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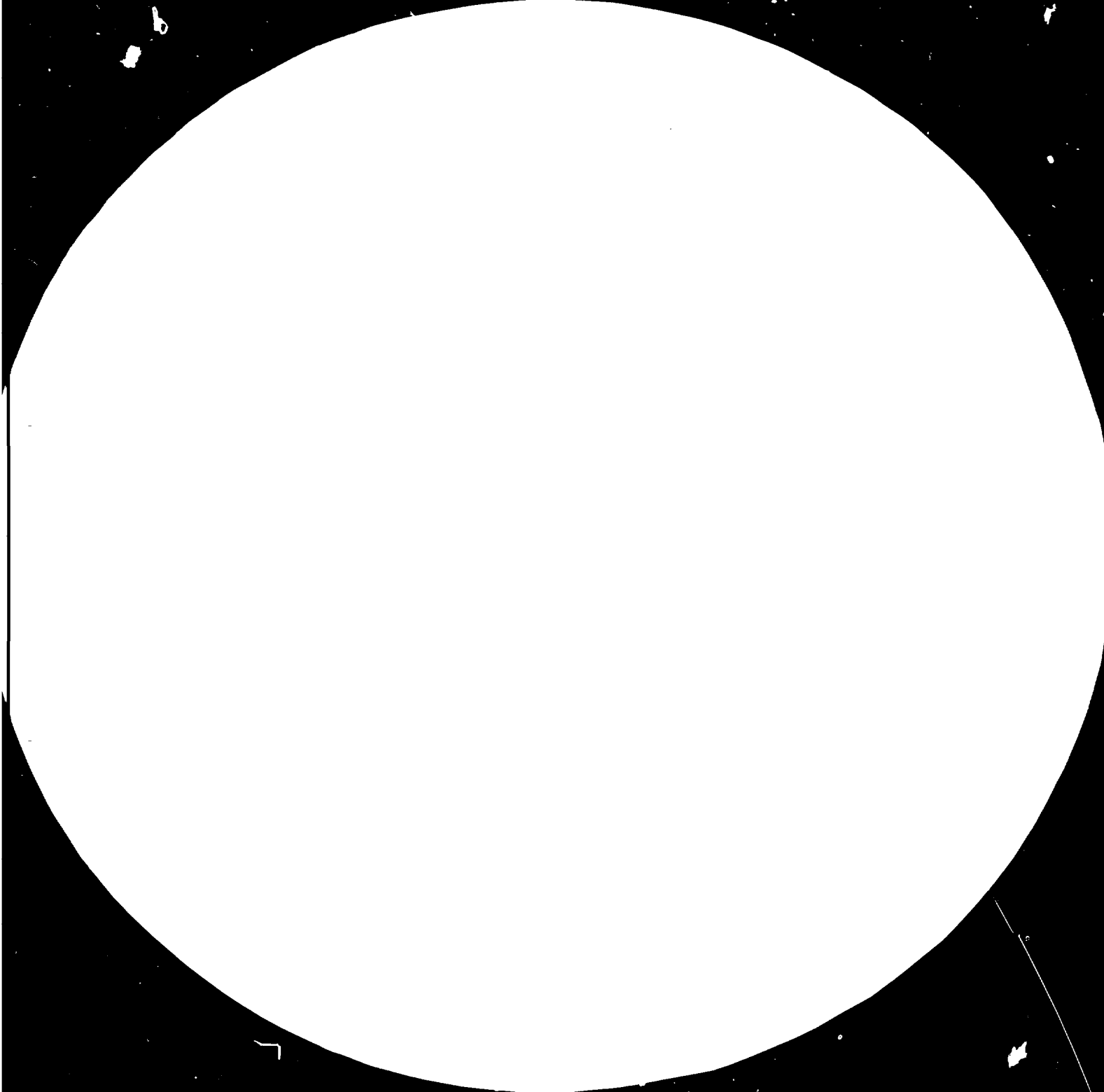

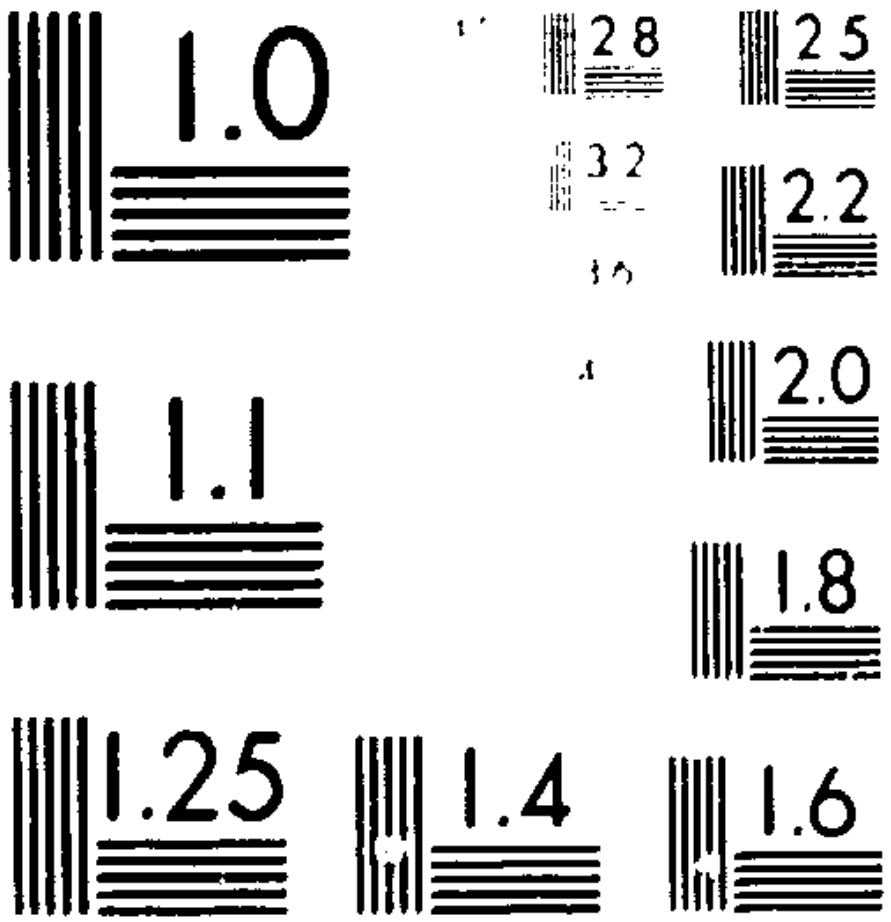
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CO-OPERATION BETWEEN INDUSTRIAL RESEARCH AND SERVICE INSTITUTES (IRSIs)

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1. INTRODUCTION

Cooperation is one of these beautiful words, everybody thinks cooperation is great. It is a key-word which opens many doors and attracts money from aid organizations. Those of us who have tried research cooperation know that it is not always so easy to establish a worth-while cooperation.

2. TYPES OF COOPERATION

I think it is necessary to define the various types of cooperation, when it is worth-while and when there are small chances of succeeding. In order to justify the word "cooperation" all the parties involved should have something of value to contribute in order to be an attractive partner for cooperation. In case of twinning between an advanced IRSI and a weak one, to use the word cooperation is somewhat misleading. It is rather a form for aid or one way transfer of know-how. The developed IRSI is compensated by being paid usually by national or multi-national aid funds, seldom by the institute or country receiving aid. The cost/effectiveness can thus be disputed. It is not my view that there is anything wrong with this type of one-way assistance. It is a desirable and efficient type of aid, but the theme today is cooperation between institutes which can give one another mutual assistance.

In case of cooperation between IRSIs the objective of the cooperation can be one or several of the following mechanisms.

a) Transfer of know-how: Training staff from the other institute, assist in planning of a new or improved service, etc.

b) Do things for the other institute based on know-how or facilities which only one of them has.

c) Joint effort to run a project which one of them alone can not run due to limited resources.

Mechanism b is probably the easiest to realize. It is like cropping out sub-projects or buy IRSI's service. Selling service is what an IRSI is meant to do. Unfortunately, very often the two partners are dissatisfied with what the other is doing. This is caused by lack of ability to assess the problems faced (a useful experience for an IRSI for a change to be sponsor!).

Transfer of know-how is O.K. if there is no competition between the two. - Joint effort projects need to be fairly large. I shall come back to joint R&D projects.

3. THE COMMUNICATION PROBLEM

In order to participate actively in an R&D project there is usually a lot of information and knowledge involved. Maybe as much as 30 % of the researchers' time is devoted to acquiring this information. All members of a team need not to know all about the project, but they must know a good deal. In case of many participants it becomes increasingly costly to inform all the members. If the cooperating parties are geographically far apart, one will have to depend very much upon written information, which again is much more costly, slow and inefficient than direct, verbal communication. Travelling and long-distance telephone calls must be resorted to, but has its limitations and is costly. The communication barrier becomes even higher, if there in addition are language problems. The result of this high cost of communication is often inefficiency and frustration over the cooperation. The advices and services received appear not to be very useful. In the final analysis it is often found that weighed against the cost, the benefits are too small. It is also everybody's experience, that people are reluctant to seek advice from somebody far away. One obvious conclusion is that the scope of cooperation must be so large that people from the two IRSIs can be exchanged for periods of some duration, so that one can become thoroughly acquainted.

4. CHEMICAL ENGINEERING VERSUS INSTRUMENT R&D

UNIDO has for some unknown reason always emphasized chemical engineering and used chemical engineers as IRSI Project Managers. Most IRSIs have costly pilot plants for chemical engineering unit operations. Development of large scale processes requires engineering and specific know-how. This type of special know-how is never found in a general purpose IRSI. The result of most large scale process R&D projects has as a rule been most disappointing.

It is my conviction that instrument R&D by its nature is much more suitable for IRSI R&D and also for cooperation between IRSIs. One obvious reason of course is that instruments are small in physical dimensions. They can be developed on a laboratory bench rather than in a pilot plant. Another reason is that even advanced instruments can be developed and built by a small team. Instrument problems are more academic in nature than engineering. A young university graduate can produce useful results. The process industry involves such large and costly equipment, that few mistakes can be tolerated. In instrument R&D it is possible to try and fail and try again without catastrophic economic consequences.

5. INSTRUMENT R&D

Electronics, and various types of computers are today an integral part of all modern instruments, except the simplest gages and pneumatic controllers. Few types of instruments are mass-produced. This makes it easier to start production on a small scale, suitable for smaller and less developed countries. It is perfectly possible for a country like Bulgaria with a centrally planned and controlled economy to decide to go into production of instruments. This will create jobs, can save foreign exchange, the products can be sold to neighbouring countries having a similar economy. The start can be simple enough. The first products can be more or less copies of products made by others, but adapted to scale of production and available production technology. Gradually more original products are developed. It is an excellent solution to have one central institute which does all the research and is responsible for calibration and quality assurance for several factories.

If another country, with which there is no or little competition, wants to start a similar business, assistance from a well established IRSI, like the one here in Bulgaria, can of course be a tremendous help.

Today, in the more advanced countries operating in a competitive, open economy, a similar process is much more difficult to realize. World-wide the instrument industry is highly competitive and dominated by large, transnational cooperations with enormous resources. To compete in price, quality and service in case of standard equipment, is indeed difficult and requires very high skills. When an industry is establishe in a shielded market, it can survive the first critical 10 years or so without being internationally competitive. But gradually, skills of international standard can be developed. Export, also to developed countries, can be possible.

6. EXAMPLES FROM A DEVELOPED COUNTRY

In smaller, but advanced countries, like Norway, many of the various IRSIs are involved in instrument R&D. My own institute has gone into development of measuring sensors based semiconductor components. We even have a lab for developing integrated circuits on silicon chips. These chips are not mass-produced. We only work on components needed in relatively small number. The EDB Division, in close cooperation with the Electronics labs, develops and builds complicated instruments and control systems used for instance in the offshore industry.
We have developed robot control systems, systems for traffic control and mechanical instruments and various gages and transducers. We build tailor made computers and solve the problems both in hardware and software. Whenever possible, we use commercial computers. Various computer languages and software packages are developed e.g. for design of ships and for numerical control of manufacturing equipment.
Other institutes have developed instruments for oceanographic research and for acquisition of meteorological data. Tailor made process control systems for the pulp and paper industry and similar have been developed. Tele-communication is a fruitful field. For a national manufacturer of telephones, we have developed a computer-based test station for quality control of microphones.

Quality control and test strategy for electronic modules is a very interesting field, well suited for an IRSI.

These various activities often require very special skills and equipment, and we have many examples of cooperation where IRSIs buy services from another. Calibration of precision instruments is one such service.

I like to mention an other interesting project: We have developed test equipment for checking jet motors. It is fully computerized. Our institute has built the special computers and developed all necessary software.

At some IRSIs in Norway, we have instrument service stations with a large instrument pool. It has a good selection of portable instruments for hire. It also provides skilled staff to operate the equipment, when such help is needed. It maintains and calibrates the instruments.

Another type of cooperation, which I know from my own country, is the "Electronic component forum", which compiles and disseminates component information. Similarly, there is a forum for production technology and for patent information.

Although only the most advanced developing countries can do all the things we do in Norway, I am convinced that all multi-purpose IRSIs need to go into the field of electronics, on-line tailor made computers, calibration, maintenance and some R&D.

7. COOPERATION BETWEEN IRSIs

It ought to be possible to have regional cooperation based on IRSIs selling special services to one another, having common facilities for calibration, patent service and information service.

Metrology. Various aid organizations have set up metrology labs in developing countries. Unfortunately, most of them are badly underutilized. Each country does not need primary standards, all it needs are secondary standards and they can calibrate these instruments at a

metrology lab which ought to serve a larger region.

Regional or national cooperation between IRSIs in the field of instrument design must start by mapping ongoing activities, skills and facilities as well as ambitions and plans of the IRSIs considered for cooperation. It ought to be possible for the various institutes to avoid overlapping in case of costly equipment which is difficult to have enough work for in one institute. Once the mapping phase has been completed, it ought to be possible to establish a group of IRSIs which want to cooperate. The group should not be too large. Two to six may be a good number. One of the first mechanisms which must be established is a mutual duty to exchange certain types of information. This information should include:

- Lists of all reports produced which are not confidential

- Whenever one of the IRSIs goes into a project (which is not secret) it should ask the other participants if they happen to have made literature surveys or have other relevant information which they are free to give away

I don't think it is necessary here to go into details. The participants will certainly identify the scope of information exchange which is useful and possible, without requiring too much paper work.

The institutes can cooperate by running joint seminars and let experts, which come to one of the institutes, lecture for participants from the cooperating IRSIs.

Within a group of for instance 6 cooperating IRSIs, the mutual obligations between them can be quite limited in scope. If 6 institutes shall pay one another mutual visits, run committees and send out lots of papers to all six, the cost will be prohibitively high. The piles of paper will become a burden and will not be read. In short, such cooperation will not be cost/effective. Circulation of a 2 to 6 page stencil from each institute once every 3 months, containing brief information on institute activities and information and services available,

can be the backbone of the cooperation. This information can trigger bilateral actions whenever an opportunity is identified. Such opportunities can be small, but important, such as receiving reports and literature surveys related to new projects, using facilities of the other institute and occasionally a joint venture. But don't expect too much. The most important things in life and in R&D can not be received as aid or gift. Only ones own hard work can create capabilities and results. Assistance can be useful as a catalyst, but can never carry anybody's burden.

8. JOINT R&D VENTURES

I know that some of you believe that the backbone of cooperation should be large joint R&D projects. I will warn against looking too hard for that. I think we ought to be critical to such ideas, and certainly should not embark upon big joint R&D ventures before the institutes have had several years of general cooperation of the type I have discussed on the previous pages.

Joint R&D projects tend to be troublesome. They are difficult to steer. In such projects there are many possible sources of mutual discontent. Rather than furthering friendship and cooperation, they may easily harm the relationship. It is a rule of thumb that less than 1:10 of the more ambitious R&D projects results in products produced with profit, and thus, most projects will turn out as failures and cause a hunt for scapegoats.

A joint venture may be the best solution in some cases, but thorough justification is necessary. The main idea behind cooperation in business is often to share the risk. But in R&D it must be indicated by a need to pool capabilities, expertise and costly facilities. R&D overhead runs at about 100 % of the R&D people's salaries. In joint ventures, increased administration, travelling, need to inform more people, production of more paper, etc. are likely to increase the cost with at least 50 %. This may have the consequence that it is cheaper not to run a project as a joint venture or that the project becomes too costly to be attractive.

I don't want to discourage you, just want you to have no illusions, so you shall not be too disappointed later on.

9 CONCLUSION

I believe that cooperation between groups of IRSIs engaged in instrument R&D can be very useful and is relatively simple to establish. But the participants must be willing to take and give. The benefits achieved must in the long run be worth more than the cost of cooperation! Cooperation is not a goal in itself. It is strictly a means, but one with a good potential. It costs a good deal to nourish a cooperative relationship and there are many constraints. It is recommended to start up with a limited scope and expand step by step as the cooperation proves useful.

In conclusion, I believe most in cooperation limited to a well defined exchange of information and services. I warn against over-ambitious projects involving a lot of administration, travelling and paper work. The key to useful cooperation is to establish lines of communication, so that good opportunities for mutual assistance can be identified. When such opportunities arise, it must be possible to act with a minimum of delay and bureaucracy. This requires establishment of smooth routines and procedures: contract forms, rules for cost sharing, confidentiality, etc. It may be useful if UNIDO or WAITRO could produce a small manual for the purpose.