The Importance Of Increase Of The Process Of Innovation And Technology Transfer To Teaching Academic And Industries In Developing Countries

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Abstract: *Within the context of globalization and internationalization of the economy and markets the advances in technology have come to be recognized as the most important single factor contributing to economic growth. The fast development of technologies, combined with increased global and more stringent customer demands strongly pressurizes companies to improve the pace and quality of product and process innovation. Therefore, companies are increasingly pushed to form technological relationship to reduce the costs. Technology is a major driving force behind industrial progress and structural change. This paper focuses the importance of university-industry technology transfer because company's competitiveness can be enhanced by forming relationships with a university. The universities have been asked to play a more "pro-active" role, acting closer to the productive sector attempt to give support to their competitive basis and also to be responsible for the cycle of the innovation process, not only for the development of technologies but also for their diffusion. However, can be identified an existing desarticulation between demand and supply of technology, at a domestic level. Among the possible handicaps found today that restrains the technology transfer to desirable levels, is the development model itself adopted by the country, which creates strong conditions of technological dependency. Although, little or no research tie are observed; this is probably for reasons such as communication gap, cultural differences, and lack of research facilities and infrastructure. Effort should therefore be made by both the government and the university to remove these obstacles. This could be achieved by setting up a coalition between academia and industry. Due to the existing desarticulation between technology and supply, the paper shows the necessity to create forms for a more dynamic technology transfer process. In addiction, very important benefits are derived by the students participating in the activity of the industries. Successful knowledge and technology transfer require proactive and persistent interaction by both the universities and the companies. The paper concludes that without organized and well focused interaction with industry the gains from basic research are not exploited.*

World Scenery And The Importance Of The Scientific and Technological Policy

"In last two decades, they happened important technological and organizational change in the poles of expansion of the capitalism, that were reflected in the international economic relationships, and that involved significant transformations in the strategy of performance of the industries" (GONÇALVES, 1993:23).

Globalization of the markets, the fall of the commercial barriers, the liberalization of the economy in developing countries, they placed the managers before the challenge of the competitiveness, in which the generation and the incorporation more and more fast of innovation to the products and processes don't allow slow solutions.

For GUIMARÃES (1992:22), the striking fact in the current world scenery has been the acceleration of rhythm of the technical progress due to significant scientific progresses - essentiality in the field of the microelectronic, of the biotechnology and of the new materials - associated to a growing research effort and to a strong disposition to innovate. There is the recognition today that the national economic performance, in a context of competition, depends fundamentally of the degree of use of the existent bases of technology, of professional and scientific training.

In the industrialized countries, the mature industrial sectors even they have been going by deep restructurings in function of the competitive pressures and of the introduction of new technologies in the productive processes. Consequently, these sectors are becoming highly intensive in R&D.

In agreement with WEISS (1995:3), this context of intensification of the global competitive atmosphere, it has been inducing substantial alterations in the focus of the scientific and technological policy.

According to SCHWARTZMAN (1994:1), the scientific and technological policy has as fundamental function to guarantee and to improve the education level in all the levels and to improve the quality and efficiency of the productive system and of services.

However, the scientific and technological politics can act basically through instruments and mechanisms of general nature, stimulating the diffusion and technology incorporation in the productive sector and like this making possible the

adjustment of the industrial park to an ambient more dynamic and competitive.

The Importance Of The Technological Developing Intern

In agreement with MORAES (1994:98), authors as Porter and Schumpeter consider the developing and technological innovation as the main factors of success in the competitiveness of companies and, consequently of countries.

According to PEREZ (1993:87), a company in the quality a group of activities, is a group of technologies. The technology is contained in all activity of value in a company and the technological transformation can affect the competition for its impact on almost all the activities. The technological developing appears as the only form of developing products before the competition and through the innovation the companies can reach the markets, in way to guarantee competitive advantage.

In agreement with RATTNER (1986:117), the absorption of foreign technology is perfectly rational inside of the entrepreneurial philosophy of maximize the return on the investment with the minimum of risk, however it can present contradictions with the objective ones wider of the nation, such as the generation of employment or the reduction of the deficit of the balance of payments.

The absorption of new technologies for the productive sector demands, usually, scientific knowledge not dominated by him and of complexity level a lot above the level the one that he is accustomed. Here the support of the university, or of the institute of scientific research, it is indispensable, besides for the selection of personal capable of, through the own productive sector, to drive the absorption process, under orientation. The alternative, when this doesn't happen, it is that the absorption of the technology just covers the know-how that allows the production, more than it invalidates the possible subsequent innovation, what hasn't been uncommon in Brazil.

The purchase of the know-how just represents a palliative solution, besides resulting in an external dependence, that almost always implies in submission in the decisions and delay in the development, because peculiar it is the reality social and economic of each nation.

In the Brazilian case, the economic growth verified in last years occurred due to the massive technology transfer from the countries of the first world for the amplification of our industrial park. That uncontrolled acquisition of technology took the country to a high state of technological dependence, demanding a great effort on the part of the government to reduce this dependence.

The company is already aware that the technology that gets in the exterior can act, long term, against its interests: testing the market, creating the demand and habituating the consumer - among other aspects - so that, starting from a certain instant, the own grantee of the technology interrupts the process and it comes to settle in the conquered market.

On the other hand, the imported products don't pay ICMS, and consequently, the sale of those products, would harm the amount that the university receives, hindering like this the science developed at the country.

Therefore the technological development and the innovation process their should be accomplished through a intern process, and one in the main ways of crystallization of this process is the university-industry technology transfer.

Industry-University Interaction

The intensification of the international competition has been forcing the fast absorption of technologies of scientific base for the productive sector of the economy, as form of increasing the quality of the products and efficiency of the productive processes.

In consequence of the high and growing costs of R&D and the intensification of the competitive pressures, the great national companies have been exploring the partnerships with universities, the strategic alliances among firms and the cooperative programs supported by the public sector.

For MORAES (1994:104), as for industry, the feeling with relationship the cooperation with universities passed of "I want" the "I need" for the difficulty every larger time in working alone with the speed, complexity and high cost of process of technological innovation necessary to its competitive position.

SANT'ANNA (1994:379), it still complements, that as the costs and development of the research accentuated tremendously, the great companies found more lucrative to delegate those functions to the universities and other research institutions, with the advantage of they be financed by the government's budgets and of philanthropic organizations.

The technological transfer appears as a new form of the alliance between the university and the industry. It means the transformation of the results of the academic research in products you marketed for the companies.

The potential contribution of the productive sector for the economic growth, based on the high technology, it is also recognized at several developed countries.

According to CAMPOS (1990), in United Kingdom, for example, the serious recession - that affected particularly to the traditional industries and it generated high unemployment levels - it took to the conclusion that the high technology is the only answer to the economic prosperity in the century XXI.

For these and other reasons, the universities come increasing their relationships with the companies and with the society in general, on one side to obtain more effective resources, and for other so that the teaching and the university research are

related with the national needs, and at the same time, to decrease the previous technological dependence.

Exist many forms of collaboration of the university with the regional development. Doesn't exist a general form for all the universities, the concrete possibilities of a more constructive interaction, depend on the economic and industrial politics, of the relationships of social forces and of the political conjuncture, of the structure of specific market and of the characteristics of the companies that compete in it.

Difficulties In The Industry-University Interaction

Meeting the greater part of the researchers of the country, the Brazilian universities have been finding difficulties to take the initiative of transferring the generated technology, to the productive units.

Frequently the researcher's work ceases in the presentation or publication of the final report or in the construction and test of prototype. Just in some cases the new process or product is submitted to an economic evaluation, but most of the time the productive sector, for several reasons, it isn't involved, it doesn't know and, consequently it doesn't absorb or it implements the developed technology. Say that the shelves of the institutes and universities are full of good ideas.

"The own scientific community has been engaging to defend the autonomy of the research, starting from the presupposition that only the more completes freedom and autonomy of the research, without impositions or restrictions of economic or political order, would be capable to provide to the society the expected benefits. That posture of "ivory tower", however, it has been constituting the main obstacle to the development of mechanisms and institutional channels seeking to intensify the relationship university-industry" (RATTNER, 1986:119).

However, according to RATTNER (1986:122), the largest problems that hinder the relationship university-industry, they seem to reside in the own university, whose structures are not adapted to that type of the cooperation with companies.

One of the largest problems appears when it wish to patent the resulting innovations of successful projects, because it is difficult to obtain the registration of a combined patent on behalf of the researcher and of the university.

According to VOGT (1995:30), the universities, arrested to a bureaucratic machine and an entangled of norms, besides they haven't tradition in the development of technological research, they lack of the necessary institutional solidity to a positive interaction with the entrepreneurial managerial sector.

What differs they aren't just the organizational structures of the industries and of the universities, but also the criterion of the priority in the development of the research, the periods and the waited result types. This turns the combination among the contractual research - short term, with commercial objectives - and projects of scientific interest, linked to the academic career, extremely difficult and complex.

"The companies, showed several difficulties in the collaboration with the universities:

- the slowness with that the contractual formalities are processed;
- the high turn-over of the personnel allocated by the university institute in the projects of the cooperation with companies;
- the precariousness of the equipments in use in the university institutions;
- the non-execution, in some cases, of the stipulated periods (RATTNER, 1986:122).

In the internal ambit, the university could rethink its organization for the scientific research. The excessive amount of the departments in the university, guided according to disciplines and knowledge areas, is now an obstacle for the interdisciplinary research, characteristic of the technological innovations.

According to GOLDEMBERG (1995:23), the other vision has been with the remuneration. In the basic institutes there aren't salary differences among teachers of the same level, and external consultations they would break this principle.

One of the mentioned most frequent problems of the analyses and discussions on the scientific-technological politics of the Latin-American countries refer to the potential of R&D of the universities and of the little use that makes its, given the non existence of an explicit demand on the part of the industries.

For that, became indispensable the implantation of a more explicit technological politics and unified in a group of measures, laws and government guidelines, with the finality of exercising a more direct and deep impact on the production and diffusion of scientific and technological knowledge in the country.

The Importance Of The Applied Research

With the intensity with that the transformations are processed in the current days, the teaching tends to assume anachronic dimensions when non ally to the managerial system, because, for more frequent than they are the reforms of the didactic methods and of the school curricula, the higher education institution will never have conditions of reflecting the reality in which the professional will act.

In agreement with RABELLO (1979:11), the intellectual teaching of class room and even of laboratories, it can offer an incomplete formation, so that the experience, under form of the activity, of practical work, comes as complementation or as part of the process teaching-learning.

The proposal of the university student preparation in terms of practical experience allows to form intellectual attitudes, it involves the sensibility of to receive and to answer to the found situations, besides allowing the accumulation of experiences.

"Only with the accomplishment of the practical activity in the company can the student live its reality, to know modern equipments, the social, economic and human problems, characteristics of raw materials, managerial development" (GLÜCK, 1979:28).

According to RABELLO (1979:13), the fact that the intelligence is only activated before situation-problem, the educational process that it doesn't challenge, it can act as obstacle in the development of this function.

The university, many times, it is repeater of accumulated knowledge, without to wake up the interest for the search of the new ones or to provide the change of methods of knowledge obtaining.

"The science is today a cooperative enterprise, what does with that a scientist rarely discovers exclusively some new thing for itself "(RATTNER, 1986:124).

With that alliance, the university acquires the possibility to test and to apply the theoretical knowledge in it generated, obtaining like this, a permanent modernization of its students and a fast and easy placement of its graduates.

"The idea that the researchers, to produce plus, needs to be devoted exclusively to theirs laboratory, it is one of the myths that the research of UNESCO comes helping to undo, when showing that the most productive are frequently those that are devoted to a larger number of different activities" (SCHWARTZMAN, 1985:57).

The use of pos-graduation students, through theirs thesis works, even of the graduates with theirs works of course end, in the search of solutions for present problems in the companies, they would allow to train students and teachers in the adapted solution of the technological problems and they would make way for a better reciprocal knowledge and consequent consolidation of the liaisons of collaboration and trust.

On behalf of the universities, it could modify (to modernize) the criterions of academic evaluation of the teachers, including a "weigh" for activities of instalment of services and projects of the research hired by companies, taking into account the volume of the resources for the university.

The agencies of fomentation, for its time, they could use as criterion of the evaluation of the researchers, for ends of the financing, the external activities of research and instalment of services.

In agreement with RATTNER (1986:125), it would be disastrous for the full development of our scientific-technological potential, the exclusive engagement of the scientists in researches that seek immediate solutions for the problems of the private and public sectors, reputed as socially important. Without long term projects, disentailed of immediatism routine and objective, the scientific research loses its innovative and critic characteristic.

To maintain the basic research in the universities, without untie their functional liaisons with the private and public companies, it is necessary the development of mechanisms capable of optimize several forms of the entail and of providing reciprocal growing social benefits.

Reference

1. CAMPOS, A.C. Transferência de tecnologia e a integração universidade-empresa.. *Trabalho apresentado no XV Simpósio Nacional de Pesquisa de Administração em Ciência e Tecnologia,* São Paulo, p. G-07. 1990.

2. GLÜCK, I. A participação da empresa no processo educacional de nível superior. In: *Escola/empresa :a qualificação pelo estágio.* Ministério da Educação e Cultura, Departamento de Assuntos Universitários. Brasília: DAU em convênio com o Instituto Euvaldo Lodi/PR, pg. 25-35. 1979.

3. GOLDEMBERG, J. A academia e o mundo real. *Revista USP.,* USP, *25* : 20-23, mar./maio. 1995.

4. GONÇALVES, R. Estratégia dos oligopólios mundiais dos anos 90 e oportunidades do Brasil. *Condicionantes internacionais de competitividade.* Campinas, 75p. 1993. http://www.mct.gov.br/mcthome/estudos/Html/ECIBafsbvi.htm - 23/05/98

5. GUIMARÃES, E. A. A experiência brasileira de política científica e tecnológica e o novo padrão de crescimento industrial. *Estudos analíticos sobre o setor de ciência e tecnologia,* 39p, novembro. 1992. http://www.mct.gov.br/mcthome/estudos/Html/EACTII.htm - 23/05/98

6. MORAES, R.; STAL, E. Interação universidade-empresa no Brasil. *Revista de Administração de Empresas.*, *34* (4): 98-112, jul./ago. 1994.

7. RABELLO, O. Teoria e prática - dicotomia. In*: Escola/empresa :a qualificação pelo estágio.* Ministério da Educação e Cultura, Departamento de Assuntos Universitários. Brasília: DAU em convênio com o Instituto Euvaldo Lodi/PR, pg. 11-17. 1979.

8. RATTNER, H. A universidade e o setor produtivo. *In: Pesquisa universitária em questão.* Org. SCHWARTZMAN, S. São Paulo, Icone, p. 114-125, 1986.

9. SANT'ANNA, S.R. Spin-offs universitários: um estudo exploratório. *Anais do XVIII Simpósio de Gestão da Inovação Tecnológica*, São Paulo, outubro, p. 377-390. 1994.

10. SCHWARTZMAN, S. Desempenho das unidades de pesquisa: ponto para as universidades. *Revista Brasileira de Tecnologia.,* Brasília, *16* (2): 54-60, mar./abr. 1985.

11 SCHWARTZMAN, S. Sumário da apresentação no seminário de avaliação e propostas sobre o desenvolvimento científico e tecnológico brasileiro. *Estado atual e papel futuro da ciência e tecnologia no Brasil.* São Paulo, 7pgs. 2 maio 1994. http://www.mct.gov.br/mcthome/estudos/Html/EAPF.htm - 23/05/98

12. VOGT, C.; CIACCO C. Universidade e empresa: a interação necessária. *Revista USP.,* USP, *25* : 24-31, mar./maio. 1995.

13. WEISS, J. M. G. Ciência e tecnologia no contexto da globalização: Tendências internacionais. *Estratégia de atuação para o PADCT III: objetivos, arranjos institucionais e alocação de recursos.* São Paulo, 18p. outubro 1995. http://www.mct.gov.br/mcthome/estudos/Html/padct.htm - 23/05/98