Universities and Industry

(Extended Abstract)

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Universities and industry appear to live on different planets. University – Industry cooperation may be just a hopeless dream (or perhaps a useful pretension). There are indeed natural forces pulling them apart. Still it is worth looking for a way to find a compromise and mutual benefit. Both parties know it, both parties try to keep as much of their own territory as possible. Is there a winning side?

The Scene (Battlefield?)

There are some general aspects in university – industry relations that also apply to the IT area. Universities strive to bring understanding to the phenomena of our world through their research activities. At the same time they provide learning environment for conveying this understanding to their students. The environment that best suits this purpose encourages open and free exchange of ideas and discussions challenging them. Industry strives to increase profit, beat the competition, be the first on the market. This requires the environment in which the new ideas can be kept secret and protected. To bring understanding takes time. To bring a new product to the market has to be fast. These contradictions make the university – industry cooperation a challenge. Let us consider their manifestations in the essential functions of the universities that are now living through the period of the industry influence.

Research.

The number of companies ready to finance their own research departments is decreasing fast. The universities used to perform the 'frontier research' but at the same time they used to consolidate the new results, sift out the important ones, find the relations among them, and also find different ways to view and interpret these results. Nowadays there seem to be no time for this. The universities are forced to research and apply fast. Our discipline, informatics, suffers a lot from this change since it did not have the privilege to go through the consolidation phase. Speeding up the research-apply loop is seemingly benefiting the industry and forcing the universities to the industry-like time scenarios.
The benefit of this short-term research scenario is indeed the possibility to use the results in a particular new or innovated product fast and bring a measurable money benefit from its sales. It is thus easy to convince politicians and the public that the money for research was well spent. On the negative side, this approach does not allow for 'building up' informatics itself, does not leave time to look for new ideas, new concepts. There is a danger that the well of existing ideas and methods will dry out. And it will take time to fill the well again. The short term benefit for industry may turn out to be a long term disadvantage.
After several 'application' oriented Framework Programs of the EU it seems that the wisdom of Marquis de Condorcet from 1775 (Rejecting theory as useless in order to work only on everyday things is like proposing to cut the roots of a tree because they do not carry fruit.) made its way to the Seventh FP. The old approach did not move EU towards fulfillment of

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the Lisbon criteria as planned. The support for basic research increased and formulations like ‘Rethinking the nature of computing, where basic notions of information, computation and communication are revisited’ in the IST FET program are encouraging. Unfortunately it may take time for this wisdom to reach the research policy makers in EU countries. This is certainly taking time in Slovakia and it would be a pleasant surprise if this were much different in the other IT STAR countries.

Education

Universities, especially the European ones, used to provide learning environment in which students learned to understand their field of study, mastered the fundaments and were ready to adapt their knowledge to particular situations. The adaptation process took some time and it was considered ‘normal’. Of course the industry always preferred to have a graduate who can come to a company and be productive from the day one. American universities adapted to these requirements of the industry many years ago and geared their curricula to this purpose. The problem is, it is impossible to conciliate the two opposing requirement of the industry – to have graduates who are both flexible and immediately usable.
A difficult question in this context is the following. Do the universities serve mainly their students or mainly the industry? Doing the best for students, namely, educating them so that they can adapt to new developments in their field for many years to come, does not mean preparing immediately productive employees for the industry.

The ‘disposable economy’ influence. Students quite often see that they need to have very little understanding of informatics to get good part time jobs in the industry. Most of the time some knowledge of a particular technology or software package suffices. This makes them think that more abstract (and usually more difficult) subjects are useless. What they do not realize is that in ten years they may become too old and expensive experts on an old technology and there will be plenty of new young graduates having just learned the newest stuff. The open question is, whether those who learned to adapt to new technologies will survive or they will be disposed of anyway due to the fact the young guys are less expensive.

The ‘cheap goods’ influence. Producing fast and cheap appears to be a necessity in today’s industry. ‘The fast’ has some difficulties with the university curricula designed to last for a specified number of years. But ‘the cheap’ seems to be establishing at the universities much too fast. The usual arguments of the type ‘students will never need this in practice’ are often supported by the attitudes of the industry. The web page of the Slovak branch of one of the worldwide leading IT services companies is offering ‘IT chance for everyone’ promising anyone a free two months training that will make him or her eligible for a well paid IT job. This of course opens the question whether we do need a university education in the ICT area at all. ‘Cheap’ is usually very expensive in the end. This is doubly true in software and IT services.

The number of public universities more than doubled within the past 20 years in Slovakia. The same is true for the number of students. Besides, there is a score of private universities. Nobody would believe the quality of education increased twice as well. Still there are optimists who believe it is still half as good as it was 20 years ago. There may be several reasons for governments pushing for higher numbers of students (less unemployed young people, bigger percentile of educated population, etc.). Universities play along since having more students implies more public funding. My experience over more than thirty years shows the absolute number of really bright students does not change. What is (necessarily) changing

is the is the general public expectation of the wisdom to be expected from a university graduate.

Getting Over the Impasse

Let us use the Comenius University Example to illustrate the developments and experiences in Slovakia. Computer Science Program at the Comenius University was established in 1973, followed by establishing the Computer Science Department in 1974. The guiding principle behind the curriculum design was 'Through Abstraction to Flexibility'. Apart from natural innovations the program is still running composed of three parts – mathematics, theoretical computer science, and practical computer science. It was the first comprehensive computer science curriculum established in Slovakia. Building a bridge to industry was not really successful until the time Comenius University computer science graduates proved to belong to the cream within Slovakia. In the eighties it was the industry that started to be busy building the bridge to the Comenius University. The reason was the same that remains the major reason for industry to cooperate with the universities – getting access to qualified personnel. The mutually beneficial form of this type of cooperation materialized through industry experts (most often former graduates with good relations to the department) giving lectures or leading practical labs groups at the Comenius University. This developed further to having Master Theses (co-)supervised by industry experts. Positive aspects of this type of cooperation for the university included the possibility to have students exposed to the particular technology used in the industry. This complemented nicely the lectures concentrating on the principles. Besides, many students were offered part time jobs in industry, getting the first hand 'real world' experience. The companies used this opportunity to 'try out' potential future employees. The negative aspects included brain-drain from the university to industry. The university salaries are not competitive and staff members, especially the young ones, became easy targets once exposed. Furthermore, many students were not able to keep their part time engagements under control, over committed themselves, and consequently started to have difficulties in their study.

Research cooperation with industry is lagging behind cooperation in education. The main reason behind is the fact the industry in Slovakia is primarily formed by outlets of companies established somewhere abroad. Therefore research, if deemed necessary, is performed in their home countries. There are some exceptions but in most cases what the local industry needs is development, not research. The expertise of the university experts is most frequently tapped via individual contracts, less frequently via contracts with the university. Traditionally the university - industry cooperation in Slovakia is better at the universities of technology (or technical universities) that house the faculties of engineering. The Comenius University is the 'classical' university and encounters more problems in the university - industry cooperation. Many companies operating in Slovakia realized that the universities do not have experience and established procedures in areas of Intellectual Property Rights. The results of research and development at the university thus seldom bring financial benefits to the universities. Furthermore, the spirit of freely providing information and know-how at the universities to students is 'naturally' extended to almost anyone willing to learn. The same companies that find it natural to pay very large amounts of money to 'famous' consulting companies come to our department expecting free advice and consulting.

Technology parks/centers attached to universities proved to be a reasonably good vehicle for transferring research results and initiating research cooperation with industry in some countries. Attempts to create such a center in information technologies attached to the

Comenius University were not successful so far. The main concern of the companies was that students moving from research and development outlet associated with one company may (without realizing it or by negligence) spread some 'private' know-how about, e.g., the software development process in one company to another one. These concerns seem to be fading away, probably due to the (de facto) standardization in tools and processes used in IT companies.

Conclusion and Open Problems

Our society is moving towards the knowledge society. Suppose we accept this new buzz word. Since nobody really knows what it means I can afford to try my own interpretations. Let me start with an utopist one. The knowledge will mean that people will be wiser and approach their way of living, the functioning of the society in a wise way. To move to the more usual interpretation, the knowledge will lead to improved functioning of the (current) industry and introduction of innovative products. I expect the knowledge society to be a society where knowledge becomes a commodity. This will require *new* type of industry that will handle it. There are two possible scenarios. The bad one would consider 'a piece of knowledge' to be something that can be sold. As a consequence, the development would lean towards the current 'industry scenario' where things will be kept as secret as possible to get the advantage. There may be requests for 'knowledge patents'. The good scenario would consider 'knowledge services' to be something that can be sold. Such development would lean towards the current 'university scenario' where pieces of knowledge will be freely shared but know-how will be required to find 'appropriate' pieces and relate these pieces to each other. As a consequence, new understanding will be needed in organizing, relating and visualizing knowledge and assessing its value. A completely knew type of industry will emerge.

One of the consequences of the above is that in the future the industry may become more like a university. However the current trend seems to be making universities more like an industry. 'Managing' the university is becoming the most important aspect. New ideas, scientists, teachers and students are becoming second in importance. Managers need measurable criteria to evaluate progress, quality, etc. As a consequence we can see a number of criteria of questionable value distorting the 'normal' functioning of the universities. If we are not able to measure certain things (e.g.: How much is it worth for a company that its employee learned at the university to thinking in a particular ways and approaching problems in a way that resulted in a new way of designing a software product? How much faster was he able to come up with a solution? How much is it worth to understand better some particular phenomenon?) is it proper to resort to a subset of measurable something?

It is unlikely the current industry like 'managerial' spirit at the universities will disappear soon. It is important to look for ways the universities can survive. What should the universities teach? Despite the current trend I am convinced that university education should *not* be reduced to training in particular technologies. These can be part of practical lab sessions, but the contents of lectures should stress the principles. There are two forces working against this approach. First, industry prefers a person that is trained in details of some current technology in order to have him/her immediately productive. Second, the universities (managed to earn some profit) have interest in having graduates who will need to take new courses at the university (and thereby increase the income of the university) when some IT technology changes. It is not clear what is the cost of providing more flexible education and expecting some training for particular technology in the industry versus

training in particular technology and retraining when a new technology arrives. Who pays the bill in each case? We do not seem to be able to measure in Euro all costs and benefits of the university education. Making our decisions based on the 'money value' is thus questionable. Can we do better when the whole society seems to be evaluating everything in terms of money only? I consider an individual or an institution 'functioning well' when they contribute towards improving our lives, our environment, our understanding of everything happening in our world. I am sure making more money is not a target helping to make *the whole* functioning better. These are surely tough questions to be left for philosophers and sociologists. However, we may be able to agree that it is not the industry but the universities that are more likely to come up with new ideas and phenomena that should/would be used in the industry in fifteen years. Communication and dialog are important instruments for making things better. However, when it comes to university curricula, the universities should have the final say. My experience makes me convinced that the more abstract approach in teaching informatics used at the Comenius University since 1973 is the right one to use.
What could be the instruments that would help the university – industry cooperation in research? Governments can force the cooperation through some funding schemes and this surprisingly worked in EU framework programs and to some extent also in some research funding schemes in Slovakia. A major push to this cooperation would be a scheme that would let the results of a joint university – industry research closed for a small number of months before releasing the findings to the public domain. Could such a scheme appear by itself or should it be imposed by a government through project funding?

I started by saying universities and industry appear to be living on different planets. Let me conclude by claiming that in the IT area universities and industry are on the same boat. The general public may not tolerate the 'warranty free' software indefinitely. Unless universities can come up with better understanding of the process and better educated graduates, the industry may get into trouble. On the other hand, once the industry is perceived to be performing under the mark, the universities may be blamed for not providing properly educated workforce. One could continue with other areas – building up unmanageable amounts of data, unclear security of the digital space, etc. These too require fundamental understanding and tools together with industry quality solutions. IT STAR could help by continuing this workshop with additional discussion and best practice examples.