Conceptual Approaches to the Support of Industrial Research and Development in Slovenia

Workshop Proceedings

Ljubljana
November 10, 1993

edited by
M. Komac, J. Krawczynski
Conceptual Approaches to the Support of Industrial Research and Development in Slovenia

Final Workshop Proceedings

Ljubljana
November 10, 1993

edited by
Milos Komac and Johanna Krawczynski

German-Slovenian-Cooperation in Scientific Research and Technological Development
Acknowledgement

The text of contribution 8, here entitled "Cooperation with Eastern Europe" by Michael Széplábi, is a chapter in the book:

SCIENCE AND TECHNOLOGY POLICY IN THE SERVICE OF A GREATER EUROPE
Proceedings of the International Conference on Scientific Policy
in the Service of a Greater Europe,
Schloß Cecilienhof, Potsdam, 28 – 29 January 1993
Campus Verlag, Frankfurt/New York 1994

We thank CAMPUS Verlag, Frankfurt/New York, for its kind permission to reprint this contribution, there entitled "Germany", (Pages 153 – 157), in the present overview.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>PREFACE</td>
</tr>
<tr>
<td>iii</td>
<td>PROGRAMME OF THE FINAL WORKSHOP</td>
</tr>
<tr>
<td>v</td>
<td>CONCEPTUAL APPROACHES TO THE SUPPORT OF INDUSTRIAL RESEARCH AND DEVELOPMENT IN SLOVENIA</td>
</tr>
<tr>
<td>1</td>
<td>NATIONAL RESEARCH PROGRAMME GUIDELINES FOR 1994</td>
</tr>
<tr>
<td>12</td>
<td>TECHNOLOGY DEMAND OF THE INDUSTRY AND TECHNOLOGY TRANSFER IN SLOVENIA</td>
</tr>
<tr>
<td>29</td>
<td>CO-REPORT TO THE THEME: THE DEMAND FOR NEW TECHNOLOGY AND TECHNOLOGY TRANSFER (IN SLOVENIA)</td>
</tr>
<tr>
<td>43</td>
<td>INTEGRATED TECHNOLOGY TRANSFER - MODELS AND INSTRUMENTS FOR SLOVENIA</td>
</tr>
<tr>
<td>57</td>
<td>SLOVENIAN COMMENTS</td>
</tr>
<tr>
<td>71</td>
<td>ORGANISATION OF R &amp; D POLICY IN HUNGARY</td>
</tr>
</tbody>
</table>

   Rado Bohinc, Minister of Science and Technology of the Republic of Slovenia

2. Technology Demand of the Industry and Technology Transfer in Slovenia
   Günter H. Walter, Uwe Gundrum, Frieder Meyer-Krahmer
   Fraunhofer Institute for Systems and Innovation Research (FhG/ISI), Karlsruhe

3. Co-Report to the Theme: The Demand for New Technology and Technology Transfer (in Slovenia)
   Igor Pompe, Iskra IEZE Holding d.d.o.

4. Integrated Technology Transfer - Models and Instruments for Slovenia
   Frieder Meyer-Krahmer, Günter H. Walter, Uwe Gundrum,
   FhG/ISI, Karlsruhe

5. Slovenian Comments
   Stane Pejovnik, National Institute of Chemistry

6. Organisation of R & D Policy in Hungary
   E. Pungor, OMFB / National Committee for Technological Development, Budapest
7. Revitalisation of Enterprises, The Role of R & D
   Rado Faleskini, Institute for Economic Research and
   Ministry of Economic Affairs
   of the Republic of Slovenia

8. Cooperation with Eastern Europe
   (Text: Science and Technology Policy in the Service of a
   Greater Europe / G e r m a n y)
   Michael Széplábi, Federal Ministry for Research and
   Technology of the Federal Republic of Germany

9. Slovenia’s R & D, Competitiveness and Development
   Lojze Sočan, Mission of the Republic of Slovenia
   to the European Union, Brussels

10. Résumé
    Milos Komac, Ministry of Science and Technology
    of the Republic of Slovenia
Slovenia today plays a pivotal role in the overall-process of self-assertion, profile development and regional incorporation of new states into the wider Central- and East European context. After its independence, the country quickly has headed for an intensification of our long-standing contacts in the field of bilateral scientific and technological project cooperation. It has, moreover, in a very early stage requested support in the actual situation of transition with regard to the further development and adaptation of R & D structures and processes to the new economic and especially industrial needs.

In the frame of the policy of the Federal Government to contribute to the stabilization of democracy and the establishment of social market economy systems in the countries of Central and Eastern Europe, the Fraunhofer Institute for System Techniques and Innovation Research (FhG/ISI) has - together with the International Bureau of Research Centre Jülich (KFA-Jülich) - organised two rounds of expert talks in Slovenia in June and September 1993. Departing from the findings gathered at those occasions, a number of recommendations for the promotion of industry-related R & D have been presented in Ljubljana on 10th November 1993.

As a consequence, a two-fold strategy has been put into operation: First, the Ministry of Science and Technology of Slovenia has assumed a pilot function through its own involvement to formulate and execute a number of decisions, so with regard to the establishment of the Technology Fund and of a number of technology transfer centers, and to the improvement of the transparency of R & D performance particularly for small and medium enterprises. Second, in those fields where concrete needs for additional support are felt, a number of special workshops are planned together with the German side. So far, the following subjects have been dealt with: Technology Transfer (8th and 9th December 1993) and Information Technology (24th and 25th February 1994). In the course of 1994, a number of additional workshops are planned to equally take place in Ljubljana, so:
- innovation management (19th and 20th May 1994)
- innovation financing (29th and 30th September 1994)
- innovation-oriented regional policy (8th and 9th November 1994, in Maribor)
- biotechnology, pharmacy and biochemistry (8th and 9th December 1994).

Publications covering the workshops held so far are available from the editors.
We hope that those publications and the present Proceedings of the Presentation of 10th November 1993 will encourage further steps on the way of the incrementally advancing transformation process, also in other countries of Central and Eastern Europe.

In this wider context, it was an impressive and promising experience, to meet guests from six other countries of Central and Eastern Europe at that presentation at the invitation of the Slovenian Government.

The recovery of the highly damaged links on cooperation and concertation among the countries of this region certainly will provide a convincing momentum for joining the ongoing European integration process.
CONCEPTUAL APPROACHES TO THE SUPPORT OF INDUSTRIAL RESEARCH AND DEVELOPMENT IN SLOVENIA

Programme of the Final Workshop on 10.11.1993

Date: November 10, 1993
Location: Business-Information Centre, Verovškova 57, Ljubljana

9.00 h Opening speech by the Slovenian Minister of Research and Technology
Prof. Dr. Rado Bohinc

9.15 h Address given by Ambassador of Germany
Dr. Günther Seibert

9.20 h Technology demand of the industry and technology transfer in Slovenia
Dr. Günther H. Walter, Fraunhofer Institute for Systems and Innovation Research, Karlsruhe, Germany

10.00 h Slovenian Comments
Igor Pompe, ISKRA-IEZE Holding, Ljubljana

10.15 h Discussion

10.35 h Coffee break

10.55 h Integrated technology transfer - models and instruments for Slovenia
Dr. Frieder Meyer-Krahmer, Director of the Fraunhofer Institute for Systems and Innovation Research, Karlsruhe, Germany

11.35 h Slovenian Comments
Dr. Stane Pejovnik, National Institute of Chemistry, Ljubljana

11.50 h Discussion

12.10 h Organisation of R&D policy in Hungary
Prof. Dr. E. Pungor, OMFB (National Committee for Technological Development), Budapest

12.40 h Lunch
14.30 h  Public Support of industrial innovations in Slovenia  
  E. Vrenko, Ministry of Science and Technology, Slovenia

14.45 h  Revitalisation of Slovenian enterprises: The role of R&D and Innovation  
  Rado Faleskini, Ministry of Economic Affairs, Slovenia

15.00 h  Discussion

15.15 h  Coffee break

15.30 h  Cooperation and support by the German Ministry for Research and Technology - experience and perspective  
  Dr. Michael Széplábi, Federal Ministry for Research and Technology, Germany

16.00 h  Discussion

16.35 h  Supporting mechanisms of scientific and technological development in countries of the European Commission and possible implications for Slovenia  
  Dr. L. Sočan, Permanent Mission of the Republic of Slovenia, Bruxelles

16.55 h  Resume  
  Dr. Miloš Komac, Ministry of Science and Technology, Slovenia

17.10 h  End
I. Overview

In 1993 the Ministry financed 730 projects within the framework of the annual scientific research programme, to a total value of SIT 3.374 billion; it also cofinanced 476 projects as part of the applied research programme, to a total value of SIT 1.54 billion and financed the young researchers programme that saw on average 900 young researchers per month supported, amounting to SIT 2.07 billion, as well as supporting numerous other programmes in the fields of research infrastructure and international cooperation.

These programmes encompass, mostly in the form of partial employment, over 6,000 researchers, more than 600 groups and over 200 institutions, including companies.

In 1993 it was estimated that the total employment of research capacities (irrespective of the source of assets for paying for work) was mainly oriented towards the following types of activities:

- basic research - 30% of capacity
- applied research - 20%
- technological development - 15%
- transfer of know-how - 15%
- expertises - 10%
- experimental production - 10%

The following figures show the share of research work financed from the budget of the Ministry of Science and Technology (MST) in 1993 by scientific disciplines:

- natural sciences - 23.5%
- engineering sciences - 41.4%
- agricultural sciences - 11.2%
- medical sciences - 9.1%
- social sciences - 7.0%
- humanities - 7.4% of all research funds
Comparison of the level and structure of investment in research activities in certain countries

<table>
<thead>
<tr>
<th>Country</th>
<th>% of NP</th>
<th>% private financing</th>
<th>% public financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>2.90</td>
<td>77</td>
<td>23</td>
</tr>
<tr>
<td>Germany</td>
<td>2.90</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>USA</td>
<td>2.90</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Sweden</td>
<td>2.80</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>UK</td>
<td>2.20</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2.20</td>
<td>53</td>
<td>47</td>
</tr>
<tr>
<td>Norway</td>
<td>1.90</td>
<td>47</td>
<td>53</td>
</tr>
<tr>
<td>Denmark</td>
<td>1.60</td>
<td>48</td>
<td>52</td>
</tr>
<tr>
<td>Ireland</td>
<td>0.80</td>
<td>51</td>
<td>49</td>
</tr>
<tr>
<td>Spain</td>
<td>0.70</td>
<td>47</td>
<td>53</td>
</tr>
<tr>
<td>Portugal</td>
<td>0.50</td>
<td>24</td>
<td>76</td>
</tr>
<tr>
<td>Greece</td>
<td>0.50</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Poland</td>
<td>0.10</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1.20</td>
<td>30</td>
<td>70</td>
</tr>
</tbody>
</table>

Source: RTD Systems Audit and Results, the CIRCA Group Europe, March 1993. GERD/GDP ratio. The figures for Slovenia are a statistically very rough estimate, particularly with respect to direct investment in the private sector.

II. Scientific and Technological Policy Goals in 1994

The main goal of the national research policy for 1994 is to increase the engagement of research capacities for the development needs of the economy, social infrastructure and the country and thereby contribute to economic growth and to stable development of the country.

In order to attain the main goal in the short term and at the same time to increase possibilities for research capacities so that they achieve the highest possible developmental effects in the coming short-term periods, in terms of what is required or as ordered by the subjects of the so-called social environment, the Ministry has set, within the framework of 1994 research policy, the following leading goals:

1. To increase the engagement of research groups with target-oriented applied research and applied services, which are ordered and financed by enterprises and
other users of know-how and which the state supports or cofinances in the interest of developing technology and the social infrastructure;

2. To increase the share of clients (enterprises and other users) in the financing of research by at least 20%, to introduce national programmes (environment, regional planning, transport, food, health, defence, critical technologies) and the introduction of new programmes to support the implementation of achievements in production and marketing;

3. To maintain strict criteria for an internationally comparable scientific quality of research group heads and members and the continuation of a systematic assessment of their capacities and professional value with international measures;

4. To preserve the achieved level of training new generations of experts qualified for research through greater support for the transfer of researchers into commercial and other user organisations, adapt the research and information infrastructure to the requirements of the operation and development of research capacities, increase the extent of international cooperation and the flow of know-how into Slovenia and establish partner relations with foreign institutes.

For this purpose a series of goals and development instruments for their achievement will be introduced in research policy, contained in four basic programme systems:

- in the field of research and development activities
- in the field of training scientific and technological personnel
- in the field of research and technological developmental infrastructure
- in the field of international scientific and technological cooperation

The fields of personnel training, research infrastructure and international cooperation are composite and supportive parts of the main activity - direct research and developmental (and university education) work.

III. Research and Development

In 1994 a policy will be implemented that differentiates - from the programme and procedural aspects - basic from applied research (target-oriented and generic research), and both from the developmental projects of technological and other development. The cofinancing of applied research by users of up to 25% will be introduced,
including those that have proceeded until now under a regime of complete subsidising of basic research.

Research activities on all three levels proceed within the framework of humanities, social science, medicine, agricultural engineering and natural sciences or national area programmes. For 1994 we announced 10 research programmes - in basic research, basic research in humanities, applied research in engineering and agriculture, applied research in social sciences, applied research in medicine, developmental projects in engineering and agriculture, developmental projects in the social sciences, developmental projects in the field of natural and cultural heritage and projects for individual inventors and postdoctoral research.

Furthermore, in cooperation with other ministries and commercial associations the Ministry will set out some eight to fourteen national area research programmes that will include linked projects from open tenders and projects with announced themes to be competed for in 1994.

Over 6,000 researchers, including some 1,000 young researchers, will participate in research activities in approximately 600 research groups in institutes, universities and development departments of companies and other organisations.

The distribution of research capacities by types of activity shall be affected by a conscious increase in the share of target, user-supported projects with the introduction of interdisciplinary target research programmes and new projects for promoting the introduction of achievements, especially prototypes, into production and marketing.

The allocation of funds for research programmes and individual areas of research will be influenced mainly by the following criteria: quality criteria, relevance criteria and the criteria of degree of engagement of a research group and its researchers.

On the basis of policy premisses and goals, the Ministry will coordinate these proposals for projects and programmes with the available funds.

Natural sciences will remain at this year's level, though cofinancing of engineering research by industry or through the newly founded Technological Development Fund of Slovenia will have to increase markedly.

1. We shall introduce target and generic applied research under an independent regime, with the cofinancing of interested users (companies), other organisations and, in the field of social science infrastructure, also other national bodies on the state and local level;
2. We shall introduce programmes for individual innovators and a programme for research in the field of cultural and natural heritage;

3. We shall introduce so-called national research programmes for the attainment of national goals in the areas of environment, regional planning, food, defence and elsewhere, in cooperation with other ministries;

4. We shall continue to establish more permanent and long-term connections between research groups/organisations and user organisations - and set up technology centres as the cores of applied research and transfer of know-how;

5. We shall continue to establish instrumental centres in order to make the best use of large equipment and to reduce maintenance costs;

6. We shall establish institutions for private financing of science and technology (foundations);

7. We shall introduce bank interest rate benefits for entrepreneurs for the transfer of development results into production and marketing;

8. We shall put into full operation the Slovenian Development and Technology Fund;

9. We shall continue to finance rectors' funds and the material costs of individual research work of university professors in the present amount, and increase the basic founding of the state research institutes up to 20 to 40% of the annual income.

In these measures we shall be leaning on the following principles or guidelines:

- making the criteria for social or commercial relevance of projects even more strict. This is mostly determined by the users, e.g., business sector, other organisations, other ministries and local community bodies;

- support for the operation and formation of mixed research or project groups from among researchers in academic institutions and the research departments of companies in Slovenia and to an increasing extent also from abroad;

- vitalisation of research fields that are relatively weak in terms of expertise but which are necessary long term and for science and socio-developmental support as a whole, with the aid of a young researcher policy, postdoctoral training abroad, location of research equipment, scholarships and cooperation with foreign partners;

- support for the flow of (particularly) qualified young researchers into user organisations;
- systematic promotion of the demand for research services through tax and customs relief instruments;
- intensified work in promotion of science and know-how in Slovenia and assistance to international presentations of Slovenian research potential and achievements;
- moving from foreign assistance to partnership in international cooperation;
- drawing up special national research programmes in cooperation with the relevant ministries and in the context of an increasingly well-defined government development strategy.

IV. Personnel training

The training of researchers or research and development professionals encompasses the young researcher programme, scholarships for advanced postdoctoral study abroad, postgraduate study, participation in scholarship funds and the programme to bring people, especially young people, into the field of science and technology.

In 1994 around 1,000 young researchers will be trained. Up to 250 will be newly accepted for training. The training programme is expected to prepare at least 250 young researchers - more than half doctors of science.

In this area we intend to implement policy through the following measures:

1. In 1994 the possibility will be introduced for financing young researchers directly through companies and other user organisations, so as to strengthen their collaboration with research groups in institutes and faculties;

Those research groups that have been more successful in recent years in training young researchers and in helping them find employment in user organisations shall be given greater opportunity to engage young researchers.

2. The Ministry will introduce partial and time-limited subsidising of payment for young researchers who take up employment in commercial companies. Likewise, the transfer of young researchers to companies or other user organisations will be enforced as a priority criterion for (co)financing of development projects within which such transfer of personnel will take place.

3. The average financing period for the training of a young researcher will be reduced from 6 to 5 years.
4. The year 1994 will see the introduction and extension of scholarships for young researchers in order to support the gradual normalisation of postgraduate study in Slovenia.

5. In conjunction with the Ministry of Education, we will prepare a plan for financing selected postgraduate programmes.

6. As a rule, the granting of scholarships will support short-term, advanced postgraduate level study, often abroad. The Ministry will increase its modest investment in the Dr Munda university scholarship fund and the Dr Trstenjak regional fund for postgraduate students. The Ministry will only in exceptions grant scholarships to undergraduate students - usually only supplementary funds - and only to the most capable individuals from the "movement for science to youth".

7. Increased support will be given to the programme to bring people into science and technology, especially to research camps for young people and similar projects, as well as to a systematic programme to inform the public, primarily the business public, of the capabilities and achievements of research community. A key role in this will be played by catalogues listing research and development experts and research organisations.

In its decisions on the allocation of funds for training young people in individual fields, the Ministry will take into consideration the principle of vitalisation of professional or even thematic fields and Slovenia's personnel requirements for development.

V. Research infrastructure

The research infrastructure will encompass a multitude of programme elements in the following programmes:

- a system of disseminating scientific information,
- research and infrastructure equipment,
- technology centres,
- construction of new facilities.

As part of the 1994 programme we will:

- significantly increase the acquisition of foreign professional literature, including CD-ROM and on-line enquiry - so-called strategic information;
- maintain the usual amount put towards cofinancing scientific seminars;
- step up support for the participation of foreign researchers in projects in Slovenia and for Slovenian researchers to spend short periods working abroad;
- support a greater number of Slovenian scientific monographs and reduce the number of cofinanced Slovenian professional and other journals, but increase the share of cofinancing so as to facilitate quality improvements in these publications and through an exchange of copies with foreign reviews assure a greater flow of foreign information into the Slovenian library system;
- extend and functionally strengthen the inter-library communication system and COBBIS reciprocal cataloguing in order to derive greater benefit from the existing sources of information in the Slovenian library system.

The research and infrastructure equipment programme will encompass:

- completion of the investment in a super computer;
- increasing the acquisition of other research equipment. The more advanced research equipment, usually also more expensive, will be set up in instrumental centres in order to increase the benefit derived from such equipment and reduce the costs of use and maintenance per unit of service. The cost of equipment under ECU 10,000 will be covered as part of the material costs of the project; more expensive equipment will be bought as an investment. In this area the Ministry will maintain the current practice of cofinancing with research organisations and their users so as to ensure a greater rationality in the purchase of research equipment;
- the continued cofinancing of large equipment such as the TRIGA reactor, and infrastructure such as collections, biocultures, computer centres, academic communication networks, and so on.

Some of the research and particularly the infrastructure equipment will serve research activities in education and for other purposes, so part of the costs will be covered by other relevant ministries by mutual agreement.

The Ministry will support the establishment or operation of up to 15 technology centres, through start-up funds and investments, as centres of know-how transfer from research institutes to users which, in line with their long-term interest in the acquisition of knowledge, will organise the centres together with research organisations and invest funds in them.

In the area of construction we plan to begin the first phase of construction of Ljubljana University Library, which will bring together parts of the present National University Library (NUK), Central Technical Library and others, along with final work on the Biological Centre in Ljubljana, and building residence halls for young researchers and guest professors at Ljubljana University.
VI. International scientific and technological cooperation

The Ministry will systematically introduce and support programmes of bilateral and multilateral cooperation within the framework of international scientific and technological cooperation, with the emphasis on the EU and its programme development schemes, within the Alps-Adriatic framework, with the USA and countries of the Far East and increase the extent of foreign technical assistance to Slovenia.

The Ministry will increase the use made of opportunities for professional training and other employment of our researchers abroad offered by foreign sources and increase the funds for paying Slovenian researchers abroad when their work is related to the programmes of vitalisation of individual research fields in Slovenia.

The new programme elements will be established by the joint US-Slovenian Fund for Research, based on a bilateral agreement.

VII. Office for Industrial Property

VIII. Office for Standardisation and Measurement

Both offices are increasing the extent of the routine work on their basic programmes as well as the number of new obligations, in accordance with the development programme of the institutions.

The programme discussion has not yet been concluded, and the guidelines for 1994 are not yet finalised but will be presented shortly.

IX. Costs of the Ministry and expert system

These costs include the operating costs of the Ministry service in the same amount in real terms as in the past and the costs of covering the work of experts and expert bodies for evaluation of research policy, research and other programmes and projects.

The expert system comprises contracted individual domestic and foreign referees and national coordinators as permanent experts. They assess the professional or scientific value of groups and proposals.
The research councils establish, on the basis of the scientific merit and of the social, developmental and economic relevance of the projects and considering the engagement of the capacity of research groups, a priority list for projects for public (co)financing.

Based on these foundations and giving consideration to research policy, the National Council for Research and Development draws up proposals for selection and financing of research by the Ministry.

The system encompasses over 60 permanent experts and hundreds of contracted experts for individual services. At the same time it relies on the priorities of other ministries, local communities etc, which increases the volume of work and costs, but simultaneously guarantees greater effectiveness, success and social benefit of the use of public funds for research activity.

X. Financial movements

The Ministry of Science and Technology has spent on all programmes and its own expenses, including the two offices, SIT 10.4 billion in 1993. This is one third less than in 1989.

In 1994 the extent to which the goals of research policy are met by implementing the planned guidelines of the national research programme will depend on the available budget and research funds, therefore also on the investment policy of individual commercial and other organisations.

The factors supporting an increase in funds are the following:
- introduction of new programmes and new financial obligations (start-up funds for the Technological Development Fund, partial subsidy of wages for researchers in the commercial sector, subsidised interest rates for bank loans for development, investment in research funds for the programme for individual inventors, investment in research funds according to international agreements, beginning with the construction of the University Library and residence halls for young researchers) and
- increasing the extent of some current programmes (programme of developmental projects, research equipment, strategic literature, postdoctoral grants and promotion of science and technology),

as well as the increase in the material costs of research activities and maintaining the current wage level, which in many research institutions still lags behind those in the universities or other comparable activities. The Ministry will propose legislation to regulate state responsibility in financing public research institutions with:
regulations on financing the founding obligations of public research institutions - these are the Jožef Stefan Institute, National Institute of Chemistry, Slovenian Institute of Urban Planning, Institute of Contemporary History, Institute for Ethnic Studies and by agreement with the Academy of Sciences and Arts (SAZU) also the Scientific and Research Centre at SAZU. We estimate that in 1994 there will be at least three more such institutions;

- regulations on standards and norms in research activity, which will adapt the inadequate provisions dating back to the mid or late eighties to modern requirements.

The level of funding for the scientific programme (including the current basic research and applied research) is expected to be maintained in real terms, while the needs for cofinancing by users, including state departments, will increase due to the need to cofinance applied research programmes.

In 1994 over 600 projects will be running on the basis of already signed contracts, and at least 200 new ones. The funds required for the already running projects amount to SIT 2.4 billion, not including new projects.

Increasing significantly is interest in funds for cofinancing development projects in the growing number of companies which, due to financial crisis or lack of research personnel, cannot afford to provide the funds or loans for their own development. The category of funds for acceleration of the transfer of know-how into commercial and other beneficial use includes the start-up funds for the newly formed Technological Development Fund, which will support the transfer of the results of development projects into production and marketing, and funds for partial subsidising of bank interest rates for entrepreneurs, innovators or researchers who are on their way to becoming entrepreneurs to finance the implementation of their production programmes.

In 1994 around 400 projects will run on the basis of already signed contracts and we expect another 150 from the tender for 1994. The funds already allocated for 1994 amount to SIT 1.2 billion, not including new projects and the necessary start-up investment for the Technological Development Fund.

Another item appears in the young researchers programme:

- partial subsidy of wages for researchers employed with a company and wages for researchers who form new companies and work in them.
The infrastructure programmes show a need for an increase in the inflow of strategic literature and maintaining the supply of research equipment on the present level.

In the field of international cooperation, bilateral agreements on cooperation have created new obligations, and the need to participate in the COST, EUREKA and Framework 4 research programmes and projects is growing.

Financing the state obligation towards the founding of state research institutions (basic funding) must encompass certain highly qualified and established researchers. The share of financing is expected to grow by 100%, partly by conversion of the funds for projects into funds for direct contracted payment of founding obligations.

The material costs in the cost itemisation of projects must be increased by at least 20%, even if partially at the expense of a reduced number of accepted projects, as the current material cost level can no longer enable sound research in the growing number of areas.
Technology demand of the industry and technology transfer in Slovenia

Günter H. Walter, Uwe Gundrum, Frieder Meyer-Krahmer

1. Introduction to the ISI project

The previous economic system in Yugoslavia and the independence of Slovenia necessitate a re-organisation of the economy in Slovenia now. In order to make optimum use of existing research potentials, cooperation between science, industry and government has to be intensified. In the context of its cooperation with countries in central and eastern Europe, the German Federal Ministry for Research and Technology (BMFT) has asked the Fraunhofer Institute for Systems and Innovation Research (ISI), Karlsruhe, to elaborate proposals together with the International Bureau of the Research Center Jülich (KFA-IB) for assisting the Slovenian side in the judicious and appropriate support of industrial innovation.

1.1 Initial theses

Reconstructing industry and science
The necessities and possibilities to reconstruct industry and science in Slovenia by support of industrial R&D in order to strengthen industrial innovational capability are the following:

Within industry:
- Establishment of a modern industrial and economic structure, especially through small and medium sized enterprises (SMEs). These companies usually constitute an important share of the manufacturing sector. They are skilled suppliers of large enterprises, realise a multitude of incremental innovations and they are flexible and close to market needs.
- Development of new markets (by new products, new product varieties, updating and replacement of outmoded products, meeting new market needs or the creation of new demands within and outside Eastern Europe).
- Cooperative Research and Development (R&D) between science and industry; preconditions for cooperative R&D are:
  o Same or similar technological fields and activities in R&D-institutions and in industry,
  o research in areas where problems with prospects of future application emerge or where the technical requirements of R&D give impetus to industrial innovation.
- Improvement of industrial and social environment for innovation, e.g. by laws, patents, norms and standards.
Within science:

- Necessity to make science sensitive to industrial needs in adopting R&D-results;
- (short-term) change of R&D-institutions to application orientation of their R&D by participation of industry (e.g. supporting especially SME-R&D to create incremental innovations);
- (Long-term) ensuring long-term application-oriented basic research by participation of industry in R&D-projects (e.g. supporting larger enterprises to generate innovations).

1.2 Work carried out by ISI

ISI has carried out the following tasks so far:

- Analysis of available data, examination of relevant technology policy measures.
- Presentation by ISI of the German "research landscape" and German R&D-promotion measures (in June 1993).
- First round of discussions in Slovenia (in June 1993) for stock-taking of present public R&D-support, industrial R&D and innovation infrastructure; continuation of discussions (in September 1993) to intensify ISI's in-depth knowledge of public R&D promotion and innovation support in Slovenia.
- Discussions with experts in Germany and from other countries (bringing in experience not only from Germany, but also from the USA and from Austria); mediation of contacts and procurement of materials for contact partners in Slovenia.
- Typification of firms according to their technological capability and, based on this, suggestions for measures for the support of R&D and innovation.

1.3 Project results

Present situation in Slovenia: in comparison with eastern Europe as a whole, this small country is highly industrialised but as it previously acted as a supplier for the whole of Yugoslavia and for eastern European countries (c. 65% of total production) it is technologically not always up to world standards. Production tended to be labour-intensive and was oriented towards large domestic markets. At present, large enterprises in particular are being privatised or split up into smaller firms. By March 1994, approximately 400 enterprises should have been converted (holdings). Employment in the larger enterprises and public enterprises is going down, the employment share of small firms in the private sector is increasing (at present, 1.9%). Employment at present is concentrated particularly in large industrial enterprises. Anyhow it is difficult at present to gain a transparent overview of the structure of Slovenian industry.
Until now, public research institutions have performed mainly scientific and technologica­
\[ \text{cal basic and mission oriented basic research. On the other hand applied research,} \]
\[ \text{and especially industrial R&D, are not so well represented. Industrial R&D is also} \]
\[ \text{hindered by the following conditions:} \]

- The financing situation in public R&D institutions is better than in industry.
- R&D jobs in Industry are less well paid than in public research institutions.
- The level of specialist qualification of R&D personnel in Industry is lower than in
  the public research sector.
- There are substantial Information deficits in Industry about the equipment and
  apparatus available in public research institutions for use by industry.
- It is also suffering from the present economic situation (adaptation to the western
  economic system, with an inflation rate of 24% and 130,000 unemployed).

All in all, there is a diversified public research sector in Slovenia, well equipped with
personnel and in technical terms; Industrial R&D is less well developed. In discussions,
public research institutions saw a lack of qualifications in industrial R&D. Enterprises
complained that public research was too little oriented towards applications and was
often inflexible; they also complained of the low level of financing of industrial R&D by
public subsidies in comparison to the promotion of public R&D. Between these two
research sectors there is a lack of constructive, deliberate exchange of Information and
experience. In public technology policy, only the beginnings of programme content
orientation (the establishing of priority areas for support) and coordination of relevant
policy fields (e.g. the coordination of economic policy and research policy) can be
observed.

The **general conditions** for the development of industry and technology are not favou­
\[ \text{rable. The uncertainties relating to property ownership make the financing of long term} \]
\[ \text{R&D-projects difficult and thus complicate the strategic orientation of enterprises. The} \]
\[ \text{re-structuring of the banks is also taking a long time.} \]

1.4  **Implications for the support of Industrial innovation**

1.4.1  **Theses on the technology demand of Slovenian industry**

The technological demand of companies is determined by their types of markets, size,
technological performance and relations to customers and partners. The available
classifications by sectors or firm size do not constitute an adequate basis for action
proposals. For this reason ISI has developed a **typification of enterprises** (transparen­
cy 1-6) and discussed with Slovenian partners. The criteria used are characteristics
such as
the technological level of products and production,
markets and market position,
R&D-potentials,
dependency on customers and partners.

These criteria are highly responsible for the kind of technological and know-how demand. This demand should be covered by the Slovenian R&D-system.

To obtain a more concrete idea of the facts, the enterprises visited by ISI were classified according to this schema and assigned to one of the various firm types (transparency 7):

These overviews clearly show a concentration of Slovenian firms on type 2 and 3. Forming concepts for the public support of innovation in Slovenia have to take these facts into consideration.

1.4.2 Supply of know-how

Public research has an abundant offer of potential know-how to supply the technology and know-how needs of industry. This is also apparent in the diversification of the Slovenian research landscape, shown by representative institutes (transparency 8), and their positions within the range of R&D from basic research, through application-oriented research and development to applications.

In discussions, contact partners in Slovenian Industry expressed dissatisfaction with the following aspects of public R&D:

- an insufficient concentration on experimental R&D,
- a one-sided orientation towards academic studies associated with numerous publications,
- a lack of capacities for the building of prototypes,
- the concentration of available funds in certain public institutes in central locations, and thus inadequate funding for peripheral regions,
- supply not appropriate to the demand (e.g. R&D being performed in the field of submicron technology, when the preconditions for its industrial exploitation do not exist in Slovenia; construction of demonstrators for which important components cannot be manufactured in Slovenia, and are too expensive to import),
- a lack of initiative on the part of some R&D institutes in making existing equipment available - e.g. for testing purposes.

This confrontation of the know-how supply from public R&D and the know-how demand from the various types of enterprises also clearly reveals: Not only high tech, but
also the field of "medium" technology appear important in order to fully exploit and/or expand all the available resources and competitive advantages of Slovenia (traditionally high qualification of employees, relatively low labour costs, good contacts with eastern European countries).

It is not sufficient to concentrate on technological considerations only; efforts must also be directed towards the following aspects:

- diversification of production,
- marketing,
- increasing productivity,
- quality assurance,
- modern design,
- improving management techniques and management behaviour.

Thus support for innovation management also has to be envisaged.

For this purpose, also the re-orientation and/or expansion of existing institutions, or the establishing of new institutions, should be envisaged.

1.4.3 Support of technology development and technology transfer

The existing and planned support measures of the Ministry for Science and Technology (MST) and the Ministry for Economic Affairs (MEA) should be mentioned here:

The budget of the Ministry for Science and Technology has a volume equivalent to 150 mn DM (1993); of this, 40 percent is spent on to basic and mission orientied basic research, 30 percent on applied research, 20 percent on the personnel transfer of young scientists from research into industry (Young Researcher Programme) and the rest on actions to build up the infrastructure (libraries, patent office) and support international cooperations (e.g. COST-programme).

In addition to these promotion activities, the MST also supports a technology development fund for the promotion of firm foundations (fund assets 10 mn DM). The Ministry holds a two thirds share in the fund, with the rest being held by industry and banks. However, the Ministry does not insist on a majority right in decisions. The fund is intended to support the development of new product ideas and reduce the risk factor for other investors. The main target group is scientists who want to realise a product idea by starting their own firm.
Programmes of the Ministry for Economic Affairs include:

- Co-financing of industrial projects for the improvement and optimisation of manufacturing processes;
- Support of management consulting actions (e.g. for reduction of administrative costs);
- Interest subsidies for investments;
- Undertaking to reimburse losses caused if export contracts fall through;
- (Planned) programmes for quality assurance and assurance of international standards.

There are public calls for tender for all promotion programmes.

Technology transfer structure and frame conditions

The Ministry for Science and Technology provides/supports special services for industry:

- The state Patent Office provides free advice on patent applications and runs a patent information service.
- Among other activities, the state Office for International Norms and Standards helps domestic industry to fulfill international quality requirements.
- Special expert groups in the Ministry and at universities, e.g. the chemistry faculty of Ljubljana University and the technical faculty of Maribor University, mediate technology information.
- A management college in Ljubljana runs expert seminars for enterprises and young scientists on planning, marketing and management. The seminars receive public support. The Ministry is also represented on the education programme advisory council and the education board.
- The Ministry for Economic Affairs assists structurally weak areas in building up a local infrastructure.
- There is a "Small Businesses Development Network" for the support of small and medium sized enterprises. This was founded in 1992 by the Ministry for Economic Affairs together with the Chamber of Industry and the Chamber of Commerce and has the following tasks:
  o building up and sustaining international contacts and cooperations,
  o measures for strengthening small and medium industry,
  o training and further education,
  o consulting, publishing a journal
  o organisation of participation in trade fairs at home and abroad.
The Slovenian Chamber of Industry provides the following central and regional services:

- promotion of international cooperations
- information and advisory services, data bank searches,
- support in quality improvement of products and services, and support in carrying out environmental protection programmes
- vocational training and further education in its own institutions,
- Certification and regulation,
- Information centre and publications.

Specific technology transfer institutions are:

- the technology and incubator centre at the Josef Stefan Institute in Ljubljana with its spin-offs, the only incubation centre in Slovenia so far,
- the planned manufacturing centre at Maribor University, intended as an institution to initiate and encourage impulses for regional support of industry, and as a vehicle for manufacturing technology competence, to maintain and improve present technological know-how,
- the project of a Graz/Maribor technology centre, intended to combine the economic and technological potential of both regions, and to combat the problems of border regions on both sides (peripheral location in structurally weak areas).

1.5 Analysis and assessment of the situation

Much of the MST funding is channelled into the agglomerations. The response to the MEA’s programmes is only moderate (due to ownership uncertainties; weak points in planning, lack of concern with business management) the numerous activities appear to be uncoordinated. The efficiency of the measures could be improved by horizontal and vertical coordination and by ensuring the industrial exploitability of R&D results. Reading between the lines, so to speak, it seems that despite cooperations in the form of supported R&D projects, little technology transfer actually takes place in fact, due to the projects being too scientifically demanding. In this sense a "re-thinking" process is necessary in R&D; interviewees in industry would like to see more interaction and feed-back between public R&D and industry, stronger support of personnel transfer between R&D and industry, and the realisation of smaller R&D-projects planned at a medium scientific level.

The peripheral conditions are also unfavourable in some respects. Support from the banks for industrial R&D is inadequate or non-existent. The innovation infrastructure offers services that are incomplete, insufficiently regionalised and not close enough to industry, and are therefore not very much used. The general perspective for enterprises is uncertain.
Not all these problems can be removed by innovation policy measures such as those that can be suggested by ISI. This would require a wide re-structuring of the economy, market-oriented attitudes, the opening up of public research and industry, and more support of innovation by banks and by consulting.

1.6 Assessments based on project work so far

The work carried out by ISI in the project so far allows the following assessments of results to be made:

- The basic assumptions underlying the original proposal have been confirmed; thus the associated problems in technology transfer and in innovation management are the difficulties that most urgently require solution.
- The activities of the FhG-ISI/KFA-IB met with great interest and great willingness to cooperate among participating actors from government, industry and science.
- Through the initial seminar in June 1993, numerous on-the-spot discussions and the mediation of contacts to German R&D institutions, FhG-ISI/KFA-IB now have now built up numerous personal contacts with a wide range of institutions in Slovenia, and are acknowledged meanwhile as cooperation partners.
- The FhG-ISI/KFA-IB have awakened not only great interest, but also expectations about the continuation of activities.

For these reasons, it would now seem appropriate to proceed with the project in the form of concrete stages of realisation.

Our Résumé: What should be done in future?

The aim is to give industry confidence in the power of public R&D to solve problems; to enable partners from public R&D and from enterprises to overcome existing discrepancies and build up confidence in their own problem-solving abilities; to increase the willingness of science and Industry to cooperate; and to strengthen the practical orientation of public R&D.

How can the actors contribute to this? Due to their empirically-based experiences, FhG-ISI/KFA-IB can assist in implementation and can function as coordinators, e.g. for other specialist institutions and experts (such as information centres, the Steinbeis Foundation). Another necessary aspect is the definition of specific tasks for government, science and industry in Germany and in Slovenia.
Type 1: Development and manufacturing of high tech

Type 2: Sophisticated conventional technologies

Type 3: Manufacturing of conventional technologies

Type 4: (Small-scale) manufacturing and service institutions

Type 5: "Extended workbench"
Type 1: Development and manufacturing of high tech

- Skilled manufacturing of high tech in large enterprises and small and medium sized companies (electronics, optics, chemistry and pharmacy)
- Favourable market position, also internationally (until now, exploitation of cost advantages); now forced towards further technological development taking account of western standards (e.g. environmental protection)
- In-house research and development department with close contacts to national and international specialist institutions
- Demand for external research in diversified areas of technology or selected technology fields as a preparation for new technologies and/or product programmes
Type 2: Sophisticated conventional technologies

- Skilled manufacturing of sophisticated conventional technologies
- Traditionally dominant market position (national), now forced towards cooperation with western partners with a high technological level (adaptation of products to western standards, help in technology development and opening up markets)
- In-house development activity, some cooperation with external specialist institutions
Type 3: Manufacturing of conventional technologies

- Skilled manufacturing of conventional technologies
- Traditionally good market position (national), now forced towards diversification and further technological development of products
- In-house design and development, but limited to existing products/technologies; little cooperation with external specialist institutions
Type 4: (Small-scale) manufacturing and service institutions

- Traditional products/processes
- Computer assembling companies
- Engineering bureaux, consultants, system companies, testing centers, training institutions
- Only one main product with a limited market area and/or strong competition; supplier
- Independent management, no specific technology monitoring, no cooperation with external specialist institutions
Type 5: "Extended workbench"

- Only contract manufacturing for high tech (microelectronics) and low tech products
- No strategically important company functions (e.g. R&D, marketing) but dependence on other enterprises and their market position
- No in-house technology demand
<table>
<thead>
<tr>
<th>Type 1: High tech</th>
<th>Manufacturing level</th>
<th>Market orientation</th>
<th>R&amp;D</th>
<th>Dependence on customers and partners</th>
<th>Industrial branche</th>
<th>Regional distribution</th>
<th>Examples in Slovenia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>high tech products and manufacturing</td>
<td>western markets</td>
<td>own R&amp;D</td>
<td>low dependence customer mix</td>
<td>microelectronics, optics, pharmacy, biotechnology</td>
<td>Lubljana, Maribor</td>
<td>ISKRA Electrooptics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type 2: Sophisticated conventional technology</th>
<th>Manufacturing level</th>
<th>Market orientation</th>
<th>R&amp;D</th>
<th>Dependence on customers and partners</th>
<th>Industrial branche</th>
<th>Regional distribution</th>
<th>Examples in Slovenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>highly developed conventional technology (&quot;middle tech&quot;)</td>
<td>mainly former Yugoslavia, western markets (standard products)</td>
<td>own R&amp;D, some R&amp;D cooperations</td>
<td>dependence will increase in future (western markets)</td>
<td>electrotechnics, household appliances</td>
<td>outside the urban centres</td>
<td>ISKRA Strel</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type 3: Conventional technology</th>
<th>Manufacturing level</th>
<th>Market orientation</th>
<th>R&amp;D</th>
<th>Dependence on customers and partners</th>
<th>Industrial branche</th>
<th>Regional distribution</th>
<th>Examples in Slovenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>conventional technology (&quot;middle tech&quot;)</td>
<td>former Yugoslavia, third world</td>
<td>own R&amp;D (mainly product-related)</td>
<td>medium to high dependence (western markets)</td>
<td>mechanical and plant engineering</td>
<td>Ljubljana, Maribor</td>
<td>Litostroj, TAM, Metoina</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type 4: Small scale manufacturing</th>
<th>Manufacturing level</th>
<th>Market orientation</th>
<th>R&amp;D</th>
<th>Dependence on customers and partners</th>
<th>Industrial branche</th>
<th>Regional distribution</th>
<th>Examples in Slovenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>suppliers, small enterprises, services</td>
<td>market niches</td>
<td>adaptation developments</td>
<td>highly dependent</td>
<td>software, computer assembling</td>
<td>Ljubljana, Maribor but also outside the urban centres</td>
<td>Nova Flow</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type 5: Extended workbench</th>
<th>Manufacturing level</th>
<th>Market orientation</th>
<th>R&amp;D</th>
<th>Dependence on customers and partners</th>
<th>Industrial branche</th>
<th>Regional distribution</th>
<th>Examples in Slovenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>low and medium tech</td>
<td>peripheral markets</td>
<td>usually no in-house R&amp;D</td>
<td>highly or total dependence</td>
<td>consumer goods, mass products and standard products</td>
<td>probably widely distributed</td>
<td>(Reemtsma)</td>
<td></td>
</tr>
</tbody>
</table>
Profile of know-how supply in Slovenia

<table>
<thead>
<tr>
<th>Basic research</th>
<th>Application-oriented R&amp;D</th>
<th>Exploitation/application</th>
</tr>
</thead>
<tbody>
<tr>
<td>academic specific purpose</td>
<td>precompetitive</td>
<td>market-oriented</td>
</tr>
<tr>
<td>Innovation management</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Universities of Ljubljana, Maribor (altogether)

Josef-Stefan-Institute, Nat. Chemistry Institute (Ljubljana)

Institute for Metals und Technologies (Ljubljana)

Manufacturing Centre of Maribor University (planned)

Technology Research Centre and TAM Development Institute, Maribor

Key
The shading indicates demand:

- great demand
- medium demand
- small demand

Profile of industrial know-how demand in Slovenia

[FhG-ISI 1993]
Igor POMPE
ISKRA IEZE Holding d.o.o.
Ljubljana

Consultation on the theme:

MODELS AND INSTRUMENTS FOR THE ENCOURAGEMENT OF INDUSTRIAL RESEARCH AND DEVELOPMENT IN SLOVENIA

A-co report to the theme:

THE DEMAND FOR NEW TECHNOLOGY AND TECHNOLOGY TRANSFER (in Slovenia)
Igor POMPE
ISKRA IEZE Holding d.o.o.

Consultation on the theme:
MODELS AND INSTRUMENTS FOR THE ENCOURAGEMENT OF INDUSTRIAL RESEARCH AND DEVELOPMENT IN SLOVENIA

A co-report to the theme:
THE DEMAND FOR NEW TECHNOLOGY AND TECHNOLOGY TRANSFER (in Slovenia)

During the course of working on their project the experts from the Frauenhofer institute took a look at the condition and points of view in Slovenia. They have rich experience of working in fast developing, dynamic, innovative, but still organized environments and their findings concerning the conditions in Slovenia and their guidelines will act as a neutral opinion. As a view from the outside this should prove useful for prescribing future guidelines for development in Slovenia as regards the administration, industrial associations as well as to business and R&D institutions. In the main our views were confirmed by theirs. On the basis of their confirmation and suggestions it may be possible to pull the right triggers. The duty of our country's administration to encourage this.

I was asked by the Ministry of Science and Technology to prepare a co-report on the header theme.

As it can be seen from the title in this report I speak only of industry and its related research and development (R&D).

I do not know Slovene industry as a whole so it is hard for me to speak in its name. We are dealing with a set of specific problems and approaches, so every statement has in special cases a counter statement. In the past different parts of industry developed with varying degrees of success and they are encountering different problems.

But we all live in the same environment and we are living through a similar period of development at home and abroad thus we at one instant live in a friendlier and at the other in a more hostile environment. It is my opinion that the experience garnered from the field of the electronic component manufacturing industry will more or less capture and describe the problems which Slovene industry as a whole is encountering.

It is a fact that there is a lot of technological and managerial knowledge in Slovenia which unfortunately we do not always know how to transfer to the end users in a suitable manner. In such a way they could use it for the creation of a more successful
operation and with this generate a greater means that also could be used for updating the knowledge necessary in the constant battle and rivalry in today's innovative milieu.

A way must be found to delegate responsibility down to lower levels and through this increase the engagement and enlarge the circle of experts, who of course would have to be properly additionally educated first.

THE DEMAND FOR NEW TECHNOLOGY

I would broaden the title a bit. It is my opinion that in the market there is always the DEMAND AND OFFER and that these are reciprocal.

The first thing we should be aware of is that the world does not need Slovenia (the size of our domestic market is negligible for everyone). It is normal that one can live better only because of the stupidity of another. Foreigners need us only if they can realize their plans more easily with us. -I need a good partner only while he remains useful and when I find a better one I will change partners. If I do not act this way, others will dispose of me. Our survival therefore depends on our own abilities and decisions.

For the better understanding of the problems relating to technology transfer it would be expedient to show some characteristics of the conditions in our country and some general truths apparent in various circumstances, which only now are we starting to understand:

- It will have to be decided whether we in Slovenia will try to preserve (reunite) large enterprises which will be able to plan development in the medium term and thus enable us to join the world economy on the same terms. There is also the possibility that this could be carried out by the state or left to chance -ie the "machinations" of the free market and small businesses. On the other hand we will allow individual foreign businesses to strategically plan and make the most of our situation. It is all about planning, controlling -leading the innovative processes. Small business can in the main only act in co-operation with larger ones which together with the government can strategically plan the development and role on the international market.

- There is a lot of knowledge in our country but demand and supply do not meet, for the reason that the financing of knowledge was realized mainly with donations based on a system of public tenders.

- Knowledge must be needed by somebody. It must be sold in an active way, it must be presented in the right way...

- A system cooperation should be established (adapting goals,...) between the R&D sphere and industry.
- Development programmes should be part of the strategic business plans for enterprise. A project approach is needed. All the necessary resources up to the market realization of a new product must be secured.

- As a small country (and small companies) we are not able to invest in some spheres. We are not able to succeed everywhere. A big selection should have been made already before deciding which projects should be co-financed. Competitive projects should be invested in. The scheduled benefit of new or innovated programmes should be evaluated. Investments in development are also investments that should be seen to (eventually) pay for themselves.

- Occasionally the demand for an article should be generated. This is possible with the planned development of articles and their constituent parts which present a complete offer (engineering) on the market. Customers expect such a service.

- It is convenient that the development of technology should be located near the place where manufacturing will take place.

- Along with the transfer of developed programmes a transfer of staff should also take place.

- The whole population should receive their elementary education (the older segment of the workforce should obtain additional re-education) for the use of new tools, methods,... The government should enable as wide an audience as possible to become acquainted with new achievements innovations and receive free education. Such a move would be well rewarded. People should learn how to obtain knowledge and how, once it is obtained, use it. Enterprises should take care of the dissemination of knowledge within them. It should be available to everybody and at the same time precautions should be taken so that industrial secrets are kept.

THE HISTORY OF THE RELATIONSHIP:
SCIENCE - INDUSTRY AND THE FINANCING OF SCIENCE

The decision regarding subjects and the financing of research (and development) from the perspective of the government funding was in Slovenia (Yugoslavia) always in the domain of researchers, experts, etc., whose roles were those of governmental advisors. It is they who suggested the tasks, selected them and evaluated their success to their own parameters. Of course they took care that they kept some sort of standard whilst enabling a lot of groups to get successfully involved in international research. This undoubtedly provided the necessary standard for the international exchange of knowledge.

The basic and almost the only prerequisite of such experts were the number of articles, invitations to lecture, citations, etc. With such criteria the researchers and developers from industrial development laboratories could not compete with the same force (except for a few exceptions) as they were expected to solve day
to day problems which occurred in the production line as well as to develop better technology and competitive products for a competitive market. Such subjects are not often touched on in appealing or popular articles.

Industry has organized its own development and tried to influence the direction of the researchers into useful avenues of R&D which are intended to create competitive products.

Industry had to foster a lot of specialists who are capable of initiating a dialogue with their partners in other institutes and are at the same time capable of defining problems, arranging co-operation and supervising the effective presentation of the results of their work.

Wise researchers helped build this bridge -build their consumption.

Here I would like to congratulate some research teams that have always tried to make their research worthwhile. They tried to think of new channels of marketing successful products and have on their own initiative searched for the possibilities of realization in the industrial sector and have thus contributed a great deal to the education of staff in industry. This is specifically true as regards the formation of particular specialist and joint mixed-discipline development teams for industry.

Some of the main problems in Slovenia were the underestimation of the necessity of marketing, lack of real knowledge as to the needs and trends in the wider environment as well as the conditions for successful marketing. In addition to this there was a general dearth of investment.

TRANSFORMATION - DISILLUSION

Unlike other East European countries Yugoslavia hadn’t had a centrally planned economy, for many years. Enterprises planned their development and expenditure by themselves. When doing this they took into account the needs of the domestic and of many foreign markets on which they were present.

Political changes in the east and the war in the Balkans resulted in the loss of the traditional, and also less demanding markets. This coincided with the recession in Western Europe and these factors acting in concert made the situation very difficult for many Slovene businesses and created a general atmosphere of disillusionment.

It became obvious that we could survive only by manufacturing products that in all aspects would be better than those of the competition and of course they should also be presented effectively. Our country’s administration does not protect anyone anymore.
In Slovenia we can not afford to spend money on projects that do not realize themselves on the market. The question is no longer the single one of whether we can do something. It is a decisive one of whether we can do it better than the others and at a competitive price. Do we have enough resources to do this and will we know how to sell the product? Will the investment into research and development be paid back through the profits generated after market realization?

THE ACTIVE SALE OF PRODUCTS - INCLUDING KNOWLEDGE

We are trying to join/keep the international market through becoming a small part of it namely by offering our products on it (knowledge is also such a product) and because of this we must adapt to it.

We are therefore speaking of a market where the supplies must be adjusted to the known needs and demands. Also the knowledge -new technology is therefore a product on a market which submits to all principles of economics. Knowledge is one of the most valuable factors in production, but it becomes valuable only if it is up-to-date, needed, used, offered and cashed in on in the right way.

(A good avant-garde artist who is not understood by anyone and fails to sell his paintings will stay poor. A good businessman can become rich selling those same paintings.)

In the market for products we become quickly aware of what the duty of the offerer of the product is, of what influences our decision for development and investment into a new product, how the market sets its value, etc. Similar rules apply to knowledge distribution and dissemination. (This acts as a warning to those scientists who are still asking themselves the academic question of whether the PUSH or PULL principle should be used when deciding which way the research and development work should go as well as in other initiatives regarding the exploitation of knowledge. These same people also complain that industry, which in its ignorance does not know their work, also fails to appreciate it.) The instigators and consumers of knowledge should therefore introduce themselves one to another, listen to each other, get to know and trust one another. The supply must meet the demand.

For the reason that new knowledge is intended for the market the decision for investment into avenues leading to the obtaining of new knowledge has to be related to the project realization. This includes everything from R&D work to (manufacturing and) marketing.

It is the best for a country if knowledge is used for the production of domestically manufactured goods which are then in turn sold in foreign markets.
In the same way we are not advanced in the marketing of goods we
lack knowledge and experts with marketing knowledge.

It would also be expedient for Slovenes to trade with knowledge on a greater scale than they are doing at the moment. They should become involved in selling and buying more and not to try to solve all of the problems by themselves (this is a result of the former internally orientated economy during which foreign currency could not be obtained).

FINANCING THE RESEARCH & DEVELOPMENT ACTIVITIES

BASIC RESEARCH

We state and it is proven that we, in Slovenia, have a lot of prominent and internationally acknowledged experts. Each year they line up in front of the ministry with a lot of interesting projects which they expect to be financed.

There is always the ever present problem of financing a large enough number (or all of the) research endeavors of the various teams within research institutions. Not everyone wishes to acknowledge the fact that we are a country with a mere two million inhabitants and that we can not gather enough money through taxation to support research in every field of science. A small body cannot support such a big head.

APPLIED AND INDUSTRIAL RESEARCH & DEVELOPMENT

It is normal for industry to choose potential research and development projects through the application of its own standards, needs, planning and financing. This then takes place within its own departments or institutes and a greater or smaller amount is passed out to outside institutes or universities.

Of course Slovene industry also invests a great amount into innovation funds and into gaining competitive qualification of their merchandise. It is known that as a rule such activities demand a larger amount of investment than that which is needed for basic research (even though often such expensive and considerable equipment is not needed for the basic research itself). In the past industry was unable to manage any accumulation of funds and this together with the world recession and the recent events in the Balkans it is now unable to afford investment by itself in sufficient reinvestment in development (even though this leads into an even deeper crisis!). The Ministry co-finances a part of development projects and thus contributes to an increase in the efficiency of the economy.
DISILLUSIONMENT:

Realism is also needed in the field of financing R&D:

The only right way is to have a selective approach. We must, of course, emphasize those fields where we already have some knowledge, experience, an acquired infrastructure as well as much as possible still functional machinery and a market that would provide the grounds for the fertile realization of the project - via direct or indirect sales (knowledge can also be sold indirectly). This would generate sufficient finance for new R&D. The closest to achieving this goal are those organizations and products who are already significant in the international market.

A greater part of the financing of research should be looked upon as a kind of investment which should pay for itself as well as generate the extra funds needed for further development.

THE RELATIONSHIP BETWEEN THE GOVERNMENT AND THE RESEARCH, EDUCATIONAL AND INDUSTRIAL ENTITIES

It is my opinion and it can also be concluded from the achievements in research that in the past the nation sufficiently funded researchers and their work. The ministry felt responsible for financing already formed research teams and usually set the condition that these teams should be engaged as a prerequisite for the co-financing research projects.

We can also conclude that the industrial research field did not start to become market oriented enough for the same reasons. The cost of research work for industry was quite often enormously high. Researchers are often unacquainted with the problems of the industrial sector and they do not meet their needs. Groups that follow world developments in their field and have been able to develop new products that could be manufactured and sold at a competitive price have also had their target consumer groups and have themselves tried to reach the buying population. It is obvious that industry in Slovenia is seriously lacking successful new products.

It is conspicuous that government supplies some finance to non-economic activities, thus into research which signifies a stability of the nation's identity these are therefore necessary for a normal national development.

The Slovene people will not be able to undertake research in many fields alone. This is where the government should play its role as a supporter of the transfer and trade of foreign knowledge, with supporting information bases whilst at the same time enabling the exploration of foreign information bases as well as the provision of university education. The government should have an interest in providing its citizens with the highest possible degree of knowledge and should therefore enable access to all knowledge in the most convenient manner.
The government should consider a somewhat different approach to "small enterprises", which are successful at reselling imported products or producing (assembling) articles from imported parts, for the Slovene market. These enterprises could well fill the gap in the structure of our economy. But to cover the expense of such activities one must be aware that other sectors of the economy should at the same time provide a sufficient realization of exports in the areas that have the toughest international competition. Small enterprises are undoubtedly a necessary part of the business infrastructure - namely as suppliers to larger enterprises. I think that regardless of the fact that small enterprises are now employing the greatest number of new workers they are not capable of taking the leading role in economic development.

The country undoubtedly needs a few big companies (companies which can also be competitive on the international market) which on one hand means consumption for the whole infrastructure and on the other the generation of a positive balance in the international exchange ledger.

With the closing down or selling off some of the larger Slovene companies the interest in specific knowledge which was generated at research institutions is lost.

STRATEGIC PLANNING - INNOVATION MANAGEMENT

Planning is today a hated synonym for a "Government (centrally) planned economy". But the economy of the state must strategically plan its development. This is primarily the duty of large industrial concerns, but in countries which wish to compete with developed countries it should also be of great significance in state politics regarding the activation and guidelines of companies. The strategy of R&D is part of the development strategy of a company (country).

Enterprises should be constantly updated as to the rapid developments in the world and they must constantly upgrade their production programmes and product offers. This is the starting point of R&D.

Not everything that shines is of gold. The fields in which Slovene enterprises are able to make an international breakthrough are rare. The primary condition is to be the best. Many times the condition is a large enough, globally competitive production or a successfully found or chosen market niche. Let's find our market place in symbiosis with the stronger!

Governmental strategic planning must therefore be based on the state of the international environment, its development trends as well as developing and evaluating one's own competitive potentials within the economy (the same awaits company management). In more and more circumstances the government has started to take over this function (in one way or another).
It is wise to plan and finance the whole chain from the basic research through applicational research to the development of technology and products. This allows for the implementation and employment of the foremost and most up to date knowledge within the whole chain of activities.

It was discovered that the most stable production programmes are those which are based on their own inherent knowledge. Basically experts from various institutions and fields should join the project, when this is the case then the fastest transfer of knowledge is feasible. It has been shown that industries had to firstly raise or acquire experts that know how to communicate with outside partners, define the problems, evaluate and take up new achievements and apply them in the production process. They represent the link between scientific institutions and industry. It is advisable that they work in mixed groups and information that is already available should be used and should not be researched and invented anew.

GENERATING CONSUMPTION

Consumption either exists or does not. Supplies should meet the demands.

Many countries have proved that consumption can be generated. This can be done only by big concerns or by government ministries which are able to motivate and guide the development and investment (eg. the development of PC production in Taiwan).

In Slovenia we could also:

- on one hand generate a consumption of products, semi-manufactures and an indigenous workforce, particularly through the motivation of foreign investors to open new production lines (the products of which of course would be intended for foreign markets).

- on the other hand we could generate a consumption of knowledge by actively keeping those Slovene companies which have their own research centres or cooperate with institutes. (If the larger companies were to be taken over part by part by foreign investors, all the research would then be done in or via parental enterprises abroad and we will soon have only manual workers in Slovenia).

TRANSFER OF KNOWLEDGE - TECHNOLOGY

As it is seen from the title this deals with knowledge transfer.

New knowledge must be brought to the users within the framework of the regular education programme and must be constantly updated (both learning and teaching). This knowledge must be available to users from scientific bases (companies and institutes must have their own), and there must be access to international data
bases. In industry we especially lack the knowledge of how to get hold of knowledge. We should educate the development engineers in companies as well as the researchers in institutes to have an economic perspective, so they will know how to cooperate in the choice and realization of development projects.

The second field is the generation and transfer of specific knowledge from the R&D sector into the users sphere. With this we think of the usage of achievements coming from basic research as well as the transfer of end results from the development process that are brought into the production line.

It is rare that the development process should only encompass the development of a new product. In most cases new production technology, processes and machinery has to be developed and installed. Of course this machinery should be both highly productive and reliable equipment which enables one to produce quality goods at a competitive price.

New knowledge is what one might refer to as "perishable goods" - it gets old very soon. That is the reason why it must be delivered directly or indirectly (in the form of products) onto the market and through this cashed in on.

When we are dealing with research that encompasses completely new spheres (usually in the field of high technology), where we are unsure about actual consumption, the decision to embark on research projects may be a risky one. The demands must be anticipated as much as possible which is feasible for larger enterprises. Small businesses can not afford these risks and the financing of such market research. Therefore it may be advisable for them to listen to special demands of buyers and realise them with known and proven technology.

In the past a lot of research and development has been financed, but not completed or transferred and therefore did not bring any useful solutions. Sometimes it was discovered only in the middle of research that there was no market for the projected new product or that resources were exhausted before realization.

Today we can more and more frequently witness production capacities being shut down. The demand for a wide variety of knowledge is disappearing this way.

THE PROJECT APPROACH

The preliminary condition for success is as mentioned a PROJECT. Before starting a project we should really think about its rationality, the need for it and its feasibility - will the transfer be possible and will the product be a marketing success.
THE LOCATION OF DEVELOPMENT

The development of technology (development of new or updating existing technology) is usually more successful if it takes place inside the development department of the company. This is because the workers from within are better acquainted with the technological problems and possibilities as well as being under more direct pressure from market forces. The last phases of the development process are undertaken and tested on a pilot production line -ie already on industrial equipment. The presence of the development engineers is essential, for it is they who have the best knowledge of the problems of the new product (this particularly holds true as regards the processing industry). The barrier between the developers and technologists should be as small as possible for they are all engaged in the process and have the same goal, -namely the successful production of the new product.

For some new types of technology, intended for use in various spheres, especially if in the beginning the level of production will be low and may require a lot of adaptations for potential buyers, a form of technological centre is advisable.

TRANSFER OF STAFF

The easiest way the transfer could be undertaken is by the development engineers who should perform the transfer of the product into the production phase. The marketing of more demanding products should also be undertaken by those involved in development. Of course the only way this would be feasible would be if a large enough number of experts were available and situated in specific positions in the chain, whilst at the same time being properly stimulated or rewarded.

MOTIVATION

R&D workers should be motivated to achieve successful, quick and complete research work and offered shares in any future profits generated.

THE FINANCING OF TECHNOLOGY TRANSFER

Loans should be available for companies carrying out the transfer. Such loans should be on the same favourable terms as companies abroad are able to enjoy.
THE ASSESSMENT OF PROJECTS SEEKING CO-FINANCING FROM THE GOVERNMENT SECTOR

(I must emphasize once again that here I speak only of industrial research.)

The published notice for tenders should always include the terms, the criteria which will be used to judge and select the projects. These criteria must be measurable and not just descriptive. They should be formed by the ministry which works in accordance with the interests of the country, regarding which field it wishes to aid. It is my opinion that industries which have already proven themselves on the international market should receive preference when seeking such finance, this is in the main interest of the country. We should help these industries to expand and adjust their production so they can keep their market share in the international markets.

The notice should therefore include specific questions which would yield accurate answers, so the evaluators will have a good insight into the validity and feasibility of the project in question. The evaluator should not be drawn from the ranks of research workers. Employing "unemployed R&D groups" which were unable to sell their work should not be the grounds for their inclusion in an R&D project, unless it is discovered that this particular activity is necessary for further realization of specific prospective projects.

Of course it is logical that any researcher or research team will try to "sell" their project as best they can. It is the responsibility of the government to choose those projects which will be most likely to return their investment through successful market realization. Our researchers are not such bad salesmen! Their buyers are sometimes much too generous and sometimes too naive when dispensing with the taxpayer's money.
Integrated technology transfer - models and instruments for Slovenia

Günter H. Walter, Uwe Gundrum, Frieder Meyer-Krahmer

1. Introduction

When taking stock of the present situation in Slovenia, it emerged that the public research institutions on the one hand (universities in Ljubljana and Maribor, national research institutes), and industrial R&D departments on the other - mainly concentrated in the large enterprises (ISKRA, Gorenje, TAM and Litostrój) - cooperate very little, but perform research very largely for their own institution. Research in the public sector has a strong basic orientation; R&D in industry is concerned only with the present product spectrum of firms and its further development. There is a lack of coordinated linking of basic research and industrial R&D in the form of cooperations or joint projects involving science and industry which, in view of the increasing science base of technology, is a prerequisite for the development of high and medium tech (cf. ISI's studies on technometrics and on technological change). Only this linking of science and industry enables the preliminary research necessary for the development of new technologies to take place in the scientific field (e.g. in microelectronics and biotechnology). The lack of a link between science and industry is particularly disadvantageous in view of the fact that the potential for research in high and medium tech, both regarding staff and equipment, is concentrated in the public institutes and universities (in Slovenia approximately 70% of scientists work in this sector; in Germany, about one third of all scientists), whereas only a few large enterprises such as ISKRA and Gorenje have highly qualified R&D departments, and the mass of small firms performs only limited development activities. Particularly the small and medium industry which is in the process of formation could urgently do with well-directed support from public research institutions; however at present these are not oriented towards the industrial need for R&D, but rather towards scientific reputation (publications, lectures etc.).

2. Integrated technology transfer models: the system and empirical samples

Against this background, transfer institutions between science and industry in Slovenia become centrally important for the support of technology development in industry. These transfer offices must ensure a continuous flow of know-how from basic research into industrial development and application and also, conversely, bring industrial R&D needs into basic research. The linking of theoretical and practically oriented research is the basis for the development of new technologies.
Figure 1 gives an overview of the complete range of measures for improving the links between research institutions and industry. The following survey concentrates on technology transfer and advisory institutions, and on public measures for innovation support (Figure 2).

2.1 Aims of the instruments

In view of the specific conditions and existing competitive advantages of Slovenia, technology transfer and innovation support measures should be directed towards achieving the following aims:

- Further development of sophisticated conventional technology ("medium tech");
- realisation of incremental innovations, support of development work in the final phase of innovation processes;
- ensuring an accessible offer throughout the country;
- addressing a large target group of enterprises which are in the process of adapting and "catching up" on innovation;
- division of tasks between public R&D and industry (R&D institutions as future-oriented problem-solvers for industry, further development and adaptative development within the enterprises);
- implementation of innovation-oriented routines in present firms and market-oriented re-structuring of existing enterprises;
- "soft" public control by face-to-face contacts, informal mechanisms, sensitisation, coordination of available resources and measures by government and industry;
- relocation and strengthening of existing firms.

2.2 Empirical examples from Germany

Technology transfer offices of this kind have been built up throughout Germany since the 1970s. Thus there is a network of specialised regional transfer offices in the Federal State of Baden-Württemberg, under the name "Steinbeis-Stiftung" (Steinbeis Foundation) (Figures 3-5). The Steinbeis-Stiftung has now been extended to other German "Länder" and also to other countries (Austria, Sweden). An example of another type of transfer institution is the Centre for Innovation and Technology in North Rhine-Westphalia (Figures 6 and 7).

These concrete examples demonstrate the importance of technology transfer and advisory services for industrial technology development.
2.3 Tasks of technology transfer and advisory offices

Transfer offices should take on tasks such as the following (Figure 8):

- General information and consulting (e.g. on founding and financing a firm);
- technology and market consulting, development of foundation concepts;
- research and development contracts in cooperation with the relevant research institution;
- training on technical and management topics (e.g. project management and marketing);
- assessment and monitoring of publicly promoted development projects (regarding level of technology, market chances, etc.);
- running and assessment of public support programmes;
- expertises in innovation projects financed by banks (reports on soundness of firm's technical position for banks and venture capital companies);
- planning and servicing of technology and incubator centres;
- technical monitoring, testing of standards, industry-wide quality control.

Transfer institutions need the following basic prerequisites in order to fulfill their functions:

- Back-up from existing research institutions in the area, and personnel links with these (via professors and their colleagues)
- flexible staffing and organisation structure (low staffing, pool of freelance consultants brought in to help with individual projects);
- self-financing through contract assignments for industry, after an initial start-up phase (initiation support);
- mutual mediation of assignments by transfer offices, division of tasks according to expertise;
- close linking of transfer offices to industrial needs (with temporary cooperations);
- supply of specialist services with maximum geographical coverage, taking into account existing research institutions and sectors of industry.

The transfer offices should be planned bearing in mind the regional research institutions (supply) and industrial sectors (demand), and should be complementary regarding the specialist fields covered. Particularly important is the formation of a consulting pool offering technological and management competence, i.e. having direct experiences of technology development and the organisation of enterprises. To encourage the intensive exchange of information and experience between transfer offices, there should be regular meetings of the office managers, which should be organised by a transfer headquarters. This head office should also deal with the inter-office mediation of assignments, with the formation of new transfer offices and with general PR relations (presentation to the public). However, the headquarters should remain a
small service office, the actual transfer activities being carried out by the regional offices. Lastly, international technology cooperation between enterprises and research institutions should be mentioned: in view of the time and expense involved in the development of new technologies, this is becoming increasingly important, and one transfer office should be set up expressly to organise and service this aspect.

3. Innovation support instruments

As well as technology transfer, there would seem to be a necessity for a coordinated bundle of measures, taking into account both the requirements of individual firm types and the needs of firms generally. The support measures should be oriented towards conditions in Slovenia. These include the large numbers of firm foundations (3000 in the first half of 1993 - primarily in the service sector), good chances of survival for technology-based firms following the isolation of the domestic market from its previous context, and the use of contact/proximity advantages in a small country.

1) A bundle of measures of this kind should consists of support activities directed towards individual firm types:

Joint R&D:
These are R&D projects of mutual interest cooperation which are based on contracts (R&D-institutes and a group of enterprises incl. SMEs). Normally each party bears its own costs.

Contract R&D:
This implies R&D cooperation for the complementation of internal R&D capacities of companies in order to develop new or improved products or processes and to draw up feasibility studies. This is especially useful for SMEs to perform incremental innovations.

Industrial use of scientific equipment of R&D-institutions:
R&D institutes in natural sciences and engineering are usually equipped with high-tech instruments and facilities for experimental activities, testing etc. In many cases this equipment can also be used by industry at reasonable cost provided there are no restrictions on the R&D activities of the institutes.

Cooperative industrial research:
This comprises R&D for specific sectors, especially R&D in the fields of natural sciences and technology. The research work is available to companies belonging to some relevant sectors.
Promotion of New Technology Based Firms (NTBF):
This means the creation of favourable conditions for NTBFs, because these enterprises are expected to make an important contribution to the conversion of innovations into marketable products. Premise: the financing issue is the main barrier to the foundation of an enterprise and these founders will have deficits in the non-technical aspects.

Incubator centres are another form of support for NTBFs. Strong industrial impacts seem to be on SMEs, cooperation research and business system; also on developing new markets and social conditions for industrial innovations.

2) Support measures which are important for all types of firms include:

Innovation and technology consultancies:
The promotion of technology consultancy by university staff where state support could provide several hours free of charge per firm per consultancy period.

Further education/training:
Technological and structural change is compelling many companies to examine new technologies. To improve the firms' adaptability in regard to the latest technological developments and tendencies, training schemes can also be developed and carried out by R&D institutions in the field of innovation and technology management.

Exchange of personnel:
The placement of qualified employees by secondment of R&D-personnel or graduates to SMEs is an important aspect of cooperative R&D projects. Only if a company is provided with qualified staff it is able to be innovative.

A "project mix" also appears necessary (smaller projects as well as large ones); it also seems necessary to limit support to selected fields of technology - possibly coordinated with activities already running in Slovenia, e.g. with partners abroad (such as Austria) or with the European Communities. All measures should be both horizontally and vertically coordinated, irrespective of the organising bodies involved. Measures include not only support programmes for R&D, but also certification as well as tasks associated with quality assurance and the inspection of standards.

It should be borne in mind that the proposed measures may be delayed or impeded by traditional departmental thinking and passive waiting for public initiatives, by the current lack of organising bodies, and by the fact that at present existing bodies are in the process of re-structuring.
4. Putting project results into practice

The complexity of the situation makes the necessity for a thorough implementation of the proposed concepts even more urgent. It is also important to make use of favourable factors such as existing personal contacts. As many of these relationships as possible should be included in future activities.

In coordination with the Federal Ministry for Research and Technology (BMFT), ISI and the KFA/IB therefore propose that following this workshop implementation activities should be commenced.

Taken as a whole, the purpose of these measures is to make use of the open attitude of Slovenian R&D towards world research, in order to achieve a market-oriented development of technology there. Slovenia can act as a technology centre and "Balkan" transit point for partners in the west, thus retaining its autonomy; in this way it will be easier to change frame conditions that are still unfavourable to technology development. This would involve the authorisation of real estate acquisition by non-Slovenians, the transaction of investment guaranty treaties, tax advantages, profit transfer, parity of treatment for domestic and foreign-owned enterprises.
<table>
<thead>
<tr>
<th>Instruments</th>
<th>Aims, effects</th>
<th>Selected problems</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institutional arrangements</strong></td>
<td>High degree of user orientation</td>
<td>Time horizon of research may be too short-term</td>
</tr>
<tr>
<td>Contract research institutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative research institutes</td>
<td>High participation of SMEs</td>
<td>For sector specific problems mainly</td>
</tr>
<tr>
<td>Network approach</td>
<td>Establishment of effective national or international R&amp;D networks</td>
<td>Precondition: a well developed private and public R&amp;D base</td>
</tr>
<tr>
<td><strong>Financial Incentives</strong></td>
<td>Enforcing of existing internal or extramural R&amp;D</td>
<td>Only small effects on initiating R&amp;D cooperation</td>
</tr>
<tr>
<td>Tax reduction or subsidies for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>extramural R&amp;D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidies for selected R&amp;D</td>
<td>Establishment of strategic technology fields</td>
<td>Diverging interests of research and business systems</td>
</tr>
<tr>
<td>cooperation projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technology transfer by</strong></td>
<td>High participation of SMEs; initiating R&amp;D cooperation and start-ups</td>
<td>Low acceptance of newly established agencies by industry and host institutions</td>
</tr>
<tr>
<td>Transfer units, innovation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>consultancies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange of persons</td>
<td>Increasing mobility of R&amp;D personnel</td>
<td>Different career structure in universities and firms</td>
</tr>
</tbody>
</table>

**Instruments to improve the link between universities, research institutes and industries - aims, effects and problems**

Fhg ISI 1993
Activity profile of research institutions in Slovenia

Basic research
- academic specific purpose

Application-oriented R&D
- precompetitive

Exploitation/application
- market-oriented

Innovation management

Suppliers of know-how

Mediators

R&D support programmes

High tech
Type 1

Sophisticated conventional technology
Type 2

Conventional technology
Type 3

(Small-scale) manufacturing
Type 4

Workbench
Type 5

Know-How-demand

Types of firms

[FhG-ISI 1993]
Steinbeis-Stiftung (Baden-Württemberg)
(Members from associations, chambers, research and higher education, government and industry)

Activities
- General advisory services
- technology and market consulting
- R&D for enterprises
- providing information for industry
- assessment and monitoring of promotion projects

2567 employees (some part time or subsidiary job)
62% academics, engineers, computer specialists
29% students
9% organisation and administration

Budget 1992 c. 92 mn DM
- c. 68 mn from R&D consulting
- c. 1.5 mn from subsidies
Residual financing from foundation funds and other sources

Partners
158 regional Steinbeis Transfer Offices
Steinbeis-Stiftung

Aims and tasks
The support of industry, particularly small and medium sized firms

Clients and contacts
- Forward-looking firms
- Diversified industrial structure

Role of the Foundation in innovative policy
- Technological competitiveness
- Endogenous development strategy
Steinbeis Transfer Offices
(Baden-Württemberg)

1993
Zenit GmbH

Associates
Carrier association of c. 100 enterprises in North Rhine-Westphalia
Westdeutsche Landesbank-Girozentrale Land Nordrhein-Westfalen

Activities
- Information and consulting on new technologies and their markets
- management, financing and qualification
- patent searches, workshops, seminars
- project organisers for "Land" programmes
- carrying out structural and technology projects

Employees
Over 50 employees, half-being consultants with practical experience
- engineers
- natural scientists
- economists

Financing (1990)
Total budget: 8 mn DM, compromising
- 2.1 mn DM financing from associates
- technology and structural projects (financed from public funds
  2.4 mn DM)
- income from services 3.5 mn DM

Partners
- Enterprises
- research institutes
- technology and incubator centres
- chambers, industrial associations
- credit institutes
- consultants
Zenit GmbH

Aims and tasks
Support of innovation and technology, particularly for SMEs in the manufacturing sector:
- Opening up new fields of technology
- Providing demand-oriented services
  - Market research
  - Management support
  - Consulting for public promotion
  - Mediation of cooperations
  - Personnel transfer
- Cooperation with communities, chambers, incubator and technology centres etc.

Clients and contacts
- Monostructural coal and steel industry
- Old industrial region in process of structural change

Role in innovation policy
- "Re-polarisation" of mining region towards becoming modern industrial region
- Endogenous development strategies, with approaches oriented towards mobility
Tasks of the transfer offices

- General information and consulting (e.g. on founding and financing a firm);

- technology and market consulting, development of foundation concepts;

- research and development contracts in cooperation with the relevant research institution;

- training on technical and management topics (e.g. project management and marketing);

- assessment and monitoring of publicly promoted development projects (regarding level of technology market chances, etc.);

- running and assessment of public support programmes;

- expertises in innovation projects financed by banks (reports on soundness of firm's position for banks and venture capital companies);

- planning and servicing of technology and incubator centres;

- technical monitoring, testing of standards, industry-wide quality control.
It was a challenge for me to participate at this meeting and I have accepted with pleasure the preparation of co-presentation on the topic: Integrated technology transfer model and instruments for Slovenia.

However, in the course of preparation I have been faced with some problems:

- 15 min, allocated for the presentation, is not enough to say something, but too much to say nothing.
- Is there really anything new I can tell you about - especially when looking at the structure of the audience - all experts in the field having a lot of experience and knowledge about the topic.

I have decided to focus my presentation on two major questions:

- What should be done in Slovenia in the respect of efficient technology transfer on a short timescale?
- What can really be done?

Therefore I decided to structure my presentation into three main segments presented in Fig.1:

**GENERAL INTRODUCTION**

The economic and the social usefulness of the basic research in modernising societies was recognised long ago. The debate continues, however, nowadays mainly

- whether
- how and
- why the basic research is useful for the country which funds it.

Although almost everybody recognises that the so-called linear model, which postulates that scientific discoveries are the main source of technology, is over simplified, it is still advocated
S. PEJOVNIK

CO-PAPER
INTEGRATED TECHNOLOGY TRANSFER
MODEL AND INSTRUMENTS FOR SLOVENIA

A GENERAL INTRODUCTION
Basic research and technology as interactive systems
- Direct interaction
- Indirect interaction

B ANALYSIS OF THE CURRENT SITUATION IN SLOVENIA
Major obstacles
- Funding of R&D
- Qualified manpower
- Selection and funding of projects

C WHAT CAN (SHOULD) BE DONE
very often.

At the other extreme, the results of the basic research are seen at worst as mostly useless and at best available to anyone in the world who wishes to use them.

Commonly heard debates along these lines are misleading and often sterile, since they oversimplify the multiple and varied nature of the links between the basic research and the technological development.

**BASIC RESEARCH AND TECHNOLOGY AS INTERACTING SYSTEMS**

In public debate there often exists a view that the main "out put" of the basic research are published papers, whereas the technological development produces knowledge in the form of patents, operating instructions, technology schemes and software codes etc.

Although the basic research and the technological development are strongly interactive, they differ in both: in purpose and in nature (Fig.2).

Basic research often simplifies, for the purpose of understanding and prediction, by creating "ideal" model conditions. One problem usually generates two or more new ones - leading to knowledge and usually to the generalised models.

Technology development is concerned ultimately with making the products, processes and systems and performs outside the laboratory conditions in a world of multiple technological economic and social interactions and constraints.

Contrary to the common belief, the main economic benefit of the basic research is not a type of the knowledge directly applicable in a narrow range of sectors but a so-called background knowledge, research skills, instruments and methods that may yield economic benefits over a much broader range of sectors.

This has major implications for the policy in countries like Slovenia. In particular, it shows that the results of the basic research are not freely applicable but must be assimilated in complex technological systems. A large portion of the economic and social benefits of the basic research is embodied in trained scientist and engineers. Such people will be (should be) employed by the Slovenian industry provided that it has a strong incentive to improve the problem-solving abilities.

This requires outward-looking policies of the industry.
ALTHOUGH THE BASIC RESEARCH AND THE TECHNOLOGICAL DEVELOPMENT ARE STRONGLY INTERACTIVE THEY DIFFER IN:

PURPOSE AND APPROACH
AN ANALYSIS OF THE CURRENT SITUATION IN SLOVENIA

Since I don't have time to present a general picture on this topic and, on the other hand, a good analysis has been given by Minister Prof. Bohinc and by the distinguished German colleagues, I will only point out three main obstacles that, according to my personal belief, hinder a good usage of the technology transfer in Slovenia.

These obstacles are:

- inadequate distribution of the available funds between the budgetary sources and the sources from industry (Fig.3).

Prof. Bohinc has shown that in Slovenia R&D is funded mainly from the budget and allocated mainly through the Ministry of Science and Technology. I have to point out that the figures about the R&D money invested from Slovenian business firms, are not based on relevant statistics and represent only a fair estimate. Nevertheless, less than 20% of the total budget is an indicator showing clearly that we are far from the situation in the developed countries. This generates a major problem:
  the funds needed for a successful implementation of the developmental projects are too low, when having in mind that the costs for this type of the projects are usually an order of magnitude larger then the funds needed for the basic research.

To visualise the situation, I will use the approach given by the Chairmen of EACRO - Georges Mordchelles - Regnier (Fig.4). The technology infrastructure could be compared with a country's motor-way infrastructure. It is composed of main roads - the generic technology funded by national bodies, secondary roads - sectorial technologies funded by a group of companies, and private driveways - proprietary know-how - funded by individual companies leading to technologies specific for each industrial firm.

Industrial firms in Slovenia are at present unable to fund even the development of their own specific technologies and no associations (with few exceptions, of course) have reached mutual strategies to fund sector technologies.

Today's situation in Slovenia could be represented by the following picture: Fig.5

Since we haven't had a general strategy and since the Slovenian market has changed in recent years, we have today all three segments in Slovenia - however, they are not inter-connected, organised, and the private drive-ways are much longer (more costly) than necessary.
THE STRUCTURE OF THE FINANCING OF THE R&D BY TWO MAIN CATEGORIES

<table>
<thead>
<tr>
<th>Country</th>
<th>Gov.</th>
<th>Ind.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR GERMANY</td>
<td>34.7</td>
<td>63.6</td>
</tr>
<tr>
<td>IRELAND</td>
<td>46.1</td>
<td>53.9</td>
</tr>
<tr>
<td>USA</td>
<td>45.9</td>
<td>50.2</td>
</tr>
<tr>
<td>ITALY</td>
<td>51.8</td>
<td>43.9</td>
</tr>
<tr>
<td>AUSTRIA</td>
<td>46.5</td>
<td>50.9</td>
</tr>
<tr>
<td>GREECE</td>
<td>74.4</td>
<td>23.2</td>
</tr>
<tr>
<td>FRANCE</td>
<td>51.9</td>
<td>41.8</td>
</tr>
<tr>
<td>PORTUGAL</td>
<td>63.5</td>
<td>27.4</td>
</tr>
</tbody>
</table>

SOURCE: WORLD SCIENCE REPORT UNESCO 1993
Technology Infrastructure

Sector A

Industrial Firm

Sector Technology

Specific Technology

Generic Technology

Sector B

EACRO
Of course, the situation is not as bad as the Slovenian motor-way infrastructure. But some action is needed.

- Evaluation of the research groups according to international standards and according to the priorities that should be, at least partly, defined.

- Taking into account the economic (market), the social and the man power resources, few sector technologies of importance should be defined and adequate funds for their implementation should be allocated. The basic question for me is how to associate small companies to agree on a program which would be interesting for all associate partners. Namely, such an association would inevitably lead to formation of a critical mass in man power and in funds needed for the technology implementation.

A second problem lies in the qualified man power. There are some figures that we have to consider in this respect. According to UNESCO - Human development report and recent World Science Report Slovenia is lacking in highly qualified personnel. The enrolment in tertiary education is lower than in the world's average (21 % of young people in the age from 19 to 24 is enrolled in the tertiary education in the world, while in Slovenia the percentage is only 18,5 %, in Europe 33 %, developed countries 37 %). The enrolment in tertiary education is in Slovenia lower then in the world's average.

According to the World Science Report 1993, Slovenia has a sufficient number of active persons who pass the necessary qualification to be scientists or engineers. The data are presented in Fig.6.

By comparing this data one may conclude that the situation in Slovenia is not too bad. But I have to mention that the number of the science graduates (M.Sc. and Ph.D.) is low if compared to other European countries, where more than 30 % of graduates continue studies and get an academic degree.

The too small number of Ph.D.'s explains why Ph.D.'s are working mainly at Universities and research organisations (Fig.7). To correct this situation one should accept a policy that would increase the number of Ph.D. and not a policy leading in redistribution of the existing potential. Of course, in short-term actions the redistribution will happen and should happen since the time needed to correct the existing situation is far too long.

I have to point out also that due to missing strategies education favours the education of scientists and is lacking in education of high quality engineers. But this is an excellent example for actions that can only be planned on different timescales and there is only one conclusion that could be drawn - on the basis of the correct and fair evaluation of a situation in the country, the policy maker should decide about future activities and persist on the given course. For me there is no doubt - we need a general strategy.
TOTAL STOCK OF QUALIFIED MANPOWER (NUMBER OF PERSONS WHO POSSESS THE NECESSARY QUALIFICATION TO BECOME A RESEARCHER) AND THE NUMBER OF ENGAGED IN THE R&D

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Qualified manpower per million population</th>
<th>Engaged in R&amp;D Sc. and Eng. per million population</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR Germany (without former GDR)*</td>
<td>45,571</td>
<td>2,713</td>
</tr>
<tr>
<td>Ireland*</td>
<td>40,618</td>
<td>1,737</td>
</tr>
<tr>
<td>USA*</td>
<td>21,748</td>
<td>3,874</td>
</tr>
<tr>
<td>Italy*</td>
<td>20,748</td>
<td>1,310</td>
</tr>
<tr>
<td>Austria*</td>
<td>17,781</td>
<td>1,007</td>
</tr>
<tr>
<td>Slovenia**</td>
<td>24,463</td>
<td>500***</td>
</tr>
</tbody>
</table>

*** ESTIMATION
* WORLD SCIENCE REPORT 1993 UNESCO
** STATISTICA YEARBOOK
NUMBER OF SCIENTIST AND ENGINEERS IN REPUBLIC OF SLOVENIA
AND DISTRIBUTION IN SECTORS

<table>
<thead>
<tr>
<th></th>
<th>Ph.D.</th>
<th>Ms.C.</th>
<th>B.SC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>130</td>
<td>1071</td>
<td>24,909</td>
</tr>
<tr>
<td>Other (Univ.,Pro.,Adm.)</td>
<td>1837</td>
<td>1769</td>
<td>19,210</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1967</td>
<td>2840</td>
<td>44,119</td>
</tr>
</tbody>
</table>

SOURCE: STATISTICAL YEARBOOK MANPOWER IN SLOVENIA 1991
Finally - the most difficult part of my talk. I have to answer the question: what can (should) be done (in short - term period of course).

I am proud to say that Slovenia has basic pro-conditions for a successful technology transfer: human resources, instrumentation and the good will of people working in research and industries to finalise projects.

1. We have to establish a policy and to work in agreed directions for a period sufficiently long to achieve results. In the past this simple rule wasn't obeyed.

2. We have to improve the communication among the interested partners.

We, who work in the research, must constantly strive to maintain the high standards in the fields of expertise, develop tools that are flexible, multipurpose and meet a wide range of needs in various sectors, and promote communication and dialogue with various "technology sources", as well as foreign universities and other research bodies.

The Industry must define their needs, isolate those who are blocking further development and invest appropriate funds for realisation.

The critical factor in transferring technology is what contract research organisations in Europe call the "transfer agent". To inaugurate it in Slovenia, selected sectorial technologies needed for group of companies should be identified and set up with a part of the budget support (technology fund). This has to be done by expert bodies nominated from the Ministry of Science and Technology.

The "Transfer agents" must be familiar with both environments - the national research policy and the industrial scene with its multitude of the technology needs.

If the "transfer agent" is to make an effective contribution to the technology transfer in a real time, then, clearly, it must participate in the research phase, too. Please don't understand a "transfer agent" as something new or as a single form only. There are many possibilities.

We have some experience in this context. The so - called mixed groups of people from research organisations and industry have successfully implemented some projects to profit making products.
Approach
To Build Technology Infrastructure

- Strategy
  Government

- Knowledge
  Research Organisations (Public and Private)

- Product
  Mixed Groups Academia/Industry
  As "Transfer Agent"

To collect industry's needs of generic nature

To analyse the needs and propose R&D projects on relevant technology

To execute the R&D projects

To practice real-time technology transfer to pilot customers

To disseminate results to industrial end-users with maximum efficiency
COMMON PROPRIETY OF MANKIND

WORLD (COMMON) TREASURY (OF SCIENCE) OF KNOWLEDGE

TRANSFER (% OF GOVERNMENTAL FINANCIAL SUPPORT)

COMMON PROPRIETY OF MANKIND

FUNDAMENTAL BASIC SCIENCE (RESEARCH)

UNIVERSITY (100%)

GOALS

EXPERTS (REQUESTED INTERNATIONAL VALUATION)

DEFINITION OF NATIONAL STRATEGIES

DEVELOPMENT OF TECHNOLOGIES

EXPerts

RESEARCH ORGANISATIONS (25 - 30%)

PRODUCTS MARKETING PROFIT

TECHNOLOGY (KNOW - HOW)

DEVELOPMENT (SPECIFIC BUT IN TOTAL NOT MORE THAN 10%)

PROPRIETARY
REVIEW of ACTIVITY
of the Hungarian
NATIONAL COMMITTEE for
TECHNOLOGICAL DEVELOPMENT
(OMFB)

Prof. Dr. Ernő PUNGO R
Minister without portfolio
President of OMFB
Member of the Hungarian Academy of Sciences

- November 1993 -
REVIEW of ACTIVITY of OMFB

1. System of applications for applied research

- R & D PROJECTS
- NATIONAL PROJECTS
- IMPROVEMENT of INFRASTRUCTURE of R & D

2. Further applications

- SMALL - and MEDIUM - SIZE ENTERPRISES (SMEs)
- EXPORT ORIENTED R & D ACTIVITY
- HELP of PATENTING ABROAD

3. International relations

- BILATERAL
- MULTILATERAL
- SCIENTIFIC and TECHNOLOGICAL (S&T) ATTACHÉS
- ACTIVITY in the field of APPLIED RESEARCH
1. **System of applications for applied research**

- **R & D PROJECTS**: INVITATION of TALENTS
  - Competitive applications (since March 1991)
  - Decision: Board of technology experts

  **Situation on 30th June, 1993:**
  - submitted: 3835 applications
  - financed: 1112 (29%)
  - completed: 238 (21%)
  - successful: 219 (92%)
  - already in production about 70% of them

  **Total sum of support awarded**: 10.7 billion HUF

- **NATIONAL PROJECTS**: (since 1993)
  - Handling and ultimate emplacement of nuclear wastes
  - Geografic information system (GIS)
  - Development of new food products
  - Development of Hungarian delivery industries for car production
  - In preparation: Development of machinery for the agriculture being in reorganization

- **IMPROVEMENT of SOCIAL CONDITIONS and MILIEU of TECHNICAL DEVELOPMENT**

  Decision: Interministerial Committee of Secretaries of State

  **Situation on 30th June, 1993:**
  - submitted: 5666 applications
  - financed: 2870 (50%)

  **Total sum of support awarded**: 6.5 billion HUF
2. Further applications

- **SUPPORTING of the INNOVATION ACTIVITY of SMALL- and MEDIUM- SIZE ENTERPRISES**
  
  380 M HUF

- **SUPPORTING of the EXPORT ORIENTED R & D ACTIVITY** (jointly with the Ministry of International Economic Relations)

  **Situation on 30th June, 1993:**
  
  submitted 60 applications
  financed 33  ""  (640 M HUF)

- **SUPPORTING of the PATENTING ABROAD for HUNGARIANS** (since 1992)

  **Situation on 30th June, 1993:**

  24 applications
  60 M HUF
3. International relations

- **BILATERAL INTER-GOVERNMENTAL AGREEMENTS** on 
  **SCIENTIFIC and TECHNOLOGICAL (S&T) COOPERATION**  
  (additional support of projects)

**BILATERAL INTER-GOVERNMENTAL S & T AGREEMENTS**  
coordinated by OMFB

<table>
<thead>
<tr>
<th>Country</th>
<th>Year of agreement</th>
<th>Projects in 1993/94</th>
<th>Contribution in 1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Austria</td>
<td>1969</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>2. Finland</td>
<td>1974</td>
<td>TEKES; CIMO: 13 (Mobility) frame programmes</td>
<td></td>
</tr>
<tr>
<td>4. Germany</td>
<td>1987</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>5. Great Britain</td>
<td>1967; 1987</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>6. Greece</td>
<td>1979</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>7. India</td>
<td>1974; 1992</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8. Israel</td>
<td>1991</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>9. Italy</td>
<td>1965</td>
<td>28 (co-operation)</td>
<td></td>
</tr>
<tr>
<td>15. Spain</td>
<td>1979</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>16. Turkey</td>
<td>1989</td>
<td>in preparation: working plan</td>
<td></td>
</tr>
<tr>
<td>17. USA</td>
<td>1977; 1989</td>
<td>138</td>
<td>1 M USD ≈ 80 M HUF</td>
</tr>
<tr>
<td>(US-Hung. Joint Board)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total 331+28 18,2 M HUF  
(all others)
PARTICIPATION in MULTILATERAL R & D PROGRAMMES and ORGANIZATIONS

* Cooperation within the framework of EUREKA - Initiative

Hungary is full right member since May 1992.

Hungarian participation -1992: in 7 projects

- 1993: 22 institutions in 16 projects
  ( 1 university
  10 research institutes
  11 enterprises )
Further 4 projects in preparation
(Situation on 31st October, 1993)

* Cooperation within the framework of COST

Hungary is full right member since November 1991.

Hungarian participation -1991: in 3 projects

- 1992: in 11 projects
- 1993: in 36 projects
(Situation on 31th October, 1993)
PARTICIPATION in MULTILATERAL R & D PROGRAMMES and ORGANIZATIONS (continuation 1)

* European Communities (EC)

○ 5 fields opened for Hungary within the 3rd R & D Framework Programme of EC:
  - Environment
  - Biomedical and health research
  - Non-nuclear energy
  - Nuclear fission safety
  - Human capital and mobility

○ EC - Hungary R&D sub-committee since March 1991, coordinated by OMFB

○ PECO '92 and PECO '93 programmes

  1992: five different forms of cooperation
  55 M ECU for 9 countries of the Central-Eastern-European region

<table>
<thead>
<tr>
<th>total</th>
<th>Hungarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>submitted</td>
<td>11.722</td>
</tr>
<tr>
<td>approved</td>
<td>3.233</td>
</tr>
</tbody>
</table>

  1993: one form of cooperation (joining to current projects)
  21 M ECU for 9 countries of the region

* CERN - Hungary is member since June 1992.

Possibilities of participation - directly in the research activity
- in tenders of delivery
PARTICIPATION in MULTILATERAL R & D PROGRAMMES and ORGANIZATIONS (continuation 2)

* OECD - PIT-Programme (Partners In Transformation)
  - Country-study of the Hungarian science, technology and innovation policy

* NATO - Scientific civil programmes, workshops (Disarmament, Environment, High Technology, Human Resources)

* ESA - European Space Agency
  Agreement of cooperation: April 1991

* CEI - Central European Initiative
  Scientific and Technological Working Group (since February 1990) - 7 groups of experts

* PHARE - ACCORD (Assistance of the Community for Cooperation in Research and Development) programme
  10 M ECU (gross value) support for the Hungarian R&D sphere
  Decision about the applications in more steps

* EMBO - European Molecular Biology Organization (Heidelberg)
  Hungarian membership: 1992 (represented by the Hungarian Academy of Sciences, HAS)

* ESF - European Science Foundation
  Hungarian membership: 1990 (represented by the HAS)
SCIENTIFIC and TECHNOLOGICAL (S & T) ATTACHÉS
(coordinated by OMFB and Ministry of Foreign Affairs)

* Posts existing:

<table>
<thead>
<tr>
<th>Location</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonn</td>
<td>Tel-Aviv</td>
</tr>
<tr>
<td>Helsinki</td>
<td>Tokyo</td>
</tr>
<tr>
<td>London</td>
<td>Vienna</td>
</tr>
<tr>
<td>New-Delhi</td>
<td>Washington D.C.</td>
</tr>
<tr>
<td>Paris</td>
<td></td>
</tr>
</tbody>
</table>

* New posts under establishment:

<table>
<thead>
<tr>
<th>Location</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brussels</td>
<td>(to the EC)</td>
</tr>
<tr>
<td>Rome</td>
<td></td>
</tr>
</tbody>
</table>
* INTERNATIONAL ACTIVITY in the field of APPLIED RESEARCH and TECHNICAL DEVELOPMENT

* Bay Zoltán Foundation and Institutes for applied research

SZEGED: Biotechnology (opened on 24th September, 1993)
MISKOLC: Logistic and production technologies
         (opening on 10th December, 1993)
BUDAPEST: Material technology

Model: Fraunhofer Gesellschaft (Society) and Institutes (Germany)

Cooperation with BMFT (Ministry for Research and Technology, Germany, Bonn) and Fraunhofer Management GmbH (München)

* Technological and entrepreneurs' parks (Innovation parks)

Cooperation with BMFT and VDI/VDE Management GmbH
(Management of Association of Engineers and Electricians, Germany, Berlin)

* Technology Exchange Service (TES)

Founded by OMFB in August 1992 - at present a data bank of 130 R & D projects and institutions

* HUNTECH

Data bank about Hungarian R & D institutes and projects
(OMFB and Office for International Technology Cooperation)
REVITALISATION OF ENTERPRISES, 
THE ROLE OF R & D

1. Introduction
There are two parallel processes running simultaneously in Slovenia, privatisation and revitalisation of enterprises:

Majority of enterprises in Slovenia (37,000) is small size private owned enterprises. The older industrial enterprises (3,000) belong to the group of medium size and large enterprises and they represent also majority of jobs in industry (85%), their economic importance is very high especially in production of goods for export. Socially owned enterprises will be privatised in 1994. Majority of old industrial enterprises should adapt to the new market conditions.

Slovene enterprises have lost 90% the domestic markets in other republics of former Yugoslavia. East European markets are not any more captive, so they have to adapt to new market conditions.

2. Revitalisation of enterprises
Government of Slovene supported sector studies in 6 industrial sectors (wood, food, textile, automotive, metal processing, electric) and revitalisation projects in pilot enterprises in this sectors.
A six step approach to revitalisation has been tested in pilot enterprises. First step was defining the business of the pilot enterprise.

Re-segmentation and repositioning were proven to be necessary to adapt to new market conditions, new markets and to avoid confrontations with world market leaders, and possibly to identify specific market niches for the pilot enterprise. Technology market matrix of an industrial enterprise should be analysed to find the answers on the questions about generic markets and opportunities. Many old markets are lost, enterprises should look for new customers. Generic technological capabilities and products are often not sufficient on new markets where they face international competition. Depending on competition in some cases normal incremental innovations in products and technologies are sufficient in other cases revolutionary innovations are necessary for entering new markets or to increase market share on an existing one. Scientific community can help find synergy and define new missions in enterprises.

Second step is market analysis. A normal up-to date production line in a factory can produce more than the domestic Slovene market of two million consumers can buy. The full utilisation of capacities means also a strong export orientation. Germany, Italy, France and Austria are the most important export destinations.

Detailed market analysis shows, that there are possibilities in the direction of differentiation of products based on increase of quality and potential growth of prices and in some cases in the direction of low prices,
based on economy of scale and low costs. Understanding the needs, the expectations and the precept values of customers in basic. Comparing purchasing criteria e.g. price, quality, product range, product design, delivery lead-time, manufacturing flexibility, sales & marketing support shows strategic gaps of the enterprise. Market data are very important for evaluation and necessary corrective actions that help R&D projects to become a success for the enterprise and to shorten time in which break even point is attained.

Third step is bench marking. An enterprise should compare its products, technologies, productivity measured by value added per employee and cost structures both with technology and market leaders and with direct competitors on the markets. Bench marking enables the quantification of strategic gaps.

The process of bench marking is dealing with all elements of value chain, and specific cost driving factors in every link of cost chain are analysed. Value chains of all products of an enterprise should be compared. An enterprise should be aware about contribution to cash flow and profit of each product. Scientists and development engineers should understand that life cycle of an product is depending on similar products of competitors, as soon as the profits and cash flow go down, there is an urgent need for a new product or a new technology, which enables significant reduction of costs and improvement of competitive position.

Comparative resource analysis, where the structures are compared, efficiency is measured against internal requirements, against external
efficiency standards, competitors standards, systems and strategies are compared etc., is the basis for revitalisation concept and its implementation through revitalisation projects. Typically action plans in pilot enterprises consisted of more than 5 revitalisation projects.

3. The role of R & D

Institute for Economic Research is doing a lot of consultancy in enterprises and is using the data of enterprises for analysing different processes in Slovene enterprises.

An analysis on a very limited number of enterprises (in electrical and electronic products, metal products, machines and steel branches) shows that some links in cost chains represent not much in terms of money, but are very influential both when analysing the level of total costs related to a product and related to separate groups of costs for the same product. The impact on total level of costs and on groups of costs (e.g. production costs, purchased materials costs, energy costs) of R&D, construction and technology preparation is very high, but this links of cost chain themselves are not so expensive. Do managers and engineers understand this challenge? Many believe that this is the reason for increasing R&D expenditures. Before doing it, the efficiency of their departments should be benchmarked, all the cost drivers of R&D costs should be analysed and in many cases new relations between marketing, finance and R&D departments should be established.
Enterprises need more small incremental innovations, than revolutionary innovations. Liberalisation of domestic market and increased competition forces decreasing costs based on technological changes in production of existing products for existing markets. Many products are to be adapted for the new (West European) markets, and many have to be developed new. There are few enterprises being able to finance development of new products for new markets combined with new production line technologies.

Scientists, researchers & development engineers at independent research institutes and university laboratories should understand this strategic marketing and financial options of Slovene enterprises. Misunderstandings between industrial - commercial community and scientific community are still present.

Some scientists and development engineers are not able to understand the importance of market needs and competition, and behave like it was normal for years. On closed markets of former Yugoslavia and COMECON countries there was always a higher demands than supply. So the enterprises were not much concerned about life cycles of the products, neither were R & D laboratories. The competitors were not offering new products each year and the time windows for innovations were large. Innovation processes were linear, after scientific discovery, the steps of applied research, development of laboratory prototypes, industrial prototypes, preparing of production technologies and full production followed in a slow pace. There were no marketing activities running in parallel, the market was hungry of new products.
Now the processes should run parallel, marketing activities are now of higher importance than technical activities. The competition determines the life cycles of a new product, the growth, maturity and decline phases of a product depend on competition, innovation phase should be as short as possible. It is known that the credibility of technical success of a new product is increasing with the time the engineers have used for development, but on the other hand credibility of commercial success is decreasing with time. For an innovation the time window available is of paramount importance.

Life cycles are not very often an issue in discussions in scientific world in Slovenia. If life cycle of a product is discussed then usually only sales volume seems to be important. But from the point of view of an enterprise profits and cash flow are even more significant. Everybody understands that the duty of parents is to help the children to became economically independent, many scientists and engineers in R&D departments do not have a similar feeling about their inventions. They believe that establishing technical feasibility of a new product and providing necessary production technology is all, an enterprise can demand. Somebody else should care about business plans, financing market launch sales, contracts etc.

The scientists, researchers and development engineers have to understand the importance of positive cash flow for the enterprise. Phases of basic research, applied research, prototype production, pilot plant and technology preparation, market launch represent negative cash flow.
Earnings from sales and level of positive cash flows depend on competition.

Break-even of a new product should be attained in shortest possible time. Fathers of inventions could be of great help in all phases till reaching break even.

Field research on a limited number of Slovene enterprises of Institute for Economic Research shows that there are 88% of innovation projects which never reach break-even point and profits. Researchers can do many things in early phases of an innovation project to provide all necessary activities and components of the project to assure their invention to become a new profit generator of the enterprise.

From the point of view of an enterprise it is very important to identify critical problems which may cause that the innovation project will never bring profits.

As early as possible in order to take corrective actions or to abort the projects early when the amount of money spent on project is not high.

4. Entrepreneurial methods of evaluation of R & D projects

Management consultants of Institute for Economic Research suggest usage of different methods of evaluation of projects.
Management must first understand, current technological and market position of enterprise. This understanding is based on procedures described above (Revitalisation of enterprises). Proposals for R & D projects must fit into the revitalisation concept.

The understanding of market and financial criteria is very important for the researchers too. The researchers are expected to think more and more like entrepreneurs. If there is a captive market for what they can develop as a new product, then they need first to prepare a sales plan. Technical standards are not to be seen as an non fair obstacle to entering market but as an opportunity to be there before less knowledgeable competitors. The researchers should judge in very beginning of an development project, weather the enterprise has available machinery and experienced work force and whether the new product will not cause devaluation of existing production plan for products which generate profits and positive cash flow. Needs for additional fixed and working capital for future production and marketing may make owners and top management reluctant in supporting an R&D project.

Assessment of market parameters for new products or a new technology is conditio sine qua non for starting R & D project. Market activities, market research, preparation of marketing actions, preparations for launching new product should be run parallel to technical activities of an innovation project. Without market parameters we can not make cash flow plan as basic part of the business plan.
After every phase of the project (typically 5 times) during a project, an assessment of both credibility of commercial and credibility of technical success should be done.

Non satisfactory answers on the questions listed bellow may cause corrective actions or (very often) abortion of project.

Questions for assessment of commercial success:
- Size of market by volume
- Market trends
- Expected life time of the new product on market
- Expected share of the market
- Time required to establish market for the new product
- Degree of competition
- Structure of market outlets
- Existence of other markets
- Long term potential for diversification
- Advantages of the product process for the users
- Environmental aspects
- Patents and licenses position
- Sensitivity to delay in introduction to the market
- Dependence on bought-out raw materials and components
- Effects of production cost and selling price on commercial success
- Company image
- Knowledge of the market
- Technical and financial resources
- Acceptability to labour and sales force
- Agreement with corporate strategy and existing product mix
- Compatibility of the product with the sales organisation
- Compatibility with existing production facilities.

Questions for assessment of technical success:
- Technical principles
- Technology and know how
- Competitive research
- Technical specifications
- Availability of components
- Technical standards
- Needs of customers
- Control over specifications
- Alternative approaches
- Forward planning
- Project equipment
- Source of finance
- Amount of finance
- Information service
- In-house experience
- Quality of staff
- Motivation
- Quantity of staff.

5. Missing links

Scientists and engineers at independent institutes and university, laboratories prefer to care just about early phases of technological part of a product innovations. Many want to be insulated from questions about market and cash-flow. On the other hand, many managers with economical or financial background do not understand technical research and development and prefer to buy licences and technologies incorporated in new machinery. Where there is today a communication barrier, new links between scientific and commercial world should emerge.

Ljubljana, 10. November 1993

Rado Faleskini
References:


2. Sharon M. Oster, MODERN COMPETITIVE ANALYSIS, Oxford University press, 1990


4. REVITALISATION OF ENTERPRISES 1993
   Project director: dr. TEA PETRIN
   Project team members - A.T. Kearney:
   Anne Deering Floris Italianer Dietrich von Bardeleben
   Mike Begg Yvan van der Oord Barry Leach
   Patricio Crespo Peter Tveit Javier Calvo
   Andrej Vizjak
   Slovene team members
   Rado Falcskini Tomaž Klemenc Olga Kotnik
   dr. Andrej Škarabot Jaro Berce Andrej Kržič
   Tone Săgadin Barbara Cerle Tosja Pušenjak
   Number of pages: 2540

5. FUNDAMENTALS OF TECHNOLOGY POLICY OF SLOVENIA
   An expertise for Ministry of science and technology 1991
   Project manager : dr. Peter Stanovnik
   Authors: dr Ivo Banič
   Milena Beve
   Rado Falcskini
   Stanka Kukar
   Number of pages: 120.
REVITALISATION OF SLOVENE ENTERPRISES: THE ROLE OF RESEARCH, DEVELOPMENT AND INNOVATION

Rado Faleskini
Institute for Economic Research
Management Consultants Group
&
Ministry of Economic Affairs

Handouts
Ljubljana, 7 November, 1993

Privatisation and revitalisation

Total number of enterprises in Slovenia 22,000
private ownership 19,000

<table>
<thead>
<tr>
<th>PRIVATISATION</th>
<th>REVITALISATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social capital is to be transformed:</td>
<td>Adaptation to new market conditions:</td>
</tr>
<tr>
<td>- Private capital to 60%</td>
<td>- Strategic planning</td>
</tr>
<tr>
<td>- Capital owned by pension fund</td>
<td>- Export orientation</td>
</tr>
<tr>
<td>- Capital owned by restitution fund</td>
<td>- Quality, zero defect, just in time</td>
</tr>
<tr>
<td>- Capital owned by investment funds</td>
<td>- Lean production</td>
</tr>
</tbody>
</table>

Source: I E R
① Defining the Business

Resegmentation and repositioning can prove to be necessary in order to avoid confrontation with world-market leaders and possibly to identify specific market niches for Slovenian Industry.

Source: A.T. Kearney

② Market Analysis

Analyse the dynamics of core country markets
• 6 core countries account for 76% Slovene international exports

Source: A.T. Kearney
Strategy of enterprise and the technology-market matrix

Revitalization Approach

A six-step approach to revitalization of enterprises

Source: A.T. Kearney
2 Market Analysis

- A detailed market analysis is key to successful competitive strategy.

![Market Analysis Diagram](image)

Source: A.T.Kearney

2 Market Analysis
Electric & Electronics

- Highest strategic gap in quality, product ranges, design and sales & marketing support.

<table>
<thead>
<tr>
<th>Product Segment</th>
<th>Electrical Industrial Machinery</th>
<th>Communication Equipment</th>
<th>Electronics Equipment</th>
<th>Household Appliances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchasing Criteria</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Price</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product design</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery leadtime</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing flexibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales &amp; Marketing Support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- □ = Customer criteria
- ○ = Segment performance

Source: A.T.Kearney
3 Benchmarking
Electric & Electronics

- Severe restructuring is needed in most elements of the value chain.

<table>
<thead>
<tr>
<th>% Cost in Total Sales</th>
<th>Critical Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net profit</td>
<td>Lack of profits as a base for investments</td>
</tr>
<tr>
<td>Admin. overhead</td>
<td>High burden of interest cost</td>
</tr>
<tr>
<td>Sales &amp; marketing</td>
<td>Uncompetitive level of overhead cost</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Low investments in market position</td>
</tr>
<tr>
<td>Production &amp; logistics</td>
<td>Low capacity utilization</td>
</tr>
<tr>
<td>Raw materials &amp; components</td>
<td>High vertical integration</td>
</tr>
</tbody>
</table>

Source: A.T. Kearney

Products of Enterprise

- Contribution to cash flow and profits generated by a product depend on market needs.

`Gap` to be filled (by new products, markets or diversification)
4 Resource Analysis
Research, development and innovation

Value-Added Chain
- Transportation costs
- Costs of storage
- Sales costs
- Admin. overheads
- R & D
- Maintenance
- Production
- Components
- Raw material

Specific Cost-Driving Factors
- Make or buy analysis,
- Research strategy (in house research, university, independent institute),
- Development strategy (in house development, university participation, independent institute participation),
- Standardization (international standards, national standards, company standards and technical requirements),
- Age and technological level of laboratory equipment,
- Available data bases, documentation
- Parallel market research,
- Value analysis / engineering methods,
- Quality assurance methods,
- Available state co financing,
- Efficiency: meeting company requirements, comparisons
- Efficiency of standards of competitors

Source: IER

5 Revitalization Concept

Alternative development options have to be evaluated to define appropriate ROS and market share goals

Source: A.T.Kearney
Costs chain and impacts on its structure

In the overall restructuring concept, the summarized findings of the resource analysis and benchmarking are combined with insights and perspectives from market analysis. The combined product is designed to substantially improve the competitiveness of the company by tangible thrusts.

Source: A.T.Kearney
Right time for launching a new product

- Credibility of success

**Diagram:**
- Credibility of commercial success
- Credibility of technical success
- MAXIMUM TIME FOR COMMERCIAL SUCCESS
- APPROPRIATE TIME WINDOW
- MINIMUM TIME FOR TECHNICAL SUCCESS
- START OF A NEW DEVELOPMENT PROJECT
- TIME

**Action Plan**

- Responsibilities and resource/time requirements have to be defined in an overall action plan to realize tangible results

**Table:**

<table>
<thead>
<tr>
<th>Project</th>
<th>Responsibilities</th>
<th>Resource Needs</th>
<th>1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Market projects</td>
<td>France - motors</td>
<td>Name X Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hungary - market research</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Italy - possible new suppliers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. R. D. Innovation projects</td>
<td>Research of steel materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development of new generation of motors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>New packaging technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Organization projects</td>
<td>Internationalization</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acquisition of laboratory A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality assurance system</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: A.T.Kearney
Who should care about profits and positive cash flow
- All participants of innovation process should understand the revitalization concept of the enterprise and have to be involved in all links of innovation chain.

Profits & positive cash flow

Source: IER

Life cycle for a typical product
- Profits and sales volume

Years from launch
Cumulative Cash Flow Diagram

- Healthy enterprise needs positive cash flow

![Cumulative Cash Flow Diagram](image)

Commercial success of R&D(innovation) projects

![Commercial success of R&D(innovation) projects](image)

Source: I E R
Entrepreneurial methods of evaluation of projects

- Marketing criteria
  - captive market
  - sales plan
- Technical criteria
  - clear scientific principles
  - technical standards
- Production (existing technology) criteria
  - available machinery
  - experienced work force
  - production plan
- Financial criteria
  - need for additional fixed capital
  - need for additional working capital
  - cash flow plan

Assessment of credibility of commercial success

- Size of market by volume
- Market trends
- Expected life time of the
  - new product on market
- Expected share of the
  - market
- Time required to establish
  - market for the new product
- Degree of competition
- Structure of market
- outlets
- Existence of other markets
- Long term potential
- for diversification
- Advantages of the product
- process for the users
- Environmental aspects
- Patents and licenses position
- Sensitivity to delay in introduction
  - to the market
- Dependence on bought-out raw
  - materials and components
- Effects of production cost and
  - selling price on commercial
  - success
- Company image
- Knowledge of the market
- Technical and financial resources
- Acceptability to labour and sales
  - force
- Agreement with corporate
- strategy and existing product mix
- Compatibility of the product with
  - the sales organisation
- Compatibility with existing
  - production facilities

Source: IER
Assessment of credibility of technical success

• Technical principles
• Technology and know how
• Competitive research
• Technical specifications
• Availability of components
• Technical standards
• Needs of customers
• Control over specifications
• Alternative approaches

• Forward planning
• Project equipment
• Source of finance
• Amount of finance
• Information service
• In-house experience
• Quality of staff
• Motivation
• Quantity of staff

Source: IER

Communication between R&D experts and entrepreneurs

• Different understanding and different orientation represent a communication barrier
1. The situation

At the beginning of 1993, the outcome of the political integration process that started out from Western Europe cannot yet be determined precisely. The experience gained in the period between the Treaty of Rome of 1957 and the Treaty of Maastricht 1992/1993 shows - in addition to phases of dynamic acceleration and expansion - also phases of consolidation and retardation.

Nevertheless, politicians and citizens of the geographical region of Europe have, in this century, never been closer than in the recent past, since the political upheavals in Central and Eastern Europe. Open borders for people, information and opinions, but also for goods and services, have largely become reality. The existence of the regional neighbourhood is bringing about more social and economic relations and interdependencies than ever before. It is therefore current and legitimate to speak of "Greater Europe" in the sense of a region sharing a common fate, even though - apart from the now somewhat less prominent 'Helsinki process' - it is not linked by a framework of political institutions. However, the mutual dependence of the peoples and states in Europe is revealed not least by the fact that crises and hazards confronting the further development of the Continent, as a result of reform processes going on in Central and Eastern Europe since 1989, have, for the time being, by no means diminished. On the other hand, this situation has also generated a growing measure of active solidarity and assistance for Central and Eastern Europe.
The situation of science and research in the Central and Eastern European states (including the territory of the former Soviet Union) is characterized by

a. the coincidence of existential crises and structural reforms - both forced by economic causes, but proceeding in the individual states with varying intensity and at a varying pace. Currently, roughly three groups of states can be distinguished:

- Advanced reform states with functioning parliamentary systems based on pluralist political parties. Here, the reform process has also reached the structures of science and research; their reorganization is an object of government policy and thus also of the dialogue conducted with other states.

- Reform states still experimenting with parliamentary democracy and this without stable institutions and governments. Here, due to the predominance of urgent problems of political and economic organization, science and research are, as a rule, largely left out of the reform process.

- Reform states which have not yet made the transition into a parliamentary system based on pluralist political parties but are still going through a phase in which they are governed mostly by authoritarian presidential systems. Here, the system of science and research is hit by the full force of economic reorganization; the focus is naturally on the existential crisis threatening science and research, also as a topic of international relations in the field of science and research.

b. The splitting up of several larger states into new independent states. In the same area as before, the number of independent states in Central and Eastern Europe has increased from 8 to 27 within a short period of time. For the researchers affected and for their institutions, this means the need for complete reorientation in a different framework with sometimes entirely different orders of magnitude.

But the same is also true of relevant cooperation, assistance and advice coming from among the western industrialized countries.
3. Cooperation and assistance

Science and research assume a special role in the reform processes in Central and Eastern Europe. Here, top performance was achieved even in the past both in basic research and in individual areas of technical development, providing an incentive for a broad measure of cooperation with partners from western industrialized countries. This incentive has grown even stronger in the wake of the opening-up of the research institutes which used to be restricted to the military sector, above all in the CIS states.

Therefore, in contrast to many other sectors where political restructuring is required, there is no need for an entirely new start in the field of science and research; what is also required here is to preserve productive potential. However, these potentials are interspersed with the overstaffed and, by modern standards, unprofitable superstructure of the science system. This is where the assistance programmes encounter real difficulties and problems: They have to organize survival aid for the 'productive elements' without preserving the overall unproductive structures.

Under the German Government's programme for assistance through advice to the Central and East European states when introducing democracy and market economy, the Federal Ministry for Research and Technology (BMFT) has set two main priorities for the field of research:

a. Support for the productive potential wherever the existential crisis (still) prevails over the reform efforts. This is the case above all in the CIS states. For lack of other objective evaluation possibilities, criteria for productivity are derived from the assessment by and the cooperation interest of reputed German research institutions. The goal of this process is to preserve productivity, e.g. by providing possibilities for visits abroad, purchasing literature, apparatuses and materials which can be obtained only with foreign exchange as well as by awarding subcontracts for research and development projects.

b. Advice and support for reforms within their research system wherever a systematic reorganization has already become a subject of official government policy. This item includes support for evaluating existing potentials against the background of open, worldwide competition as well as review of reorganization concepts and of models for a future research infrastructure.
For both approaches, more funds are, obviously, available under EC programmes than in national budgets. On the other hand, the expertise and experience concerning specific situations as well as personal contacts and links are naturally more readily available in individual member states. This is true in particular of Germany where, as a result of Germany's location between east and west, a large number of intensive contacts and cooperative activities had already existed in the past. Also, there is the added asset of direct experience existing in the new German Länder as a result of earlier links with COMECON states.

4. Prerequisites for medium-term success

The crucial factor for the assistance - i.e., survival aid and reform support - to be effective will be using effectively the cooperation experience of the national science institutions in combination with the financial possibilities provided by the EC and within the framework of other multilateral efforts (OECD, G7). At the practical level, the following, frequently underestimated, prerequisites for success, which concern in particular the political responsibility of the receiving countries, are becoming apparent and should be taken into consideration when taking concrete steps:

- a time limit on purely preserving support measures in order to provide incentives for the necessary reforms;

- transparency of support for individual countries in order to avoid duplication of efforts and ineffective competition among the providers of assistance (the OECD is at present preparing a documentation in cooperation with the EC Commission);

- encouragement of the receiving countries to accommodate in their political and economic reform concepts the crisis and reorganization of science and research;

- greater consideration of the research infrastructure when using the EC's technical assistance programmes (PHARE, TACIS);

- preference, or bonuses, for reform measures over preserving measures;

- for the new smaller independent states: development of profiles and priorities for science and research under the new conditions;

- revitalization of regional work-sharing across the (old and new) borders;
avoidance of a one-sided orientation to the West in response to the compulsory integration into Eastern Europe in the past;

- regular assessment of the success of support measures (both individually and jointly between providing institutions and receiving countries).
1. Introductory Remarks

2. Evolution of Global Competitiveness

3. Slovenia's R&D Position Among the EU Member Countries
   (indicators, strategic targets, policy measures)

4. Some Development Considerations for Slovenia
1. Introductory Remarks

It is a great pleasure to take part in such a well-designed workshop. Since knowledge in the broadest sense has become the fundamental basis for global competitiveness and sound development, my presentation tries to elaborate the potential role of Slovenia's R&D in its future development. I am going to focus on the following issues:

- A general evolution of competitiveness in the coming information and communication era, particularly elucidating the role of R&D in this process.

- The assessment of Slovenia's position among the EU member countries with regard to the selected OECD R&D indicators, the R&D strategic targets as well as concentration on the R&D policies.

- And finally, the elaboration of suggestions related to Slovenia's future system environment and policies in order to employ the R&D as one of the crucial levers for a sound development and progressive integration of the country into Europe.

2. Evolution of Global Competitiveness

Competitiveness can be achieved by reducing the prices, by improving performances of goods and services, or by joint efforts of both factors.

Hitherto, the dominating attention, at least in Europe, has been devoted to improve the cost structure and, as a consequence, to reduce the costs and prices or increase profits. In this respect the reduction of manpower has been one of the measures causing high unemployment in EU, which the most recent White Paper of the European Commission intends to lower first of all by decreasing taxation on labour (from about 40% towards US's average /30%/ or even Japan's average /20%/). Among the other efforts to improve the cost structure is better "materials management", including the cost of capital.

Through the growing influence of the information and communication technologies, and through the advancement of globalization, the performance competitiveness, based on massive technological diffusion, total quality approach, standards, and general innovation, is becoming the dominant base for competitiveness. In addition to the above mentioned, the proportion between the "investments in the past" (e.g. the amount of agricultural, various industrial, and state monopolies' subsidies) in relation to
"Investments in the future" (total R&D funding, human resource upgrading, modern infrastructure building, innovation promotion, etc.), the strategic component of competitiveness is growing as well. Among the elements of strategic competitiveness, we may add the investments and other financial efforts of the firms and countries to increase their global market share of prosperous goods and services, as well as joint efforts of larger or smaller number of firms to carry out R&D projects in R&D-intensive areas (information, communication, aviation, space research, and similar technologies; even some recent new car development projects cost up to 7 or even 8 billion US$). E.g. more that half of the EUREKA projects are targeted to develop new technologies. All these efforts lead towards creation of European and global business alliances.

Let me conclude by the following:

For Slovenia, which is a small and rather open economy with reasonable human resource potential, the capacity to diffuse technologies and to innovate is a priority target in order to achieve a niche-oriented (EFTA countries' type) development strategy of business integration into European and global markets with goods and services of higher quality.

Therefore, a comparison with the EU countries' R&D potentials and targets is not aimed at achieving an comparison per se. Such a comparison may serve as an indicator to what extent Slovenia may employ its R&D potential as a basis to improve its performance competitiveness.*

3. Slovenia's R&D Position Among the EU Member Countries (Tables 1 and 2)

In terms of some fundamental OECD R&D indicators, Slovenia's position is comparable to the one of the less developed EU countries. Its GERD/GDP ratio has been favourable during the last two decades (currently about 1%). As a consequence, its R&D staff has reached a critical mass and is a promising factor at the present level of country's development. The weaker part is the number of researchers, scientists, and engineers in the enterprises. Even more critical is a very low level of firms' own investment in the R&D as well as the share of research performed by the enterprises. However, it must be stressed, that recent weakness in business sector is to considerable extent due to the present deep economic depression, caused by the sudden loss of more than 1/3 of total sales and intense restructuring.

*) According to the Institute for Economic Research analyses of relative prices and performance competitiveness, the majority of
Slovenian goods and services find themselves in the below-average price classes on the EU countries' markets. However, in comparison to the other economies in transition, Slovenia's exported products and services are, as a rule, in higher price classes.

Among its strategic targets, Slovenia must considerably improve the existing economic policy, so as to promote business attitude towards the firms' direct investment into R&D. Because of the hitherto successful pollicentric development, Slovenia must concentrate first of all on the promotion of general R&D infrastructure and human resources, in particular in the enterprises. Slovenian priority areas are to a considerable extent already elucidated by its present economic and primarily export structure, particularly in light of the necessity to integrate as soon as possible into the European information, communication, transportation and energy infrasctructure.

In order to promote technological diffusion, applied research and innovation, Slovenia must improve its scientific, research and development links among both universities, research institutes, and research and development units in the major enterprises and SMEs in all sectors. The advanced education is promising sufficient receptivity and capacity of Slovenia to diffuse technology and to innovate. In comparison to more or highly developed countries of the EU, with uncomparably larger economic potential, Slovenia has to be extremely selective in its decisions to build state-of-the-art scientific and research infrastructure in capital-intensive areas.

Following the present relatively successful participation in the EU projects (TEMPUS and PECO projects, seeking to regularly participate in the IV. Framework Programme) and other European projects (over 50 participations in COST, expecting to become the member of EUREKA in 1994) Slovenia should make every effort to accept the European R&D criteria and to improve its position in Europe-oriented projects. These efforts represent one of the important steps towards the European business alliances.

In order to structure its promotion policies, Slovenia has to take into account its general level of economic development as well as the R&D potential and efficiency. The focusing on the following activities seems to be realistic:

- In order to promote the firms' investment into R&D and their rapid revitalization, measures such as tax incentives, advanced depreciation in case of investment into equipment and intangibles, partial refunding of investments in development of new products and services and innovations, especially for exports, etc. are still required in Slovenia; the present weak financial situation of the
majority of firms, coupled by the lack of cheap capital to finance restructuring, is only an additional argument for such measures.

- Slovenia requires considerable efforts to promote R&D infrastructure. Such a support is possible through promoting national projects, state's support in building modern infrastructural hardware and software, particularly in the field of information and communication technologies, centers of excellence, information centers, through partial subsidy of R&D wages in business, particularly in the SMEs, by stimulating mobility through state financing of R&D experts working in business projects, by the financing of patent protection abroad, standardization procedures, etc.

- Slovenia is sufficiently mature to foster intense cooperation among the university, institutes and enterprise joint R&D projects by considerable reimbursement of such projects' costs, by subsidizing joint projects (domestic and international), by supporting group-firms' projects, by pooling the R&D funds from various ministries, etc.

Slovenia is also gradually maturing for a full-scale technological diffusion and innovation. It should be supported by interest-free and cheap seed money and venture capital, by promoting export competitiveness, in particular through quality and technological performance, by means of a technology bourse, by subsidizing the transfer of available technologies to firms, especially to the SMEs, by organized technological consultancies, feasibility studies, pilot projects, etc.

- Slovenia has begun with successful integration into the EU and other European projects. However, consistent "investment" in this genuine integration into Europe has to be enhanced as soon as possible. There are promising indications that such projects will be supported also by the EU International co-operation fund and Phare resources.

4. Some Development Considerations for Slovenia

A: Points of departure

I am taking the liberty to compare two very diverse areas of development, which, to my understanding, have a lot in common: World-class alpine skiing and qualitative economic development. One may ask why a small Slovenia has such a large number of skiers, who have been winning world-cup ski races for the past 3 - 4 generations (past 15 years). Let us look at the background of this phenomenon in Slovenia:

- favourable cultural attitude towards skiing;
- skiing, as the principal national sport, assures critical mass of infrastructure and talents;
- the school system allows to foster the best alpine skiers and to detect talent from elementary school to the end of high school;
- highly capable management assures constant top level training as well as required financial support;
- direct contacts with ski-equipment and other producers worldwide;
- equal training opportunities in comparison to the skiers from larger and richer countries;
- continuous presence on the tough world-cup competition circuit of all generations of skiers.

The background for S&T improvement and the R&D role in qualitative restructuring, technological diffusion and innovation in Slovenia could be assessed in the following ways:

a. Good cultural basis and general environment for R&D:
- historical affiliation with Central Europe;
- exports amounting to over 50% of GDP has been long -term and predominantly oriented to the western markets;
- as a consequence, the elementary feeling for quality is present in Slovenia;
- good technical education;
- recent widespread and progressive equipment with computers and modern software, including networking and online contacts;
- recent opening of the economy which further strengthens these trends.

b. Inadequate system and policies for technological expansion:
- for many reasons the level of internal and external confidence in the system is still not sufficient for and appropriate investment climate;
- although the economy has been stabilised and there is a surplus in foreign trade the economic policy measures have been concentrated on monetary policy;
- in particular, a modern type of structural, industrial, and development policies, targeting the improvement of competitiveness by decreasing costs and improving performance,
have been lacking;
- insufficient investment into modern infrastructure, particularly in the area of communications and informatics;
- insufficient support to exports and R&D in enterprises.

c. Insufficient policies regulating applied research and its implementation in large firms as well as in SMEs:
- still insufficient infrastructure, particularly in firms (hardware and software);
- lack of national projects in the crucial areas of development (e.g. communications and information field) with global links;
- very poor links among the University, Institutes, and Enterprise R&D;
- existence of several elementary nuclei of excellence;
- practically no support to technological diffusion and innovation;
- existence of support to the projects, participating in the EU programmes and other European programmes.

We may conclude that the fundamental promotion of R&D, as one of the crucial levers of sound development in Slovenia, stems first of all from an improved system and economic policies.

B. Improving the environment for R&D, technological diffusion and innovation

Slovenia has a good chance of becoming an open and prosperous country in the future European trends. However, its present high exports-GDP ratio should be targeted to reach, if not surpass 100%. The current number of over 150 million border crossings per year indicates that Slovenia may become one of the major European north-south and west-east crossroads, certainly not without modern infrastructure. Much higher wages in comparison to the majority of countries in transition are pushing Slovenia towards higher value-added programmes and permanent innovation in order to remain competitive. The solution lies in the creation of an environment in which the major intellectual and creative potential of the nation will be integrated into a sound development.

Once embarked on this course, Slovenia will have to share a good deal of its sovereignty with the future partners (particularly the EU) in order to adhere to the global technological and business norms, to develop and exploit the democratic state and civil society institutions, and to adapt its fundamental system (political, economic, and human values) and economic policy
measures to the ones of its potential partners. The sooner this adaptation occurs, in order to diminish the present intense preoccupation of political, media, and other creative potentials in the parties' struggle for economic and political power in "too small a pond," the better for Slovenia's development.

Slovenia must continue with its system adaptation, in particular in the area of economic (ownership, openness, level of factor price distortion and investment criteria, etc.) and legal system, so as to transform itself into a country of safe and promising investments. Furthermore, a stabilized economy is not an end, but rather, an elementary base for a consistent structural and development policy, which employs the R&D, technological diffusion, and innovation as the crucial lever to decrease costs and improve performance, to raise competitiveness, as well as to redirect the economy towards higher value-added goods and services.

And finally, Slovenia (like the EU) is still investing too much in the "past" (keeping alive some uncompetitive infrastructural sectors and state protected branches; covering too many losses; allowing an excessively large share of hidden economy; etc.) and not enough in the "future" (combining the education, health- and social-care with permanent upgrading of human resources, fostering communication and information as well as traditional infrastructure; investments in R&D, technological diffusion and innovation; supporting Slovenian firms in their efforts to join the European and global business alliances; etc.). Slovenia must also develop strategic investments as an important base for future competitiveness. E.g.: Keeping alive one unpromising capital-intensive branch employing several thousands workers instead of modernizing and technologically upgrading a considerable share of Slovenian exports, or developing an up-to-date communications and information system, etc.

We have every reason to believe that Slovenia will sign the Association Agreement with the EU by the end of 1994. The vision becomes clearer and the problems are multiplying.

Lojze Sočan
Table 1

DEVELOPMENT STAGES, STRATEGIC TARGETS FOR THE 90' AND PROMOTION POLICIES IN THE EUROPEAN UNION (E.U.) AND MEMBER COUNTRIES - A COMPARATIVE ANALYSIS, INCLUDING SLOVENIA

<table>
<thead>
<tr>
<th>Country</th>
<th>Fundamental Data</th>
<th>Strategic Targets</th>
<th>Intensity of Promotion Policies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4/5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td>0.47 34 1.4 19.4/22.3</td>
<td>I II III IV</td>
<td>+++</td>
</tr>
<tr>
<td>Portugal</td>
<td>0.61 52 1.2 27.0/26.1</td>
<td>I II III IV</td>
<td>+++</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1.00 79 1.7 25/30</td>
<td>I II III IV V</td>
<td>++</td>
</tr>
<tr>
<td>Ireland</td>
<td>0.90 97 3.0 60.0/60.7</td>
<td>II III IV V</td>
<td>++</td>
</tr>
<tr>
<td>Spain</td>
<td>0.85 111 2.5 47.4/58.0</td>
<td>II IV V VII VIII</td>
<td>+++</td>
</tr>
<tr>
<td>Italy</td>
<td>1.41 235 3.2 45.3/57.0</td>
<td>II IV V VI VIII</td>
<td>++</td>
</tr>
<tr>
<td>Belgium</td>
<td>1.69 276 4.4 70.4/72.6</td>
<td>IV V VI VII VIII</td>
<td>++</td>
</tr>
<tr>
<td>Denmark</td>
<td>1.69 280 3.8 46.8/55.0</td>
<td>IV V VI VII</td>
<td>+</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1.95 323 4.0 51.1/55.5</td>
<td>IV V VI VII IX</td>
<td>+</td>
</tr>
<tr>
<td>UK</td>
<td>2.22 352 4.6 49.5/66.6</td>
<td>IV V VI VII IX</td>
<td>+</td>
</tr>
<tr>
<td>France</td>
<td>2.42 442 5.1 47.8/61.1</td>
<td>IV V VI VII IX</td>
<td>+</td>
</tr>
<tr>
<td>Germany</td>
<td>2.58 499 5.9 59.9/68.4</td>
<td>V VI VII VIII IX</td>
<td>0</td>
</tr>
</tbody>
</table>

| European Union | 1.96 313 4.2 51.7/62.9 | -Intense flow of funds from E.U. to cohesion countries | E.U.'s support in upgrading R+D environment and technologies through joint projects |
|                |                     | -Targets: I - IX | Promoting state-of-the-art infrastructure and joint projects |

Column headings from 1 - 15:
1. GERD/GDP in %
2. GERD p.c. in US$
3. RSE per 1000 employees
4./5. GERD invested/GERD performed by enterprises
6.-10. Main strategic targets
11. Tax incentives
12. State and region. infrastr.
13. U - I - B links
14. Techn. diffusion and innovation, including SMEs
15. EU and global projects

Source: OECD, Main S+T Indicators, 1993 and various E.U. sources

Dr. L. Sočan
Table 2

MAIN STRATEGIC TARGETS FOR THE 90's

I. Create a stimulative environment for progressive business investments into R+D

II. Create general, including regional, R+D infrastructure

III. Develop R+D priority areas, based on country's vision and strategy

IV. Improve S+T+R+D links among the Universities, Institutes, and business research units (U – I – B)

V. Foster the applied R+D, technological diffusion and innovation activities in enterprises, including SMEs

VI. Develop the "state-of-the-art" infrastructure and technologies in strategic areas, including their massive diffusion

VII. Promote social and political environment for farther development

VIII. Intense joining the EC and other European projects and programmes

IX. Participation - leadership in strategic European and global projects
CONCLUDING REMARKS

Although the workshop was mainly aimed at mapping and discussing the S/R/D and industrial landscape in Slovenia, the focal point was the interface between these two sectors, with the main objective how to make the links between the science-base and the industry more effective. It was shown unequivocally that the promotion of coordinated linkage of basic and applied research and industrial R/D in the form of different cooperations is a necessity, especially in view of the fact that in Slovenia the potential for the research supporting the development of middle and high tech enterprises is located mainly within public research institutes and universities.

Various forms of cooperation did exist in the past, especially with medium and large industrial enterprises which provided with their own R/D departments or groups. However, present unfavourable economic circumstances reflect in (hopefully) transitional diminishing scope of cooperations, shifting the academia towards research which is aimed at scientific reputation.

Hence a national system of innovation is needed, meaning:
- basic and strategic research in science and technology and training of new generations of researchers,
- more responsiveness of science base to the needs of industry,
- much higher level of investment by industry in applied research and development,
- transfer of researchers from science base into industrial research departments,
- promoting the creation of new technology based enterprises,
- excellent science and engineering teaching, etc.

Especially the emerging small and medium enterprises call for special attention. Not only that the special funds for innovation have to be available, the well directed support from public research institutions as well as special consultancies and services are needed for their survival and healthy growth.

In this sense, the technical assistance like the present German project, points at issues which are important in the implementation of innovation policy. Let me mention some of them:
- design of transfer institutions between the science base and industry
- realizing the potential of information/documentation centers
- acquisition of knowledge on innovation management, innovation financing, etc.

Incremental steps, rather than strategic jumps are necessary.
previously published in this series

Joint German-Indonesian Seminar on R&D Activities using the MPR-30
Jakarta, August 19-21, 1985
GERMAN-INDONESIAN COOPERATION
ISBN 3-89336-011-5

Joint German-Indonesian Seminar on Public Acceptance, Waste-Management, and Nuclear Safety
Jakarta, October 7-9, 1986
GERMAN-INDONESIAN COOPERATION
ISBN 3-89336-012-3

Vllith German-Yugoslav Meeting on Materials Science and Development Ceramics and Metals
edited by Drago Kolar, Marija Kosec and Johanna Krawczynski
Brdo pri Kranju, May 18-21, 1987
GERMAN-YUGOSLAV COOPERATION
ISBN 3-89336-001-8

Proceedings of the Fourth Workshop on Two-Phase Flow Predictions
edited by M. Sommerfeld and H. Zeisel
Erlangen, October 21-23, 1987
GERMAN-YUGOSLAV COOPERATION
ISBN 3-89336-002-6

11nd Workshop on Process Automation
Darmstadt, November 2-6, 1987
GERMAN-YUGOSLAV COOPERATION
ISBN 3-89336-003-4

1st German-Yugoslav Meeting in the Framework of the Bilateral Project Development of Innovation Structures in Yugoslavia
edited by G. Bräunling and V. Matejić
Innovation Consultancy Centers
Plitvice, September 5-7, 1988
GERMAN-YUGOSLAV COOPERATION
ISBN 3-89336-024-7

Proceedings of the 8th Winter School on Proteinases and their Inhibitors: Recent Developments
edited by E. Auerswald, H. Fritz and V. Turk
Tiers, March 8-12, 1980
GERMAN-YUGOSLAV COOPERATION
ISBN 3-89336-020-4

Second German-Greek Workshop on Materials Research for Information Technology
edited by G. Kaiser and H. Wenzel
Jülich, May 22-23, 1989
GERMAN-GREEK COOPERATION
ISBN 3-89336-018-2

Seminar Fertigungsplanung und -steuerung
zusammengestellt von Burghild Wienecke-Toutaoui, Rolf Albrecht
Split, 7. und 8. Juni 1989
GERMAN-YUGOSLAV COOPERATION
ISBN 3-89336-025-5

IXth German-Yugoslav Meeting on Materials Science and Development Emerging Materials by Advanced Processing
edited by Wolfgang A. Kaysser, Jutta Weber-Bock
Hirsau/Stuttgart, April 16-19, 1989
GERMAN-YUGOSLAV COOPERATION
ISBN 3-89336-026-3
Bilateral Seminars of the International Bureau

1. 1st German Yugoslav Meeting in the Framework of the Bilateral Project
   Development of Innovation Structures in Yugoslavia
   Innovation Management
   Plitvice, October 18-20, 1989
   edited by Vlastimir Matejić
   GERMAN-YUGOSLAV COOPERATION

2. 1st Workshop on Plasma and Laser Technology
   Cairo, February 21-28, 1990
   edited by E. Hintz
   GERMAN-EGYPTIAN COOPERATION

3. Seminar on Emissions and Air Quality
   Thessaloniki, October 9, 1990
   edited by N. Moussipoulos, D. Kaiser
   GERMAN-GREEK COOPERATION

4. 5th Workshop on Two-Phase Flow Predictions
   Erlangen, March 19-22, 1990

5. 1st Workshop on Plasma and Laser Technology, Volume 2
   Cairo, February 21-28, 1990
   edited by Ph. Mertens, B. Schweer (1991)
   GERMAN-EGYPTIAN COOPERATION

6. 2. Brasilianisch-Deutsches Symposium für Naturstoffchemie
   2. Simposio Brasileiro-Alemao de Produtos Naturais
   herausgegeben von G. Habermehl (1991)
   DEUTSCH-BRASILIANSCHE ZUSAMMENARBEIT

7. 3rd German-Greek Workshop on
   Materials Research for Information Technology
   Thessaloniki, September 26 – 27, 1991
   GERMAN-GREEK COOPERATION

8. Egyptian-German Springschool and Conference
   Particle and Nuclear Physics
   Cairo, April 11-19, 1992
   GERMAN-EGYPTIAN COOPERATION

9. Seminar on Monitoring and Modelling in the Mesoscale
   Thessaloniki, September 27, 1991
   edited by N. Moussipoulos, G. Kaiser (1992)
   GERMAN-GREEK COOPERATION
Bilateral Seminars of the International Bureau

10 3rd Workshop on Process Automation
   GERMAN-SLOVENIAN COOPERATION

11 Course on Medical Aspects of Nuclear and Radiation Accidents
   Cairo, April 11 -16,1992
   GERMAN-EGYPTIAN COOPERATION

12 Egyptian-German Springschool and Conference
   Particle and Nuclear Physics, Volume 2: Contributed Papers
   Cairo, April 11-19,1992
   GERMAN-EGYPTIAN COOPERATION

13 Indo-German Workshop on
   High Pressure Technology-Engineering
   Pune, January 3-4,1992
   GERMAN-INDIAN COOPERATION

14 6th Workshop on Two-Phase Flow Predictions
   Erlangen, March 30 – April 2,1992
   edited by M. Sommerfeld (1993)

15 3rd Workshop on Plasma and Laser Physics
   Ismaillia, October 3-7,1993
   edited by Ph. Mertens (1994)
   GERMAN-EGYPTIAN COOPERATION

16 Utilization of the Low Active Waste Incinerator
   Facility (LAWI) for Research and Development Work
   Cairo, December 11-12,1993 (1994)
   GERMAN-EGYPTIAN COOPERATION

17 8th SIMCER International Symposium on Ceramics
   Biomaterials – Special Meeting of the Project EUREKA 294
   Rimini, November 10-12, 1992
   edited by I. Stamenković, J. Krawczynski (1994)
   GERMAN COOPERATION with the University "Sv. Kiril i Metodij", Skopje

18 Conceptual Approaches to the Support of Industrial
   Research and Development in Slovenia
   Ljubljana, November 10, 1993
   edited by M. Kornac, J. Krawczynski (1994)
   GERMAN-SLOVENIAN COOPERATION