The impact of innovation on culture and social knowledge

Héctor Zamorano
Facultad de Ciencias Económicas y Estadística Universidad Nacional de Rosario (Argentina)
zamorano@citynet.net.ar www.citynet.com.ar/estudio

Theoretical Framework:

When we want to explain an abstract concept, we usually use metaphors, like the metaphor "impact" used in the title and in the Call for Papers. But a metaphor some times hides more than it shows. When an innovation is introduced, experts say that it will produce an impact on the area of its application. This is true, but, what kind of impact? Which is the impact? What changes with this impact? These are the topics I will analyze.

The word "techno-science", which is used in the title, was originally coined by Paul Virilio, and it implies the fusion between science and technology that takes place nowadays: science produces knowledge and requires tools in order to advance. Technology produces these tools for science, and with these tools science modifies the old knowledge and produces new one, and it requires more new tools ... This feedback process is so quick that we cannot separate the technological products from the scientific products.

Some Ideas:

The aim of this paper is not to analyze innovation products, but rather to look for the "doors" where innovations come into the system.

Innovation is knowledge, and this knowledge allows us to produce devices or new procedures. So we can see innovation as a new device or as a new procedure. These are the techno-science products, which impact culture and social knowledge.

Nowadays, a deep differentiation process characterizes culture, and it requires specialization and excellence. Thus, experts are necessary. In other words, to be cultured we must be experts in some topics. This situation creates a new demand in enterprise, where experts take on the role of decision makers instead of capital owners as it used to be. This is a very important change because those who are not experts become average people.

The effects:

Neil Postman makes us reflect on some ideas he explained in his conference "Five Things We Need to Know About Technological Change "(Denver, Colorado, March 27th, 1998)

1. Culture always pays a price for technology.
2. New technology benefits some and harms others. There are winners and losers.
3. New technology predisposes us to favor and value certain perspectives and accomplishments.
4. Technological change is not additive, it is "ecological", because it doesn´t add, it changes what already exists.

5. Technology becomes mythic, and it is dangerous because it is accepted as it is, without discussion or control.

Another effects:

a) Tendency to individualism
b) Rationality as a kind of ideological domination
c) More inequality (base exclusion and elites exclusion)

To Sum Up:

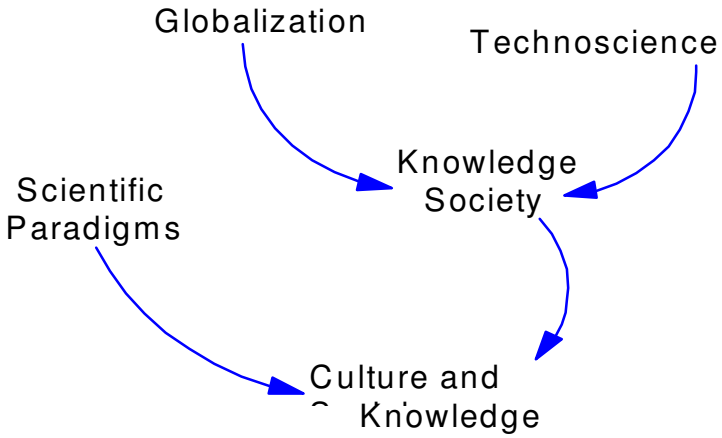


Figure Nº 1

Culture and social knowledge is affected by the scientific paradigms and by what is called knowledge society that is conformed by globalization influences and the innovations that techno-science produces.

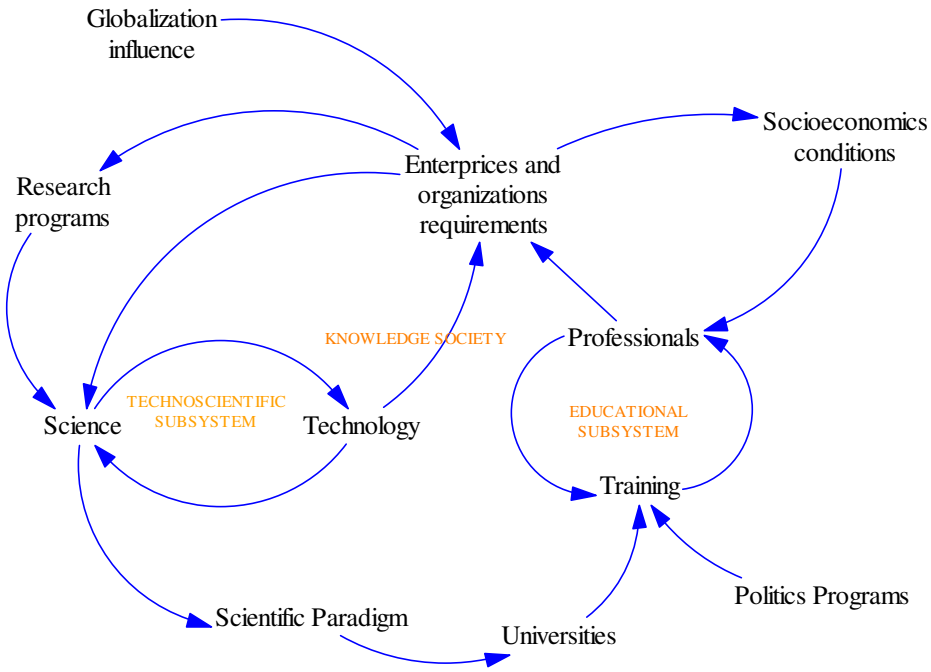
The goal:

We are socio-cyberneticians, and we have a very important scientific paradigm made by cybernetics, informatics and the General System Theory. This paradigm has tools to apply concepts to reality.

Innovation does not appear in the environment floating only to be observed or admired. An innovation usually has a goal. It is developed for some specific purpose, to be used instead of another device, which is considered old or that does not exist any more, so some activities are not longer possible. So we can start our analysis looking into those organizations (governmental, no governmental, enterprises), because it is there where innovations take place. And so, we can see the system behaviour and the changes produced by innovations.

Starting from the Sum Up graph, and using a System Thinking model I will present a causal graph that shows, as the Call for Paper asked, the feed-backs across a variety of different social subsystems, and where we can see, as a photograph, how the behaviour of the system is, where the "doors" for innovation are, how what we called "knowledge society" behaves, what happened into the countries that did not produce innovations. With this model, we can see the principal feedback loops among the elements of the system under analysis, and we can discuss not only the advantages of innovation, but also the disadvantages that we must take into account and their possible effects.

Last, as the Call for Papers asked, we can see the "impacts on social institutions", and the "side-effects and feed-backs across a variety of different social subsystems, long term effects affecting future generations, and how the phenomena of synergy and emergence may easily produce unexpected, unrecognized, and unwanted results endangering the sustainability of social systems and society at large".



The globalization appears as the element that introduce unestabilities into the system.
when the society is not prepared to provide "experts" (education subsystem)
and the technoscience that the national organizations requaire.

Figure No 2

However, we can introduce another interrelationship among these principal variables, making the model more complete.
In figure Nº 3 we can see the system that is affected by innovations, and it is possible to analyze the principal interrelationships, the feedbacks, and how a change in one variable affects the others.

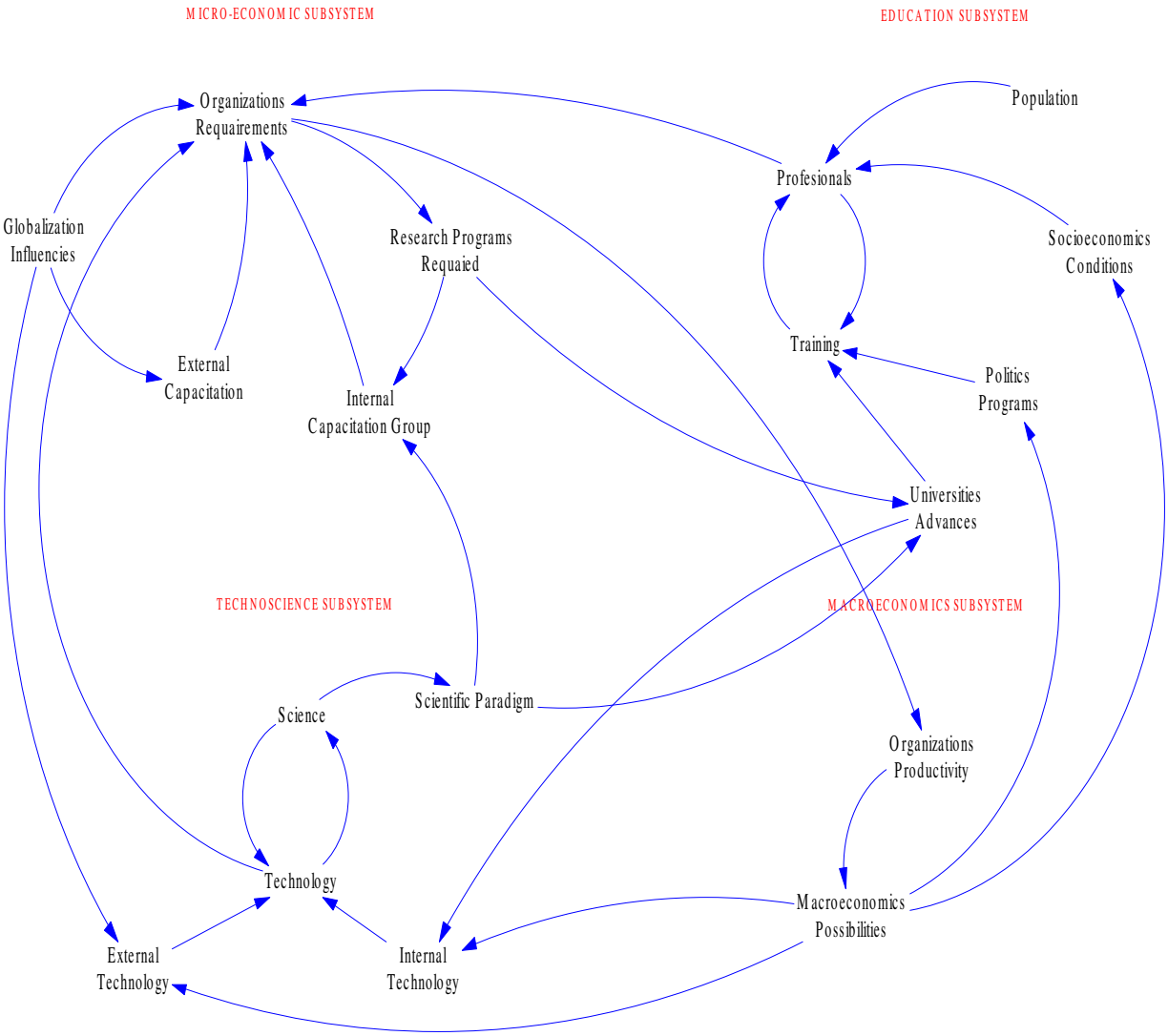


Figure Nº 3

The Innovation "Doors":

This causal-effect graph made with the System Thinking methodology, shows us the whole system and the interrelationships among the variables of the system where innovation appears, showing the behavior of this system, and allowing to understand what may happen if some modification affects one of

the variables, and how this modification extends it along the others changing the whole.
We can identify four subsystems:
1.- The micro-economic subsystem where the organization (governmental, not governmental, enterprises) develop their activities.
2.- The education subsystem where experts required by the knowledge society are trained. Universities activities are very important during this stage.
3.- The macro-economics subsystem that shows the impact that organizations produce on the macroeconomic conditions of the country (may be a city or a region) under analysis.
4.- The techno-science subsystem that produces knowledge innovations that will impact and modify the internal knowledge conditions.
Looking this graph model, the "doors" through which innovation comes into the system are:

a) Globalization effects represent the innovations produced outside the system.
b) New technologies developments.
c) The scientific paradigm changes.
d) Universities developments, which introduce the new knowledge with professional training.

The principal loops:

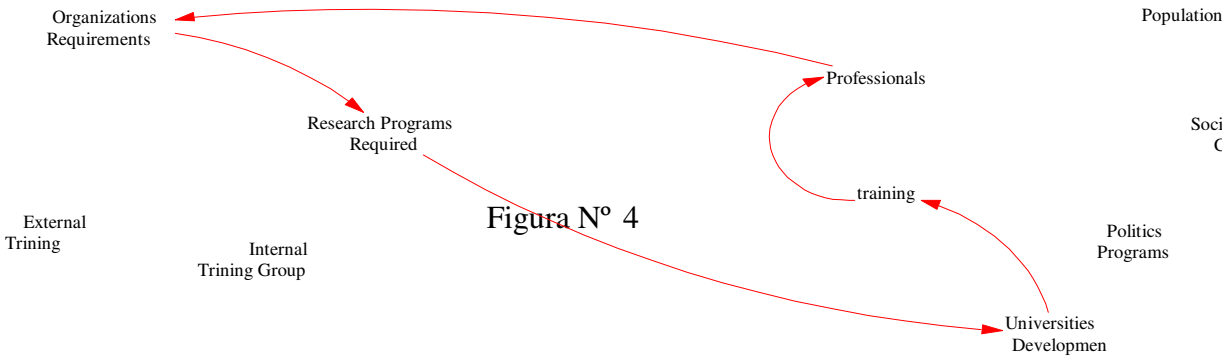


Figura Nº 4

Organizations have needs. They must adapt production systems to cut down on costs, to produce new products, and the like. So they require research programs, they need experts. These experts are university professionals. The universities, with their training plans prepare the experts that organizations need.

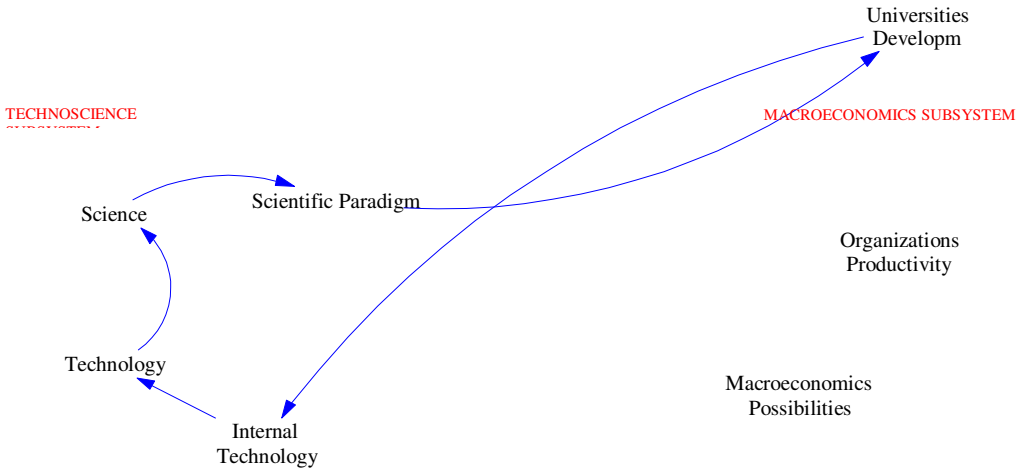


Figure Nº 5

In figure Nº 5 we can see that universities appear as a key element in this loop. They can grow (or not) depending on the techno-science subsystem behavior, but this subsystem depends on the universities developments, too. So, in this loop university performance can grow or drop producing the same effects into others loops (figures 6 and 7).

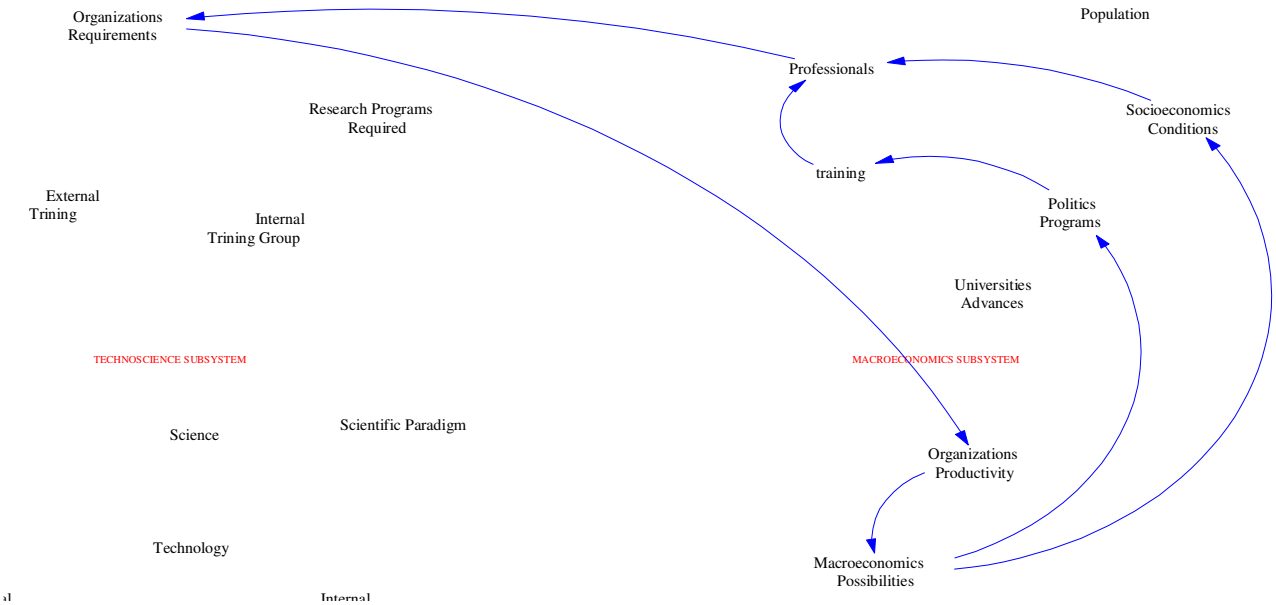


Figure Nº 6

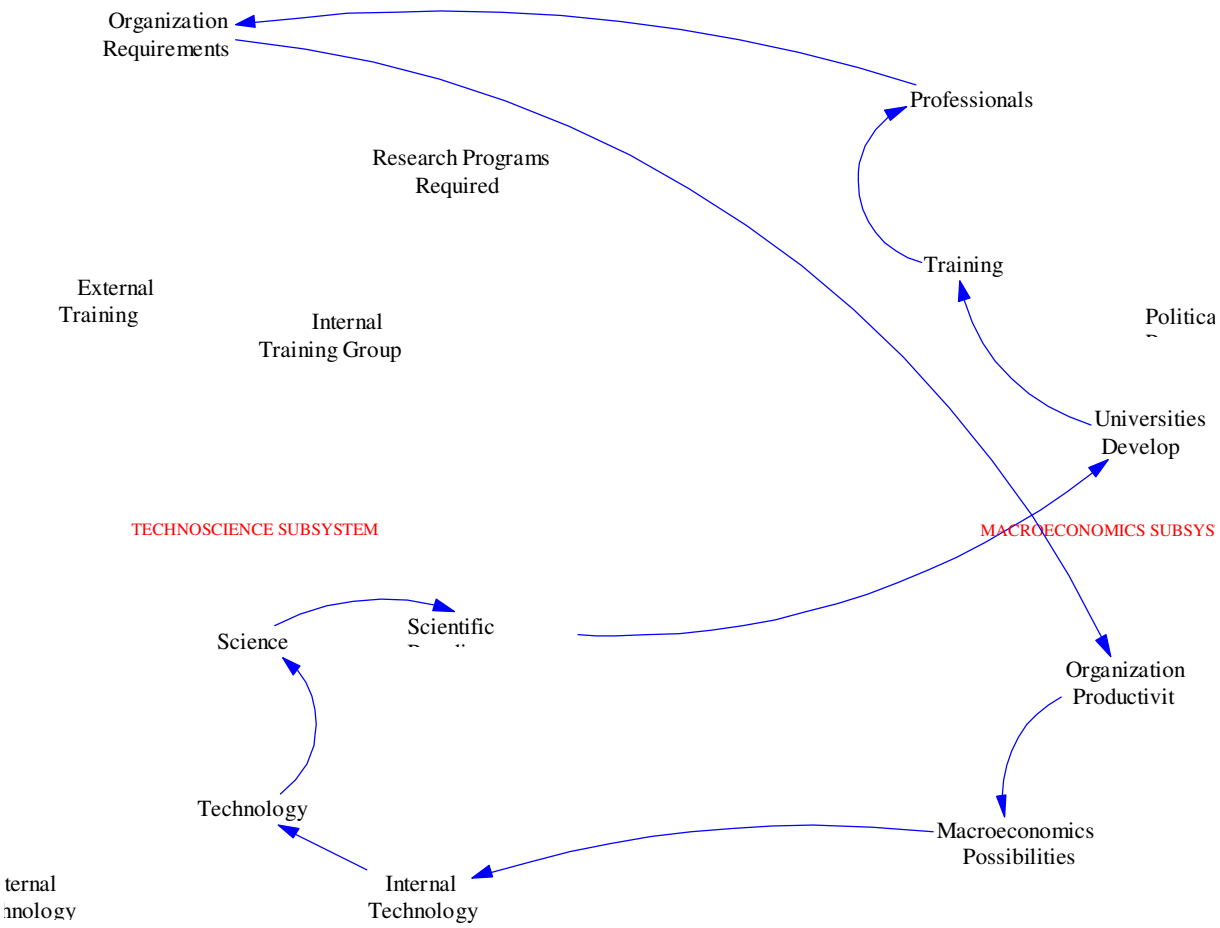


Figure Nº 7

If organizations can meet their requirements, they will have a better productivity and thus, the economic conditions of the country (city or region) will be better, allowing internal technology production. As a result, technoscience subsystem can incorporate new knowledge into universities. Consequently, they can train professionals required by organizations.

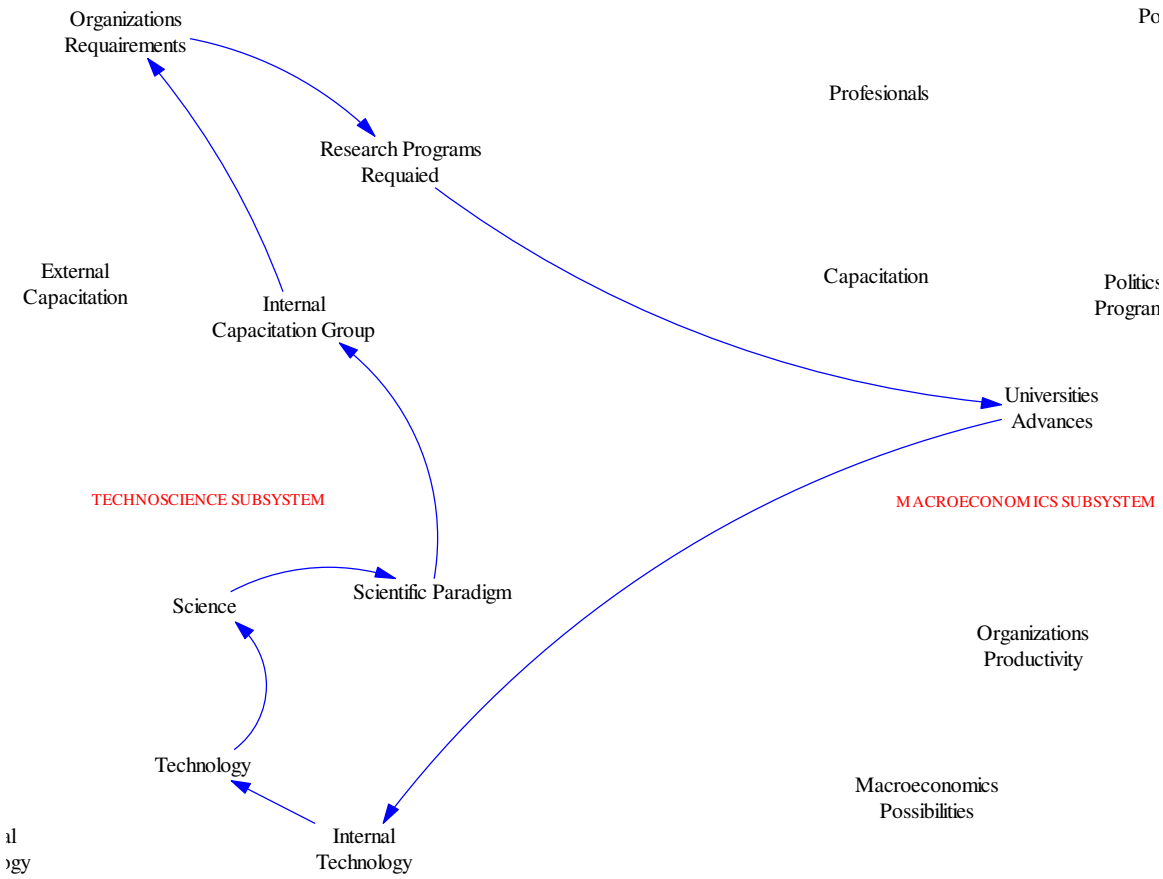


Figure Nº 8

In figure Nº 8 another possibility appears for the organizations: the internal training. It depends on the internal techno-science production that relies on universities developments.

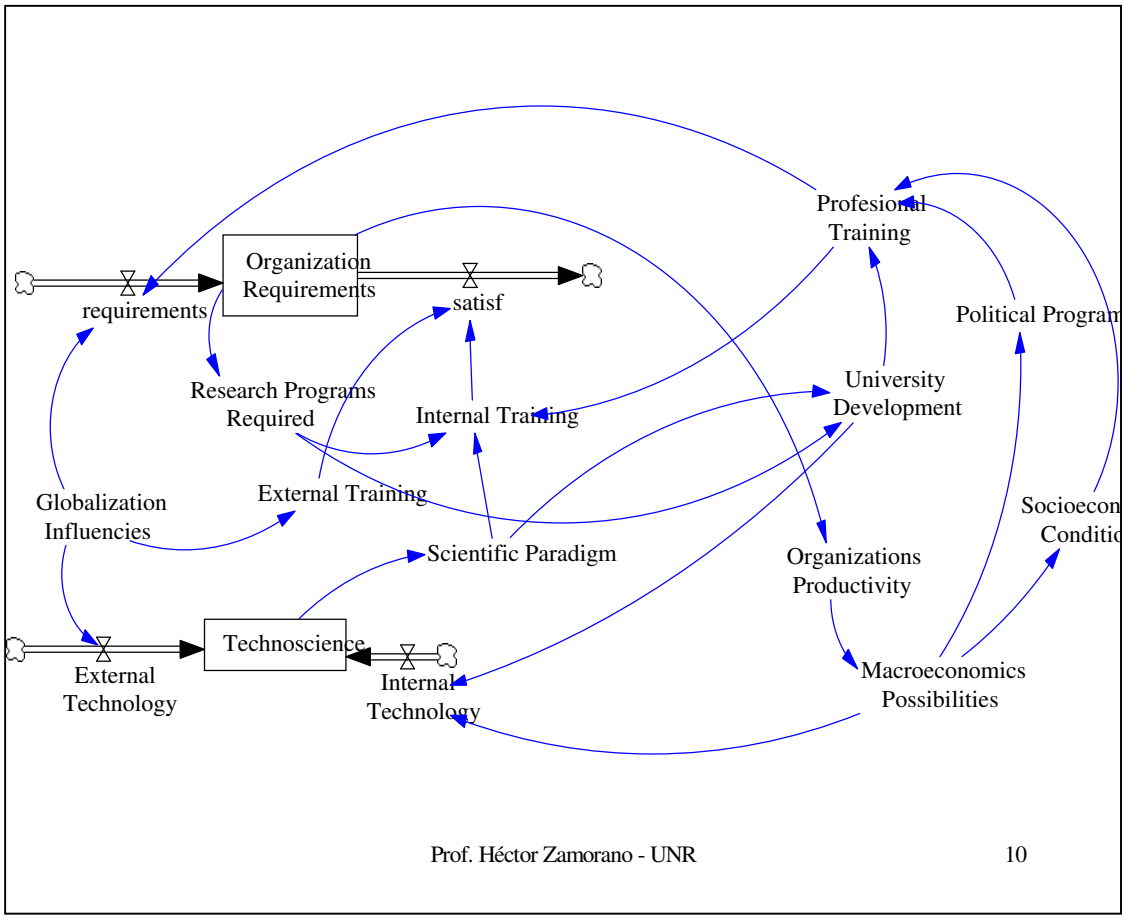
All loops what were described show the principals interrelationships in the system.

Starting from the causal - effect graph we saw, if I want to make a mathematical model for it simulation, I must draw a Stock and Flow Graph.

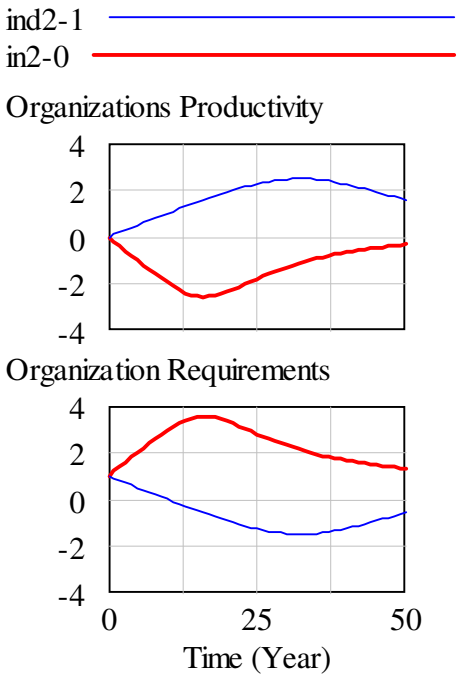
This sort of graph is knew by the software I´m using (Vensim) and so it can help me to make the formulas.

This graph represent the same we saw with the causal - effect graph.

Now I will show you the trend of the principal variables when I simulate the model.



Now, making a mathematical model where those connections appear as mathematical equations, it will be possible to analyze the behavior of this system if one of the variables changes. In the simulation play we could observe, as it is showed in figure, when globalization effects are reduced, the internal behavior is better.



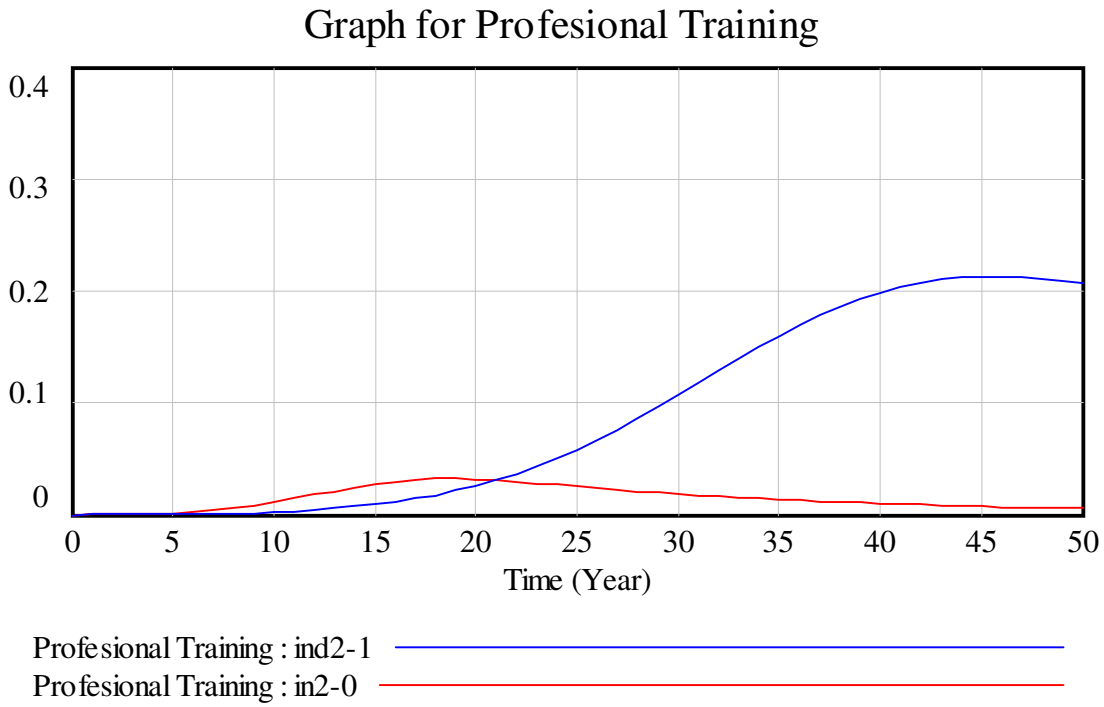
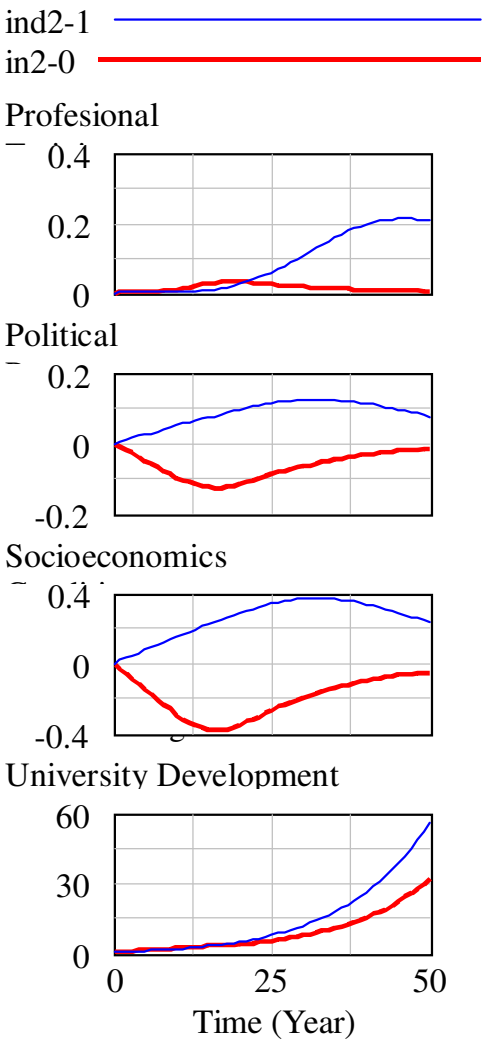


Figure N° 10

We can explain the behavior of this variable with the behavior of the Political Programs, Socioeconomic Conditions and Universities Development (Figure Nº 11)



Remember: in red the original start point, in blue the globalization effects reduced.

Conclusion:

The cause – effect graphs show us the interrelationships among the variables of the system. That corroborates that what happen in one variable affect the others. With a mathematical model we can simulate the behavior of the system and measure the effects of the changes with a long-term view.

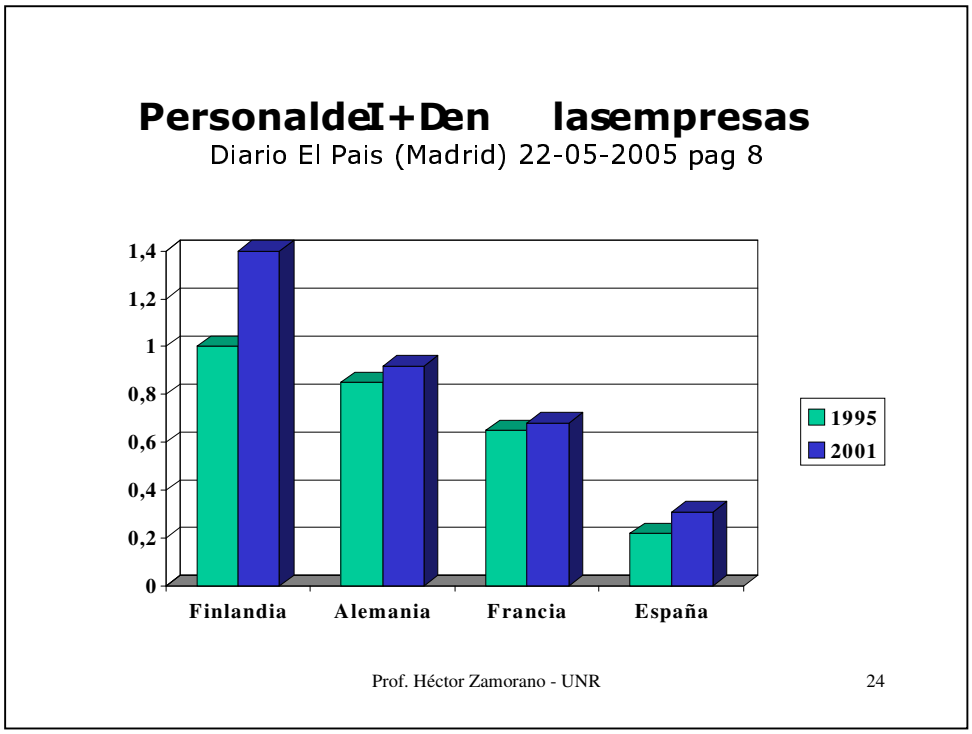
In this case, the "doors" for the innovation are:

a) Globalization influences
b) Technology developments

c) Science producing new knowledge and new paradigms
d) Universities Development

For the internal innovation production this last point is very important.
Another conclusion is that globalization influence increases the innovation. From these two observations we can arrive, simulating the model, to another conclusion: if the system where innovation take place does not belong to a develop country, the system has problems. First, the delay to introduce innovations (figure Nº 9, in red, the actual scenario, in blue, if globalization influence is reduced to a half. However, as we can see in figure Nº 10, with less globalization influence professional training must/will rise, because this will produce bad results in a long term, if Universities do not develop their training plans as the reality (organizations) requires.

Perhaps somebody think that this idea about simulating the behaviour of a social system is not possible. Some times I though that too.
But, after I sent my paper, I received, as all Sundays, an Spanish newspaper: El País of Madrid corresponding to May the 22nd. There was an article referring that European Countries have more and better innovation.
Eurostat, an statistical agency of EU, measured about 50 variables that include innovation and its effects, the macroeconomic context, the enterprises, and the public policies, all regarding new technologies and globalisation..
This work classify the countries depending their evolution in these concepts from 1995. For example: the expenses in technologies, or how many people are include in research and development into enterprises.



This is the format that EUROSTAT uses to present the variables and its values , country by country, and using one graph for each variable they are measuring.
Other variables are:

- number of enterprises that make innovation activities
- expensive in technology in each country
- investment into research and development activities
- and the like.

This methodology (of EU) provides photographs from the past.
The methodology I used (SD) provides a movie of the future allowing us to see, to show and to explain what happened into the whole system if some variable changes taking into account the interrelationships among all the variables of the system.
As I said in Corfú and in Lisbon Conferences, the methodology I have just used (SD) allow the sociologists to apply the sociocybernetics concepts to analyse real social systems using General System Theory and second order Cybernetic
Playing with the model, I discovered something that is very relevant:
We cann´t assign the same level of importance to all innovations; there are very important innovations, but there are unnecessary innovations too.
I was making a list of unnecessary articles, for example a coat with a cel phon in one sleeved and the receiver on the lapel.
I think this device cann´t have the same value, the same consideration as a vaccine.
This point is very important for countries that are not developed, because, as we have seen, one of the doors of innovations is Globalisation Influences, and it makes that the macroeconomics possibilities go down. (like I said at the beginning of this speech when I referred to Nail Postman conference where he said that always there are winners and losers): **when this innovation door is opened introducing devices that are not necessary this is not good for these countries, as a consequence their macroeconomic possibilities goes down because resources are not used properly.**

(During the speech at Maribor, the author will analyze more deeply the system simulating some changes in some of the most important variables.)

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