

Technology Transfer at CERN

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Abstract

After a review of the past experience, the present policy of the Organisation is described.

In addition to the proven technology transfer effect resulting from procurement contracts, emphasis has more recently been put on collaborative projects which play a key role in the present R&D phase of the LHC and its detectors.

Other actions, such as licensing, training and information dissemination are also briefly described.

1. INTRODUCTION AND HISTORICAL BACKGROUND

Technology transfer is already an old concept at CERN although it is only rather recently that it has become an element of the policy of the Laboratory and a topic of discussion in its governing bodies.

Already in 1974, CERN organized a meeting and an exhibition on the technologies arising from High Energy Physics [1].

At about the same period, a study on the economic utility arising from CERN contracts [2] demonstrated that a substantial amount of technology transfer was taking place during the execution of procurement contracts of high technology products.

In several technical fields, CERN was perceived by industry as a source of innovation through its requirements for advanced instrumentation and sophisticated data analysis and a number of rather informal collaborations took place. This was in particular the case for computing, where CERN was considered as an ideal test bed for new concepts and products which often benefited from ideas and suggestions from CERN engineers.

When the first discussions on the LHC started, already ten years ago, CERN was in the middle of LEP construction. No substantial resources were available to start the necessary R&D for the advanced superconducting magnets and the cryogenics systems which would be necessary to achieve the ambitious design parameters of the new collider. It was also obvious that the construction of such a large machine would require the active participation of industry. Furthermore, because of the competition with what was to become the SSC, the time scale was relatively narrow. It was felt that if one could associate industry to the R&D phase one could hope to find additional resources and suppress the technology transfer phase which occurs when a prototype developed in a research laboratory has to be manufactured in large quantities by industry. This is the origin of the present practice of R&D collaboration with industry in the accelerators field.

Technology transfer has more recently become the subject of discussions in CERN's governing bodies, the CERN Finance Committee and the CERN Council.

2. TECHNOLOGY TRANSFER THROUGH PROCUREMENT

The basic pattern is for CERN to prepare specifications and ask industry to build the required equipment. If the technology is known there is of course no ground for technology transfer. But in many cases, it may concern the production of equipment first developed by CERN. Industry will, through the manufacture, acquire new skills and gain a new know-how and ultimately the possibility of new products. There are also cases where CERN asks for improved specifications, inducing firms to improve their standard products.

The benefits resulting from this kind of contracts between CERN and industry have been proven by two economic utility studies, the first one in 1974 as mentioned above and a second one covering a later construction period in 1983/1984 [3].

The result of these studies demonstrate that CERN contracts induce an indirect economic benefit of about three times the amount spent for the contract. They were widely publicized in Europe and in the US¹. In 1989, ESA, the European Space Agency, commissioned a study on the same lines which gave similar results.

These studies revealed the magnitude and the unsuspected wealth of the technology transfer occurring through the procurement contract mechanism.

One should however be aware that the largest part of the economic utility induced by CERN contracts does not appear as a patentable idea or by the direct commercialisation of a product made for CERN following CERN's design. The process is much more indirect. It occurs through acquired know-how in advanced technology fields leading to decisive quality or performance improvements or with the opportunity given to enter new markets. There is also the marketing value of having been able to satisfy a demanding customer or of having been associated with a successful large project².

When such a contract leads to the direct commercialisation of a product made for CERN following CERN's design, the contractors must seek the prior approval of CERN to use any piece of knowledge acquired from CERN in relation with this contract. The practice has always been to agree to such

¹ These results have in particular been used by the US Department of Energy to promote the SSC (Superconducting Super Collider) project.

² This is confirmed by recent interviews made in the framework of a Ph.D. research based on CERN contracts.

requests. Since 1988 a licence fee is asked as a compensation of part of the development costs.

In order to achieve a better distribution between Member States of procurement contracts and of the implicit technology transfer which results from them, CERN has changed its purchasing policy since the beginning of 1994 with a view to achieve a balanced return to all its Member States.

3. TECHNOLOGY TRANSFER THROUGH COLLABORATIVE DEVELOPMENT PROJECTS

The basic idea is to associate interested industrial firms to the development work. It is foreseen in the contractual agreements with partners that the rights and benefits are shared by both parties. In case of commercial exploitation, CERN asks for its share of the benefits.

As explained in the Introduction, this concept first arose in a rather informal way in the computing field. It has then been extended to the R&D for accelerators, namely the LHC and has more recently been extended to the particle detectors and fast electronics which will be necessary for the LHC experiments.

One of the motivations for industry, besides the expectation of future orders, is the possibility of the acquisition of new technology and its exploitation rights. The offer of sharing the technology is a valuable incentive which has encouraged firms to accept these contracts and invest some of their resources in the development. Sometimes such contracts help them to obtain support from national agencies. All in all, this has brought substantial additional resources to the CERN programme while ultimately benefiting to the European economy. Such an initiative brings to Member States an identifiable technological return which is precisely what they often expect nowadays from national and international research institutions in addition to their basic research programme.

As far as intellectual property is concerned, the basic principle is to leave all the initiatives for protection through patent filing to the firm, while preserving CERN right of free access to the technology developed in common for its own use and a fair share of the eventual profit in case of commercial exploitation.

In as much as it can be assessed, this is a successful policy, well supported both by Member States and by industry. It is fair to say that so far CERN has not received any meaningful income through this means, but the objective of transfer to industry of technology developed for CERN is well achieved.

4. LICENSING

A number of technologies developed by the Organisation have a commercial interest. Although CERN has the policy not to take patents³ not to seek in an active way to identify and market technologies which may have potential industrial applications, the Organisation does regularly receive requests from industrial firms which want to acquire the licence to

reproduce a CERN design or commercialize software written at CERN.

In these cases, the Laboratory will assist its licensee, within agreed limits, to understand and master the technology so as to enable him to develop it into a marketable product. However, CERN gives the technology 'as is' and does not participate in the further development towards the market.

5. TRAINING

It is well known that technology transfer is basically achieved through people.

During the execution of the types of procurement contracts described in Section 2 above, where the development has been done at CERN, considerable assistance may be given to the personnel of the contracting firm by the CERN staff who have made the design.

In the case of the collaborations and licence agreements mentioned in Sections 3 and 4, provisions are made for the training of staff from the industrial partner, through short or extended visits to CERN, participation in the design, participation to tests and measurements,...

It should be recalled, although it is outside the immediate scope of this report that CERN does achieve an impressive amount of training in numerous technologies, through its general research activity. There is a flow of about 1'000 newcomers coming every year to CERN for an average period of 3 years. A large fraction of these young people who come as students, bursaries, unpaid associates to participate to physics experiments learn in that way a variety of advanced techniques ranging from superconductivity to computer networking and will ultimately end up working in industry. One should also recall the training offered through the various 'technological' CERN Schools (Accelerators and Computing) which are attended by engineers and applied scientists from industry.

6. INFORMATION DISSEMINATION

The essential ingredient for efficiently involving industry in CERN R&D is to maintain a high quality flow of information with industrial partners. CERN has undertaken a number of actions to disseminate systematically the information relative to its technology.

6.1. Annual Report

The annual report of the Organisation contains a dedicated chapter describing briefly the technological collaborations with research institutes and industry.

6.2. Permanent Exhibition

Since about three years, as part of its visitors' tour, CERN has installed a permanent exhibition which contains a section on technology describing the major existing facilities and some key on-going developments.

6.3. External Exhibits and presentations

Elements of CERN's technology are often presented in the numerous exhibits organized throughout its Member States.

³ There has been a few exceptional cases in order to assess the problems which a change of policy might create.

One should in addition mention specific exhibits such as, for instance, the participation to the Seville Expo in 1992 or SITEF-93 in Toulouse and of course EPACs. In the context of the LHC project in particular, CERN is also regularly invited by Member States to present to groups of industrialists the opportunities offered.

6.4. Publications

CERN technology is described in a large number of publications and presented to specialised conferences focusing on topics like particle accelerators, applied superconductivity, cryogenics, ultra-high vacuum, computing, data networks, process controls, pulsed power, microwave engineering,.... to name but a few.

6.5. Industrial Liaison Officers

Several Member States have appointed Industrial Liaison Officers to improve their commercial return from CERN. Some of them have also taken an active interest in CERN's technology and are in an ideal position to play a key role in the technology transfer process. A good knowledge of CERN activities and of the industrial potential of their country is essential to detect opportunities and propose adapted practical actions.

6.6. Market Surveys and Call for Tenders

These are part of the procurement process addressed to specific sectors of industry but they also constitute a channel to inform industry on CERN needs and the associated technological opportunities.

6.7. Visits of industrialists

CERN receives frequent visits from industrialists in a variety of circumstances. Most of them are connected with the attempt to present their products and obtain CERN contracts (national industrial exhibits, visits from specialised groups, visits organised by Industrial Liaison Officers, follow-up of contracts,....). This is however an opportunity to see related CERN technologies and has been the origin of technology transfers.

7. CONCLUSION

CERN has a long experience in technology transfer with industry. A large amount of technology has been and is still being transferred very successfully through normal supply contracts for high technology items based on CERN developments or induced by its requests. More recently the policy of joint developments, in particular for the LHC machine and its detectors, has opened new and wider opportunities, while there is a growing number of licence requests, in particular for software.

However, if it were possible to monitor, even approximately, the later career path of all the young people coming to participate for a few years to the physics research experiments which constitute the 'raison d'être' of the Laboratory, one might very well find there the main carrier of the technology which CERN develops.

8. REFERENCES

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