Hungarian IT technology transfer results and problems – some EU perspectives

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Abstract[1]

This paper deals with some issues of technology transfer (TT) taking into account some politics and economy during the past 10-25 years in Hungary. TT is concerned as transfer of knowledge from 'academia' to 'industry'. Generally there is nothing surprising in the above definition, however in Hungary in most cases TT does not only mean the transfer of knowledge, but the transfer of people, too. We are not going to analyze TT in general, just through some cases where university teachers and academic researchers started to be part of the real, market economy by means of bringing their knowledge to the private sphere, forming small/medium enterprises (SME) to take part in industrial competition. This personal move had (and still has) two basic types. Some 'academicians' completely gave up their academic positions forming either spin-off or completely independent companies. Some other teaching and research people try to survive having a part-time job as private entrepreneurs, keeping strong ties with their research institutes or universities. Examples of different types of successful SMEs will be given together with they TT activities and successes. TT results and activities are discussed in connection with European Joint Research and Development (R&D) projects where researchers and industrialists of SMEs have to take part together. Some effects of the recent economic crisis are analyzed, too.

1. Introduction and historical overview – results in research, education, TT

Hungary, as member of NATO and as member of the European Union cannot be taken into account today as a developing country. However based on our history in the 20th century, and mostly after the Second World War it can be seen that our industry always needed and needs technology transfer (TT) from the more advanced world. This fact is getting to be a more economical and less political issue in recent years. Automation was always a main issue in Hungary: it was recognized by the foundation of the Research Institute for Automation (Hungarian Academy of Sciences) already in 1964. This institute was the forefather of our recent Computer and Automation Research Institute of the Hungarian Academy of Sciences (CARI) and it had great influence in providing information technology (IT) infrastructure in the country. One of the main goals of our institute was to make R&D to try to decrease the gap between the Western world and us. These type of efforts were similar in all Eastern European countries between which a kind of a scientific co-operation existed, but did not function too successfully, as there were no direct economic drives within the COMECON (Council for Mutual Economic Assistance) co-operation, and political drives were not enough.

1.1. Positive changes in the last 20 years of the old politics

At the same time for Hungary there existed a kind of openness from both the Western and Eastern side in the form of mutual conference participations, bi-lateral joint R&D projects, mutual visits and information exchange – as long as it did not touch the technology transfer restrictions, the so called "embargo" (COCOM: **Co**ordinating **Com**mittee for Multilateral Export Controls list). Our Western academic partners admitted that our leading researchers and engineers had the appropriate knowledge to speak to each other, to have joint paper work, even professor invitations were realistic to the West for some of us from the early seventies already. All these were based on our excellent high school and university level education.

In spite of the separation of education (universities) and research (research institutes) after WW II: from the late eighties both university research and academic education became stronger and stronger. This was achieved by means of personal contacts of people involved: some researchers became part-time teachers/professors, while more and more professors/teachers became part time

Proceedings of the 11th international workshop on computer science and information technologies CSIT'2009, Crete, Greece, 2009

researchers. And on the other hand university level research got momentum, too, to reach a healthy level.

Different fields of industry had (and have) different development levels; however the appearance of computers and related technologies were in the worst position in the sixties and seventies. The development was so fast in the Western hemisphere that in spite of all efforts of our researchers and software experts our handicap increased all the time.

We suppose that TT problems in the so-called ex-socialist countries were similar in several aspects to those of the developing countries.

The political and economic events of the past 10-25 years resulted in dramatic changes in the Technology Transfer (TT) in Hungary and probably in all similar countries. TT was a natural and flourishing activity between academic and industrial partners during the years of 'embargo', when the Western politics did not allow the delivery of high tech equipment and technology – defined in the so called COCOM lists – to East European countries. At the same time from the sixties, when 'détente' started and cold war was more or less over, until the end of the eighties our economy was strong enough to support R&D activities up to 2.5% of the GDP. The country was open enough to see what are the leading achievements of the Western hemisphere, and industry knew that innovation is needed to keep quality production to be able to export at least to the brother - COMECON countries. As most R&D goals were well known and the ways to reach them were top secrets we were forced to achieve several genuine results. Some results just from the narrow field of IT related manufacturing engineering: adaptive control, direct numerical control (DNC), dialog CNC, multi-axis machining, CAD/CAM/CAPP systems, Flexible Manufacturing Cells and Systems (FMC and FMS), etc.

To reach these results a good and closed cooperation of academia, industry and government was necessary. Academia meant the Technical University of Budapest (TUB), the Miskolc University (MU), the Computer and Automation Research Institute of the Hungarian Academy of Sciences (CARI) and some industrial research places. Industry was represented by factories producing machine tools, control devices and other electrical and mechanical products, etc. including the IKARUS bus factory with a production up to 15.000 buses/year. Government was represented by the Ministry of Industry and by the State Committee for Technological Development (SCTD) to manage financing/funding, to approve the goals and to take care of contractual bases of some big national TT projects. Some results were really outstanding and used for longer time periods by our industry.

1.2. The beginning of the free era

Our industry and the market collapsed together at the beginning of the nineties, universities and academic research institutes survived, but became very poor, and R&D support from the government decreased to 0.3-0.6% of a decreasing GDP. Recently it is a little more, but no real hopes to increase it in the near future. Big industrial firms were simply closed, or privatized in one or broken to several parts. Some of them survived, others disappeared within 5-10 years. Hungary became full member of NATO and of several other international organizations, and we joined the European Union. Some of the **positive factors** of the nineties were the following:

- Multinational firms, as General Motors, General Electric, SUSUKI, etc. appeared in Hungary giving several jobs, increasing the production using modern technologies.
- Several SMEs (almost 1 million to compare with the 10 million inhabitants) were formed; some of which are ready and are forced to invest into development to be able to survive. We have to mention that some private SMEs in the field of information technology and computers started to work already in the late eighties. SMEs in our understanding are firms having 1-10 (small) to 100-200 (medium) employees, however this paper speaks mostly about the lower edge.
- Several joint ventures taught us how to survive in the world market.
- European joint R&D projects (TEMPUS, PHARE, ESPRIT, EUREKA, BRITE, COPERNICUS, Framework Programs, etc.) became available for our academic and industrial community to prove our abilities and to learn a lot. The EU Fifth Framework Program that started in 1999 finds Hungary already in the position of a full right partner country. In the Sixth and Seventh Framework programs we take part as EU member states already.

At the same time "brain drain" began to increase due to the free travel and due to the very slowly decreasing technical and economic differences between East and West. We lost and continuously loosing highly educated technical (and other) people, which is double/triple loss: decrease of the population, loss of education costs and loss of working forces. As far as our institute concerned we are in a relatively good position: several young people join us and there are some who returned from the USA and from Western Europe to work with us – at least the half of each year. Some others are back in Hungary to be part of the TT as researchers/professors, running SMEs or representing big multinational firms.

2. Some general problems of Technology Transfer at the end of the twentieth century and today

Our paper deals with TT problems in connection with some SMEs focusing on the problems and methods of transfer and implementation of R&D results, mainly in

the information technology field, which does not need too much investment in materials and equipment. The transferred technologies themselves will not be the main topics of the paper. Such topics as motivation and business objectives of the transfer projects and problems and methods of communication between technology supplier and user/customer (acceptance of technology by employees, organizational implications and side effects, training and education, management of the transition process, etc.) will be emphasized.

Two early papers of the author from 1985 and 1988 ([1] and [2]) discuss the role of three levels of academic and industrial employees (top management, middle management, and software developer and software user) in the transfer of CAD/CAM systems. That time the academic side was taken into account as 'vendor' and the industrial side as 'purchaser' of most CAD/CAM systems. CAD/CAM was an early example of IT in our TT studies, now we are dealing with several more aspects and a broad sense of IT.

The recent TT situation in general is more or less the same as it was in the specific domain of CAD/CAM 10-25 years ago, just 'technology supplier' and 'user/customer' should substitute the 'vendor' and 'purchaser' respectively. The power is in the hands of the top management, but they are not always interested enough in innovation as suppliers and they are afraid of the risks of the new investments as users. The innovators/programmers of the suppliers are interested in TT but the same level future users are not always ready to change their work by learning and applying new technologies. The middle-level management can play the most positive role on both sides if they are allowed to do so.

This model is not really good for TT with new, small SMEs, where the three levels of staff do not exist in many cases, as several SMEs have only 1-2-5 employees altogether. It means that the managers have a very important, decisive role in all cases.

Different types of SMEs will be taken into account to be able to draw more or less general conclusions:

- spin-off SME companies of academic institutions,
- independently formed SMEs, based on heterogeneous basic knowledge of the founders,
- SMEs based on trusting in one or two 'big' ideas,
- SMEs formed to promote products of some 'real big' firms,
- SMEs based on the ruins of the socialist industry (with or without privatization),
- SMEs working as joint academic-private firms,
- SMEs, as parts of new, national 'big' enterprises.

A relatively detailed discussion of several TT problems is in [4].

We have to mention that when we speak about technology transfer, we mean Knowledge Transfer (KF) as well. Technology and the corresponding knowledge were subjects of TT earlier as well, however researchers (and engineers) began to use Knowledge Bases and Knowledge Management Systems as new disciplines to better classify and manage knowledge only in the past 10-15 years: Knowledge and its transfer often means specific problems. These problems are especially interesting if we take into account incomplete and uncertain knowledge on one side, and more complicated extended (virtual) enterprises oh the other hand [5]. These problems would be subject of an other study, now we do not discuss them.

3. TT in Hungary - some success stories

We are not dealing with TT directly from more advanced to a less advanced country, but with TT within the country, however it will be seen that as a matter of fact the objects of the TT are coming from more advanced countries first, and they can move within the country only then. Success stories of some of the above type SMEs will be detailed. They deal with different types of technologies, but all of them are IT (Information Technology) related. The national character of TT should not be emphasized as in most cases the actual scope and objects of the TT is not Hungarian, but comes from the world market, as some successful SMEs are selling products and services purchased/contracted from the more developed part of the world.

Next we deal with some SMEs and other initiatives, with their stories and ideas based on some publications, advertisements and based mostly on private discussions. Some information is based on the presentations and discussions of the successful TT day organized in Budapest with international participation in 1999, as an accompanying program to the International Exhibition and Fair, MACHTECH [3]. It happened 10 years ago, however there is not too much to change in the stories. Among others the following **success stories** were presented:

- A spin-off of our institute (CARI) deals with design and implementation of telecommunication systems built up from off-the shelf products adding IT integration (LX Ltd.). They became successful representatives of more advanced foreign firms and successful system-integrators based on the products they represented. We were partners in a EU Sixth FW R&D project.
- Another spin-off SME deals with R&D and with implementing their robotics and vision related R&D results providing IT integration, too (CX Ltd.). This SME just continued the academic R&D they started, but could have a more successful market strategy in Hungary and abroad as well. They are our partners in several Hungarian and EU joint R&D projects.

- A successful CAD/CAM provider SME added to its main profile the production of rapid prototypes on a LOM 2030E machine (LOM=Laminated Object Manufacturing), which they purchased with several difficulties and which led to the real success (FD Ltd.). Finally it was proven that it was worthwhile to fight for government support and loans to purchase sophisticated equipment and software to be used by an SME to better serve the customers and to make more profit. Partners in some EU R&D proposals.
- Another SME was formed from software guys of a machine tool factory and it makes genuine software development in the field of NC/CNC programming and it sells the software products with total support mostly to customers of the factory (NM Ltd.).
- A small SME of a very big Hungarian private enterprise provides IT integration based on existing software products in the field of (multimedia) information systems in Hungarian and international projects, as well (MS Ltd.). They were partners in 3 different EU R&D projects. This SME does not exist any more due to personal reasons.
- A joint venture of an academic research staff and some private engineers takes part mostly in virtual enterprise related international projects (CM Ltd.). This is the typical example when the SME gives only a part time job, and the main research activity continues. However involvement in international projects is a real challenge and a high level work on one hand, and a good, little income for survival. Our partner in some EU projects, and independent partner in some other EU joint R&D projects.
- The co-operation and merge of two existing SMEs to provide rapid technology transfer based on one of the most successful CAD/CAM products, namely on CATIA formed a brand new SME (HT Ltd.). This is the only one of the investigated SMEs with mixed, Hungarian-foreign capital. We had joint proposals.

There are **two other interesting cases**, which give more general and partly different views:

- The long-term co-operation of several departments of the Technical University of Budapest with different industrial firms to 'sell' academic knowledge. To make this type of co-operation more profitable and better organized a well-informed office works at the university to collect demands and to distribute tasks. This way the university and the professors involved in the activities will get a good support from the involved industries, and on the other hand R&D works and expert support plus easy recruiting of new engineers will be the main advantages for the industries. Similar efforts and positive results can be found in the case our other universities, including different faculties/departments of the University of Pécs.
- The Information and Technology Innovation Park (InfoPark) in Budapest. This is a completely different, but still positive experience. The InfoPark was a government initiative to establish a 140.000 square meter territory in Buda for effective TT. Some banks and government offices supported the initiative on a territory the 25% of which is owned by two big universities (Technical University of Budapest and Lorand Eotvos University of Sciences). The idea is – as generally in the case of such type of parks – to give home to big and small Hungarian and multinational industries, and to take advantage of the neighborhood of universities, to use the professors' and students' expertise. This initiative has scientific, economic and even human policy advantages, and it is the most effective way of TT. Recently InfoPark Ltd. is working as a private, organizational SME trying to support TT, playing and active role in innovation activities, and it intends to be a workshop of the Hungarian Information society. Several multies and other firms are working there – according to the expectations.

3.1. General, common features of the success stories

Some spin-offs started their negotiations with western partners already during the time when they were still members of our institute. That means that the partners were impressed with the big, powerful, government owned and run CARI having more than 800 employees in 1986 which decreased to 300-340 by 1989 and which is stabilized around 300 today. See "brain drain" in chapter 1.2.

There are about 200 so called researchers, from who at least 60% have Ph.D. or higher (Dr. Ac.) grade. The institute had (and still has) a relatively high level infrastructure and a very good scientific reputation worldwide. This led our partners to negotiate with the institute and even to make representative/reseller/partner/etc. contracts with us. They learnt it together with us that an 'academic' institution has to be involved in moneymaking activities, too.

Our researchers, who were involved in these types of co-operation had to decide to stick to the so-called pure research and science (and remain personally poor) or to try to sell their knowledge and experience. The successful ones decided to try to keep the 'level' and to sell their knowledge (not to remain poor). When the guys dealing with these kind of relations decided to be independent from the institute to better know their real possibilities, to enjoy the income they produce and to try their 'lion-nails' in the real market, the management did not say no, moreover assisted them.

Typical to these spin-offs is that they rent the rooms and several facilities (networks, computers, fax, copy, library) of the institute even today. This way they are independent, but still work in an unchanged

infrastructure among people they know well and who can help each other if necessary.

These spin-off SMEs became Ltds, and in some of them the Institute kept shares up to 30-50% to have the right to know what is going on. To be honest the management of the Institute never bothered the SMEs, and after some years most of them could purchase their shares from the management, but they are still working at the same place using the same high level, comfortable infrastructure.

Which were the basic new ideas for researchers of the spin-offs and for all other SME formations, they had to learn if they wanted to survive in the market:

- How to find suppliers?
- How to find customers?
- How to design and build hardware from building blocks instead of circuits?
- How to design and build software from building blocks instead of writing several thousands lines of code?
- How to customize software instead of develop it?
- How to provide the best available solutions and support?
- How to add value?
- How to compete with others including the 'big' firms and beat them?
- How to co-operate with European partners in joint projects?

A few rather simple minded answers were easy to find to some questions:

- To keep the high, academic level in development
- To find appropriate niches of activities
- To become system integrators and
- To be there and be polite but aggressive at the market.

The rest of the questions were answered positively with different soft- and hard efforts on different ways, sometimes going on rough roads, but finally led to success.

One of the successful SMEs proved that even genuine software solutions might be the way to go. NM Ltd. works with a strong factory background providing NC/CNC solutions first of all to 'their' factory, but they are selling software to other firms, too.

4. Working together in EU Joint Research Projects

Some Hungarian research institutes and University departments started to participate in joint European research projects already in the nineties, when Hungary was still far from the EU. Brussels had a policy according to which we were allowed to participate as partners, but no payments were guaranteed from the EU. Finally – based on special agreements – we were always reimbursed the same way as all other partners. This policy pushed EU member institutions to involve some non-member partners into the joint work – probably to test our abilities and infrastructure. These project-consortia were organized based on previous personal contacts from conferences and from long bilateral academic co-operations, and our academic institutions got possibility to work together with EU member academics and industries.

We rarely had a chance before to get acquainted with SMEs in the West. When we became candidate- members and then members (in 2004) the request to take along (industrial) SME partners to the joint projects became strict from the EU side. And that was the beginning of taking mutual advantage of some of the above-discussed new firms of our ex-colleagues. They and their firms understood the European norms, could write and communicate in English, were professionals in their activities, thus became perfect partners in several R&D projects – mostly as demonstrator sites.

EU project participation was/is very important to our SME partners, as this is the easiest way to have European partners not only for the joint R&D activities, but for future business as well. To be honest: on the other hand with "real" industrial partners in Hungary we often had infrastructure, language and mutual understanding problems if participated in joint proposals and projects.

5. Conclusions

The above mentioned firms and their stories are naturally only one side, the sunny side of the Hungarian picture, as life is not easy in the private business after the several years of 'socialist' economy. All managers of the successful SMEs and other initiatives had to learn how to use the professional engineering and IT knowledge they collected and accumulated in the past during their academic and/or industrial years. And on the other hand some business knowledge had to be picked up. Several SMEs failed and fail from day to day, as the managers are unable to adapt to the market economy, they do not understand what to sell, how to sell, whom to sell, how to find the real (technological) needs. To survive means a perfect knowledge not only of professional things, but of the customers' needs, too. The recent world wide recession cannot be taken into account at all, just risks are increasing. As a conclusion we can say that our recent, global world requires global understanding and global services. And we can compete only if our local knowledge and expertise is used appropriately. As it can be seen from the above stories and cases the managers and their people understood the above needs and requirements.

The participation in EU joint R&D projects (and proposals) assisted a lot to open they horizons and to have more potential business contacts.

We can conclude that the TT from 'academia' to 'industry' works in all examined cases keeping the academic level co-oping with the market requirements. Another important conclusion is that the international scientific activity during academic years assisted in building up international relationships in the private/market life, and it helps to co-operate in the EU.

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