

# IT Education and Competitiveness in Developing Countries: The New Scenario in Argentina

Uriel Cukierman<sup>1</sup>, Juan Palmieri<sup>2</sup> and José Virgili<sup>3</sup>

**Abstract** - In the successful countries, skills, technology, education and the economy interact in important ways to create a virtuous cycle of productivity each feeding on the other. The present scenario in Argentina consists of excellent connectivity in the international bandwidth front, well trained population, comparatively low wages, a government that is promoting foreign IT investment (Congress recently enacted a law giving fiscal incentives to software development), national software export success factors. Most of the factors mentioned above are also essential for a good linkage through national borders. The IT sector in Argentina is growing at a fast pace. Statistics show increasing numbers in every aspect of it: employed professionals, exports, percent of GDP, etc. This reality demands a huge and increasing amount of well trained human resources. The question is: how to get them? The answer is, from our point of view, cooperation. Cooperation among government, industry and academia, not only within countries but, essentially, across borders; in the form of international integration treaties, multinational companies and international academic collaboration. This work will describe how Argentinean universities, and especially the UTN, are carrying out this vision and will show foreign countries universities interested in collaborating with ours, the way to go.

**Index Terms** - Argentina, Competitiveness, Developing countries, Education, Information Technologies.

## SOME FACTS ABOUT ARGENTINA AND THE IT MARKET

At the end of 2001, Argentina fell down into a very important economic and social crisis. That was the forced touchdown of a decade of bad politics and severe corruption. This situation was worsened by the fateful decision to change the exchange rate between the Dollar and the Argentinean Peso, which had been until then one to one, and was suddenly modified into a four to one relation, what meant a devaluation of our currency of 300%.

During those years, all the IT market indicators had had a very significant reduction. Just as an example, during the first trimester of 2002, the hardware imports went down to a 7% of those registered during the same period of the previous year.

Recovery started in the second quarter of 2002, and there have been eighteen consecutive quarters of growth, thus improving the sequence that had taken place in the previous bullish cycle (IV Q 1995 – II Q 1998). Sectors related to tradable goods led the initial GDP recovery, but later the impulse extended to all kind of goods (Figure 1) [1].

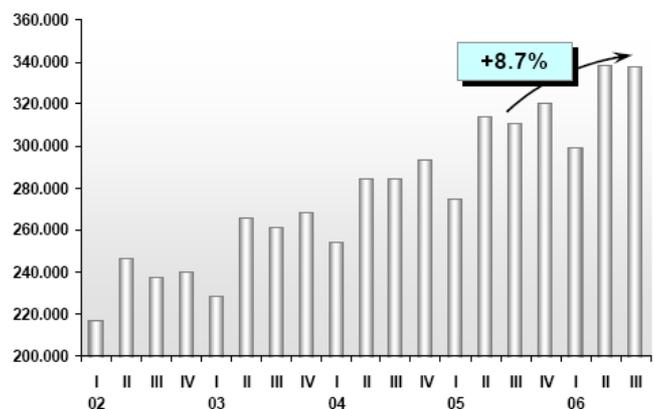


FIGURE 1  
GROSS DOMESTIC PRODUCT AT 1993 PRICES – IN MILLIONS OF PESOS.

In comparison with those figures, the year 2003 showed growing indexes of approximately 20% of those registered during 2002 for the whole IT market. For example, the hardware segment alone had, that year, a 72% annual growing rate boosted by the significant increase in the number of personal computers sold. In the same direction, the import segment showed an important rise led by servers with an 80% increase [2].

Another important Argentinean IT market index was the increase in the number of Internet accesses estimated in 28% during 2004. In that segment, the broadband users rose by 50% compared with 2003, and it is estimated to reach the two millions at the end of 2007 (half of them with velocities of 512Kbps or 1Mbps, considered high velocity compared with other countries in the region).

The permanent growth of the local IT market, contributed to the spurt and development of IT related services such as e-banking, e-commerce, e-government and e-learning. Likewise, the dollar exchange rate, the technological convergence and the improvements in national and international connectivity have been leading to fantastic business opportunities for international enterprises and corporations that decided to concentrate their global client

<sup>1</sup> Uriel Cukierman, Universidad Tecnológica Nacional, uriel@utn.edu.ar

<sup>2</sup> Juan Palmieri, Universidad Tecnológica Nacional, jpalmieri@rec.utn.edu.ar

<sup>3</sup> José Virgili, Universidad Tecnológica Nacional, jmvirgili@rec.utn.edu.ar

services in our country. The increase in these businesses was of about 15% in 2003, totaling 1.9 billions of pesos (more than U\$S 600 millions), and similar increases in the following years. Many multinational corporations have concentrated in Argentina services such as help desk, client support, call centers, contact centers, systems management, remote operation processing, software development, outsourcing of professional services, real time infrastructure, etc.

The previous year, 2006, showed a total growth of about 24%. The services and software segment had an increase of 25%; in the same way, the consumables segment increased 33% pushed by the hardware selling that had a rise of 23%, that means a record in the last years with 1.4 million computers (PCs and portables) sold [3]. According to the Software and Information Services Enterprises Chamber (CESSI) [4], the products exported (software, services, etc.) have had a significant rise in comparison with previous years.

This year (2007) is expected to be the one of the dawn of those sectors, and a more important growth has been forecasted for 2008 [5]. There are several initiatives that made the PC products more affordable for the typical middle class families. The “miPC” (myPC) program [6] organized by the local government, and supported by major IT companies like Intel, AMD, Microsoft, Hewlett Packard and others, is a very good example of these initiatives.

As a result of what we have been describing in the above lines, Argentina climbed eight positions in the Networked Readiness Index 2006–2007 rankings recently published by the World Economic Forum, reaching the 63th position. Though this may seem a poor sign, it is in fact a good one since in the 2004–2005 rankings we reached the 76th position [7]. Another good sign is the “Digital Access Index” which places our country in the “upper” group of nations together with Brazil, Mexico and some Europe union countries, in the 54th position (Figure 2) [8].

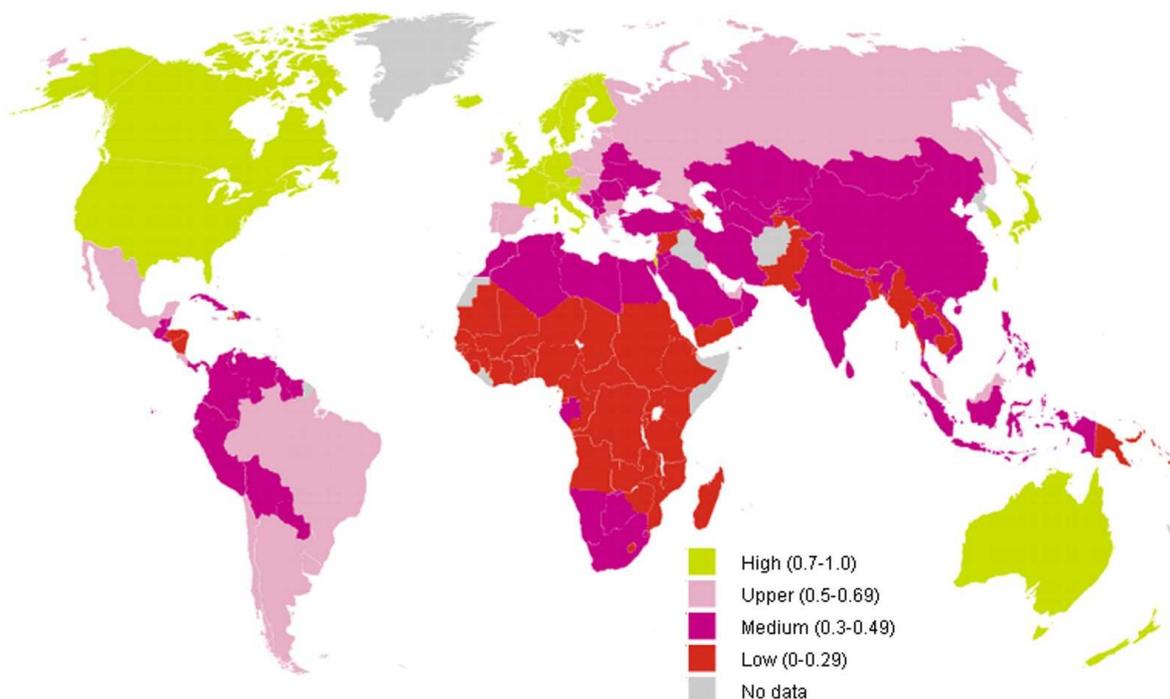


FIGURE 2  
DIGITAL ACCESS INDEX - ACCESS TO INFORMATION AND COMMUNICATION TECHNOLOGIES.

**ANALYSIS SYNTHESIS AND IMPACT ON THE WORK MARKET:  
NEW REQUIREMENTS AND NEEDS**

This outstanding growth of the IT market in Argentina is, undoubtedly, one of the indicators of the economic recovery of the country. Such improvement is quantitatively remarked by the rising business volumes generated in each segment of the IT market, in the numerous small and medium enterprises that offer their products and services both in the local and international markets. It is also qualitative evidenced in the new local, regional and global business models within the new business niches.

The growth of the IT market produced an important and increasing demand of well trained professionals in order to

satisfy the requirements of the enterprises and businesses in that sector. It is at this point, where most of the work market analysts say that there is a “bottleneck” situation, since there are not enough qualified workers who can fulfill such demand.

But, what does “qualified workers” imply in the present IT market? What skills and abilities must those professionals have? Are those skills and abilities the ones mastered by recently graduated professionals? Finally, what role should, in this framework, Argentinean universities play?

The UTN is one of the most important universities in our country. In its more than thirty campuses, distributed all over our vast territory, the future engineers are being educated and also, the professionals are being updated. More than 60.000 students are presently being educated in order to

be prepared, in the near future, for the challenges that they will have to address in their respective working areas. It is because of that, that answering the previous questions is essential for the definition of the type of education that they will need as soon as they start working.

Among all the abilities and knowledge required by an IT professional, there are three in which the universities are supposed to play an important role: proper knowledge regarding their special field and the related technologies, how to get engaged with companies, and collaborative work, especially between teams conformed by members who are geographically dispersed and who speak different languages.

### HOW TO DEAL TO THIS SCENARIO AND TO TAKE ADVANTAGE OF IT

As it was proposed by Erran Carmel [9], there are eight factors that lead nations to software export success. These factors are, according to Carmel's work, arranged in a so called "Oval Model", that is showed in figure 3.

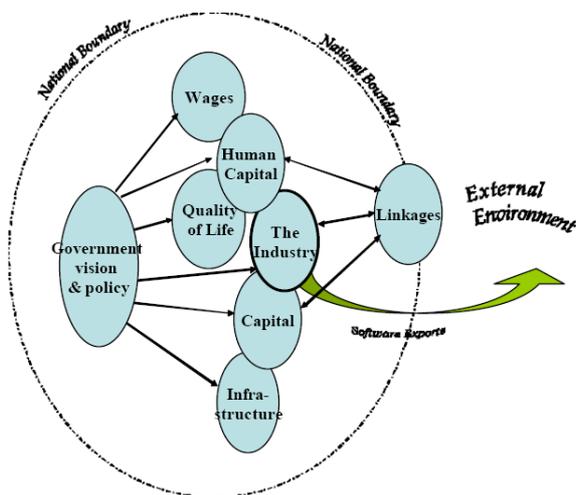


FIGURE 3

THE "OVAL MODEL" DEPICTING NATIONAL SOFTWARE EXPORT SUCCESS FACTORS.

As it is obvious, most of the factors mentioned in our previous analysis are included in this model and are essential for a good linkage through national borders.

It is absolutely well known that competitiveness is the goal for succeeding in the Global Knowledge Economy. We may also assure that education is the way to achieve that goal. Finally, IT industry is the key factor and the opportunity of gaining complete access to the globalized world, especially in developing countries. Since it is a knowledge intensive industry it requires educated people. None of these elements works isolated from each other, neither the education institutions can do so.

In successful countries, skills, technology, education and economy interact in important ways to create a virtuous cycle of productivity each feeding on the other (Figure 4).

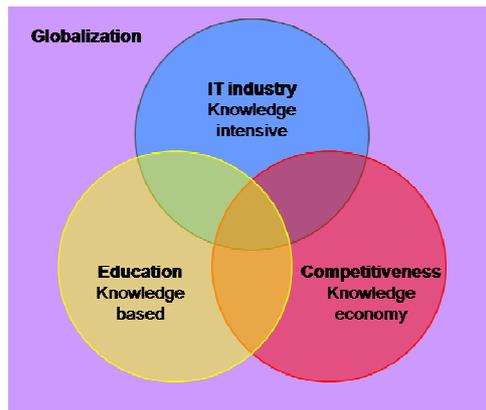


FIGURE 4

VIRTUOUS CYCLE OF PRODUCTIVITY.

The reality described demands a huge and increasing amount of well trained human resources and the question is how to get them. We think that the answer is cooperation: Mainly, cooperation among Government, Industry and Academia. Long time ago, almost forty years, a very well known Argentinean researcher and former National Minister of Education, Jorge Sábato, conceived a relations system represented by a triangle in which each vertex corresponds to one of those three elements and each side to the corresponding interactions.

Based on that idea, and in the previously stated necessity of cooperation, and having the globalization process that is taking place nowadays in mind, we propose that we need not only national collaboration among Government, Industry and Academia but international collaboration as well.

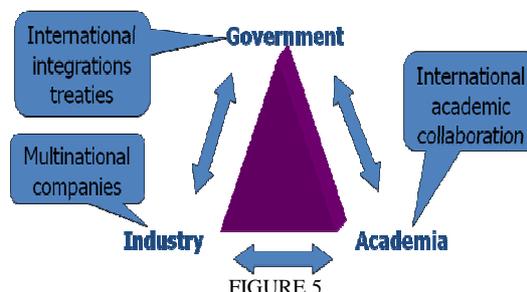


FIGURE 5

COLLABORATION AMONG GOVERNMENT, INDUSTRY AND ACADEMIA.

The Government must bet on it in the form of international integrations treaties, open the borders and compete within the globalized markets, not recklessly but in a very carefully and with a well projected strategy. The industry, especially multinational companies, must support and boost research both in the local and international arenas, particularly in universities environments, offering also internships for advanced students in order to allow them to have the chance to get real experience while studying. Finally, the Academia has its own responsibilities in this arrangement, promoting international academic collaboration in the form of student interchange programs, joint research activities, cooperative teaching activities, etc (Figure 5).

## SUCCESSFUL EXPERIENCES

Various successful experiences are being carried out in our country and especially in our own University. As it will be described in the following lines, all of them involve the Industry, the Government and the Academia in different ways.

### *I. Programs +MAS and Enter Tech*

These initiatives were organized by the Government (Labor Minister), the Software and IT Services Chamber of Commerce (CESSI) and the companies Microsoft (+MAS) [10], Sun and Oracle (Enter Tech) [11]. Some Argentinean Universities also took part of these programs, which aim to train young people as .Net and Java developers in order to allow them to be rapidly hired by the local IT companies that are requiring these kinds of skilled workers. The three companies mentioned above donated the hardware needed for each participating university in order to be available for the students' courses. The Government paid the professors' salaries and the operational expenses, and the universities organized and developed the courses with their own professors and trainers. Thousands of students attended these courses and passed through the examinations and are now satisfactorily working many local software companies.

### *II. Requests for Proposals (RfPs) issued by important IT companies*

Even though the RfPs are not a new initiative, they have been transforming, during the last years, into a very successful activity within the local academic community. As it is probably well known, the available resources for R&D in our country are very poor. In that sense, the RfPs organized and sponsored by very important IT companies like Microsoft, IBM and HP, represent a very interesting chance for researchers of our universities to be able to access, at the same time, to significant amounts of money and, what is also very important, international opportunities of sharing knowledge and experiences with "first class" peers from all over the world; This is because, as winners of those grants, they are invited to show their works and findings in international events and conferences. The following are good examples of these opportunities:

- AMERICA@UTN: Learning through Advanced Communication and Information Technology Resources and Means [12]
- PAMPA, A Tool for Integrating Formal Methods in model-driven Software Engineering Course [13]
- Trace it!: Event Trace Generator for Distributed Embedded Real-Time Applications [14]
- Techniques of Robotics and Artificial Intelligence Applied to a Personal Robot [15]
- Neuropsychological Tests Automation [16]
- and some others listed at the Microsoft Research University Relations Web Site [17]

### *III. IT education promotion*

The National Education Ministry and the CESSI developed this project, called IT Generation [18], in order to promote the IT related studying programs and to encourage those young people graduated from secondary level schools (high schools) to enroll themselves into those programs presently offered in local universities.

### *IV. Hardware donations*

Because of the reduced amount of money granted by the National State for public universities in our country, there is a significant lack of good and updated hardware resources available for students while taking their courses. Trying to help those universities in their effort to solve this situation, some companies like IBM, Microsoft and HP have donated hardware for establishing dedicated laboratories where the students are able to develop their practical works and experiments using the most recently developed technologies in those environments useful for them.

In the same direction, some agreements reached between IT companies and universities allow the latter to access very important hardware resources previously donated to other Latin-American universities. That is the case of the high performance servers donated by IBM to the University of Campinas in Brazil, accessible from our campuses through the national and international advanced performance networks.

## A FINAL THOUGHT

We, as world citizens, are not in a position in which we are able to decide whether to adhere or not to the globalization process, it will go on with or without us. So, it is better to be well prepared for that rather than being forced to in a disorganized way.

In that sense, collaboration is a must. We need to share our own experiences and to learn from other ones from universities all over the world, especially with those involved and specialized in the IT sector.

We are ready to collaborate; we hope that there are some others out there willing to collaborate with us; let's give it a try.

## REFERENCES

- [1] Source: Argentine Ministry of Economy and Production
- [2] Source: U.S. Commercial Service (CSA) at the American Embassy in Argentina
- [3] <http://www.lanacion.com.ar/885175>
- [4] <http://www.cessi.org.ar>
- [5] Source: IDC Latin America
- [6] <http://www.programamipc.gov.ar>
- [7] Mia, Irene; Dutta, Soumitra; "The Global Information Technology Report 2006-2007: Connecting to the Networked Economy", March 2007, MacMillan
- [8] Source: Global Map of Digital Inclusion – World Economic Forum

- [9] Carmel, Erran; "The New Software Exporting Nations: Success Factors", The Electronic Journal on Information Systems in Developing Countries, (2003) 13, 4, 1-12
- [10] <http://www.microsoft.com/argentina/mas/>
- [11] <http://www.comunidadjava.com.ar/educacion.html>
- [12] <http://www.america.utn.edu.ar>
- [13] <http://www.frlp.utn.edu.ar/pampa/>
- [14] <http://dependex.dc.uba.ar/traceit>
- [15] <http://www.secyt.frba.utn.edu.ar/gia/vstudio.htm>
- [16] [http://www-304.ibm.com/jct09002c/university/scholars/success\\_stories/clinical\\_engineering.html](http://www-304.ibm.com/jct09002c/university/scholars/success_stories/clinical_engineering.html)
- [17] <http://research.microsoft.com/ur/us/latam/default.aspx>
- [18] <http://www.generacionti.net/>