

UNIVERSITY-INDUSTRY: INTERACTION BETWEEN UNIVAP AND ADVANCED TECHNOLOGY COMPANIES

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Abstract – Univap is located in the area of the Vale do Paraíba, part of the State of São Paulo, one of the most developed regions in Brazil. In that region, the city of São José dos Campos, concentrates a great number of advanced technology industries, besides several research and development institutes. The potential demand for the formation of highly qualified professionals in those areas is high. In this paper, we present the interactions between Univap and the following companies: EMBRAER and ERICSSON. EMBRAER is an aerospace company and ERICSSON acts in the area of telecommunications and information technology. Those interactions occur, mainly, by means of specific formation courses denominated Sequential Courses, that allow to the undergraduate formation in at least two years.

Index Terms – Specific Courses, University-company interaction.

INTRODUCTION

We intend to analyze the concrete situations of University-Company interaction, with the purpose of reflecting on the practical reality of a particular type of that interaction. From that reflection, and with the relation to the experience acquired in the practice, we intend to delineate a procedure that may serve as reference for similar experiences that may be implanted in the future by Univap. That way, what we intend to do is try to fit in the experience inside a theoretical corner stone that will allow for the widening of the purely subjective vision, obtained through this experience. Inside that context, we will also analyze the present scenario of the high technology companies for the development of the valley region where the university is located. We will analyze the possible conditions for the insertion of Univap, as a Teaching, Research and Extension Institution in a location where there are, mainly, high technology industries and which may, potentially, still attract others.

PARTNERSHIPS: WHY SHOULD THEY HAPPEN?

We intend to discuss, from the point of view of someone who is inside a superior education institution, the advantages that appear when there are partnerships between society sectors and the university. We will analyze some of the accepted premises on the role of the University, and Superior Education, for the development of a society integrated to the modern world, where knowledge has a leading role for assuring a development that may reduce the disparity that separates poor and developing countries from developed countries. To emphasize that, we may quote the 17th Article of UNESCO's World Declaration on Superior Education, [1] of 1998, that deals with Partnerships and Alliances:

"Partnerships and alliances between involved parties, people who define national and institutional policies, and pedagogic professional in general, researchers and students, administrative and technical personnel in superior education institutions, the working world and groups of the community - constitute a powerful factor for administrating transformations. The non-governmental organizations are also fundamental agents in that process. Therefore, partnerships based on common interests, mutual respect and credibility should be the main matrix for the renovation in the scenario of the superior education."

The quoted document, emphasizes the importance of the role of the superior education institutions for the construction of the future. It will be a world for which the new generations should be prepared with new abilities, knowledge and ideals. One of the ways to build that future is, no doubt, through reinforcing the cooperation with the working world, as a continuous source of professional training, updating and recycling. Besides that, to fulfil the demands placed in the workplace, the superior educational systems and the working world should develop and evaluate, together, the learning processes the transition programs, the evaluation and validation of knowledge that integrate the theory and the formation of the work itself. That vinculum is particularly vital for the developing

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countries, specially for the least developed, because, without the formation of a critical mass and qualified and cultured people, no country will be able to assure a sustainable development. That is even more important in a world full of uncertainties, that reinforces the need for changes that fulfil social needs and promote solidarity and equality of opportunities. Those changes should fulfil the needs in all aspects of human activity, offering relevant qualifications, including professional capabilities that are combined with high level theoretical and practical knowledge through courses and programs that adapt to present and future needs of society.

The Education Directives and Bases Law of Brazil, [6] promulgated on December 20, 1996, has the same point of view as the precepts about superior education mentioned above when, in its 43rd Article, VI Incision, determines that the *Superior Education has as its purpose:*

" To stimulate the knowledge of the problems of the present world, particularly the national and regional ones, to supply services to the community and to establish a reciprocity relationship with it."

The changes induced by the superior education institutions should, as a principle, preserve and exert the scientific rigor and originality, in a impartiality spirit, as a basic previous condition for reaching and maintaining a indispensable quality level. Besides that, they should place the students in the center of those worries, inside a continued perspective, to allow for the integration in the society that, in this new century, requires global knowledge. The appropriation of technological knowledge and the capacity for the development of technological innovations are a few of the fundamental issues for the integration to happen, because it is evident that technology requires specialized personnel and can only be of use for those who detain the specific knowledge. However, it is not only technology which requires specialized personnel; planning requires also a comparatively high level of knowledge and specialized talent, since, more than machinery, the large and complex entrepreneurial organizations of the modern world represent the palpable manifestation of the superior knowledge. [4] That way, the pure and simple appropriation of procedures or the capacity to absorb existing technologies, do not fulfil anymore the needs for the formation of high level personnel since, learning should have an evolution and should not anymore be considered as the simple transmission of more or less customary practices ,although they may have a formative value that should not be left behind. In fact, the technical progress modifies, inevitably, the qualifications required by the new production processes. The purely physical tasks are replaced by production tasks that are more intellectual, more mental, such as the operation of machines, their maintenance and surveillance, or by tasks that involve the conception of

study, organization in the same pace that machines become more "intelligent" and work becomes more "dematerialized" . We should consider, still, that in the whole process of the formation of people there is the previously acquired experience, which should be used positively for the final result, reinforcing the notion that education is an individual process and an interactive social construction. That is what, in the modern industry, specially for the operators and technicians, the cognitive and the informative domain make a little obsolete the notion of professional qualification and leads to an emphasis on competence and personal experience.

TECHNOLOGY

One of the main thinkers of the century, John Kenneth Galbraith [3], presents a critical discussion, enviably didactic, of the role of the technology for the modern state in his book "The New Industrial State". In spite of the speed in which present transformations occur, many of their conceptions and critiques on the modern society are still valid, others not so much. The importance of the book, as a reflection object, remains. One of the high points of the work, from our point of view, is when the author describes the need for the division of qualified work for the production of an automobile (which may be transferred to the production of any good until the 80's).

"...There is no way through which we may force organized knowledge in the production of an automobile as a whole, or even in the production of a truck or chassis. It can only be forced if the work is so much subdivided that it will begin to coincide with a certain area of knowledge or established engineering. Although we can not apply metallurgy knowledge to the manufacture of the whole vehicle, we can apply it in the project of the engine block cooling system. Although we can not apply mechanical engineering knowledge to the manufacture of the whole vehicle, we can apply it in the construction of the camshaft...In the matured company, the decisive factor in the production, according to what we have seen is the offer of qualified talents."

The author sees technology, as the application of scientific or other kind of organized knowledge, as a logical point that should be considered for the explanation of the economical changes, since technology itself not only provoke changes, but also it is a reaction to the changes:

"Although it forces specialization, it is also a result of the specialization. Although it requires extreme organization, it is also a result of organization."

As far as the last paragraph is concerned, we can affirm that in spite of the fact that the division of the qualified work, in the manufacture of goods, has lost ground for the so called "Total Integration", where the ideal is that each member of the process has a vision and

knowledge of the whole process, the change is a result from the organization of the work division itself, and in the usage of the technologies that incorporate knowledge and procedures that were performed only by human beings in the past. They are the so called "intelligent processes".

Galbraith, with his extreme critical-reflexive position, realizes and sustains the importance of an educational system that is highly developed as a decisive factor for the productive system. He points out, however, the critical role of the educator [3]:

"...He [the educator] is the production factor, of which the industrial success depends; he should understand that and perform his power not in favor of the planning system, but in favor of the whole human personality."

TECHNOLOGICAL INNOVATION

The demand for technology exerts influences on two different levels: on a macroeconomic level, it influences the development of countries and, on a microeconomic level, it influences the performance of companies that need constantly new and better technologies for the maintenance of their competitiveness in the marketplace. That means that the present companies should search for the production of knowledge materialized in the form of new products, incorporating research and development activities, which, in the past, had been restricted to universities and research institutes. A new product, in this case, appears: "technological innovation".

When a company embraces a technological innovation, it unchains a sequence of procedures that involve technical data collection, definition and specification of products/processes, research and development, engineering and marketing. Economists usually call the whole process innovation chain or innovation process. Companies that need technological innovations on a constant basis to keep updated are concentrated mainly in the areas of information technology, aerospace, biotechnology, robotics, high precision instruments, telematics, bio-genetics, semi-conductors, etc.

It has been noted that for the creation of industries and businesses related to advanced technologies, the existence of individuals who have the domain of, or access to technological knowledge, is an indispensable condition for the strengthening of the company. Besides, the professional staff is generally from the same technical community, which is linked to a same vanguard area, even in the most developed countries. However, the complementation of the formation of those professionals happens by means of the interaction between the universities and the companies since the domain over productive techniques does not include only the knowledge

of the operations done by machines but, after all, the knowledge of the processes that happen in the production chain.

UNIVERSITY-COMPANY

The whole preceding argumentation demonstrates that Univap is inserted in an environment that facilitates the development of partnerships with businesses, since São José dos Campos [2] has all the necessary conditions for that interaction. As a matter of fact, the University is in a potentially rich environment in terms of opportunities, and it is up to the University itself to take advantage of this creating conditions for cooperation actions that may help the development of its region, harvesting its own development advantages in doing so. We know that certain opportunities occur in function of factual conditions, and, particularly of the scenario that a certain business is facing, and that is why even a university should be prepared, structured, to enjoy the opportunities that emerge. That has been happening in the two cases we are going to analyze.

SPECIFIC FORMATION COURSES

The possibility for the creation of short specific formation courses, so called Sequential Courses, allows for the institutions to offer courses that fulfil the needs for qualified personnel. Those courses may be conceived as additional resources in the complementation of the formation of specialized technicians, and as instruments of knowledge update and recycling, mainly for those who are outdated and out of the marketplace for a long time or even for those who want to change their professional activity.

There are great potentialities to be explored in those courses which have been legally authorized by the legislation relative to superior education. We will present as follows the two aspects of the specific law for the Sequential Courses, featuring mainly the possibility of offering courses of specific formation.

With their quality sustained - for the ability they have been legally authorized - those courses may be of great utility mainly in the areas of knowledge that undergo fast changes.

INTERACTION WITH EMBRAER

EMBRAER, the Brazilian Aeronautical Company, is, today, the largest Brazilian exporter, and its headquarters are located in the city of São José dos Campos. It is clearly a company which benefits from the students who graduate at Univap, on several levels. Besides, it is a company that needs to maintain its international competitiveness, generating new products and new technologies. The formation of highly qualified personnel is a real need and

Univap is a potential partner, since the later has been developing alternatives for the region of São José dos Campos to maintain its aerospace park active and alive. Furthermore, it is a company that may help, in the future, Univap to develop other fund sources for the expansion that should occur in the near future.

Considering the potentialities shown in the previous paragraph, the College of Engineering, Architecture and Urbanism reached out to a close relationship with the company. Initially, the aim was to develop specialization programs for engineers and technicians. The response to that approximation initiative was promising, though unexpected: there was, at that moment (November 1999) a real need for qualification for the high-school-level technical staff because the company needed to be granted an international certification of a new airplane at the end of 2001. For the certification to be successful, it was highly recommended that the technical personnel had received qualified education from an extremely recognized institution such as an university, and in a relatively short lead time, or rather, two years. We demanded then, while we were analyzing the alternatives for a solution for the presented demand, a formal requirement for the implementation of a training program. The requirement resulted in a letter from the Director of Human Resources of EMBRAER to Univap's Dean, who, promptly determined that a proposal compatible to the needs presented by EMBRAER should be presented.

As we have seen, the Sequential Courses are divided into specific formation courses and complementation courses. The specific formation courses should have a minimum of 1600 compulsory hours and 400 class days. That means the possibility of offering a superior level course, with a certificate recognized by the national system in a period of two years. Certainly, that was the alternative that would fit in the conditions established by our partners.

After having defined that a Sequential Course would be implemented, we began to design the structure of the course in a close collaboration with the company. For that, we used the experience acquired during the initial meetings of the Commission of Specialists of the National Institute for Pedagogical Studies - INEP, an organ of the Brazilian Ministry of Education of Brazil - MEC, that demonstrates how to draw the profile, the abilities and the competencies of the candidates for the undergraduate courses. We had several meetings with different sectors of the production area and established the interest profile, the capabilities, the competence instances, and the contents of the course. While we were taking care of the process for the implementation of the course, the juridical departments of the companies were registering official cooperation documents, establishing a wide cooperation agreement, in which the Sequential Course fit in through an addendum, denominated Work Plan 01.

SUPERIOR SEQUENTIAL COURSE ON AEROSPACE TECHNOLOGY - CSSTA

The Superior Sequential Course on Aerospace Technology has as its target the formation of professionals to work in the aerospace area and to contribute for the development of a strategic area of the human knowledge in the 21st century.

The candidate should have a vision of the interdependence of the different systems of the airplane (electrical, hydraulic, pressurization, etc.); should be capable of making elementary calculations relative to the airplanes (potency, electrical energy, material endurance, etc.); should have a general view of management; should be an interface between the technical and engineering areas; should have general knowledge on subjects related to: a: life cycle of the product, structural project, aerodynamics, aerospace systems, homologation, on-flight essays, instrumentation, maintenance, operation, customer support; should be able to relate the theoretical learning to his/her practical abilities.

The candidate should have acquired competence for:

1. Understanding the operation of the aerospace systems and subsystems;
2. Understanding how an airplane is maintained and operated;
3. Preparing for following up new perspectives and trends of the aerospace market;
4. Knowing how to interpret and discuss a project related to aerospace systems;
5. Helping out, when necessary, airplane homologation processes;
6. Understanding how to define, project and manufacture aerospace vehicles.
7. Teamwork, helping and investing in programs that include groups of people involved in the development of one product (conception, project, homologation, production, maintenance, customer support and discontinuing).;
8. Using the knowledge acquired for improving and understanding his/her own limitations in his/her area of work.

Besides the contribution for the determination of the contents, Univap counts on the help of the involved institutions by means of the indication of professionals for teaching the professional disciplines. The preference has been for those who accumulate education, professional experience and didactic experience. In function of the great demand for qualified professionals, who fulfil those requirements, the course has a very high quality faculty.

UNIVAP-ERICSSON RELATIONSHIP

Univap has recently become one of the universities of a selected group of 12 which have partnership projects with Ericsson, a multinational company of the telecommunication area that is present all over the world, and that is strategically spreading its competence in information technology and data communication systems.

Ericsson has carried out partnerships with Brazilian universities which develop research in the areas of telecommunication and computer sciences, and it applies resources in research and Development creating its own Research and Development centers in several states of Brazil. The partnerships created are based, mainly, on the Law Number 8248, of October 1991, Law Number 10176 of January 11, 2001 and on the Decree no. 3800 of April 20, 2001 [7], which deal with the fiscal benefit conceded to companies of the areas of development or production of computer and automation services that invest in research and development and information technology development.

Based on the cooperation with EMBRAER, we presented a proposal for the creation of a Sequential Course in the area of telecommunications. Besides, since we had the experience of having worked in a project of expansion of the didactic laboratories at FEAU, we presented a large project for the improvement of our laboratories of computer sciences, electricity, applied electronics, telecommunications and data communications, for the campi of Urbanova and Santa Branca in Jacareí. Our project was accepted and within the Work Plans elaborated the following results for the educational area were indicated:

- I. implementation of the Sequential Course on Telecommunication Systems, with the duration of 4 semesters (1600 hours).
- II. purchase and installation of teaching equipment for the undergraduate courses of the FEAU;
- III. lessons and activities for the 6th and 7th year students of the Electric Engineering Course at the ERICSSON Technical Center;
- IV. granting of scholarships for students of the undergraduate course and of the sequential course.

SUPERIOR SEQUENTIAL COURSE ON TELECOMMUNICATION SYSTEMS - CSSST

The Superior Sequential Course on Telecommunication Systems - CSSST, was created after the agreement with ERICSSON, and has as its main purpose to offer professional formation in the area of telecommunications to people who have concluded high school. It is a result from a demand from ERICSSON to improve the professional quality of its technicians and future employees

and of the need for Univap to become a new knowledge pole in the area of telecommunications.

The process for the definition of the desired profile and abilities of the candidates to be accepted counted on the contribution of managers and technicians from ERICSSON, which led to the following result:

Profile: professional able to act in specific areas of telecommunication companies, with a general view of the processes involved in the productive chain, and in the market of telecommunication services; adaptable to changes; with an idea of planning and supply chain; capable for critical analysis and for proposing solutions for problems; available to work in teams, capable of building an interface between the technical and administrative activities with a notion of the company/market relationship; with some knowledge of quality systems, logistics, business management and project management.

Abilities: the candidate to be chosen to take the Superior Sequential Course on Telecommunication Systems should have abilities for:

- applying mathematical, scientific, instrumental and technological knowledge to telecommunication systems;
- analyzing experiments and interpreting results;
- analyzing and implementing systems, products and processes;
- planning and coordinating the execution of telecommunication projects and services;
- identifying and formulating solutions for the productive chain.

Future Perspectives for the CSSST

In the end of 2002, the first class of the CSSST will graduate. The continuity of the course, like in the case of the CSSTA, is subject to the approval by the Ministry of Education - MEC. In the beginning of 2002 we will submit the Pedagogical Project for the recognition process. ERICSSON has confirmed the maintenance of the scholarships for the first class, with the possibility of expansion for the second class. A Work Plan 03 is been elaborated and the main item of that addendum to the agreement signed is the continuity of the support for the Sequential Course. That demonstrates that we are fulfilling the expectations of our partners and that they believe the course is important and necessary inside the context of telecommunications.

CONCLUSIONS

Nowadays, fortunately, the proximity between the university and the productive sector, mainly in developing countries, is a relevant factor for the technological

development because, in highly developed regions, like the silicon valley in the United States of America, the presence of high level universities has been a decision making factor for the feasibility of the development. That is, in fact, a vicious circle, because with the development, universities gain more prestige and attract better professors and researchers and, on the other hand, the best pupils. From our point of view, Univap has to explore, with competence, the fact of being located in a privileged region, in a developing country which needs highly qualified people for assuming, at least, the responsibility to maintain itself in the position it has reached. As it has been said before: *"we will have to run a lot to stay in the same place"*.

We believe that the following items are essential for the existence of a well succeeded university-company interaction:

- I. availability of time and motivation for trying a new contact to the target institution or company;
- II. existence of a concrete proposal to be presented, preferably in the business field of the potential partner;
- III. experience, knowledge and domain of what is going to be proposed;
- IV. awareness of the specific legislation on fiscal incentives, or other benefits that may provide or facilitate the implementation of the proposal;
- V. patience for negotiating and perseverance during the negotiation period;
- VI. flexibility, to be able to take advantage of new opportunities that may emerge;
- VII. implementation of the proposal and maintenance of the control over the process;
- VIII. constant evaluation of the process, with the purpose of giving feed back to the partner and maintaining the quality
- IX. competent and available team to sustain the implementation;
- X. juridical support in the elaboration of the agreement or other legal requirements.

Many of the proposed items are related to personal interactive actions, since it is extremely necessary to count on people who are motivated and want to create new situations and opportunities. Experience shows that, in the beginning, a few people will be voluntarily available for helping out in the implementation of the project, however, but as the project advances and the results begin to show up, new adepts star joining the team to help and be part of it.

Our observations mentioned above alert for the fact that it is necessary to create motivation mechanisms for the people to create new ways. Some people have a natural

self-motivation, which is difficult to explain, while most of the others need incentives. It is difficult to obtain good results through the imposition of objectives for unmotivated individuals.

We believe the specific formation courses represent, as they have proved, the interests of the companies and recently graduated technicians, since the duration of the courses is relatively short and the acquired knowledge corresponds to the needs of the market. In that case, we have reaffirmed the importance of the participation of the partner for the design and implementation of the course, because in order to create courses of that nature, which allow for specific formation but are not much comprehensive, makes sense only when there is an evident need from the professionals. Here, evidently, what takes over is the logic of the market but the university should create conditions for those professionals for deepening the formation acquired in an undergraduate course with a solid and well established basic formation. The workplace reality shows that the best technicians are those with the most comprehensive formation, they are the ones who make a difference. Therefore, we defend the creation of the sequential courses with the purpose of allowing young people to apply for a professional position as a better prepared candidate than if he/she had taken only high-school. However, we do not believe that those courses should replace undergraduate courses which provide a wider formation. As educators, we should see the sequential courses as a step to be taken along the formation of a college education

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