South Moravian Region and to transfer the outputs of such research, the main focus is on TT barriers**. Barriers are assessed and differentiated with respect to the extent to which they can be influenced or overcome. Therefore, factors affecting the TT process are divided into the following categories: *internal*, which affect the academic institutions from within and can be directly influenced, and *external*, which cannot be influenced directly and particular steps need to be taken if one wants to eliminate their effects on TT[3]. Either way, there are strong mutual ties operating between the two categories of factors, which includes close ties between the internal and external environments of academic institutions (an example of this is, for example, the influence of national methodology for evaluating research results on the internal processes of institutions and their respective departments).

The results presented in this chapter are arranged according to this structure and also taking into consideration the mutual relations within this complex issue. First, a brief overview of the main findings related to the forms of TT is provided. Then, individual categories of factors are described in detail, as presented in Fig. 2 above. The following section then focuses on the structure of the individual branches of science and on aspects specific for the group of participating institutions. It includes a map depicting the structure of research activities in the region, namely key branches of science (i.e. key specialisations), and the main links to, and interactions with, local companies. The succeeding chapter contains synthetic conclusions combined with an assessment of demand for assistance tools, plus recommendations related to their settings.

Before we present the results, we should again point out that the validity (cumulative frequency within the group of participating researchers) of the findings specified below largerly depends on (and/or is affected by) the individual branches of science concerned and by the process of selecting these respondents, which was not random[4]. Particular attention is paid to generally valid findings in individual chapters. The key characteristics of the individual branches of science (if any) are described in detail in the respective sections.

III. 01. Definiton of the term technology transfer (TT) and description of the situation in the South Moravian Region

Professional literature offers a variety of definitons for the term **technology transfer (TT)**. For the purpose of this report we use the term in its broader sense – **as the transfer of knowledge conceived by academic institutions to entities that can put it to practical use. Practical use may occur both within the business (private) as well as the public sector.** The reason we opted for this general conception of TT is our attempt to describe the significance of the creation and transfer of new knowledge for the economic development of both the region and participating companies.

3 The best way to do this is through the cooperation of parties involved across institutional sectors. The platform for such cooperation is represented by the RIS SMR, or the respective discussion and communication bodies and networks developed within this initiative.

4 See the chapter on methodology.

To better understand the following chapters, we shall mention here at least some basic forms of TT. Probably the most frequent form of knowledge transfer is **contract research**. In principle, it is a commercial relationship in which **tailor-made research and/or development services are provided to a customer** (usually a company). Individual cases differ widely from one another in terms of the broad scope or specificity of customer requirements[5]. Similarly, differences were noted in terms of cumulative frequency (continuity) of cooperation of a company with the respective research team/institution. Another frequent form is the **sale of licenses** for the use of already conceived knowledge[6]. Usually this knowledge does not originate from research conducted for a particular company/client, even though some outputs of contract research may be subject to intellectual property protection. Another way to transfer knowledge is by **setting up companies whose purpose is the commercialization of research and development outputs**. Most companies set up under this form of TT may be correctly termed **spin–off companies.** These are founded, supported in terms of assets and managed by the parent company[7] of the author of the commercialised technology; alternatively, they are companies founded by the author or their business partners with no direct ties to the parent institution.

Aside from the aforementioned forms of TT, knowledge is also transferred via the process of educating **highly qualified future employees**. Graduates (especially PhD. graduates) have direct contact with the most recent research outputs achieved by the department at which they have been studying. The circumstances of their involvement in research activities during their studies, combined with their creativity and subsequent employment, determine the extent and nature of knowledge transfer between academic institutions and companies. Among the significant TT factors that emerged during the survey is (i) the involvement of former top-of-the-class doctoral graduates in structures of MNC and (ii) the fact that graduates set up their own companies.

The fact that former graduates are employed by, or otherwise involved in, multinational companies was mentioned by several researchers as **a key condition for the development of close cooperation with their (the researchers') centres**[8]. Although only a few respondents cooperate with foreign MNC research centres on a continuous basis, the respondents agree that **without the involvement of former top-of-the-class graduates in senior positions within MNC structures, cooperation would not develop as much** (see the chapter on human resources for more details). With respect to TT, **the fact that graduates set up their own companies is important** in that many researchers (not just the best ones) want to be involved exclusively in academic activities, they do not want to "do business" and are convinced that supporting TT results in the departure of top personnel whose professional development has cost considerable resources and personal energy. Without the companies founded by graduates, the potential for TT cooperation of such research institutions would be much smaller. Furthermore, former graduates who have founded their own companies tend to stay in touch with the university departments at which they studied. **Within the context of the need for mutual trust in order to develop close cooperation between companies and research teams/institutions** (for more information, see the chapter on the demand for innovations) **graduates turned entrepreneurs represent a signficant factor for the future development of TT**.

Before we focus on the basic overview of forms of TT recorded with respect to the survey respondents, we should point out that the aforementioned TT forms are all "official". However, there exist **innumerable informal forms of TT**. For example, researchers are often self-employed businesspersons providing tailor-made services to companies. Allowing for a certain degree of exaggeration, we can say that they constitute a specific form of contract research. Based on a survey of companies conducted in the spring of 2008, it emerged that that **(i) informal forms of TT are frequent, (ii) in the case of SME, it is the dominant form of TT in terms of number of cases and the financial value(s) of business transactions, (iii) this form of cooperation includes regular "free-of-charge" use of research institution equipment and (iv) a significant source of formal and informal cooperation with SME is represented by former academics, who have taken advantage of new opportunities and are fully engaged in developing their own business activities.** These conclusions were confirmed by several researchers (provided they remained anonymous). The issue of informal forms of TT was not even a planned topic on the interview agenda; this topic "just came up". Hence, not even a rough estimate can be made as to how many researchers interviewed would have agreed with the survey conclusions.

Normative evaluation of informal forms of TT is not among the purposes of this report. However, the combination of results from both surveys shows that **the extent of informal forms of TT would be significantly smaller, and the income of academic institutions from contract research would be significantly higher – had academic institutions been better prepared for cooperating with companies**. Many companies stated in the 2008 survey that **the reasons for informal forms of cooperation** with academic institutions **lie in the rigidness, pointless bureaucracy or absence of a client-friendly approach, etc.** and not just solely in the financial benefits of informal cooperation. However, they also emphasised that although **some needs cannot be satisfied within informal forms of cooperation, due to aforementioned reasons, they choose not to cooperate formally and search for other forms of cooperation, even though they might not be less effective in terms of client-friendly approach of academic institutions.**

5 Large companies usually approach researchers with a very specific and precise job assignment that is a part of their R&D initiatives. On the other hand, SME usually have somewhat vague ideas, the details of which are specified during the course of cooperation with the research partners.

6 Licenses commonly relate to know-how or technologies that are subject to intellectual property protection (especially patents, utility designs, etc.)

7 University, research institute, etc. A spin – off company represents a way to (i) capitalise research outputs and (ii) retain some influence on the way they are commercialised.

8 This is especially the case of foreign research centres operated by MNC, although it does not relegate the role of graduates in the process of developing cooperation with local research and engineering centres operated by MNC.

In pointing out the above, we do not mean to suggest that academic institutions should prioritise TT and the provision of services to companies to the detriment of developing their research and teaching activities. Some respondents mentioned this as a potential consequence of developing the TT system when discussing internal conditions for TT development (see the dedicated chapter below for more details). **When we discuss improving conditions and preparedness for TT, we are referring to the deliberate development of a system of activities both within and without academic institutions that (i) run parallel to research and teaching, i.e. the deveopment of such activities will not syphon off existing financial and human resources, (ii) will enable academic institutions to communicate with companies 'officially' in a friendly way and to effectively respond to their needs for cooperation on research and development and (iii) will enable sufficiently motivated researchers to exploit outputs commercially, without having to say good-bye to their research teams forever** (see the chapter "Conclusions and recommendations" for more details).

The overview of documented forms of TT provided below provides basic information on the extent and intensity of official forms of TT. Besides the transfer of knowledge into practice, attention is also paid to some forms of knowledge transfer and cooperation between basic and applied research. If the frequently repeated thesis is true that "the precondition for good applied research and attractive outputs for TT is good basic research conducted well in advance", then we shall also have to examine this additional level of relationship.

III. 01. 1. Forms of TT

Contract research is clearly the dominant form of TT. Sixty-six (73 %) out of 90 visited researchers stated that they personally conduct contract research projects (or that they participate in such projects within their respective groups/teams). However, these researchers and their teams differ markedly in terms of the quality (expertise vs. routine) of services they provide to companies and the supply overhang/shortage of demand for contract research among companies. Generally speaking, **the survey showed that there are significant differences between supply and demand for contract research (cooperation) within the group of respondents, especially in terms of structure and content.** This disparity between supply and demand for contract research **is connected in particular to personal motivation** combined with internal conditions at the research institution and, consequently, the national institutional framework for realisation of public-sphere research **as well as the nature of the demand for innovation** (see individual chapters for more details).

Cooperation with companies through business contracts (referred to as "additional activities" according to legislation) or informal cooperation contacts **is, according to most respondents, a key condition for acquiring the financial resources necessary to keep a research team together. Due to low demand among companies for research that is truly professionally motivating or that produces well-paid publications, most of the 66 visited institutions frequently provide services of routine nature**. There is a thin line between professionally motivating research and routine services (even though the latter might be very demanding in terms of knowledge), it is therefore impossible to quantify the exact ratio of these two categories of activities carried out by research institutions. However, it is obvious (and confirmed by most respondents) that most of these 66 institutions **frequently provide consultancy or engineering services** that might very well be provided by specialised private companies and that **do not conform to the nature of public-sphere research. This fact serves to generate conflict and sharpen dispute between competing opinion and interest groups within academic institutions** (for more information, see the chapter on internal conditions in research institutions).

The remaining forms of TT, with the exception of mechanisms related to the education of future graduates (the charting of which would require a totally different form of survey) are only marginal. One distinct form of TT, meanwhile, is the sale of licenses for the protected outputs of research. Survey respondents show relatively strong interest in this form of TT. **Twenty-four (27 %) respondents take steps to commercialise the outputs of their research through the sale of licenses. However, only six of them declared that these activities had already started generating income**.

There are nine cases of TT as a result of newly-founded companies, i.e. 10 % of respondents. In those cases where the same company was named by several respondents as being their form of TT, only one of them was taken into consideration. While pointing out the methodological problems encountered when trying to define a spin-off company, we can nonetheless say that four of these nine cases genuinely involve spin-off companies. As far as the remaining five are concerned, they consist in the foundation of private companies with no direct link to the parent institution of the authors of the applied know-how[9].

Naturally, some teams combine a variety of forms of TT. In principle, the fact that contract research is the dominant form (in terms of cooperation through HS) can be attributed to the structure of economy and the resulting demand for innovation among companies as well as the level of preparedness of internal rules and assistance services in the area of IPR, license sales, spin-off setup, etc. To generalise somewhat, we find connections between the nature of research at an institution and the extent and forms of TT employed. These connections are rather loose and largely depend on the branch of science. However, the general conclusions are as follows:

9 According to some authors, a spin-off company can also refer to a company where one of its partners is the author (or part of the author's team) of the outputs exploited in business activities of the new company, where the outputs are not paid for and/or the institution of the author has no ownership interest in the company. In such cases it is very hard to say what exactly constitutes a spin-off company, and what does not. However, dwelling on the specifics of such detailed definitions would lead us far astray from the real purpose of this reportpurpose of this report.

- The TT of researchers whose institutions (teams, departments, etc.) focus mostly or entirely on basic research tends to take the form of protecting research outputs and commercialising them through the sale of licenses. This can be attributed to the fact that basic research has typically little in common with the specific issues companies deal with. This even applies to biology-related branches of science, where some basic research topics are just a few steps away from practical implementation. Considering the scope of these institutions activities (to discover the "essential nature of reality"), this form of TT is most suitable in situations where usually generally valid know-how (having many areas of potential applied use and therefore subsequently requiring more or less extensive applied research) is capitalised.
- Researchers whose teams/institutions are mostly, or totally, focused on applied research conduct contract research much more frequently (in some cases these activities are not even "research", see above). This reflects in part the nature of their specialisation which, basically, consists in synthesising knowledge to solve a specific issue.
- With one exception, the spin-off companies referred to in the survey are concerned with developing know-how created at institutions where applied research is the dominant form. This can probably be attributed to the fact that the commercial exploitation of applied research outputs is costly and only financially strong companies can afford it.

Considering the expected future increase in demand for knowledge inputs to build competitive advantage, we can also expect (i) changes in the structure of companies' demand for cooperation through business contracts, i.e. a shift from relatively routine services in favour of closer cooperation in applied research[10] and as a result, (ii) an increase in the number of opportunities to sell user licenses for copyrighted research outputs. **With respect to the aforesaid, we can expect a rise in the demand/need for assistance in the search for potential contract research partners among institutes that focus on applied research. On the other hand, institutions that focus on basic research will require, if anything, targeted marketing in order to promote research outputs that might have some potential application and to develop relations with companies possessing the ability to exploit these outputs. Tied in to such activities should be a system of measures to "woo" this potential business sector capacity to the region.** Even a few successes represent many positive synergies for the development of the knowledge economy in the region and in the Czech Republic as a whole. In this context it should be pointed out that the ambition to attract strong foreign partners was similarly voiced by the participating researchers.

III. 01. 2. Geographical area of TT

Looking at the geographical area of TT, 32 out of 66 researchers involved in contract research list only Czech-based companies (or Czech branches of MNC) as their most significant partners from the business sector. Nevertheless, it is not possible to draw any simple conclusions from the place of business of key partners in the business sector. The survey shows that **it is inaccurate to assume that a big foreign partner equals demand for cooperation that would stimulate extensive and professionally motivating research. No direct connection has been found in this respect. Although there have been cases where a local research team has become part of main research activities conducted by a MNC, it is more likely that a foreign partner's decision to cooperate is motivated by price.**

Cooperation between a MNC and research team from the South Moravian Region must be looked at in more dimensions and contexts. The survey respondents generally agree with the idea that in order to establish a relationship with a MNC, and to be included in the MNC's core research and development activities, the research team must not just offer top-quality research, it must also have established a long-term close relationship with the company. In this regard, **any relatively routine inquiry from a foreign division of a MNC must be looked at as an opportunity for future possible involvement in their core research and development activities**. Without too much exaggeration, this situation can be compared to a relationship between two people: it too must pass through stages when trust is built, joint activities developed and common assets obtained. Besides potential future benefits, we should also repeat what has been mentioned several times already about the benefits of cooperation with MNC even in areas of relatively routine activities, i.e. access to global capacities and MNC networks, etc.. As far as the process of long-term relationship building is concerned, **the main recorded factor accelerating the process by which local teams become involved in the "core" R&D activities of an MNC is the involvement of former graduates (who have become top experts able to succeed in a globally competitive environment of peers) in decision-making (or at least decision-affecting) processes within the structures of their MNC.** In two cases they were, in the respondents' own words, **"the best doctoral programme graduates"**. The role of these individuals in decisions made by MNC on the geographical structure of active capacities is confirmed by managers approached by the authors during surveys in companies in other regions of the Czech Republic (see Berman Group, 2009).

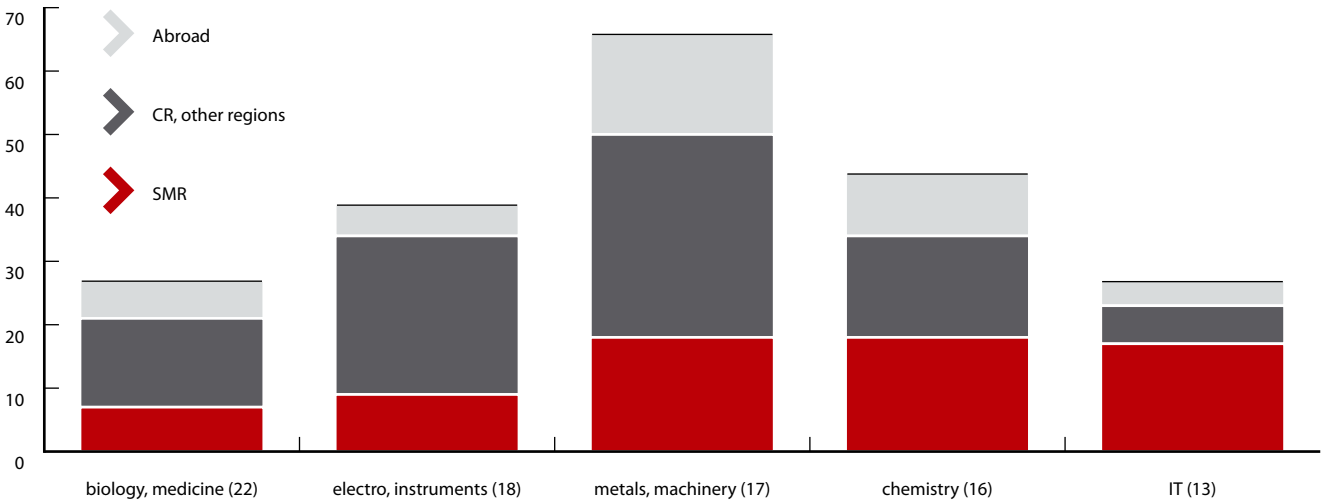
Other forms of TT are so rare that it would be misleading to assess their geographical extent.. However, let us look at the more detailed geographical structure of cooperation between participating researchers (respondents) and companies. Diagram 1 represents the geographical structure of companies named by respondents as key cooperating partners from the business sector (the diagram is grouped by business sectors). It should be pointed out that "cooperation" does not necessarily have to include any cash flow (as it may consist, for example, in joint participation in FP projects).

10 This does not mean that demand for routine services in the medium term would drop in absolute terms.

The researchers were asked to name five key partners from the business sector. Fourteen (16 %) out of 90 researchers stated they had no key partners from the commercial sector. Of these 14 researchers, ten are involved in biology and medicine. This is consistent with the fact that most teams in the group are (mostly or entirely) focused on basic research[11]. The most developed networks of co-operating partners from the business sector are those of teams focused on mechanical engineering, material physics and related physics-oriented branches of science. Quite often these teams could not name their most important business partners from industry. Despite this difficulty, however, not more than five companies per researcher were considered for the purpose of the diagram.

The numbers of business sector partners does not differ much in case of the remaining three groups. However, there are differences in the geographical structure of their origin. While researchers concerned with mechanical engineering, materials engineering and chemistry have almost equal numbers of local, Czech and foreign partners, **teams concerned with electrical engineering, precision engineering and IT have far fewer foreign partners in industry. In the case of IT partners, this is probably due to the large number of IT companies headquartered in Brno and the fact that IT teams tend to commercialise the outputs of their research through their own companies, or companies founded by graduates, students and/or acquaintances.** Hence, local companies are by far the most common partners across all branches of science. On the other hand, in the case of teams belonging to the category "electrical engineering and precision instruments", several researchers stated they had only one or two companies or mentioned several one-off orders, stressing the very limited demand for innovations. The actual quality of know-how offered by such teams is a question that would require separate research to answer. Another reason for the low figure is a requirement on the part of partners for exclusivity and the presence of electron microscope manufacturers whose demand for some teams fully or for the most part satisfies all cooperation requirements.

Diagram 1: Geographical structure of companies cooperating with respondents



Source: interview with 90 selected SMR researchers. Four respondents not categorised in terms of sector are not included in the chart.

So much for a basic overview of the situation in TT. The whole issue and especially barriers to TT will be analysed in detail in the following chapters. Before we proceed, however, let us list the companies that were mentioned most often (see the summary below). In terms of the business sector structure, we can see that 11 are concerned mostly with engineering, 7 with IT and/or IT-electrical engineering, 6 deal with biotechnology and 4 are concerned with precision technology. All these companies, then, belong to one of the five aforementioned categories, defined as being critical for the development of the region within the framework of the RIS for the South Moravian Region.

List of companies mentioned more than once as being the "key partner"

- Local companies (located in SMR, irrespective of the HQ country)
- ABB (2), BVT Technologies (6), Camea (2), Delong Instruments (2), EMP Slavkov (2), FEI (3), Honeywell (6), PBS (3) RedHat (2), Siemens elektromotory (5), Synthos (2), Tescan (3), Unis (3), VF (4)
- Czech companies (located in other regions, irrespective of the HQ country)
- Bonatrans (2), CPN (3), ČEZ (3), Evektor (2), Freescale (2), Generi biotech (3), Genomac (2), SHM Šumperk (5), Solartec (4), Škoda auto (5)
- Foreign companies (their organisational units located abroad)
- IBOK (2 – Slovakia), Philips (2 – NL, 1 – GER), Siemens (4 – GER), Volkswagen (2 – GER)

11 As far as cooperation with research institutions is concerned, biology and medicine is the group with the largest network of partnerships (see Chapter 3.6).

III. 02. Personal goals and the motivation of researchers

The extent, content and forms of TT assessed in the interviews often differ fundamentally from the personal goals and wishes of respondents. Personal goals and motivations may well be a decisive factor in the future development of TT as well as being a significant signpost in setting public assistance tools in this area. During the interviews, particular attention was paid therefore to personal motivation with relation to activities in TT and how it is contingent upon the nature[12] of research activities now being implemented. Before we offer a more detailed analysis of the issue, we feel it is important to discuss a related topic that was more or less common to most interviews.

Most survey participants mentioned a **personal desire to discover and research (or to solve a technical problem) rather than any need to "become rich" or secure funds for further research, or indeed finalise their own research so that a particular product (technology) might be created and commercialised.** It is not the purpose of this chapter to judge the personal motivations of researchers, but to assess the causes underpinning the structure of personal motivation that is strongly reflected in the overall potential of research teams when it comes to TT and, consequently, in the absorption capacity of assistance tools.

Aside from the specific qualities of the "cultural climate" in the Czech Republic (and other post-socialist countries) as well as certain persistent behavioural paradigms and personal preferences developed in different socio-economic conditions, **the aforementioned finding can be attributed to (i) the wave of staff who found new jobs in the private sector in the nineties, (ii) the high number of (mostly young) researchers who left for more or less prestigious universities abroad, (iii) the overall image and actual conditions offered to young people by the academic sector**.

The massive exodus of research staff who found new jobs in the private sector was caused by "pull" factors (e.g. the possibility to set up their own companies[13], well-paid jobs with foreign companies opening branches in the Czech Republic, etc.) and "push" factors (pressure for change within academic institutions, changes to existing relationships with large companies, lack of public resources, etc.). In addition to career possibilities in the private sector, researchers suddenly had new opportunities to develop academic careers at foreign universities which had immeasurably better financial resources, technical facilities and other conditions (and still do today). Young and middle-aged researchers seized opportunity. It can be assumed that the proportion of researchers with strong personal need to earn money by commercialising their own research output results was higher than in the case of researchers who did not take this opportunity. **Among the participating researchers several had taken this opportunity; practically all of them strive for the commercialisation of research outputs, this being a main factor of their research activities** (including those who focus on basic research).

The personal desire to discover and research is the most frequently mentioned factor in answers to questions about problems hiring and retaining personnel. The vast majority of participating researchers agreed that "**academics who come and stay are mostly those who do not find salaries to be the number one or essential[14] personal priority**". Although a career in the academic sector need not necessarily be associated with low salaries, in comparison with the private sector, a combination of the widely accepted image – "low income for a lot of work" – and the actual low income during one's doctoral studies and first few years after graduation make a career in the academic sector unacceptable in the eyes of potential candidates for whom financial rewards are a priority in their personal development.

In light of the above, it is obvious that we cannot expect to see **greater numbers of researchers with a personal desire to commercially exploit the outputs of their research**. **This affects the internal potential of academic institutions with respect to active TT. The less researchers feel the need to commercially exploit the outputs of their own research, the more important (for the process of knowledge transfer to firms becomes the extent and nature of the demant for innovations among companies**. **This further increases the contribution of academic institutions for regional economic development.** The chapter on the demand for innovations shows, however, that the extent and especially the content of the demand for innovations among companies cannot be compensated by the low TT potential of academic institutions.

III. 02. 1. Roles of research and development teams in TT

Let us now look closer at the structure of personal preferences and goals of the participating researchers in terms of TT. Even though any typology of personal preferences is rough at best, it is still useful to make one so that we can use it to demonstrate other barriers to the development of TT. We can identify four basic groups of researchers, based on their personal motivations, goals and realised activities in the area of TT:

12 For the purpose of this report, the "nature of research" refers to its position on the imaginary axis: basic research – applied research – development of technologies for commercial purposes

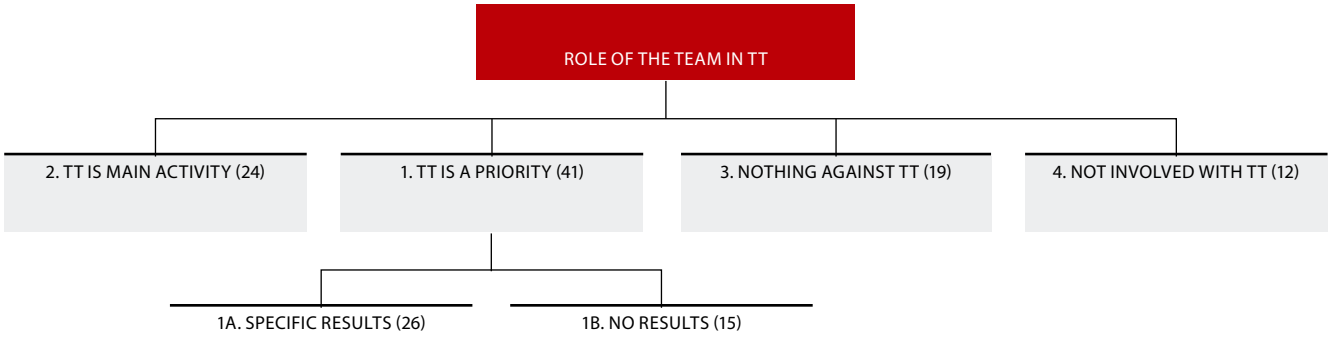
13 This step has become even more attractive thanks to opportunities in relatively unoccupied markets (the intensity of competition has increased over time), which has made top-quality know-how (idea for a product) even more marketable.

14 Among the frequently mentioned problems is the fact that young researchers have to quit their recently started academic career due to the need to support families. For more details, see the chapter on human resources.

Role 1) Development of applied research and TT are among our priorities (41 researchers)

Researchers belonging to this group answered that **they actively strive to implement or develop TT activities at their workplaces**. The term "to actively strive for" refers to intentions and specific steps taken to initiate cooperation, to seek out suitable partners, etc. The basic difference between individual researchers consist whether their efforts are manifested by particular steps in the area of TT development[15], or whether these researchers (or members of their respective teams) have any outputs ready (or at least *almost* ready) for commercialisation. Based on the above, we can identify two subgroups:

Fig. 3 Classification of visited teams according to the role/significance of TT



1a) We have (or are preparing) specific outputs that we are trying to commercialise (26)

Twenty-six (twenty-nine %) researchers, for whom the development of TT in their team is a priority, named specific activities and steps they take in order to achieve this goal. These activities include targeted research (usually in cooperation with companies) or the development of internal activities the purpose of which is to strengthen cooperation with companies. It should be pointed out that these 26 researchers, or their respective teams, have only just started developing their TT-related activities (in their own words). Therefore the relatively large size of this group is not to be overestimated.

Differences among novice researchers were noted in terms of their motivation to TT. One group is represented by researchers who focus (almost) exclusively on basic research and who, having amassed some research outputs, identified what they thought was potentially applicable knowledge. Given the right conditions, these researchers would in time shift their focus to applied research as well, including the possible commercialisation of outputs. Another group is represented by researchers motivated by the increased demand for applications, particularly on the part of SF projects, and/or by changes to the system of science funding (and awarding) in the Czech Republic. For this latter group, the extent to which they are genuinely interested in commercialisation is questionable.

Aside from the aforementioned research novices, this group is also represented by researchers who have had some previous success(es) in the area of TT (including participation in TT at a foreign institution). Typically, these researchers have problems finding partners and investors for current technologies intended for commercial application. Thanks to their previous experience, they are able to conduct a much more targeted search and are much more demanding than their novice counterparts. Although some have numerous potential partners, most of these are rejected, however, as researchers emphasise the importance of specific qualities and other aspects expected from the "right" potential partner interested in the technology – see box below.

Infobox 1: Qualities expected in investors

Several interviews revealed instances where a certain researcher may have at their disposal technology that companies or investors looking to set up new technology companies find interesting. However, these researchers stated that so far none of these potential partners were sufficiently attractive. The most frequently cited problem was an unsuitable business model and/or the relatively short period of time within which the potential investors expected to see some profit from the commercial application of the particular technology. One thing was common to all such cases. The researcher-respondents were interested in the successful commercial application of their technologies and they had relatively good knowledge of the necessary conditions for commercial application. Therefore, they had a need to more or less influence the ways in which their technology would be commercialised. At the same time, however, they did not wish to become businesspersons or want to commercialise their technologies using their own companies. The lack of interest in business activities on their part was not based on a fear of the risks involved; they just did not want to leave academia or to give up projects they had already started.

15 For an overview of particular steps, see the chapter on research and TT specialisation

This situation suggests that there are certain opportunities **in terms of assistance in: a) the process of searching for investors or business angels (BA) who are right partners for the respective technology and fulfil the criteria for its commercialisation, or b) setting up specific spin-off companies in which the author of the respective technology is not a manager (not even for a limited period of time) but at the same time he/she retains a previously agreed level of influence over some strategic decisions.** Although it may seem at first that this space is the exclusive playground of private companies and investors, the respondents pointed out the importance of the fact that the environment is undeveloped and, consequently, that brave, creative and educated investors and BA with whom the researchers can conclude the necessary agreements are rather thin on the ground. In the respondents' own words, the basic precondition is a combination of (i) previous business success, (ii) extensive experience in the respective sector and (iii) investors having a longer term vision, i.e. not obsessed with 'making a packet by the end of the year'. Realising that there are no promising investors or BA's forthcoming, respondents are focusing on the further development of their technologies, hoping that eventually commercial salvation will appear.

In this respect, we should mention an idea for a system through which a university is able to set up spin-off companies where the institution can appoint professional managers who are able to communicate closely with the authors of new technologies. These managers can further apply other related technologies and accessories through their company as well as devising topics for theses related to the issues that companies are in the process of resolving. In order to acquire financial resources (so that financial risks are not borne solely by the university) it would be advisable to seek BA who would enter into close liaison with the manager and technology author and who participate in the decision-making processes.

1b) We have no outputs ready for commercialisation, neither are we currently working on any (15)

It is hard to tell whether the TT-related efforts made by entities belonging to this group are genuine or hollow declarations. Aside from smaller ad-hoc jobs for various companies, research teams have no real results in TT and do not show any systematic efforts in this regard. They do, however, declare that they are seeking partners for these activities. In most cases, however, no convincing TT-related activities were noted. The fact that a team keeps repeating that no companies are showing any interest might suggest that the team's declaration of interest in developing TT is made largely for affect, or that teams by themselves are unable to take meaningful steps in this regard.

Notwithstanding the above, most teams that belong to this category name two or three partners. Their main motivation, however, is to acquire public funds so as to achieve sustainable conditions to keep talented employees. Consequently, cooperation is not funded by companies but by the Ministry of Industry and Trade through its applied research support programmes. Moreover, in some cases researchers seek companies for joint projects from the Ministry, not vice versa. This supports the frequent assertion that the support for applied research from programmes of the ministry has significant negative effects on the motivation of companies to invest their own money into research and development.

Role 2) Applied research and TT are our key research activities

Twenty-four (twenty-seven %) researchers-respondents declared that applied research and TT (especially in the form of business contracts) are among the key activities of their research teams. Applied research is the dominant form. Individual researchers who fall into this group differ in the ratio of TT spent performing relatively routine services and actual applied research. All declare that they would not be able to guarantee decent salaries to employees without financial resources from partner companies. Although most teams in this group focus overwhelmingly on applied research, there do exist some that strive to cover both good quality basic and applied research. As far as individual institutions are concerned, this is the case of teams from BUT, the Institute of Scientific Instruments of the Academy of Sciences of the Czech Republic and Mendel University.

Some teams in this group are concerned exclusively with applied research and though their employees take part in teaching activities, their revenues come from private sources only. TT represents a key process and source of revenue At the same time, however, the fact that they are part of a university enables them to use the name of the university to their benefit and to access numerous internal partners and the outputs of their work. This scenario proves that TT can be approached in various ways and that, even now under existing processes with their resistance to change (see the chapter 3.3), independent (financially self-sufficient) units under the auspices of a university or institution of the Czech Academy of Sciences can represent an effective way of TT development. The school receives revenues from the activities of the team, with no initial costs incurred. Moreover, the team educates students on doctoral programmes, especially in much sought-after applied research, where the students can participate in tailor-made projects for specific clients (companies).

Role 3) We have nothing against applied research/TT, but neither will we initiate any ourselves

Nineteen (twenty-one %) researchers showed latent interest in the applied research directed towards TT. Their attitude can be described by **"we have nothing against commercial applications and TT, but their initiation, management and resourcing are up to our partner, whose job it is to come to us"**. This group has much in common with the 1b subgroup. Nonetheless, absorption capacity for assistance may be higher in this case, because some researchers in the 1b group will probably only feign active interest in TT. This group also includes researchers focusing on applied research, but who have lately been concentrating on teaching activities and related research and who participate in numerous academic or managerial roles within research institutions.

There are several reasons why a team is "reluctant" or "passive" with respect to TT. This is especially the case of teams that are focused (almost, or entirely) on basic research. Hence, some of them are afraid of the possible impacts of activities in applied research and TT on the quality of their basic research (see the infobox below). Others experience a lack of capacity and partners for top-quality applied research, hence they prefer focusing their resources entirely on basic research. In the present survey, this was true of some researchers concerned with biology, whose outputs would be potentially sought by the pharmaceutical and biotechnology industries.

Info box 2: Risks and misgivings considered by researchers with respect to applied research

When considering commercial applications, some researchers take into consideration the following issues and risks:

- What is going to happen if results are not presented in due time or lack sufficient quality? (impossible to guarantee in advance in the case of research – e.g. a substance is not going to work and further research will be necessary)
- Who is going to resolve these issues? How is it going to affect my evaluation and other activities (e.g. teaching) or my team and department, or my eligibility for public funds?
- Who is going to provide warranty, how are guarantees to be secured or funds returned (when the institution has no resources)?

Projects offered by the Czech Science Foundation (GA ČR) do not pose this risk. Publication can be "adjusted" in line with results, so that measurable results are achieved at all times (although IF might be 2 instead of 7). Considering all such unresolved issues and unanswered questions it is obvious that BR projects are much safer. When combined with a situation in which there is a certain atmosphere of distrust towards commercial applications in the respective institute, department or faculty, where publications with a decent IF are the only "good results", these fears become a strong barrier to TT. It also explains the passive attitude towards TT (which can be described as "waiting for the other party to make the first move").

Role 4) We focus entirely on basic research

Twelve (thirteen %) researchers stated that they focus entirely on top-quality basic research. In their opinion, applied research and TT would be "drain" on resources allocated for BR. Although some of them are interested in TT – enough to try to attract partners for applied research and TT thanks to top-quality results from the basic research (these partners would then take care of applications and commercialisation themselves) most of them are not concerned with applied research and TT at all.

Numerous researchers from the third and fourth group (and 1a, to a lesser extent) are **afraid that by developing activities in applied research (not to mention TT) they could harm the quality of basic research**. **These fears were voiced mostly by older researchers. On the other hand, young and middle-aged researchers (especially those who have some experience of long-term fellowship programmes) do not seem to share these fears. Based on their own experience from abroad, some strongly disagree**, saying that they are aware of potential consequences for the quality of basic research but at the same time they are certain that the applied research and TT can be managed as to eliminate said risks. They also pose the alternative viewpoint, stressing the importance of mutual synergies between basic and applied research.

Info box 3: An example from abroad: Intermediary Technology Institutes (ITI), Scotland

During the late 1990's a Scottish-based economic development agency, Scottish Enterprise (the local equivalent and long-term role model for CzechInvest) initiated the foundation of public-private technology institutes, the role of which was to accelerate the exploitation of know-how conceived in Scotland, so as to promote consumption of Scottish-made products on international markets. These institutions operate within four cross-sectional branches that represent the current and potential „spine" of the Scottish economy (see Peters, et al. Smart Successful Scotland, 2005) – Life Sciences/Biotech, ICT/Electronics, New Media, Energy.

The ITI concept is simple: ITI is an association of companies, knowledge institutions and related entities within the respective sector with a budget and system for verifying the market potential of research outputs or experimental technologies based on these research outputs and which are currently under development. The process of evaluation has several stages in order

to avoid the wasteful use of funds. Decisions are made in every case on the next stage of the process, i.e. whether it is a form of intellectual property that is (1) "beneficial" to Scotland, i.e. whether it is going to improve its competitive advantage, in which case it is evaluated whether the respective research outputs might be exploited by Scottish companies (including start-up or spin-off companies founded for this very purpose) or whether further research is necessary (and where to obtain funds for it) or (2) "uninteresting" for Scotland, in which case it can be sold or licensed elsewhere (mostly UK- or US-based companies).

ITI do not have their own in-house experts. They hire top specialists from all over the world on a case-by-case basis. ITI represent especially a system-based approach (i.e. defined in terms of the branch of science and territory, not institutionally) to the process of transforming R&D outputs (whether conceived at a university, research institution or company) into outputs that are marketable on global markets. Such a system is hard to organise and is very complex in terms of the knowledge of the respective branch of science and its global geography. One has to take several issues into consideration: Where are the global centres of excellence located with respect to this particular branch (or branches) that are further down the value chain? Who are the major players in these branches, are we in contact with them, and how? Can they be any good for us in terms of improving the competitive advantage of Scotland?

The commitment to operate an ITI is made for the long-term. The first funds were allocated for a period of ten years. Last year, ITIs went back under the auspices of the Scottish Enterprise as the global economic crisis made it difficult to sustain four parallel systems with their individual fixed costs. The competitive advantage of Scotland is, for the time being and for the years to come, based almost exclusively on the export of knowledge. Hence, it is natural that new methods for the creation and export of knowledge are tested in order to support the nation's continuous economic development. For the South Moravian Innovation Centre, Brno and SMR, this Scottish model might prove inspirational when it comes to improving organisation of the whole system of knowledge value chains: from the researcher and his/her basic research team and the genesis (as well as funding) of applied research tasks, to the subsequent transformation into intellectual property that is easily marketable in the global excellence centres of the respective branch of science. Contact with "highly demanding customers" represents a key motivational factor ("pull factor") with respect to improving competences and augmenting competitive advantage based on know-how created in Brno.

Irrespective of the group they belong to, researchers often mentioned **the need for changes and the need to focus on commercial applications**. It cannot be assessed, however, what percentage of them did so only due to **changes in the system of financing research in the Czech Republic**[16] **and/or the conditions of projects such as CEITEC**. However, we can see significant differences among individual generations of researchers. There are many young and middle-aged researchers who want to get involved in applied research and close cooperation with companies. On the other hand, researchers of all ages agree that **"the precondition for top-quality applied research, the outputs of which may represent a significant factor in improving the competitive advantage of companies, is top-quality basic research conducted sufficiently in advance". The implication for assistance tools of the RIS SMR is the need for combining (i) support for excellence**[17] **in basic research and (ii) the establishment of ties between the outputs of top-quality basic research and strong applied research teams, especially teams that cooperate with (local) companies to resolve their strategic requirements (i.e. not teams that only provide routine services).**

The current structure of personal motivations of researchers (which cannot be assessed accurately even in in-depth interviews) is reflected in numerous aspects related to mechanisms through which the role of academic institutions contributes to the economic development of the region. In the context of TT, these primarily concern the predominant forms of knowledge transfer and cooperation with companies, the divergencies of opinion within committees and the authorisation bodies of academic institutions, research specialisations, etc. See the following chapter for more detailed information on internal conditions and processes in the participating academic institutions and on the role played by the structure of individual researcher's personal motivations.

III. 03. Internal conditions of academic institutions

The internal conditions of academic institutions strongly reflect the national situation (see Chapter 3.5 National framework) and also the fact that significant changes to the system of financing research, development and innovations took place only recently. Even though changes are occurring in the participating research institutions, **most respondents argue that (i) these changes are much too slow, (ii) their impact is limited and (iii) in the case of numerous decision-makers, the motivation to make changes is insufficient or even self-serving**[18]**. According to some respondents, the latter reason is the main factor why steps that have been made so far with respect to providing internal support for TT have been slow and ineffective.** However, most admit that even

16 See the chapter on the national institutional framework.
17 We are talking about global-level excellence, or at least the highest possible levels that Brno-based teams are able to achieve.
18 It was stated several times (off the record) that the main interest of people occupying management roles is to acquire and maintain control over TT activities, not to ensure the effectiveness of these activities.

where sufficiently strong interest in the development of TT exists, the speed and benefits of the process would lag far behind expectations due to the shortage of experienced TT specialists on the labour market. Since most of the procedures and rules introduced have little positive impact on the development of TT in the participating teams, spontaneous development takes place at the level of individual teams, departments or institutions. This affects the overall effectiveness of TT support. In addition some assistance tools cannot even be created due to this decentralisation.

Most academic institutions that participated in the survey have so far not implemented sufficient internal rules regulating the development of TT, even though the need to do so arises from both national and EU standards. Allowing for a certain level of exaggeration, we can speculate **whether the formal fulfilment of legislative requirements is a more important motivational factor for the implementation of TT-related internal regulations, rather than TT effectiveness as such**. The absence of mandatory internal rules under the present conditions (national legislation) significantly hampers the realisation of certain activities. This is particularly the case for privately-funded applied research or cooperation with the application sector, or TT as such. The absence of simple, paperwork-free and time-efficient procedures results in numerous and ineffective costs (including time) on the part of TT implementers. Consequently, it discourages many researchers from being personally involved, especially those who are not motivated primarily by applications.

Another barrier is perceived at the level of *funding research, development and* **innovation**. What we can see both at the national level and within individual institutions a dominant effort to secure "solidary" funding, which does not encourage sufficient excellence and quality. Whilst its true that excellent and top-quality research institutions often have more money at their disposal, the amount does not always reflect the fact that they are far ahead of rather average or even below-average institutions and teams. Considering the complexity of assessing the quality of outputs created by research teams and the difficulty of finding suitable national-level and institutional reference frames of excellence, this issue requires a separate survey. However, with respect to the system for developing TT one has to expect that these issues will represent a key context in promoting particular activities to support TT.

Not only senior managers repeatedly draw attention to **the absence of financial resources that are not subject to publications**. In their opinion, the absence of such resources **hamper the realisation of an effective strategy and substantive TT support (academic entrepreneurship) from levels lower than faculties or the rector's office. Therefore, if effective TT is not a priority for the rector's (vice chancellor's) office or faculties, this fact represents a very effective barrier to TT, including any personal initiative of department heads, institution heads and heads of other units within faculties or research institutions.** This is perfectly illustrated by the following quote:

- **"I even have the people to do the job and many doctoral students are interested in applications, but how can I pay them when I do not have money that is not subject to publications."**

Some (directors of larger institutions) admit that it might be possible to generate financial resources for the realisation of this type of strategy even under the present conditions. However, they immediately add that **current decision-making processes** (committees of institutions at which all departments are represented) **combined with the "internal culture"**[19] **and fears that one department will get more money than another impedes any ability to act or concentrate resources,** which are both imperative in the case of such strategy. **Some of them also point out that any effort to introduce strategies, changes or TT development is a waste of precious energy, or even a potential cause of sharp internal conflicts that cannot then be effectively resolved.**

Consequently, **researchers are under constant pressure to focus on research outputs for which their research institutions will be granted public resources**. They are not discouraged from being involved in other activities, provided however that they remain sufficiently focused on the required prior tasks. However, these tasks are so onerous that researchers **have almost no capacity or energy left for applications**. These problems are corroborated by the statements of several researchers (see below):

- **"The way the evaluation system is established at BR institutions does not generally give precedence to practical applications. Some people express the reasonable fear that it would affect the quality of BR: i.e. that the quantitative and scientometric indicators would deteriorate. These are the indicators most frequently used to evaluate such institutions"**
- **"I can focus on it (TT) only after I have finished everything in terms of teaching, research and the paperwork associated with the assignment and management of projects"**
- **"Researchers are (mostly) paid for good publications, which is hard to combine with the realisation of applied research, not to mention commercialisation-related projects"**
- **"Changes in internal processes that facilitate TT are slow. Considering the fact that there are numerous approaches to TT and the need to ensure that TT must not affect the quality of BR, it is logical that the school cannot allocate substantial resources of its own to TT "**

The lack of capacity is further amplified by **paperwork demands** with respect to teaching, individual projects and other activities. Any paperwork associated with project management and applications for Czech and international research competitions as well as TT should, according to most respondents, be handled mostly by the current administrative staff of the managing bodies at research

19 Many people in the academic sector remain convinced that so-called academic entrepreneurship is (i) the reason for internal disputes, (ii) risky with respect to the quality of research, and (according to some people) (iii) not at all suitable for the academic environment.

institutions (especially the dean's or rector's office), also via financial resources returned from individual projects (mostly as overhead costs). However, this does not happen in reality or else existing support lacks the necessary quality, which means that a significant amount of paperwork must be done by researchers themselves. **Consequently, they have little time and energy for TT and research. This problem is significant because it affects team leaders the most**.

For the time being, limited public resources for research in the Czech Republic are (i) not allocated to truly excellent teams, (ii) reduced in favour of supporting applied research, mostly at the level of business and (iii) are subject to so many regulations that research institutions are often unable to provide decent salaries to top-researchers. **This situation often results in rudimentary (and often legitimate) disputes over whether (i) public resources should be used only for excellent basic research and (ii) whether applications and development should be funded by companies who are planning to exploit the respective research outputs.** The latter opinion is supported by current regulations, according to which outputs from research and development that is 100-percent funded from public resources must be accessible to everyone and under the same conditions. **On the other hand, in most cases basic research outputs are not ready to be used commercially. Quite often it is not even possible to say whether commercial exploitation is going to be possible, or if it is, under what conditions. Hence, exploiting the outputs of basic research requires large amounts of additional financial resources, knowledge, know-how and expertise that do not conform to the resources of the business sector in the Czech Republic.** Consequently, numerous promising outputs of basic research are commercially exploited abroad.

The aforementioned facts prove **the need for open and effective discussion on TT**. Individuals who feel neglected in this discussion tend to start and exacerbate conflicts among interest and opinion groups within academic institutions. This results in confrontation between "die-hard" academics (some of whom are, however, top researchers involved in global-quality basic research) and researchers who focus on applications. Efforts to find a balance and seek understanding between these two groups have so far been unsuccessful, even though balance and understanding are important for the long-term success of research organisations and their role in regional economies.

In terms of processes, we must point out that **several respondents mentioned the need for an experienced manager who would be in charge of managing financial matters and internal processes not directly related to the research process as such** (see the info box below).

Infobox 4: The need for a professional manager?

The vast majority of visited research institutions employ a management model in which the institution is managed by a leader of one of the research teams. In order to eventually be able to go back to his/her research, individual team leaders often "take turns" in the position of director. This system has both pros and cons. One important pro is the fact that anyone in the position of director must be a top specialist in the activities of the entire institution. However, no matter how good a researcher is, it does not make him/her a good institution manager.

While superb knowledge of a certain branch of science may allow a director to respond to issues and research-related needs quickly (e.g. the ability to make budget decisions on purchasing priorities for various types of lab equipment), a person's limited personal experience in management may be a source of anxiety, resulting in a significant barrier to developing new activities at the institution. This is especially the case when well-established procedures need to be challenged. Consequently, the director largely depends on the level of support from the members of the Committee of a given institution with respect to any planned changes (including financial resources).

The need for a professional manager was mostly expressed, with various degrees of intensity, by institution heads (or heads of departments). According to the respondents, such a person should have sound managerial skills and a relatively thorough knowledge of the branch of science in which the particular institution specialises. **In their opinion, a professional manager must be responsible especially for (i) the economic management of the institution, (ii) management and introduction of internal mechanisms for supporting relationships and cooperation with companies and (iii) the introduction of internal support mechanisms for the process of administering project applications and projects as such.** However, respondents also admit that it is extremely difficult, if not impossible, to recruit such a person. Many of them fear that there is no suitable candidate available on the job market; and even if they did exist, their salary requirements would be inconsistent with what the research institution could afford to offer.

Many researchers (especially those who have recently returned from long-term fellowship programmes abroad, where TT-related issues are dealt with systematically) point out the barriers to founding spin-off companies. Those most frequently mentioned are as follows:

- Both real and irrational fears regarding the misuse of public resources earmarked for; In fact, the respective legislation does not regulate this issue accordingly and firmly held beliefs support these fears.
- Professional jealousy and a not being accustomed to markedly different salaries. Personal income from the sale of licenses or ownership interests in spin-off companies inevitably results in significant differences in the overall personal income of team members.

Numerous respondents are worried by this scenario and expect they would generate numerous internal disputes and animosities that currently either do not exist or are concealed.

- The question "Who owns the outputs?" has not been answered – the current legislation offers several provisions, hence several interpretations. Respondents claimed that the present legislation fails to deal with several issues, such as (i) how to appoint members of statutory bodies of the new company, (ii) who will provide the funds for the registered capital, etc. Only relations to outputs are dealt with, while the conditions of commercial exploitation are ignored.
- Last but not least, the system needs a functioning securities market so that it may be possible to sell these companies at a profit and go back to research activities.

III. 04. Demand for innovations among companies

There is a trite but well-attested saying in management that the "**customer is the alpha and omega of innovation**". This saying summarises in one sentence the key significance of the mechanisms through which the needs and wishes of customers affect innovations. It should be stressed that this involves much more than the development of highly variable needs and wishes on the part of customers. Internal processes are also a key factor in the creation of innovations, especially processes (i) through which new opportunities are sought and identified[20], (ii) involving the selection of those opportunities for which resources will be allocated and (iii) managing the 'exploitation' of opportunities, as the resources allocated for the purpose are always limited.

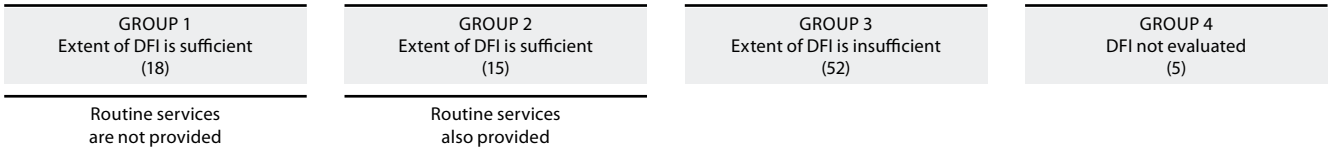
An important aspect in these internal processes (the level of importance fundamentally differs for each individual company and its type of activity) is the attitude towards new knowledge and technologies. Large companies usually carry out large-scale research and development activities of their own, while SME usually depend on external sources of new knowledge and technologies, i.e. they must cooperate with academic institutions. **Companies are therefore (in addition to customers) key players in the process of creating innovations as they represent the venue where the practical needs of the market meet the technological opportunities offered by academic institutions and the amassed knowledge they have to offer. Considering this role in the process of innovations, we must concede that researchers are right in their opinion that the impetus for cooperation and TT should first come from companies**[21]**. *The demand for innovations from companies is one of the most significant factors affecting the extent and nature of the transfer of knowledge and technologies between the academic and the business sector and, consequently, the potential of academic institutions in the process of developing a knowledge economy.***

Interviews with participants at the same time demonstrate that the extent **and especially the nature of the demand for cooperation with academic institutions among companies represent a significant barrier to a much more intensive transfer of knowledge between the academic and business sector**. This barrier is very complex and if we are to progress we will have to analyse and structure it in detail. However, before we do so, let us look at a rough typology of the researchers, based on their understanding o the extent and nature of the demand for innovations among companies.

"Extent" refers to the volume of demand for innovations with respect to the interest of the respective researcher (team) in cooperation with companies. "Nature", for the purpose of this report, refers to whether the innovations demand motivates the researcher professionally (i.e. whether it is "genuine" research, usually applied research) or whether it is limited to routine services. **By saying "routine", we do not mean to denigrate the tough knowledge requirements needed to carry out the services provided. Rather, the term is our way of identifying demand that does not require any subsequent (applied) research, i.e. it can be satisfied by using already conceived and well-tested knowledge and technologies (e.g. taking specific measurements, verification of technology, researching the professional literature, etc.).**

In line with the terms explained above, the participating researchers can be divided into four groups:

Fig. 4: Typology of researchers according to the nature of the demand for innovations (DFI)



20 For example, new opportunities thanks to market changes or new discoveries and the resulting new technologies. Successful innovators are able to identify and exploit them in due time.

21 We are not referring to situations where authors of research outputs themselves decide to enter the business world in order to keep the process of commercialisation under their full control.

Group 1: The extent of demand for innovations is sufficient, and we do not even have to offer large-scale routine services (18 researcher-respondents)

Researchers from this group usually cooperate with foreign companies (not just with their branches in the Czech Republic) or institutions (including foreign institutions). However, they differ in the capacities they are willing to allocate for contract research. The respondents stated on several occasions that demand is sufficient because contract research is a marginal activity for them and they have no intention of changing this fact. Even though these teams have no problem finding partners who seek more-than-routine services, most agree that demand for routine services is the dominant form.

Group 2: The extent of demand for innovations is sufficient, provided we also offer routine services (15)

Strong interest in cooperation is expressed especially by companies from the business sectors of mechanical engineering and electrical engineering. However, demand is dominated by companies interested in services that do not include joint research activities. However, this group also includes researchers who refuse to acknowledge the term "routine services", claiming that some researchers only use it to conceal their inability to satisfy the particular needs of companies. The scope of this survey did not enable us to verify to what extent this claim was valid. Of particular interest, however, is the frequent emphasis on the role of gradually built up relationships and mutual trust as enabling factors for cooperation with companies (see infobox below).

Infobox 5: Significance of the 'routine' demand for innovations

Heated debate ensued at one of the visited research teams specialising exclusively in applied research on the topic of the routine nature of demand for innovations. This particular team has numerous partners in industry with whom continuous cooperation has been established. The respondent mentioned his personal experience by saying that what appears to be a routine activity at first often becomes the opposite, i.e. what starts out as a minor problem eventually turns into an interesting and complex piece of research (interesting in terms of application, which according to the respondent should not be a problem for a technology university).

As far as the advantageous role of research institutions in the process of regional development is concerned, this particular researcher states that companies (most notable SME's) tend to see the surface features of a problem, not its true inner causes. Although not all routine problems turn out to be interesting research topics, companies often find just having an opportunity to discuss it very beneficial. The researcher stated that it consists in finding the root causes of the problem at hand and understanding the potential benefits of cooperation with researchers in the area of improving competitive advantage. Many researchers point out the importance of continuously developing relationships with individual companies by saying that without cooperation on routine issues, partners could not take the next step towards cooperation on more complex issues, i.e. the research institution cannot gain the trust of the company or, more importantly, its money. Close company-university cooperation is subject to a prior stage of relationship building. Therefore, the authors of assistance tools should not ignore routine demand for innovations (i) because it represents potential for the development of intensive TT (as a first step); (ii) because it represents an opportunity – it has inspirational and educational effect on companies; (iii) because it is the product of companies that represent the core of entrepreneurship in the South Moravian Region.

Group 3: The extent of demand for innovations is insufficient

Researchers who belong to this group offered several different explanations why they thought demand for innovations among companies was insufficient:

- There are no companies in the Czech Republic or neighbouring countries that belong to the branch of industry in which our outputs might be applied (23)
- This explanation is typical for researchers in biotechnologies and special materials. Their potential business partners are headquartered abroad and they carry out their research and development activities in these countries in collaboration with local research institutions and teams whose scope and facilities are immeasurably better than the equivalent in the Czech Republic. The impossibility to even try to "make the first league" motivates researchers here to stay focused on basic research.
- Those areas in which the outputs of our research are potentially applicable are represented by only a small number of SME's that have very limited resources for these purposes (14)
- A practically identical explanation of the causes of low demand for innovation also mentioned by some respondents is the interest in the step-by-step development of top-quality applied research, even though this would be done almost "from scratch". The problem that researchers have to face is that there are not enough companies in the respective business sector, or companies that would be interested in research and development, or (especially) the fact that their resources are usually limited.
- There are many companies in the Czech Republic that belong to a branch of science in which we create our research outputs but (i) they are not interested in cooperation, or else (ii) their R&D activities are carried out abroad (15)

Group 4: Demand for innovations not evaluated (5)

This group includes researchers who have absolutely no involvement with applied research or TT. With respect to this issue, they stated in the interviews that any evaluation of demand for innovations would be potentially misleading.

The aforementioned typology for understanding the demand for innovations is related to the capacities of the respondents, or their respective teams, and some common characteristics of DFI are not reflected, or erased from the picture. By focusing on these characteristics, then the most frequent problems with demand for innovations are as follows:

The demand for routine innovations is the dominant type. Some researches do not mind this fact, while others appreciate it (as a potential source of income that provides their team with financial stability). However, there are many researchers who argue that, in principle, these activities do not require research and therefore they are not, and cannot be, the subject of close cooperation – and not just because this level of cooperation does not yield outcomes that are published in well-established journals, which, in turn, are the best at being converted into public resources. Thus, most point out the **importance of "match-making" – the basic precondition for large-scale and continuous cooperation with a company is, according to researchers, a combination of (i) goals and/or strategies of the current research, (ii) sufficient professional significance of the topic to be resolved, (iii) the company's ability to allocate funds for this partnership**. See the infobox above for an example of a partnership with a company that has to be developed on a continual basis (some researchers stated that it may take more than five years to build such relationship).

In order to better explain the **problem of "limited" demand for innovations** that was frequently mentioned by the researchers, we shall apply the concept of knowledge bases[22], because the differences in understanding and needs with respect to the demand for innovations are caused by research specialisations:

"**Synthetic" knowledge base**. Teams whose main research agenda consists in specific problem-solving assignments (e.g. improving the capacity, distances and speed of wireless data transfer) emphasise a strong need for cooperation with companies. This is because these companies represent a unique source of all kinds of information on the problem at hand. These teams are mostly concerned with applied research[23], which is typically defined as a single-purpose synthesis of miscellaneous forms of knowledge. Due to the need for various forms of knowledge, these teams (or their partner teams) are concerned with a certain degree of basic research. However, it is often focused on the particular needs for key activities within the applied research. For example, the need for basic research into the behaviour of an electron ray when passing through various types of gases at a in a team focusing on the research and development of special methods (or components) for electron microscopy.

Analytical knowledge base. Teams whose main research agenda is making new discoveries concerning "the basic principles of how reality operates" are often focused entirely on basic research. Most do not even feel any real need to be in contact with companies, and some researchers stated they do not need such contact at all. In cases where a company has no (top-quality) research programme of its own, it has practically no use for any outputs of these types of research teams.

Although the aforementioned categories are hastily generalised and although most larger research institutions are concerned, more or less, with both forms of research activities, this differentiation has its purpose with respect to understanding some complex relations in the area of knowledge transfer between the academic and business sector.

Synthetic knowledge base teams (especially BUT departments, ISI ASCR) frequently cooperate with companies. Compared with other groups of researchers, these researchers believe that the current extent of demand for innovations is sufficient, although many of them would appreciate a change in the ratio between routine services and real applied research. Those who are "the best of the best", meanwhile, cooperate with many foreign companies and point out that they have no financial difficulties and that acquiring partners from the ranks of eminent global companies is challenging, but by no means impossible. **Thus, by "limited demand for innovations", synthetic knowledge base teams mean various combinations of (i) a dominant demand for routine services instead of an anticipated demand for applied research, (ii) a lack of adequate ties with foreign companies, (iii) an inability/reluctance on the part of local companies (not just SME's) to invest their own money into joint R&D activities, (iv) a lack of interest among local companies in improving their knowledge-based competitive advantage, or a weak compatibility between the requested research and development and corporate strategies/market needs, (v) inability to define the problem the company needs help with, etc.**

Analytical knowledge base teams should be differentiated according to their approach to applications and TT. Teams that carry out (or are interested in carrying out) follow-up applied research even though it may not involve the main specialisation of the team/institution, view "limited demand for innovations" as follows: i) industrial sectors in which research outputs may potentially be applied are not even represented in the Czech Republic (and if they are, the companies are just starting out), or, ii) there are numerous potential partners in the Czech

22 Differentiated knowledge bases – see e.g. Asheim, Boschma, Cooke (2007): Constructing regional advantage: Platform policies based on related variety and differentiated knowledge bases.

23 Or even in some cases development, especially where their outputs are not being exploited by companies.

Republic but the vast majority of these companies focus on production and assembly. Their added-value key activities (including company R&D), where close cooperation with academic institutions is strongly desired, are conducted abroad. The **consequence for analytical teams interested in developing applied research and TT is that the portfolio of potential Czech partners able to apply (either financially or through the existence of their own developed applied research) the results of basic research is extremely restricted, even when such outputs might be quite extraordinarily significant. The most notable example in the global economy is the pharmaceutical industry, in which the vast majority of business sector capacity capable of exploiting basic research outputs is located in the United States.**

III. 05. National institutional framework

The national institutional framework, which reflects, *inter alia*, EU legislation on higher education, public-sphere research institutions and use of public financial resources for research, combined with the systems for evaluating and financing public-sphere research activities, significantly affects the internal conditions of academic institutions and, consequently, the motivations and expectations of researchers. The purpose of this chapter is to illustrate those elements of the national institutional framework that (according to the respondents) have the strongest impact on the TT process and cooperation between academic institutions and companies, as well as to explain how the described mechanisms work. The chapter does not provide the "full picture" or analyse the complete institutional framework for the realisation of public-sphere research activities in the Czech Republic, nor does it suggest ways it might be improved.

We are seeing a qualitatively new stage of state support within the cohesion policy for the EU programming period of 2007–2013. This new stage consists in partly in the accessibility of a relatively high volume of financial resources for research, development and innovation, and partly in legislative reforms. New rules mean new requirements and risks, especially in terms of the internal rules adopted by institutions obtaining state funds for research, development and innovation. **According to some respondents, a general barrier to the effective and prompt adoption of new rules and procedures is caused by the fact that researchers have limited previous experience adopting such a relatively complex framework, one that encompasses both changes to national legislation and the requirement that EU regulations be followed. This demonstrates at the very least a latent demand for assistance consisting of legal advice which would help managers define internal TT processes to suit local institutions.**

This situation is made even more complicated due to recent changes, primarily Act no. 110/2009 Coll., on public support of research and development and on amendments to the previous act. The new law charges all legal entities **with the obligation to change the way all outputs of research and development activities are treated, providing such outputs are not the subject of public procurement contracts.** These internal rules must at the same time reflect statutory regulations on the exploitation of outputs based on the amount of funding provided from public resources. If statutory regulations are not followed, in some situations support for R&D activities could constitute state aid. However, much stricter rules apply to state aid, including maximum limits for a period of three years (it must not exceed EUR 200,000). Beneficiaries who exceed this amount must return the difference.

Furthermore, new regulations apply with respect to the issue of cooperation with third persons in contract and collaborative research, partnerships between research organisations and subcontracts. However, the present legislation does not regulate these issues in detail, which may lead to confusing interpretations. The fact that this issue has not been resolved sufficiently may represent a significant barrier to closer cooperation with the private sector, or due to the non-existence of decision-making mechanisms and insufficient flexibility of research organisations it may result in significant complications (including termination of activities) in the process of preparing and realising projects. In principle, a situation might well arise where a researcher working on an assignment for a company needs to use instruments owned by an institution that has no rules in place stipulating when these instruments can be used for the respective activity or how much the institution will charge. It should be noted that **in situations where some researchers (especially team leaders – see the chapter on internal conditions) are swamped with work, the absence of clearly defined procedures and rules is perceived as a significant barrier, even though it might be dealt with easily**. Consequently, the conditions set for cooperation by institutions, as well as response times to enquiries, may easily create the impression in the minds of potential business partners that researchers are **"very unwilling to help and inflexible",** when in fact they are indeed interested. Such an evaluation is quite commonly made by companies (see research among SMR companies, Berman Group, 2008).

The vagueness of statutory regulations and related internal regulations was often mentioned during interviews as a significant barrier to TT. Employees who plan to develop applications and TT within their respective institutions (despite the lack of legislative framework) are forced to seek out elaborate routes (by doing so, they lose valuable time that might have been devoted to applied research and development) enabling them to carry out applied research and development in cooperation with the application sector while fulfilling conditions defined by the applicable legislation when no strict rules have been defined at the level of their respective institutions. The fact that individual researchers working in any particular institution have a unique set of interests, any effort therefore to find these alternative routes and especially to realise such efforts results in "attacks" from rivals who see matters differently (e.g. those promoting "academic purity"[24]). Hence, a researcher who shows too much enthusiasm causes themselves problems that they would not otherwise have had.

24 An expression used by one unnamed researcher to describe the philosophy that only basic research is truly valuable scientific research, while the process of applying research outputs properly belongs in companies.

Institutions that apply for public resources for research, development and innovation (in cases where provision of these resources does not constitute government funding) must fulfil the following criteria: (i) the main purpose of their activity must be the research, development and transfer of outputs though teaching activities, publication and technology transfer, and (ii) any profit generated must be reinvested into such activities. Moreover, (iii) **outputs of research 100-percent financed from public resources must be equally accessible to all interested parties**. Research activities financed from private resources may be treated by a research organisation only as an "additional activity". In reality, however, it is often very hard to distinguish between publicly-funded research outputs and privately-funded research outputs.

Research organisations intending to apply for public resources for research, development and innovation must have the main purpose (or their key activity) clearly declared in their memoranda or foundation charters; also of important is their actual activity, which may be subject to thorough inspection. As far as applied research and development for innovation is concerned, the new statutory regulations stipulate the obligation to set up a functional system of intellectual property protection. These two areas of activity must be strictly divided, as there is a rule applicable to most research and development programmes according to which subsidies may only be granted for non-profitable project activities.

Research institutions must therefore make sure that public financial resources allocated for basic research are not used for private sector development. The easiest way to achieve this and abide by the said regulations is to avoid contact with commercial research and not to cooperate with the application sector. These "legislative" rules thus hamper internal changes in institutions as they suit (i) those who claim that applied research should be the preserve of companies and that it is not fit for top academics, and (ii) those who make decisions at the helm of academic institutions and who are happy with the status quo. Commercial (additional) activities represent a decent source of income for institutions; this form of income is not subject to strict regulations (compared with government funding), especially in the remuneration of overhead costs that the institution is entitled to and that can be allocated to just about any activity (even to other teams). However, there is still pressure for traditional R&D outputs that researchers must produce no matter what (according to one of the respondents, laconically expressed as **"give me 20 percent from the business contract, apart from that you can do what you want, as long as your team has results that are exchangeable for public resources").**

The evaluation of achievements in research and development for innovation, or the evaluation of research institutions and colleges/universities, is another significant barrier to TT and cooperation with the application sector, at least according to most respondents. Pursuant to the new act, institutional support – i.e. key financing for the long-term conceptual development of research institutions – will be allocated upon the evaluation (grading) of particular achievements. The amount received from the total sum of institutional support allocated will correspond to the ratio of the total points received by all research institutions over five years. **Publication activity still dominates the evaluation criteria for output. According to those interviewed, any attempt to achieve a balance between various forms of achievements – e.g. by giving more points for patents irrespective of the way they are actually used (capitalised through income from the sale of licenses) often heats up existing disputes and sharpens differences over the need for changes to the system of evaluation and financing research in the Czech Republic**.

With respect to changes to the system of financing and due to the fact that organisations are required to carry out applied research activities, some researchers logically fear it will affect their basic research, even though their results within the present grading system are satisfactory (at least in case of the teams that have been visited so far). However, a reduction of national resources for institutional financing and the reallocation of resources to TACR may mean that, in a situation when BR is not receiving any significant finances based on achieved excellence, there is a dramatic reduction of resources for top-quality basic research, once the resources from EU SF are no longer available. In this regard, the most frequently mentioned problem is uncertainty about the ongoing changes to the system of financing, especially the termination of research plans, excellence centres etc., all of which are going to be replaced by results-based financing.

The interviews show that due to the aforementioned high degree of uncertainty and the suggested changes ***all research teams fear that, despite taking many years to assemble, at the very least some of them will have to be disbanded due to the end of the current system of institutional financing and the adoption of new rules.*** **At the same time, "team building" is exactly what they consider as a key long-term responsibility. Many researchers were appalled by the current situation, stating that no sooner had they finally managed to build a team, suddenly there are confronted by these 'existential' risks that make it unclear whether their teams will survive.** Moreover, research teams need time before they can start producing decent outputs, i.e. before they acquire the minimum amount of knowledge and experience necessary. They also need time to establish contacts with key partners in the Czech Republic and abroad.

Furthermore, it seemed that none of the respondents was able to say for sure that the current situation would persist for any considerable length of time and that were no additional changes to the system of financing of research and development activities in the pipeline. The overwhelming majority of respondents would strongly welcome **a stable system geared for the long-term, in which they would be able to predict years in advance the influx of financial resources into their research institutions and to plan the process of developing their institution and individual teams. They do not want to deal with these issues under different circumstances every year. With respect to the enormous amount of paperwork team leaders have to deal with, there exists an opportunity for regional assistance especially in the area of top-quality support services to top-quality basic research teams, provided by the regional "grant office". This assistance is highly sought after (see the chapter on the demand for assistance tools).**

Another frequently discussed framework-related topic was support for applied research and development in cooperation with the private sector. The debate largely focused on programmes offered by the Ministry of Industry and Trade, which is the most significant supporter of industrial research. The Ministry's programmes are focused on the targeted support of research and development for industrial applications and on assistance in the area of mutual cooperation between industrial companies and research organisations (ASCR, colleges and universities, etc.).

Opinions differ when it comes to the benefits of the industrial research support programmes. **Some of the respondents speak very negatively about these programmes (especially with respect to the reduction of national resources for basic research). According to their own experience, such industrial research support programmes "teach" companies not to allocate their own money for research. In addition, realization of research and development activities in companies is often managed in line with how theseprogrammes are set up.** This results in two things: a weakening of the links between corporate strategy and the company's own expenses on research and development for innovations and the company begins to rely on public resources as the principal form of financing its own research and development activities. Furthermore, even though it may not be easy to apply and obtain financial resources from these public programmes (it involves a lot of paperwork), many respondents claim it can be "learned". Simply put, once an applicant (company) has learned the rationale and requirements of these programmes, it is no longer too difficult to obtain the resources. As they point out, the proof of the above can be seen in the recurring names of successful applicants in all kinds of industrial research programmes.

On the other hand, there are other researchers who welcome the existence of industrial research support programmes. They say that these programmes stimulate the demand for cooperation on research and development. If it was not for these programmes, some companies (especially SME) would prefer simpler forms of cooperation on particular jobs and tasks and would reject long-term projects with less certain outcomes. Besides, there have been cases when local SME have gained a lot from cooperation on research as it has produced key ideas resulting in successful innovations. Cooperation between the company Mesing and ISI ASCR is one of many examples.

III. 06. Structure of branches – specifics, synergies and cooperation

The purpose of this chapter is to introduce the structure of the branches of science the respondents represent and to point out some specific qualities of individual branches that are related to TT and to illustrate the main ties (cooperation networks) between branches in question. It is often difficult to allocate researchers, or their respective teams/institutions, into a single group due to the interdisciplinary nature of some topics they are concerned with. This is why we devised a classification of our own, albeit somewhat rough. It does, however, comply with the goals of the client, i.e. (i) to assess the level of correlation between the structure of the business sector in the South Moravian Region and the structure of the branches of science which produce potentially applicable research outputs as created by the local academic sector and (ii) to find the key "interfaces" between any two branches in which new specific knowledge is conceived that has commercialisation potential.

Considering the above goals and based on the main topics research teams are concerned with, the ties among them and our subsequent generalisation, we grouped the participating researchers as follows:

- Biology and medicine (a total of 22 respondents)
- Electrical engineering and instrumentation (18)
- Physics, metallic materials and mechanical engineering (17)
- Chemistry and non-metallic materials (16)
- IT (13)
- Uncategorised (4)

In order to get a basic idea of where outputs generated by participating research teams are (or might be) exploited, we asked participating researchers what they thought was the key application potential of their research outputs. We asked researchers who focus entirely on basic research about the business sectors in which their research knowledge is applied most often. The data collected is summarised in Table 1 below. Individual rows indicate groups of industry sectors, organised with respect to the intensity of mutual subcontractor relations, so as at least roughly to conform to value chains in the economy. Individual columns indicate the categories to which the participating teams belong. Some researchers mentioned more than one branch of industry for research output applications, but they all mentioned at least one.

Table 1: Main sector(s) for the potential application of research outputs created by participating research teams

Industry sector groups	Research team specialisation(s)						
	Biology + medicine	Electronics + instrumentation	Physics, metals, machinery	Chemistry + non-metals	IT	Uncateg.	Total
A – agriculture and foodstuffs	9	x	1	1	1	2	14
B – textile, clothes, leather processing	x	x	1	x	x	x	1
C – timber processing, furniture, paper	x	x	x	x	x	1	1
D – drugs, medical preparations	21	4	1	9	x	1	36
E – other chemicals, plastics, ceramics	1	2	4	12	x	x	19
F – metals, structures, machines	x	7	16	2	3	1	29
G – electronics	x	14	6	2	4	x	26
H – precision instruments	8	13	14	6	9	x	50
I – power engineering	1	4	11	5	x	1	22
J – software	4	8	5	3	13	x	33
K – uncategorised	2	1	x	1	10	1	15
Number of respondents	22	18	17	16	13	4	90

Classification of economic activity according to branches of industry (CZ-NACE)

Based on the responses, we can say that **by far the most developed knowledge base[25] in the local academic sector is that of manufacturers of precision instruments**. Fifty-six percent (50) of respondents said that outputs of their research activities are potentially applicable, inter alia, in the production of specific types of precision instruments. **Examples include microscopes** (both electronic and optical), **medical devices** (magnetic resonance, EEG, EMG, etc.), **measuring equipment, optical instruments, special laser equipment,** etc. Most knowledge of this branch of science is concentrated in the Institute of Scientific Instruments of the Academy of Sciences of the Czech Republic. However, the field of microscopy and other precision instruments in medicine, optics, metrology, etc. is the main area of application for numerous other research teams/institutions. Particular examples from the applied research category include some teams at FEEC BUT and the Institute of Analytical Chemistry of the Academy of Sciences of the Czech Republic. Specific examples from the basic research category include the Faculty of Science of Masaryk University and the Institute of Physics of Materials of the Academy of Sciences of the Czech Republic.

Some key specialisations of basic research are a powerful driving force for the comprehensive development of the knowledge base in the fields of microscopy and medical instruments in Brno. Strong teams in the area of structural biology and its related branches (biophysics, biochemistry and organic chemistry, genomics, proteomics, etc.) and as well as equally powerful counterparts in optics, physics and material chemistry, both represent sufficiently diverse and yet strongly interlinked environments characterised by an abundance of knowledge and specific sophisticated needs. This is a source of significant stimuli for developing new knowledge in the area of microscopy, medical (and other) equipment and related SW. **The basic research teams focusing on this area are highly sophisticated users of state-of-the-art microscope technologies and authors of unique new knowledge with application potential in microscopy**. The **concentration and formation of new sophisticated needs combined with the creation of new knowledge in order to satisfy these needs usually leads to the creation of new technologies of global significance.**

The fact that the local knowledge base is attractive to companies from the field of microscopy is confirmed by the presence and success of leading manufacturers of electron microscopes who have their capacities in Brno. Moreover, other manufacturers of microscopes (including optical microscopes) who do not have their own capacities in the region are the most common business sector partners in cooperation. **There is probably no other business sector with a knowledge base quite as developed as this one; certainly none that can boast the presence of key capacity from the illustrious companies working here in electron microscopy. And yet in terms of the academic sector, such potential is indeed manifest in some other branches of science.** Several interviews made it clear that research into **medical instruments was attracting cooperation and strong interest** from leading multinationals (General Electric, Philips, Siemens etc.). It was heard time and again that the combination of specific research activities and outputs in the field of instrumentation for cardiology and neurology is the main reason why the Rochester-based Mayo Clinic (that has some of the world's most renowned companies as its partners) wants to build its centre in Brno. One example of outputs is an internationally patented method for predicting sudden cardiac death.

All precision instruments need high quality software. Examples of the potential of the local knowledge base in the field of IT include CAVER software enabling a specific analysis of proteins. Originally a special-purpose freeware application, today it has more than 2,000 users from all over the world (as estimated by respondents), most of whom are specialised in structural biology. The application is being developed on a continuous basis and it is far ahead of its competition. This example shows the **significance of cooperation between what seem at first glance to be two totally different research fields. CAVER software is the product of cooperation be-**

25 At least in terms of quantity.

tween experts in structural biology and IT experts. As representatives of partner teams themselves stated , the unique CAVER programme would not have been created without close cooperation and the joint development of interdisciplinary knowledge (especially true in the case of improving knowledge of biology among IT experts).

The local academic sector can also offer well-developed knowledge base to companies from **pharmaceutical and biotechnology industries. Unlike with instrumentation, however, here any potential commercial use is very firmly wedded to the general level of development of the pharmaceutical and biotechnology industries in the Czech Republic and the rest of Europe**. The participating researchers declared repeatedly that the development of applied research (not to mention plans for commercial exploitation) is hampered by (i) the absence of financially strong pharmaceutical and biotechnology companies in the Czech Republic, (ii) the fact that these industries lag far behind in Europe (as compared with the U.S.) and (iii) legislation. We know of particular cases where, due to these barriers, local companies (i) have given up the idea of developing their applied research altogether, (ii) prefer to register their patents for some research outputs using their foreign partner teams (especially in the United States). At the same time, teams belonging to this group have launched a specific and powerful initiative ("informal consortium"), the goal of which is to develop top-quality research with results that can be exploited commercially. The teams taking part in this initiative are determined, ideally, to bring some aspects of R&D activities of some MNC to Brno, the result of which would be further impetus for the development of research in fields that have ties to molecular biology. Some representatives are also interested in cooperation with local companies that might be interested in developing new business sectors in biotechnology.

The mechanical and electrical engineering industries also have at their disposal a strong knowledge base in the academic sector of the region (SMR). **These two industry sectors even outnumber the pharmaceutical and biotechnology industry in terms of the number of professionals and created added value. They are the region's most important industries. Despite this, most participating researchers whose research outputs are transferred to these sectors stated that the demand for innovations was insufficient and/or that the nature of the demand does not usually require high-quality applied research**. On the other hand, many researchers who belong to this group have at least one or two industry partners with whom they cooperate on a continuous basis (even on research). Only a few teams mentioned they had many more potential partners for cooperation than they could handle, thereby allowing them to be more discriminating and make sure the projects they eventually chose conformed to the research and development goals of the team. Teams belonging to this group and teams whose research outputs are applied in biotechnologies (except for pharmaceuticals), declared the strongest demand for assistance in seeking partners for contract research and for other tools for developing cooperation between the academic and business sectors. Although we were unable to carry out any unbiased validation, we assume that many of these research teams lack partners in cooperation due to the quality of their research activities.

Even though IT researchers experience the same barriers to commercialisation as their colleagues in pharmaceuticals and biotechnology, most of them cooperate very closely both with companies as well as other research and public-sphere institutions in the Czech Republic and abroad. **With respect to actual achievements (e.g. voice identification technologies) as well as the companies interested in some new technologies (e.g. Google, Yahoo), it is evident that local research in the field of IT represents another key knowledge base for the development of knowledge entrepreneurship**. Aside from the aforementioned CAVER software, there are several companies that have been founded directly by researchers, their students, graduates or closely associated persons with direct links to local researchers.

III. 06. 1. Transfer of knowledge between research institutions and other public institutions

Publications are the most common method of disseminating the outputs of basic research. It is generally assumed that the more significant the research output, the more prestigious will be the journal who wants to publish an article about it, and in turn more researchers and industry experts will read about it. However, when it comes to the actual overall intensity of information and knowledge flows (basic research-applied research-actual application in innovations), there are more important forms of disseminating outputs and knowledge. Continuous cooperation, periodical cooperation and face-to-face communication are important for most researchers. This issue cannot be analysed in detail, its internal dynamics prevent any such investigation (to name one reason). Therefore, this survey tries simply to give a rough analysis of those main links in which intensive dissemination and the interdisciplinary combination of information might reasonably be expected to occur.

The results are summarised in Table 2 below. The collected data demonstrates that **teams in biology and medicine have the most developed cooperation networks. Unlike their colleagues from other branches of science, besides intensive mutual cooperation, these researchers also have many significant partners from other science disciplines**. Most of these fall into the categories of chemistry, especially analytical chemistry and biochemistry. However, in some cases the key partner is a team concerned with special syntheses in the field of an organic chemistry. The significance of chemistry for biology-related fields of research is logical and is clearly encapsulated by the following quote "the converter between our outputs and their application is the chemical synthesis of active substances". With respect to the above, it is worth pointing that several biologists expressed the need to acquire their own top-quality teams for chemical syntheses, as well as their disappointment that so far they have not been successful. One respondent stated that being able to contract a small team for chemical syntheses would be a key factor in deciding whether the team would run its own applied research.

Table 2: Geographical and sector structure of partnership networks operated by participating researchers

Respondent's branch of science		Cooperating partner's business sector						Contacts mentioned (total)	Contacts outside own related sectors
		biology, medicine	electronics, instruments	IT	Chemistry	physics, metals, machinery	Uncateg.		
biology, medicine (22)	SM	22	6	5	4	0	6	42	20
	CZ	11	0	0	8	0	1	20	9
	A	38	0	0	2	0	1	41	3
electronics, instr. (18)	SM	8	7	3	1	1	2	22	15
	CZ	1	4	0	1	2	1	9	5
	A	1	12	2	0	0	0	15	3
IT (13)	SM	6	0	10	0	0	2	18	8
	CZ	2	3	9	0	0	0	14	5
	A	0	1	10	0	0	0	11	1
chemistry (16)	SM	13	0	0	6	1	2	22	16
	CZ	3	0	0	7	2	0	12	5
	A	0	0	0	17	0	0	17	0
physics, metals, machin. (17)	SM	1	0	0	2	10	0	13	3
	CZ	2	0	0	1	14	1	18	4
	A	0	1	0	6	24	0	31	5

NOTE: SM – South Moravian institutions, CZ – institutions from a different Czech region, A – foreign institution (abroad). The number in the brackets refers to the total number of respondents. The four uncategorised respondents are not included.

Chemists are not the only partners for researchers belonging to the "biology" group; they also cooperate with local hospitals. The most frequently mentioned benefit is the opportunity to obtain samples for research, or to access data on the effects of specific substances, etc. To some extent, cooperation with hospitals also constitutes cooperation in research. Table 2 categorises it as co-operation within the same group of sectors. However, participating respondents working in medicine are also leading specialists at local hospitals. Data in Table 2 also confirm **the existence of significant relationships with researchers in the field of IT and special instruments. This corresponds with the aforementioned knowledge potential available to manufacturers of equipment and precision instruments for medical purposes. This relation is even stronger in the case of researchers in these branches, which is consistent with the conclusion that strong local teams in the area of structural biology and its related branches of science are an important driving force in developing specific research specialisations in the area of instrumentation and IT**. Examples of areas where this relation is strong include the use of electron microscopy in the study of living substances. Although electron microscopes offer better resolution, current technologies limit the study of living substances since living samples are destroyed upon contact with the rays/environment in the sample chamber. Biologists are therefore voicing a demand for better resolution electron microscopes that do not precipitate undesirable changes in samples (i.e. 'undesirable' since they are a by-product of the technology used and not due to the nature of the particular experiment).

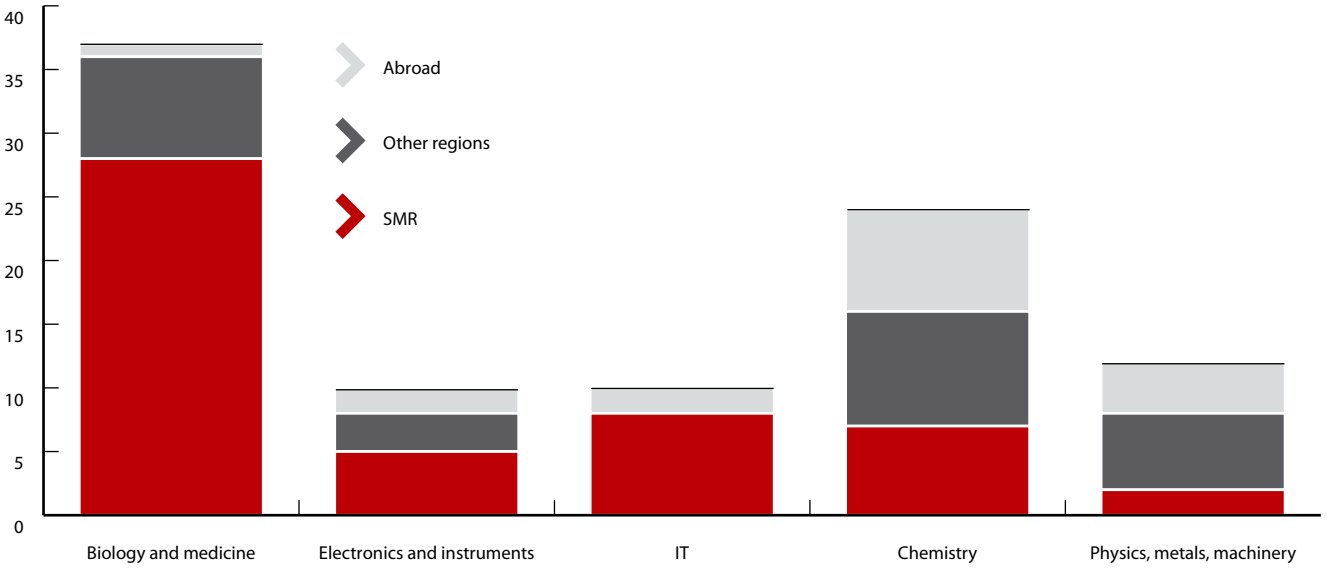
Aside from strong networks of relationships among the fields of structural biology – chemistry – medicine – precision instruments – IT, yet another example of interdisciplinary cooperation is materials research. Relatively strong relationships were found to exist between teams focusing (almost) entirely on metals and teams focusing (almost) entirely on ceramics and/or specialty polymer materials. This can be explained by new trends in materials research, especially **special composites**. One specific form of relationship around structural biology is represented by **biopolymers for medicinal applications**.

Looking at the geographical structure of the partnership network in biology, we can see **that cooperation with foreign teams in the biology/medicine group is particularly significance. In most cases, this cooperation consists in relations with leading global or European institutions focusing on molecular biology, genetics, cancer treatment research, etc. The regional level of cooperation is also very important to biologists, which is not really the case of other groups**. Only in IT is the extent of regional cooperation with companies from the same business sector comparable to that of the field of biology. While cooperation between biologists, IT teams and precision instrument teams is almost exclusively regional, partner institutions working in chemistry are, on the other hand, almost exclusively from Prague. This supports the established **view shared by biologists that any further development of research, especially in application-related fields, is subject to the development of top-class research in the field of chemical syntheses, as well as other chemistry fields**. Numerous biologists, when asked about "beneficial partnerships", named the local Institute of Analytical Chemistry of the Academy of Sciences of the Czech Republic. It is, however, focused on the development of instrumentation, not on chemical syntheses.

In conclusion, summarising the entire group of participating researchers, we can say that the most important forms of cooperation are partnerships with foreign and local entities. **If it was not for close local contacts around biologists and physicians, then foreign partners as "key partners" would predominate**. The participating respondents mentioned 119 foreign entities as their key partners, especially from the United States, Germany, UK, France, Italy and Scandinavia. Several researchers also stated they had key partners in Japan or South Korea.

If we look at cooperation with respect to the cooperating entity (see Chart 2), we can see that, **aside from partnerships within the same branch of science, the most frequent partners are local research teams in the fields of biology and medicine**. When we combine this finding with several particular examples (e.g. the CAVER programme) and with other findings above, we can conclude that ***basic research in structural biology and related fields represents a key source (but not the only one) of new knowledge within the framework of the regional innovation system of South Moravia. It represents a significant stimulus to the development of applied research both in the field of biology and elsewhere. As such, it creates (albeit through intermediaries) attractive conditions for the development of innovative entrepreneurship in several business sectors in the region.*** This finding is consistent with the opinion repeated by most researchers – that top-quality basic research which has a sizable lead over its rivals is the key source of input for top-quality application and related commercial exploitation.

Chart 2: Geographical and sector structure of partnership networks among branches of science



III. 07. Human resources for science and research

Human resources (HR) are a key aspect of research institutions and their development – as confirmed by the fact that entities interested in assistance seek help with recruitment processes (see Chapter 4). Therefore, key barriers to development in this regard were also discussed. The vast majority of respondents agree that retaining current employees is not the biggest HR-related issue. This is, however, related to massive employee turnover (to foreign countries and the private sector – see Chapter 3.2 for more details) during the 1990s. **Although some researchers are returning from their long-term assignments abroad, some respondents still point out the problem regarding the loss or absence of the middle generation.** Some even claimed that a variety of research activities had to be reduced in their teams and more attention paid to raising a new generation of young researchers. Generally, according to some researchers, development temporally ground to a halt.

A new middle generation of researchers in most teams is emerging from the ranks of former young researchers. Moreover, the situation has been improving thanks to the fact that many researchers are returning from fellowship programmes. Even though most participating respondents who are team directors/managers expect that the maturing middle generations will take over key decision-making processes during the next few years, we also know, however, of **several key research teams that have problems finding suitable replacements for aging team leaders. This problem makes the continuity of long-term leadership particularly complicated**.

According to the participating representatives of research organisations, their key problem is how to **attract skilled and talented young people (both Czechs and foreigners) and convince them to focus on a career in science**. Most new employees are doctoral graduates from the respective departments. This staffing source will remain important. However, the importance of increasing the internationalisation of doctoral study programmes has been pointed out, in terms of both attracting foreign PhD. students and improving the quality of fellowship programmes for Czech doctoral students. In this respect, we noticed **demand for assistance in seeking out and intermediating the best possible internships and fellowship programmes for Czech doctoral students and for assessing opportunities to support repeated internships at top-class global excellence centres in the relevant field of study**.

Overall conditions for doctoral students, according to most researchers, remain one of the most significant problems facing the long-term development of research in the Czech Republic. The current national system for setting the levels scholarships is utterly unrealistic and generates the following problems:

- **many potential candidates for an academic career are not interested in doctoral study programmes; meanwhile, such programmes are filled with many relatively poor quality students, or students who inappropriately motivated[26],**
- **save for some exceptions, most excellent doctoral students are forced to have part-time jobs and in most cases the work has nothing in common with their studies; consequently, Czech students simply cannot measure up against leading PhD. Students globally since they cannot devote 100 percent of their time to science,**
- **some students, having found out they cannot keep pace with their peers abroad, lose motivation after a few years and find jobs without finishing their doctoral study programme,**
- **the system motivates some ambitious students to stay at prestigious foreign universities indefinitely.**

The combination of problems above result in ***a system of doctoral study programmes that produces graduates whose average quality is far behind a standard that is potentially achievable. And since the outputs of the system for educating doctoral students lags far behind its potentially achievable quality, the overall potential of the region with respect to global excellence is inevitably harmed with respect to both basic and applied research.***

Salaries are totally inconsistent with the overall situation in the labour market for highly qualified professionals, even for researchers who have a PhD. Although this issue is highlighted by the majority of respondents, many also point out that ***salaries are not the decisive factor with respect to the attractiveness of individual research teams within the framework of (global) labour market competition.*** **The key factor, especially for foreign researchers, is whether they are offered an interesting, high quality job, with good facilities, and whether the respective team (and institution as a whole) enjoys an international reputation**. The fact is that even researchers may currently earn **decent salaries** (subject to, however, an above-average workload). Nevertheless, many such high earners have a degree of seniority at the respective institution. Which is why salaries for **young researchers, who are starting their career in science around the same time as they are starting families**, must continue to play a significant role for them.

Teams of young researchers must include (as most respondents argue) talented young researchers not just from the Czech Republic but from foreign countries, too. Besides the opportunity to attract excellent talented employees from abroad, this would also contribute to the required internal competition among researchers, thereby making individual activities much more dynamic at all levels, be they doctoral students or professors. Local institutions cannot compete with their leading counterparts in the 'west', especially when it comes to these overall conditions. Consequently, the only thing left to do is focus on neighbouring countries or former Eastern Bloc countries sharing cultural similarities, i.e. Slovakia, Poland, Hungary, Ukraine, Russia and Romania. Some teams noted significant interest expressed by students and/or PhD graduates from developing countries (especially India, China and the Arab world). While Czech research teams are generally interested in researchers from these countries, they are discouraged by repeated negative experience with these researchers' low quality and insufficient motivation. **Therefore, local academic institutions are becoming more and more interested in assistance with carrying out "background checks" on potential research fellows and doctoral study programme students from developing countries in order to verify their quality.**

How do we attract talented researchers from abroad? Talented young researchers from abroad who are sought-after by local teams must be **well paid** (Czech teams compete with teams from more developed economies in this regard). Another important aspect is **assistance overcoming any culture shock ("acclimatisation")** – support with respect to their arrival in a new environment; this should not only cover professional matters (grant application support, involvement in national networks, etc.), but also offer effective support in terms of personal issues (formal work permit paperwork, dealing with authorities, accommodation, etc.). **This is an opportunity for a suitable combination of proposed tools, one that would (i) result in better salaries for top young researchers from abroad, and (ii) offer background assistance with transition, so that they can get used to working and living in SMR.**

Info box 6: Role of young researchers in research excellence

"The public perception is that important scientific advances are made by scientists with at least a few gray hairs, but the reality is that most scientists perform their groundbreaking work early in their careers". This is clearly demonstrated in the development of the European Molecular Biology Laboratory (EMBL), founded in the 1970s. Inspired by the support provided to young researchers in the United States, the EMBL has always recruited young researchers to be team leaders (immediately after graduation or early postdoc) for a period of nine years. "Selection is based on stringent personal evaluations, and the most promising candidates are often identified by tracking people through personal contacts… Judged by quality of research, the model is a success. According to citation numbers, EMBL has the highest impact of any European research institution in the two 10-year periods since 1990." This example (albeit a foreign experience) shows the **need to focus on talented young researchers and to give them the room and conditions they need for their own activities. However, establishing such conditions in the current Czech climate is problematic, which makes initiatives and resources at the regional level ever more important.**

Source: Nature Methods, Volume 7 (3), March 2010

26 The assertion was made repeatedly that many students lack any real interest. Instead they just want to postpone their entry to the labour market. However, without making a study, it is almost impossible to discern the real motivations of student applicants.

Another problematic issue experienced by participating researchers is **the lack of opportunities for post-doc employees** (full- or part-time jobs). The purpose of post-doc positions is to support PhD. graduates and to launch their career in research. This type of job is practically nonexistent in the Czech Republic (save for very specific programmes run by individual institutions). The result is limited possibilities to apply for subsidies for the long-term financing of post-doc researchers, i.e. employees who are often essential for the future development of research teams. The financing of post-doc employees focuses on the young scientist's own research so that he/she may start up their career. However, young Czech scientists are typically "roped into" becoming directly involved in all the activities of their employer, include a large teaching load, paperwork, etc. Consequently, they have little time for research of their own (a situation similar to the experience of their senior colleagues).

This is the reason why doctoral students are often involved in research, as they have relatively more time. While it is important to have students involved in research activities, problems arise when the better part of research is based on their involvement. These students rarely stay at the university from which they graduate. Furthermore, many respondents stated that they thought it was important for students to gain some experience at other research institutions, preferably abroad. **This leads to disruptions in the continuity of research teams and their activities**. Hence, this survey shows that for the sake of the long-term development of research teams it is desirable that most research activities be conducted not by doctoral students, but by researchers who already hold a PhD.

Previous chapters focusing on cooperation between researchinstitutions and the application sector repeatedly refer to **the importance of personal contacts for establishing cooperation-based relationships and for joint applied research projects**. Besides contacts between researchers themselves, of particular importance are (as we found out in the survey) **contacts made through former students and graduates both at the master's level and especially doctoral programmes**. These contacts represent a significant source of relations with foreign entities where (as mentioned earlier) mutual trust and personal relationships are more important than is the case of cooperation with Czech entities. In some cases, these contacts (whether individually or cumulatively) played a key, sometimes *the* key role in the arrival in the Czech Republic of some sophisticated activities of MNC. This is because people in strategic roles and decision-making positions (within corporations) seek partners on the basis of their own knowledge and contacts. **Considering the global footprint of MNCs, graduates who work for these companies are able to assess the price:quality ratio and to play a significant role in the process of selecting partners in cooperation. As close proximity is vital in the case of some highly sophisticated activities, there is a chance that some activities may (in part) be relocated closer to external cooperation partners. Partner search and support for this type of partnership represents yet another form of public assistance that, if combined with other tools, may contribute to the further development of contract research or the location of some activities of MNCs or their partners in the region.**

Another relatively well-known and frequently discussed issue is **the low level of interest in technical and natural sciences** compared with social sciences or economics and business. Considering current demographic developments (as a result of which we can expect a significant decrease in the numbers entering college and university over the next decade), there is an enormous increase in the need for a local-level initiative to create a critical mass of prospective students interested in the technical and natural sciences and thereby establish the necessary environment of competition to enrol in such colleges and universities. Even today, faculties of technical and natural sciences are not the school of first choice for many new students. It is safe to assume that this results in graduates lagging far behind of their actual potential (which is similar to the situation in the system for education doctoral students in the Czech Republic – see above).

Under the current system of university financing, in which the allocation of lump-sum funds according to the number of enrolled students plays an important role, there exists a strong **pressure for increasing the ratio of students-per-teacher at faculties and departments of technical sciences and natural sciences**. This is especially the case at Masaryk University, where faculties teaching the arts, humanities and social sciences put extreme pressure on these indicators that (according to respondents) do not reflect the complexity of the curricula for the technical and natural sciences. According to the participating researchers, to succumb to this pressure would cause a deterioration in the quality of teaching. Educators who are also researchers perceive this as yet another barrier to research of their own.

III. 08. Comparative study among R&D institutions in Prague

The twenty interviews with Prague-based researchers are enough only to give a "rough outline" of the situation of R&D institutions in Prague. However, even as few as 20 interviews are enough to conclude that **the basic barriers to achieving research excellence and the transfer of research outputs into practice are virtually identical. Such barriers therefore are national, not simply regional, in nature**. This does not mean, however, that the identified problems ought to be solved purely on the national level. On the contrary, **regional and local initiatives represent a basic factor able to help in overcoming existing barriers and contributing to significant differences among individual regions in terms conditions for research and the transfer of new knowledge into practice**.

Whilst acknowledging the limited sample of respondents, we can still point out the slightly higher level of internationalisation of R&D institutions in Prague. Save for a few exceptions, we think that this is not because Pragues R&D institutions are, *per se*, more attractive in terms of the conditions they offer, compared with R&D institutions in Brno. However, the capital city is able to offer more attractive

external conditions (outside the host institutions itself) and the concentration of top-class research is indeed higher. Prague has at its disposal all the qualities of a capital city in this regard, be it in terms of international travel, the concentration of related and research fields (both adjacent and remote), the generally larger research teams enabling a higher level of creative freedom at the workplace and indirect cost sharing, the significantly larger cosmopolitan community and the offer of services for researchers' family members. On the other hand, the other barriers that we managed to identify are identical to those in SMR.

Aside from the aforementioned qualities inherent in any capital city, Prague is home to some research institutions that represent the very pinnacle of global science, e.g. the Institute of Organic Chemistry and Biochemistry of the Academy of Sciences of the Czech Republic. One of the things that makes it unique in the national context is its system of financing, where most financial resources come from private and foreign partners. Moreover, this institute does not attempt to seek talented doctoral students and researchers in countries to the east of the Czech Republic, which is what most other institutions do. People in this institute "aim higher", meaning that, for example, four department heads are foreigners. It should be noted, however, that this institute is rather a unique example even for Prague, and there are only a few research institutions that even come close to approaching its excellence.

As far as partnership networks are concerned, the survey on this limited sample of research institutions showed that local-level partnerships are much less significant and that foreign research institutions predominate among key partners. We can observe this fact in the very low number of R&D institutions in Brno as key partners of R&D institutions in Prague: only four out of twenty listed R&D institutions in Brno as a key research partner. Interestingly enough, the FEI company was listed as an SMR-based partners; the FEI company is one of the market leaders in developing the knowledge economy in the South Moravian Region. Representatives of the Institute of Molecular Biology of the Academy of Sciences of the Czech Republic stated that cooperation with FEI in developing new instruments is one of the main activities in their research-industry cooperation. A separate survey among Prague-based institutions would be necessary for a more detailed analysis of partnership networks. Moreover, it would require a higher number of respondents, so as to provide results comparable to those retrieved during the ninety in-depth interviews in Brno.

» IV. Demand for assistance tools

In line with present knowledge of the situation in TT and the conditions for research excellence, a list of assistance tools was drawn up as a part of the preparation stage for the updated Regional Operational Strategy of the South Moravian Region (RIS SMR). Many of them are inspired by similar tools from abroad that are proving effective. The assistance tools now being considered are still in the stage of rough concept. If they were to be prepared in detail, it would be necessary to investigate the demand for these tools among potential beneficiaries (besides the TT survey). This is why the interviews with participating researchers included presentations of, and discussions on, the proposed tools.

Analysis of demand for instruments of assistence should be construed by other Centrope regions as an inspiration to perform a similar survey. Identification of problems and barriers to technology transfer, and creation of instruments for their solutions is another step in supporting the development of the competitiveness of Centrope as a functional knowledge region.

The following presentation of outputs should not be overestimated – it is far from representative of the entire South Moravian academic sector, as respondents were not selected at random. The selection process was planned with respect to the main goals of the project, i.e. to assess barriers preventing TT and the development of research excellence in teams, and to collect information on whether and how such barriers might be overcome within the RIS SMR platform. **The recorded answers to questions regarding the demand for individual assistance tools were not statistically standardised. In order to save time, participating researchers were only presented with the research tools planned to suit their particular requirements, identified during the previous course of the interview. Therefore, interviewers were able to assume some "no" answers based on the respondent's previous replies regarding the same issue.** However, this does not undermine the value of the data collected with respect to the extent and nature of the demand for the proposed assistance tools. Questioners have successfully tried this method before. Moreover, unlike a purely statistical survey, this method guarantees the collection of qualitative data on the demand, which is often more suitable for the selection and development of assistance tools than totally accurate (in statistical terms) quantification of demand.

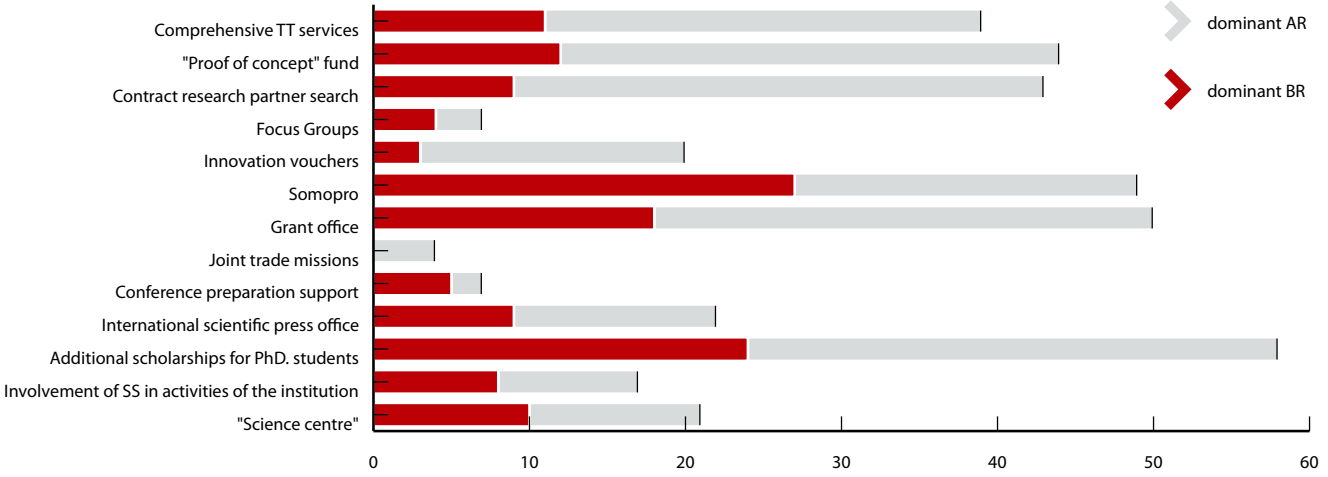
Generally speaking, all the proposed assistance tools are welcome. Hence, researchers were asked about their specific interest in particular assistance tools; the summarising quantification did not include their opinions on the broader need for such tools among academic institutions in general. Besides assessing the demand for the proposed assistance tools, one of the most valuable outputs of the survey is a series of useful tips and recommendations for other assistance tools and activities that had so far not been considered and discussed within the context of RIS SMR.

The extent of demand for assistance tools proposed within the updated RIS SMR is shown in Chart 3. Categories are based on the main subject of research and since in some teams this subject may change over time, categories are used for indicative purposes only. The chart offers some general conclusions:

- **Irrespective of the respondents' dominant research activity (and their teams), the strongest demand was for tools related to the (i) HR development of research teams; and the (ii) generation of financial resources for research.**
- **Teams that focus mostly on applied research are primarily interested in tools directly related to TT (aside from additional scholarships).**
- **Teams that focus on other activities are mostly interested in tools related to the promotion of research institutions and their research outputs.**

Low interest in certain tools or issues cannot be interpreted as "nonexistent interest". This is because answers largely depend on the respondent's personal experience with analogous tools abroad and thus their ability to imagine the benefits for their team or institution when applying such tools here. A detailed description of interest in individual tools/issues is provided below.

Graph 3: Demand for assistance tools proposed within the updated RIS SMR



Source: answers of participating researchers

IV. 01. Comprehensive TT services

The demand for comprehensive TT services was significantly stronger and broader (in terms of structure) among institutions focusing mostly on applied research. While research institutions focusing mainly on basic research show most interest in IPR, research facilities conducting primarily applied research request the complete portfolio of services: IPR, assistance with commercial exploitation models and assistance setting up companies (including, but not limited to spin-off firms). The issue of the current model of TT assistance services in individual institutions is described in the chapter on the internal conditions of institutions. For the purpose of this chapter, we will examine the most frequent topics, needs, tips, risks and fears, etc.

- **Availability of top-class IPR services (prices, quality verification, etc.)**
  Researchers who have previous experience with IPR generally agree that top-quality services are available on the market – at least abroad, if not in the Czech Republic. They point out, however, that **it takes time, money and other resources to find these services**. If a researcher with no previous experience with IPR is to find top-class IPR services on their own, he or she often does so by „trial and error", some respondents claimed. Moreover, only once a suitable service provider has been found can the research institution verify its quality in terms of actual protection of the research output in question. **Hence, researchers who have no previous personal experience with these issues express a strong need for custom-designed intermediation of top-quality IPR services which also include quality verification**.

- **Bridge financing**
  Many researchers stated during their interviews that the only the international protection of research outputs has any real sense. Some claimed that Czech-level protection by itself is only a source of information for technology scouts, rather than relevant protection. On the other hand, in one particular case it was noted that even national protection had considerable potential for commercial exploitation. **With respect to the costs of international protection, some respondents pointed out the suitability of bridge financing for the period between securing IPR and the actual commercialisation of the protected research outputs. They also added that such source, if it is to be effective, must be based on the same principles used by venture capitalists – i.e. (i) one has to expect to support projects that may turn out to be unsuccessful and (ii) income from successful projects shall at least cover losses from investments into unsuccessful ones**.

- **Marketing and trade representation**
  The survey revealed a significant difference between the total number of protected research outputs and the number of research outputs whose protection has actually already been exploited commercially. This difference is common throughout the world. It was not a goal of this survey to make any comparison of this difference with that of other regions or countries. Despite this surveys show that some outputs are in fact used in practice (i.e. finally reach a point at which they are commercialised) years after protection was applied, thus the difference proves that protected research outputs can be managed actively with an eventual aim of commercial exploitation. **Active marketing, the purpose of which is to seek partners interested in the use of protected research outputs produced by local institutions is an area where assistance and/or other activities within RIS SMR might be profitably targeted**.

Some participating researchers point out that **there are specialised companies in developed economies that focus on this type of activity and/or that there exist networks of cooperating individuals** (these individuals are quite often former researchers; if it is necessary to find a partner they can put their knowledge to use and intermediate protected research outputs on the respective market). **Some respondents are indeed members of such networks of intermediators**. However, this type of activity has not yet developed into a commercial enterprise in the Czech Republic. **Considering the potential sources of income and other benefits for local research institutions, including the demonstration effect of successful examples, we recommend that opportunities for initiating and supporting the development of these activities be considered within the RIS SMR platform.**

Alongside the active search for potential partners who might want to exploit protected research outputs created by local institutions, many participating researchers mentioned the need for commercial and legal representation in negotiations, contract drafting, etc. Researchers (especially team leaders), who are often the main authors of protected research outputs, are swamped with paperwork already – see the chapter on the internal conditions of institutions. Bearing in mind their workload and the need for relatively extensive knowledge and experience in order to provide effective business and legal representation, it is unrealistic to think that researchers are able to handle these issues themselves. Companies providing IPR services offer this type of assistance as well. However, as respondents themselves recounted, any **opportunity for flexible consultations and/or representation without the need to use for commercial services (as they too involve paperwork) is extremely desirable**.

- **Assessing the (economic) potential for IPR**
  The very process of IPR and the capitalisation of protected research outputs are often preceded by many relatively **tough decisions made by researchers on (i) whether something should be protected and how and (ii) which of the possible forms of research output application they should go for.** Due to the aforementioned enormous workload of team leaders, who are often the main authors of protected research outputs, it would once again be extremely helpful if they could consult the issue or if they could contract exploratory or verification studies. This form of assistance would, according to some respondents, **resolve situations in which individual employees of basic research institutions decide whether it is meaningful to try to develop applications for particular outputs**. A recommendation was made to **create a network of top international technology scouts, where JIC would find these individuals, serve as a mediator and locate (at least some partial) resources from which the services of these scouts would be paid**.

- **Concept verification/opposition**
  The need referred to in the previous paragraph was also expressed by institutions that are application-oriented. In this case, however, these situations are much further down the imaginary axis leading from basic research to commercial applications. In particular, they involve **situations where the authors of applied research outputs (the product of research in which the original aim was not commercially exploitable outputs) have to decide on the exact terms of any commercial exploitation (what and how). This scenario has a lot in common with the tool for providing "proof-of-concept" funds. It proves the fact that funding itself is not always the decisive factor in successful commercialisation**.

- **Selecting the commercialisation model**
  Once researchers have decided on the technical aspects and form of the commercially exploited research output (whether they arrived at this point with the use of other assistance tools, or without them), some of them would appreciate the opportunity (i) to be able to discuss further steps with experts on processes related to starting companies, (ii) to have access to top-class marketing services, so that they can make an effective decision on how to proceed. Subject to this decision, some of the requirements described above again come into play (IPR, legal representation, etc.). An important aspect in this regard is how ready are the internal conditions of the relevant research companies for the complex issue of spin-off companies.

- **Professional mentor in TT**
  Some participating researchers noted that the TT process is very complex and that its development would be made easier if they could draw on the services of a "professional mentor in TT", someone would coordinate and manage all issues related to the planned commercialisation. This person would be act as an interface between external services and internal processes. In general, this role has so far been played by the developing CTT MU and UTT BUT. However, interviews showed that while there might have been some minor successes, the extent and quality of services provided are inconsistent with actual needs (for more details see the chapter on the internal conditions of institutions). It was pointed out several times that the current labour market does not offer almost anyone able to offer these services at the desired level of quality. This aspect is highlighted by some researchers as one of the main causes for the slow development of TT assistance in academic institutions**.**

IV. 02. Proof-of-concept fund

This particular tools was the "second most wanted" tool among researchers focusing mostly on the applied research, next to the contract research partner search. However, these researchers pointed out repeatedly that it should not simply replicate the resources currently obtainable from TACR. According to the respondents, the key aspects would include the (i) definition, verification and sanctioning of the outputs of funded R&D activities, (ii) methods related to evaluation, especially assessing the commercialisation potential of research outputs.

As far as the latter point is concerned, it is essential **to make sure that the selection process is not based on references and testimonials from companies, which, researchers say, are easy to obtain, and to make sure projects are not mere updates of already existing technologies with little, if any, commercialisation potential. Some researchers stated that setting this system is a matter of gradual trial and error that may take several years**.

Some respondents also expressed their opinion that if there are companies already interested in the research output in question, they should bear a significant amount (in the case of SMEs) of the cost or indeed the entire costs (larger companies) of activities focused on adding "the final touch" to these outputs, so that they can be exploited commercially. With the above in mind, this tool should only be used to support **research activities motivated by a specific commercialisation objective, but where existing outputs are at a stage, nonetheless, where they are not sufficiently attractive to companies. A slightly different scenario is represented by the lack of companies which, due to the novelty of the application, would be able to identify the commercialisation potential – and therefore finance the associated research**. Which brings us again to the question whether it should be a subsidy fund, or "open society fund" where revenues from successful projects cover the costs of unsuccessful ones.

IV. 03. Contract research partner search

Contract research partner search is yet another area highly sought after by institutions focused on applications. The issue that respondents mentioned most often was **the essential role of personal contacts and mutual trust** that no form of assistance could substitute. As far as the slow process of building trust is concerned, many researchers stated that **it starts with simple and often routine cooperation activities**. In their opinion, they have to go through this stage of building relationships with companies in order to be able to win contracts that consist in systematic applied research.

Research institutions that are active in the search for partners in contract research declare that **the labour market offers practically no applicants who would be suitably qualified for effective activities in this area**. **One example mentioned of the "right man for the job" was a former CEO of a renowned company whose personal contacts enable regular meetings to occur between the CEOs of the largest Czech companies. These companies possess the necessary financial resources and in-house research capacities to develop cooperation on truly top-class applied research.**

At the same time, the portfolio of respondents includes several applied research teams that refuse any assistance in contract research altogether. They have their own network of contacts which generates demand overhang for their capacities. Having analysed these teams, we can say that they list many foreign companies as their key business sector partners. This fact per se does not, however, guarantee sufficient demand for innovations (see the respective chapters). Representatives of these research teams repeatedly asked "Where are you going to find people capable of providing these services? If you find them, let us know. We'd be interested in them." The statement clearly shows that the process of recruiting the best staff and networking are sensible areas for potential assistance.

IV. 04. Focus group

According to many researchers this tool is one of the methods of contract research partner search. In this regard, it is necessary to be aware of the respective extent of demand. Some researchers stated that this method may be a suitable tool for communication with local SMEs working on similar problems and/or SMEs aiming to cooperate on joint or related projects. The number one requirement is excellent preparation, in order to achieve maximum correlation between the specific needs of a small number of companies and the needs of research teams.

IV. 05. Innovation vouchers

Based on the answers received, innovation vouchers were given an overwhelmingly positive response. Negative reactions touched upon the ballot principle or the fact that the amount of financial resources is much too small. Numerous interviews also showed that researchers were unfamiliar with the purposes and goals of this tool, i.e. (i) to enable companies to "test" a researcher and/or team in order to assess potential closer cooperation; and (ii), by extending the demand for official cooperation among companies, to encourage academic institutions to implement internal processes and rules for improving flexibility with respect to cooperation with companies. Negative attitudes towards innovation vouchers stem from the lack of understanding of how these tools work, which can be resolved by better promotion.

As far as the first goal is concerned, based on the information collected, innovation vouchers indeed resulted in the establishment of new, previously non-existent, relations between companies and local researchers. However, approximately three-fourths of the cases were represented by already established cooperation networks. It is necessary to point out that an assessment of the benefits of innovation vouchers was not the subject of the survey and that there were only a few researchers who obtained vouchers or filed

applications. Nevertheless, the information acquired suggests that the first goal has so far been reached only partially. This significantly affects the potential degree of influence on the adjustment or implementation of internal procedures. Be this as it may, impacts on internal procedures were indeed recorded in several cases.

The aforementioned findings suggest that the first round of innovation vouchers served as "subsidies for already-established partnerships", not as "matchmaking vouchers". This does not mean, however, that benefits from the first round of this tool should be viewed negatively. Such evaluation can be made only once a certain period of time has expired, i.e. when it is possible to monitor the actual use of financial resources, especially in the case of newly established relationships. We should also mention a frequently expressed opinion that innovation vouchers should be made available to foreign companies as well. This suggestion is consistent with currently planned activities. Considering the extent and structure of research activities in Brno, we think that it may play a significant role in developing a supra-regional significance for Brno as a centre of top-class research and in further internationalising partnership networks.

As far as the demand for internal changes at academic institutions are concerned, we must also mention an observation frequently made by several researchers in top managerial posts, which was that innovation vouchers are worth insignificant amounts and will not stimulate the necessary changes.

IV. 06. Somopro

Somopro is one of the three most demanded of the assistance tools on offer. In part, this is due to previous personal experience of many participating researchers. The main reason, however, is that it is an ideal response to some of the most important needs of local research teams, i.e. (i) the return of top researchers from long-term fellowship programmes and (ii) long-term fellowship programmes for foreign researchers in research teams in SMR.

The portfolio of tools also included a series of services focused on providing a "soft landing" for foreign researchers in their new environment (EURAXESS). The interviews showed no real difference between the demand for Somopro and the demand for transition services (e.g. with job searching for a spouse, international school, kindergarten, communication with authorities, apartment hunting, etc.). The EURAXESS was not evaluated as a separate tool for this very reason.

Generally speaking, most researchers expressed the need for the creation of **a comprehensive system of support for (i) reintegrating "Czech brains" and (ii) selectively recruiting young PhD. students and post-doc employees from developing economies** whose culture is close to that in the Czech Republic (Russia, Ukraine, Romania). This system of activities should be closely related to support tools for top young researchers – i.e. future leaders of excellent local teams (see e.g. "young researchers start-up grants" below).

The main objection against the current terms of the Somopro programme is the complaint that **it does not apply to the re-integration of researchers who have returned from another EU country**. In practice, there have been cases when a researcher considering returning from Oxford (UK) was not eligible to receive support.

IV. 07. Grant office

Practically all respondents mentioned problems associated with the process of preparing project applications and with their subsequent realisation in the competition of successful projects. The **enormous workload experienced by research team leaders that is unrelated to research and planning activities represents, for the visited teams, a significant barrier to the development of TT and any improvement of research quality** (for more details, see the chapter the on internal conditions of institutions). Aside from being swamped with paperwork, researchers concur that **the chances to access some foreign financial resources are too low**. Whether this is caused by the low quality of local teams or by insufficient or ineffective representation of Czech interests is debatable (a topic for a different survey). One thing is certain, however; having experienced failure and problems with the existing administration, some researchers have given up trying. This is especially the case with support from EU Framework Programmes.

Research teams/institutions from all fields and specialisations expressed a strong demand for various services related to accessing public financial resources for research. We include here the frequent opinion that *"competition for public resources for research is sometimes a lot tougher than what companies are used to dealing with; no wonder effective assistance is a significant competitive advantage"*. Respondents say that this assistance should consist of an **amalgam of services with respect to (i) close contacts with resource providers in order to obtain "inside" information for correctly interpreting the terms of calls, (ii) coordination of teams and partner search, (iii) preparation of all other parts of applications not dealing purely with specialist passages, (iv) project administration management with respect to application submission and regular reporting on its progress and conclusion**. In summary, the purpose of a grant office should be **(i) to improve the success rate** especially **in foreign programmes and (ii) to significantly reduce the paperwork** currently undertaken by researchers.

Once the interviews progressed beyond the basic definition of the mission and goals of the grant office, all consensuses disappeared completely. Opinions differ widely in many aspects. Most differences of opinion are the result of the fact that researchers could not agree which activities should be realised across the entire SMR and which activities should be carried out institutionally or even individually (within research teams). Different opinions are significantly reflective of the already existing variety and quality of services provided to institutions, or activities that participating researchers have already started. **Any solutions in this regard should to the maximum extent take into consideration activities already in place at all levels (from individual teams to the regional or national level), while supplementing them to ensure as many synergies as possible. Most researchers pointed out the need for improving the quality and effectiveness of existing services and structures, whereas the introduction of new ones should be a last resort**.

IV. 08. Joint trade missions

The idea of supporting the participation of researchers in trade missions was received neutrally, though it was conceded that this might be very useful in specific cases. However, most respondents stated that they had never encountered such situations or noticed any interest among companies, save for a few exceptions. One example of such a scenario is a company's need (or a group of cooperating companies) to find or convince foreign companies about the opportunities and benefits of potential cooperation. This type of need was recorded in a survey among companies. The role of a top researcher during a joint mission consists mostly trying to convince (potential) foreign partners that the SMR / Czech Republic is also a place where top products can be developed (often for less money) and that there are adequate technical facilities for such demanding activities.

However, these needs only arise between a company and researcher once cooperation has become well established. Therefore, the question is why public resources should be used to finance the participation of researchers in the process. Two explanations exist; firstly, **young "start-up" companies (similar to incubated firms) may have problems allocating even this small amount for investment purposes**; secondly, some researchers focused on applications, or even *researchers considering commercialising their own research outputs* (especially through spin-off companies or their own firms) **may establish important contacts during trade missions or become inspired** to successfully carry out commercialisation or help partner firms.

IV. 09. Support in organising scientific conferences

The most frequently mentioned demand (recommendation) was that greater use should be made of the symbolic significance of J. G. Mendel. The potential of this symbolism was noticed at a leading basic research team in SMR where **"a certain internationally famous specialist sought Brno-based partners on the grounds of an admiration for J. G. Mendel."**

Another inspiring recommendation is the proposal that the new campus in Brno-Bohunice include luxury apartments for short-term stays of top foreign researchers. The short distance between such apartments and the campus facilities, plus additional services (e.g. a technical library in the communal areas of such apartments, study areas and places to meet local colleagues, etc.) may increase the overall popularity and reputation of the city of Brno as a "global" research centre.

As far as financial support itself is concerned, it was stated several times that conferences could be financed within other types of projects. However, some respondents claimed that it would be helpful to have a source of financing (and coordinating) for some types of activities related to specific conferences attended by some of the world's top researchers. Several respondents also stated that the Brno could not offer adequate technical capacities for a truly major international conference. The question is, however, whether, given the costs for establishing such capacity, and the fact that such capacities already exist in Prague, the initial outlay would ever be recouped. The need to hold a truly major international conference in Brno was not mentioned as a priority.

IV. 10. International scientific press office

This recommendation was well received, but on the other hand hardly anyone mentioned promotion abroad as the most important priority. There is therefore a general interest from researchers in this tool, but it should not be prioritised over solutions for some more important needs. At the same time caution was expressed against overstating the reality, as this may have negative consequences.

IV. 11. Additional scholarships for doctoral students

Based on the information collected, it is evident that if the conditions offered to doctoral students are intended to promote a subsequent career in research, then such conditions are problematic. **The current nationally set level of scholarships is utterly unrealistic. This causes problems (see the chapter on human resources above), due to which the system of PhD. studies in the Czech**

Republic produces graduates whose average quality lags far behind their potential. Although this phenomenon is largely abstract and no valid statistical proof is possible, the fact that signs indicating the affects of just such a failure are currently being observed by respondents does in fact validate our conclusion.

Additional scholarships for the best doctoral students must therefore be considered as one of the most necessary tools for the qualitative development of research and thereby improving the potential for developing the knowledge economy. In this context, let us repeat what some respondents stated, i.e. that **"CZK 10,000 per month definitely helps; but even if we add this amount to a state scholarship, the resulting sum is still much less than the amount that would solve the root cause of the trouble, which is the lack of acknowledgement that top doctoral students are highly qualified experts who can easily find jobs in the commercial sector paying two or three times more than the university through a scholarship."** One might object to this statement on various levels. Yet despite its debatable points, the statement must be taken seriously when deciding on the amounts for additional scholarships, i.e. with respect to allocating overall financial resources for this tool. **Some participating researchers claim that a solution lies in the potential of those activities leading to an increase in the ratio of private capital within the overall financial resources for this important support tool. Already, today some companies support PhD. students financially, in exchange for the promise that they will come to work in the company after graduation. For the sake of quality research, we need companies to additionally finance doctoral students who would stay in the academic sector after graduation.**

With respect to the first round of competition for additional scholarships, several respondents criticised the fact that **the selection of eligible fields is made within individual academic institutions**. Several respondents stated that the **"negotiation strength" of individual faculties, institutes, departments and their representatives on the statutory bodies of universities play an unfair role, making competition purely based on quality impossible**. In our opinion, this feedback should be analysed within the evaluation processes of the support tools. Furthermore, we heard repeated requests that **such tools should not only apply to colleges and universities, but should include local departments of the Academy of Sciences of the Czech Republic as well**.

IV. 12. Involvement of secondary school students in research

Support activities in this area are naturally appreciated by everyone, as they are closely aimed at tackling the combined consequences of (i) the preference for studying economics, law and other social sciences and (ii) demographic changes which are going to result in a significant decrease in enrolment at higher education. However, the vast majority of respondents stated that they were already using the capacities of their research institutions (e.g. open days, popular science lectures for pupils and students, etc.). They also point out that the short-term and mid-term benefits of activities focused on secondary school students are much smaller than those focused on college and university students. However, should any third-party entity propose activities for raising interest levels in science among secondary school students, the participating researchers (save for a few exceptions) are always willing to cooperate, provided the activity does not overstretch research institution capacities.

Nevertheless, there is still some space for mediating specific contacts and cooperation between local research institutions and exceptionally talented secondary school students who want to get involved and learn how a particular research team works. It emerged from the interviews, however, that the number of such cases was very small. With respect to potential benefits in developing the innovation system of the region, respondents prioritise the need to encourage children (and their parents) to become involved in the natural sciences and the need to motivate young people to achieve goals through personal endeavour.

IV. 13. Science centre

As in the case of the "international scientific press office", this tool is generally supported by most researchers, but not regarded as a key priority. Respondents mostly point out the need to motivate children and their parents so as to boost young people's future interest in studying the natural and technical sciences. Some fear, however, that this project might quickly become *"an amusement park of some sort",* to the detriment of the project's potential.

Researchers interested presenting their team or institution point out that while they may have ideas and good results, they do not have money, personnel and experience in marketing. In their opinion, it is desirable to look at the various possible forms they could become involved during the preparation of activities and exhibitions at the centre.

We should also mention the fact that numerous researchers noted that the new centre should not be competing in any way against the Mendel Museum.

IV. 14. Other proposals for tools, activities proposed by researchers

- **Companies sponsoring R&D activities**
  Eleven of the ninety respondents suggested, more or less explicitly, that **JIC attempt to set up a system of activities to encourage sponsorship of research by companies**. These researchers claim that "companies would sponsor just about anything" (sport, beauty pageants, etc.). The fact that there is almost no sponsoring of research is caused by a combination of factors, i.e. (i) lack of interest or understanding from prospective sponsors of the significance of research for the whole of society and (ii) extremely poor promotion of research institutions or their respective departments. Specific suggestions in this area relate to the subject of promoting research institutions and their outputs. Notable examples include: **"fellowship paid by a company or a group of companies"; "foundation for the development of research activities around a specific issue that draws contributions from companies in exchange for certain advantages, e.g. participation in the internal theoretical activities of the institutions being supported", "fund bringing together contributions from companies intended for the development of PhD. studies – yet another source of funds for additional scholarships for doctoral students".**

- **Promotion / popularisation**
  Frequent interview topics included the need for the promotion and popularisation of key research outputs and the overall education of the general public in science and its significance for social development. However, many researchers also added that a "science centre" is not what they had in mind (or at least not the only thing they had in mind). However, they did not say what they meant, mostly claiming this was a subject for specialists in marketing. They emphasised the general principles of a selective marketing mix based on target groups, the regular exchange of information (not just during visits), high quality information for all the general public, not just children and parents, etc.

- **Money for post-docs ("young researchers start-up grants")**
  With respect to the importance of top local post-docs (novice "principal investigators" – see the chapter on human resources for more details), twelve of the ninety respondents mentioned the need for a regional equivalent of a scholarship fund for the best doctoral students, but this time for post-docs whose personal qualities destine them to be future leaders of local research teams (currently existing or new). When asked about the sums, respondents mentioned five to ten five-year grants amounting to circa CZK 6 million per grant (i.e. circa CZK 1.2 million per grant annually). They also pointed out that an even bigger challenge is to seek these candidates out and to evaluate their potential to become future leaders of excellent teams (or teams that strive for research excellence).

- **Need to improve the knowledge and personal experience of (team) leaders in academic institutions with respect to TT and the realities of the commercial sector**
  Several respondents warned that, on average, the knowledge of, and personal experience with, TT issues among team leaders in academic institutions is insufficient. They said that inflexibility could be reduced and internal changes made easier if top leaders were motivated and regularly confronted with the situation and trends in TT at key centres of the global network of R&D activities. "Inspiration trips" to these centres should also be attended by politicians and top civil servants, so as to enable and facilitate effective cooperation on solving several local problems.

The following needs and issues were also remarked on (without detailed specification for a desired tool):

- Assistance in finding and remunerating top experts from the business sector to become involved in research institution projects for a limited period of time (few months or a year at most).
- Absence of larger premises to accommodate the joint activities individual teams from one institution ("all under one roof"). The fact that individual teams are scattered all over town renders internal cooperation ineffective.
- Financing selected (regional excellence-based) interdisciplinary projects that do not fit into current projects (in terms of content, not quality).

» V. CONCLUSIONS AND RECOMMENDATIONS

The benefits from research activities for the development of society come in a great variety of forms. With respect to the increasing importance of (new) knowledge and very highly qualified people for the ability of the state and its regions to succeed in a globally competitive environment, such issues now find themselves top of the agenda of (not only) the makers and executors of development policy. Practically at every level, from the international (see the Lisbon agenda of the EU) all the way down to regional/local, all kinds of tools are being offered to support research, technology transfer, company innovations, etc. The South Moravian Region is no exception; in fact, in terms of supporting the development of a knowledge economy development, it is the Czech leader.

As part of the regular update of the Regional Innovation Strategy of the South Moravian Region, the region collaborated with the Berman Group to carry out a field survey among the region's public-sphere science and research teams/institutions. **The main goal of the survey was to acquire a deeper, primarily qualitative knowledge of conditions of, and barriers to, (i) the development of research activities conducted by public science and research institutions in the region and (ii) the transfer of research outputs into the business sector**. Continuity of first class quality in research is a fundamental condition for the benefits that transform society, and yet continuous quality of research alone does not automatically guarantee such benefits. The overall benefits of research for the economic and social development of a society largely depend on the extent and nature of the process for transferring research outputs to the business sector (*i.e. into practice*). In other words, what is crucial is how research outputs are exploited for the development/growth (i) of the productivity of companies based in the region, (ii) of the competitiveness of local peoples on the (global) labour market and (iii) of the effectiveness of local self-government and the usefulness of local public services. Whilst highlighting the fact that the two processes of creating and practically exploiting knowledge are inseparable, we present a summary of the results of the field survey, in particular, of the barriers to developing research excellence and for barriers to technology transfer.

V. 01. Brno as a centre of research excellence?

Participating researchers claimed that **the basic precondition for developing applied research and TT development is top-quality basic research**. However, the word "quality" is rather a vague term in this regard. High quality at a national level does not necessarily mean high quality in global terms. In a context of global competition, **the reference level used shall be that of global excellence**. In no way can we expect that most local teams are able to achieve global excellence levels. Setting such a goal might well end up being counterproductive. Wanting to achieve global excellence, however, should be the logical default position of all teams, especially in those fields of science that form the backbone of the region's research community.

Due to the breadth of topics in the field research, we were unable to assess accurately the level of excellence in participating teams (the distance from "global excellence"). Having processed the data collected we can state, however, **that the key specialisation of the research community in the South Moravian Region is evidently molecular biology and its related fields** (structural biology, biophysics, genetics, etc.) **as well as fields exploiting recently conceived knowledge** (protein engineering, bioinformatics, oncology, neurology, cardiology, etc.). Concentrated in this interwoven network of research activities is a critical mass of resources and outputs (HR, financial, knowledge-based, infrastructure, etc.) that are necessary for developing research towards a maintained state of global excellence. In these specialisations, at least as far as publication of research outputs are concerned, some teams are just a few steps away from global excellence. Based on an evaluation of mutual relationships and partnerships, we can assume that **teams which are part of this research network (i) are engaged in close cooperation resulting in strong transfer of knowledge between basic and applied research within the territory of SMR, or Brno, for that matter; (ii) affect the research agenda of many teams outside the field of biology and medicine; and (iii) assume roles as initiators of research in various new (usually interdisciplinary) disciplines with notable potential for practical exploitation** (for more detailed information, see chapter 3.6). **Basic research in molecular biology and its related branches of science represents a key source of new knowledge within the framework of the regional innovation system of the South Moravian Region. It serves as a significant stimulus in the development of applied research in biology and elsewhere. Hence, it creates (albeit through intermediaries) favourable conditions for the development of innovative entrepreneurship in the region across several business sectors.**

Very high quality was also assessed in several other fields. However, with respect to the critical size of capacity in SMR, the intensity of local-level cooperation and the initiation of new (interdisciplinary) research topics , the quality level of research activities in these fields does not attain the level of quality of the key network of research activities described in the previous paragraph. These fields include especially **materials research**, where notable success was achieved in both basic and applied research. Materials research is an activity conducted at numerous institutions, including a dedicated department of the Academy of Sciences of the Czech Republic. Of equal importance to the South Moravian research community is a related branch of science, **research in instrumentation**. Evidence of quality is manifest in the interest of global leaders (Siemens, Philips, GE, etc.) and in international patents, etc. The potential for developing excellent applied research is further represented by the presence of strong research teams focusing on applications in the fields of **mechanical engineering, electrical engineering and IT**.

With respect to the need for the selective allocation of resources and assistance tools, and considering also the need for setting the mix of assistance tools to suit the needs of various types of R&D institutions, **we recommend that an audit of R&D institutions from the South Moravian Region follows after this field survey, so as to (i) identify the qualitative status of teams in leading R&D specialisations, in comparison with global excellence centres; and to (ii) draw up a detailed "technology map" of the research community in the region**. This map shall provide a detailed overview of individual research topics in which local research teams are at least in the "broader" global excellence group. It shall also depict the mutual links between these topics and the respective teams, and it shall identify the main opportunities to achieve global excellence, especially in interdisciplinary topics. Based on the information collected during the survey, we can assume that to catch up with the global leaders in well-established branches of science is virtually impossible. However, **as new research topics are developed which require an interdisciplinary approach and unique combination of knowledge, new opportunities similarly emerge. It may be much easier to achieve global excellence in these new challenges**. With respect to the aforesaid, we should point out the existence of developing interdisciplinary relationships among the aforementioned specialisations of the research community in the South Moravian Region. These relations are producing unique technologies of global importance (see Chapter 3.6). There are particular examples which prove that global excellence is achievable in the South Moravian research community. The challenge for setting the support system is to generate as many cases of the above as possible, and to make sure they play positive roles in the economic development of the region. According to the authors of this report, the key condition for the strategic setting and targeting of assistance tools is the aforementioned audit of R&D institutions.

What are the main barriers to pushing the level of research activities towards achievable levels of excellence? Practically all of them are related (directly, or indirectly) to the people involved in research or to students about to become researchers. Below are the main barriers concerning students, or the process of educating young people intending to work in the most demanding (knowledge-wise) positions within the institutional sector:

- **The system of doctoral study programmes in the Czech Republic produces graduates whose average quality lags far behind their actual potential** (for causes, see chapter 3.7). **The fact that the process of educating PhD. students does not exploit their potential to the full extent inevitably affects the overall potential of the region with respect to achieving global excellence in both basic and applied research.**

- **The low level of interest in technical and natural sciences among students of secondary schools in the context of recent demographic changes, due to which the numbers of students enrolling at college/university is going to decrease over the next decade, will strongly affect the quantity of talented young people needed to replenish (not to mention further develop) the human resources in science and research (to name just a few examples)**.

- **The idea of an academic career does not seem especially alluring to young people ("too much work for almost no money"). Plus, the objective conditions offered to young researchers in the academic sector (salaries, process efficiency within academic institutions, flexibility in decision-making, opportunities to build one's own team, etc.) represent key negative aspects that discourage young people from choosing an academic career or even PhD. studies, as they contemplate their future employment.**

The combined result of the aforementioned barriers is a significantly smaller pool of new talent (compared with countries having a comparable number of inhabitants). Moreover, it can be assumed that the average level of talent and/or personal qualities for conducting top-class research is lower. If these barriers are not effectively dealt with, the efforts of the South Moravian Region (or the Czech Republic in general) to achieve excellence in research can be likened to a motorcycle race where motorbikes of several classes are competing simultaneously; while the a weaker 125cc bikes start way back on the grid, the best racing teams with the 750cc bikes are busy recruiting the best riders.

Leading research centres are usually characterised by a relatively high number of foreign researchers and PhD. students. The **long-term employment of foreign researchers in SMR is a rarity, however. The case of PhD. students is different, although most of these students are not nationals of countries with highly developed market economies.** While these PhD. students do represent a significant opportunity, their presence by no means suggests that the Czech Republic is an "attractive" country (the same applies to the South Moravian Region) as a place for receiving a first class doctoral education and/or where one can start one's academic career.

There are several reasons why foreign researchers of all ability levels find the Czech Republic less attractive in terms of long-term stays. One of the main reasons is a **salary that does not reflect the real labour market situation with respect to highly qualified experts**. Although a lot interviewed researchers raised this issue, many respondents also pointed out that **salaries are not the main decisive factor defining the attractiveness of specific research teams in terms of competition within the global labour market. Researchers, especially foreign researchers, give priority to attractive and interesting jobs, good facilities and the international reputation/image of the research team and institution itself**. Most respondents agree that foreign researchers represent a potential key resource for improving the quality of personnel in the local teams with whom they cooperate. However, increasing the internationalisation of R&D teams in the South Moravian Region to any significant extent represents a real challenge. It requires enormous effort, substantial resources and a comprehensive mix of activities and tools from the various elements of the Triple Helix, be it image-building for individual teams and the city as a research venue, the provision and allocation of financial resources for foreign researchers, or top-quality assistance services offered to foreigners and their families.

As far as experienced researchers are concerned, experts who have learned how to function under present conditions and who have been able to obtain the resources they need the biggest barriers to research development are as follows:

- **The very high ratio of "unproductive" activities that have to be carried out by team leaders. These activities typically take up one-third or even one-half of their working hours**. These activities consist mostly in paperwork related to teaching activities or to preparing applications and managing individual projects, as well as other activities in the capacity of positions of responsibility within the researcher's university or other institutions. Although the central bodies of institutions offer internal-level support services, these services can usually be summarised by the tart advice "here is the information you need, now go and get on with it by yourself". However, team leaders need someone to shoulder this burden for them, and to do it accurately as per instruction and at the required quality. The above scenario has only one result: **team leaders are under constant pressure for time and they have almost no strength for research or the conceptual development of their team and TT activities. This is a key barrier to development as it affects mostly the leaders of research teams**. The significance and extent of the problem is illustrated by the fact that irrespective of the main focus of a team (BR/R) we noticed a **very strong demand for a top-quality grant office/regional system that can offer a mix of first-rate tailor-made services,** to complement the already established internal services at the respective research institution.

- **Salaries for highly qualified experts are completely divorced from the real situation on the labour market**. Although motivated and hardworking researchers may have above-average salaries even under present conditions, the current system of remuneration is nevertheless a significant barrier to developing research excellence. Very low index-related wages can be, to large extent, correlated with poor time efficiency. They force researchers to "scrabble around" for money from grant systems; even though they might often be minor grants where the ratio of costs incurred with respect to submitting applications with the subsidies actually granted is very high. Similarly, many respondents have to provide an extensive range of services (formal and informal) which may have nothing in common with their research activities, but whose only purpose is to make money and ensure finance for retaining key employees, who would otherwise leave to find jobs elsewhere. In other words, **under the current system researchers are expected to work very hard (top-quality research, teaching, etc.) for extremely little money, while a 'blind eye' is turned to secondary income streams which bring in more money than their official salaries. The main consequence of this scenario is that the researcher spends fewer hours on research activities compared with the average foreign researcher, whose base salary reflects much more accurately the demand on the labour market for highly qualified experts.**

- **Instability of the financing system**. Strategic planning activities are hampered by current changes in the financing system and by the uncertainty about the period following termination of the Operational Programme Research and Development for Innovations. In light of the gradual winding up of the national system of research plans and centres, many respondents fear they will no longer be able to maintain established research teams. The consequences of breaking up an established team are fatal with respect to research quality and further development.

Is it even possible to remove these barriers impeding progress towards research excellence at the regional level? Even though many of the aforementioned problems apply all across the Czech Republic and even though the most effective solutions are generally introduced by central government, we think that there is still plenty of room for numerous activities at the regional level. Some of them are already in place. They should be examined to see whether they need extending, or how they might be better adjusted. Based on findings from this field survey (as analysed here in the report), we recommend the following:

- **Further implementation of the SOMOPRO programme is advisable**. If possible, more money should be allocated for this programme, **provided, however, that only truly top-quality researchers are re-integrated/recruited**. Because "Quality" is a vague term in this regard, particular attention should be paid to the **verification/evaluation of the role of researchers receiving support**, especially with respect to benefits for the team in which they work. The data collected is particularly important for taking decisions on the overall amount of resources allocated to this programme, or to any eventual change in the conditions under which support is granted. Stress should be placed on a reduction of paperwork for applicants and beneficiaries. The necessity to carry out requested activities, provide confirmations, etc. on their part should be examined and reduced on a continuous basis.

- **The Somopro programme model (in the case of reintegration) should be applied to researchers from EU countries as well**. There are many expats in EU countries (especially UK, Germany, France or the Netherlands) who work in leading research institutions. With respect to the aforesaid **it is not necessary to focus on expats from the South Moravian Region only**. Numerous researchers stated during the survey that they were interested in implementing the Somopro model with respect to these researchers. In most cases, the plan was to make them key team leaders at their respective research institutions.

- **It is necessary to keep developing the system of support services offered to highly qualified foreigners and their families who stay in the region for longer periods.** As far as foreign researchers are concerned, this system of services should be **coordinated with other activities aimed at making the South Moravian Region (and Brno) more attractive to foreign researchers on extended stays in the region**. As a result of close cooperation with R&D institutions that can afford to host these researchers, we propose a whole range of suggestions for "packages" of tailor-made services, in order to best exploit the synergies of assistance tools and to minimise weaknesses related to conditions extended by the hosting insitution. Similarly to that described above,

numerous proposals might well be generated by evaluating the effects of assistance tools already in place. The process itself could generate some additional resources, should any activities prove inexpedient. An important contribution to the accessibility of the region is the introduction of the HeliTaxi from Vienna to Brno, in order to assist companies and universities in their efforts to invite VIP visits to the region, especially visitors who need to return to Vienna to catch their flight back home in the evening. Consequently, this then affects the travel comfort of top researchers staying in Brno for a longer period.

- **It is essential to continue supporting talented PhD. students with additional scholarships and to seek other opportunities for increasing the resources allocated to this tool.** This tool is very well received. We recommend that an evaluation tool be introduced in the mid- to long-term . Its main purpose must be to collect information on the actual progress of the research activities of PhD. student beneficiaries and their role in the team/institution. Based on this data the tool may continue to be improved.

  We see an opportunity in actively initiating a system under which companies based in the South Moravian Region (or even companies from other regions, provided they cooperate with SMR-based firms) would contribute into a discretionary fund. The aim would be to combine both private and public resources in funds for additional scholarships. Early stages of the system may also include an option to introduce **a mechanism for the shared payment of an additional scholarship to students selected by companies** contributing to the system. Such a tool could be beneficial for, inter alia, incubated firms at an early stage of their existence looking for future key employees in close cooperation with a selected research institutions.

- **It is advisable to set up an effective system of assistance tools that provides a flexible mix of tailor-made services (Grant office).** The purpose of this tool is to ease the paperwork burden experienced by researchers and thereby free them to focus on real research or take over management tasks, so that they are not having to deal with bureaucracy requested by third-party entities (but with zero benefit for the team). It is necessary to point out that these services **do not involve setting up a new institution, rather a new set of services would be introduced to be carried out and provided within universities and in cooperation with already established intermediators**. The interviews showed a demand for organising the system of services on at least two levels:

  » Joint university-level (or research-institution level) grant office. This entity has already more or less been set up, and, though it needs improvement, is now running.

  » Project managers who are "implanted" into research teams as team members. They liaise closely and ensure regular communication with the grant office. However, they work for and with the research team.

- **The role of established intermediary institutions** would consist especially in the following:

  » Offering top experts who would represent so-called last-resort help/advice in cases when employees of a university grant office are unable to provide this top-quality service themselves.

  » The recruitment, coaching and continuous training/education of specialists according to the particular needs of local R&D teams. As far as coaching is concerned, these services may consist in temporary (one-year) management and joint agenda management by the top exert (coach) who will fulfil the role of last-resort mentor.

  » The coordination/facilitation of (i) the development of a system and regular quality evaluations of the services provided combined with the issuance of recommendations for specific improvement measures, (ii) cooperation among individual parts of the system within SMR.

  » Searching for financial resources to start-up and operate the system. In future, individual parts of the system should be Abe to generate their own resources to cover running costs.

- **It is essential to prepare and implement a joint marketing strategy to promote Brno and the South Moravian Region as venues for first class science, research and technology**. This will be a participative preparation process, the main aspects to include establishing a consensus on target groups, messages and their forms, budgeting and planning for multi-year implementation.

- **The implementation of a new tool referred to as "young researchers start-up grants" should be considered.** The tool would consist of a limited number (approx. five) multi-year research grants (approx. five to seven years, in the amount of CZK 1.5 million to CZK 2 million per year) for top young researchers from all over the world. Specialisations would be highly selective, depending on the outcomes of the R&D audit recommended above. Eligible research teams would include institutions that are close to achieving global excellence and are therefore able to attract future leaders in world-class research. This tool and the related selection process would be managed by the leaders of top Brno-based teams as well as other renowned experts. **This tool should exploit the synergy between the Somopro programme (the possibility to recruit a skilled foreign researcher), the PhD. scholarship programme and the overall programme for promoting the city of Brno as a research excellence centre**. **Potential synergies with the Somopro – Enterprise programme might also be identified (see below).**

V. 02. What problems and opportunities are there in developing the TT system?

The transferral of research outputs into practice is affected by numerous factors (see chapter 3). Based on the source for initiating TT, we can identify two categories of factors: demand – (*pull*), where interest in exploiting research outputs is manifest mainly by companies; and supply (*push*), where interest in practical exploitation is initiated by the authors of the respective research outputs, or other persons closely involved. **As far as demand is concerned, this field survey showed significantly limited interest from companies in cooperation on research and development**. Demand for cooperation is dominated by an interest in "other services" that (albeit demanding in terms of knowledge) have often nothing in common with research or development. Such services include expert consulting, taking measurements, design calculations, materials testing, etc. The limited extent of the demand for cooperation in research and development among companies results from a combination of several causes listed below:

- The main drivers of the Czech economy are the local branches/subsidiaries of large foreign or multinational companies. Their own research and development activities are almost exclusively located abroad, usually in their country of origin, where in-house research and development capacities may cooperate with established research teams that are often global leaders, whose size is also usually much bigger than that of most SMR-based teams. This situation is reflected in the conviction voiced by many researchers that any transfer of largest amount of R&D activities by an MNC to SMR is highly unlikely.

- Where an MNC does locate some part of its research and development activities in the Czech Republic, they mostly consist (save for exceptions like ABB or FEI in SMR) in the final-stage activities of the research and development value chain. For the most part, these activities consist in specific tasks that do not require any substantial (if any) research. The real research has already been completed abroad and is internalised within the task for local "final-stage" research and development activities.

  Consequently, there is very limited demand for cooperation in research and development among companies that form a direst part of multinational companies. If they show any interest in cooperation with local research and development institutions, respondents say, they are interested only in the very best researchers, even on occasion trying to poach selected academics for their own organisations. Where these companies are interested in research and development, then thanks to the position given to local companies by MNC, i.e. at the very end of the research and development chain, such cooperation generally involves less complex topics. Plus, these needs on the part of MNC are infrequent and cannot be relied upon. Nevertheless, some rare cases of more intensive cooperation were reported. Participating researchers usually stated that **the main reason why MNCs seek partners in cooperation is to reduce costs and/or the need to have the desired form of R&D activities close to other activities, especially manufacturing**. Cooperation established with a MNC due to the unique nature of research outputs or know-how is very rare.

- Numerous companies which are not a direct part of MNC structures are still very much dependent on the local branches or subsidiaries of MNCs. MNC for represent the main customer for such companies. During the period of enormous foreign direct investment and the resulting strong economic growth in the global economy (until 2007), many companies were sought out by customers and, consequently, many of them enjoyed a demand overhang. They did not even have to actively seek their customers. Under these conditions, (i) the market did not force these companies to develop their own competencies in relation to the active search for new markets and opportunities, trade, strategic planning, etc. and (ii) the companies usually did not need to cooperate much in R&D with the academic sector, as this was not required in the type of transactions entered into with MNCs (see e.g. Berman Group 2010, 2009, 2008). **The job-order manufacture of products with relatively low added value, where the product concept is not developed by the manufacturer, does now allow much space for the development of a knowledge economy. However, numerous Czech companies (and companies in other former Eastern Bloc countries) operate based on this principle. Logically, this results in low demand for innovations and is mirrored in the scant interest shown in R&D cooperation with universities.**

The aforementioned causes of low demand for innovation are reflected both the scope and content of demand for cooperation from companies with R&D institutions in SMR. Although the extent of demand for cooperation among companies might in itself be sufficient, its content is dominated by the need for various services, but not by research or development as such (see chapter 3.4). This is why a **significant barrier to TT development is the disparity between the supply of and demand for cooperation.** Even though researchers are able to substantially boost their low incomes by providing, to a limited extent, these services, the fact nonetheless remains that researchers from public research and development institutions specialise mostly in research, not in services.

Based on the survey outputs, we were able to identify the following barriers to TT development on the part of research institutions and individual researchers and their teams (the supply side):

- **Insufficient preparedness of TT-related internal procedures and assistance tools** at universities and the research institutes of the Academy of Sciences of the Czech Republic. Although the related procedures and internal services may be developed formally, the vast majority of respondents claimed that they are currently inconsistent with their needs in terms of function or quality. With respect to this issue, most respondents warned against the **insufficient or improper motivation of some persons involved in the management of universities. Consequently, such staff hamper implementation of the desired internal changes**. A related issue in this regard consists of **the need for professional managers who would work full-time and be able to put their previous experience to good use resolving economic and organisational issues at the research institution** (for more details, see chapter 3.4).

- **Significant lack of experienced experts for managing and implementing support activities in the field of TT**. Heads of institutions and larger teams who have extensive experience improving the conditions for TT at their respective institutions agree that the labour market offers almost no suitable candidates trustworthy enough to be able to manage operations and develop the respondent's research institution.

- **The relatively low number of people with the right entrepreneurial spirit**. The commercial exploitation of research outputs is no longer just "pulled" by company demand. The activities of research output authors themselves are also vital, provided the outputs have some commercial potential. In this sense, barriers to TT have come about due to the departures in waves of commercially minded people (see chapter 3.2), which has in turn hampered the overall potential for developing the so-called third role of academic institutions in SMR.

Having considered the aforementioned barriers to TT in SMR, and other findings from the field survey, we recommend the following:

- **to consider initiating and facilitating an effective discussion** among senior representatives of (i) regional and local self-government, (ii) local universities and other research institutions and (iii) leading local businesses or their representatives (e.g. the Chamber of Commerce). **The purpose of this discussion would be to define specific steps to speed up the implementation of effective procedures and TT assistance services in academic institutions**. In our opinion, unless the issue of the preparedness of internal procedures and tools is resolved, any benefits from the remaining TT support tools will be compromised. This is why it is necessary to invite senior political representatives of the region and the City of Brno to the discussion, as these two bodies are the two main authorities financing activities that support the development of a knowledge economy in SMR.

- **based on the progress and outcomes of the aforementioned discussion, to prepare tools for the current edition of RIS SMR that would best facilitate the implementation of internal changes at local R&D institutions.** The primary task of these tools and activities would be to:

  - » **ensure or improve availability of the best possible experts who have previous experience with the management and implementation of TT-related support activities** (e.g. support cooperation with foreign experts, provide coaching services from top foreign experts to local specialists, actively recruit suitable candidates at local universities and assist with their inclusion into the system of HR development for TT, and other sophisticated services within the infrastructure that support the development of an innovation system for SMR, etc.)

  - » **improve knowledge and inspiration in the managers of research institutions and their respective departments in the field of (i) TT assistance tools and (ii) the conditions and issues that represent the main agenda of commercial sector managers** (e.g. trade mission or inspirational trips to global R&D centres, special education packages for researchers, discussion groups, workshops, etc.)

  - » **facilitate coordination in the development of internal assistance tools at individual R&D institutions, so as to allow maximum exploitation of potential synergies, including providing for the efficient use of support resources.** With respect to the above, we think it is essential to initiate discussion **on which types of activities and TT support tools should be provided by institutions themselves, and which types of activities can be offered with a higher degree of quality and more effectively at the regional level**. This discussion may be a part of, or a follow-up debate to, the discussion of specific steps towards accelerating internal changes in academic institutions (see above).

  - » **facilitate the acquisition of public resources for financing the necessary changes to internal procedures and assistance tools at local academic institutions** (especially consultancy on the preparation of projects for OP RDI and any further OPs during the following programming period(s).

- **to continue with a mix of activities and tools that help overcome the low demand for innovation and minimise the gap between the divergent nature of supply and demand in the cooperation between local R&D institutions and companies.** With respect to this issue, we recommend the following:

» **applying the innovation voucher model to foreign companies.** This step must be supported by sufficient PR activities (in relation to the overall marketing strategy of the South Moravian Region as a venue for top-quality R&D) and by increasing the per-voucher value for foreign companies, so that they actually become relevant to companies from Germany, Austria and other countries with much higher price levels. If sufficient resources for this step are not available, then a worthwhile alternative is expansion into Slovakia, Poland and Hungary. We believe this to be opportune, as many participating researchers are frequently approached by companies from these countries.

» **considering the need for, form of, and opportunities for implementing a regional "proof of concept" fund**. This tool should not compete against TACR. Respondents, however, illustrated an important scenario not covered by TACR. This occurs when researchers have some outputs whose potential for commercialisation they are aware of, but who need to further develop these outputs with respect to this potential. Unfortunately they lack a business sector partner who would be interested in the outputs at this stage or provide funding for the development towards commercialisation. It is clear that this situation concerns R&D activities which have produced very uncertain results and that the necessary conditions and selection procedures cannot be perfectly defined right at the very beginning. With respect to this issue, we recommend that this fund be managed in future not as subsidy fund, but as an open society fund, , i.e. a smaller number of successful projects would cover (partly, or in full) costs incurred by unsuccessful projects. As the estimated ROI is (conservatively) at the earliest 10 years from the time the fund is founded, it is essential to secure adequate resources at the beginning. This would mean that at the beginning, at least, the fund must be operated as a subsidy fund. The overall success rate of funded projects should be further improved using other related tools (e.g. incubation programme entry, if necessary) and by employing sophisticated monitoring, based on which further resources would be allocated as promised in future.

» **considering the opportunity for supporting the development of businesspersons (independent technology scouts) who would be in charge of the active marketing and representation of local R&D institutions.** This form of activity has not yet evolved into a commercial enterprise in the Czech Republic, save for a few exceptions. We see an opportunity in setting up a system where institutions interested in representation and/or active marketing in terms of commercialising research output will be granted assistance in the search for and (partial) remuneration of suitable candidates. Subject to agreement with the respective research institution, these businesspersons would also be provided with offices, e.g. in incubators, which would make it easier for them to establish contacts with a specific group of technology companies. As the businessperson built up a track record of success, their own revenues would increase and the need for a salary from the R&D institution or intermediary institutions ("former employers") would decrease. These businesspersons would then become independent and provide markets with contacts and information on the commercial potential of local academic institutions. **Allowing for certain simplification, we might describe this scenario as a special incubation programme for businesspersons providing independent services as technology scouts.**

Final Report

Field research of public R&D teams
in the South Moravian Region (2010)

centrope_tt
TECHNOLOGY TRANSFER COMMUNITY
POWERED & CONNECTED BY CENTROPE

Centrope_tt project

The objective of the **Centrope_tt project** is to support cross-border technology transfer through the initiation of international cooperation between firms and R&D institutions in the Centrope region. Fifteen partners from Austria, Hungary, Slovakia and the Czech Republic work on the project. Nearly 2 million euro (financed by Central Europe programme) is allocated for the activities related to the project implementation (2009–2012).

The project covers the following areas:

- Mapping of R&D institutions in the Centrope region
- Training in technology transfer for TT experts
- Implementation of international instrument aimed at support of innovative SMEs – the so-called „international innovation vouchers'
  (The aim is to support R&D collaboration of companies with academic institutions)
- Initiation and support of technology transfer community in Centrope region

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