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**Interactive Learning Spaces and Development Policies in Latin  
America**

By

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## **Interactive Learning Spaces** **and Development Policies in Latin America**

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### **Abstract**

The emergent “learning economy” is truly global in the sense that it deeply affects the whole world. The emergence of “learning societies”, though, is a process that takes place only in some regions, the patterns followed by this highly complex social process being far from converging. The fact that some societies are becoming learning societies and others are hardly following that type of path is the new and most relevant feature of the development-underdevelopment divide: this is the “learning divide” which is studied in the paper. A main point at stake is that learning is bounded to having opportunities to learn, which are related with access to education and also with possibilities to apply knowledge creatively while interacting in problem solving activities.. The name “interactive learning spaces” is proposed to describe these opportunities. We study them from a Latin American point of view.

**Keywords:** development, innovation, learning processes

**JEL:** O15, O31, O54

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## **Introduction**

It has been suggested that at present, trends towards a globalised learning economy can be discerned. (Lundvall and Borrás, 1997) This paper is concerned with the way those trends can be understood when studied “from the South”. The main tool is the concept of “interactive learning spaces”.

Section 1 is concerned with the “learning divide” and “innovation gaps” between regions and countries in general. The issues considered in the following sections are in each case related with the Latin American situation. Section 2, by focusing on educational trends and R&D efforts, relates learning divides with human development and economic performance. Section 3 studies the influences on learning opportunities and innovation capabilities derived from interactions between universities, governments and productive sectors. Section 4 discusses the prospects for building learning opportunities -and the difficulties faced by the attempts to do so- in the midst of the structural reforms and the modified external relations currently occurring in the region. Section 5 shows how some policies can foster processes of “de-learning” -quite different than those of forgetting-, taking as an example a biotechnology project applied to cattle health in Uruguay. Finally, in section 6, some ideas about specific policies to foster learning capabilities in the South are sketched.

### **1.- The “learning divide”**

#### Non converging patterns within global trends

The “new global economy” is global “because the core activities of production, consumption and circulation, as well as their components (capital, labour, raw materials, management, information, technology, markets) are organised in a global scale, either directly or through a network of linkages between economic agents” (Castells, 1999, Vol.1, p. 66). It is new because the technologies that make possible this global scale organisation have matured to its “operational level” in the last twenty years. However, as Castells also points out accurately, the new global economy is not planetary: “(it) does not embrace all economic processes in the planet, it does not include all territories, and it does not include all people in its working, although it does affect directly or indirectly the livelihood of the entire humankind.” (ibid, p. 102)

Some years earlier François Chesnais proposed the same conclusion: "Available studies suggests that in the context of globalisation uneven development has gained in importance and strength." (Chesnais, 1992, p. 291) This author goes further by stating a sort of Mathew Effect stemming from globalisation. The weakest countries in terms of knowledge, innovation and learning capabilities will be pushed even further towards an internationalisation geared by assembly and low value added activities. Only those who enjoyed already a fair position in these issues would be able to turn into their benefit the new "patterns of cumulative causation".

One of the main features of the new global economy is that it is knowledge-based and innovation-driven (de la Mothe and Paquet, 1996). In this sense, also, globalisation coexists with heterogeneity. Of course, the diffusion of technologies, news, advertisements, multimedia programs, financial offers, etc. generate remarkable similarities between countries and regions that up to yesterday were completely different. Nevertheless, substantial and even growing differences can be observed in the realms of economy, politics and culture. The point we want to stress is that some of those differences arise precisely because of the world expansion of the knowledge-based and innovation-driven economy.

A comparison may be sketched with the diffusion of industrialisation during the XIX century. The world expansion of the West was reinforced by the new economic and military powers stemming from the new technologies. In one way or another, every continent got involved in the great wave of technological and social changes from which industrial societies emerged. But differences were not less relevant than similarities: only a few nations became industrialised countries and all the other countries, while remaining basically agrarian societies for a long period, were deeply transformed by their relations with the industrialised "centre" of the world economy, albeit in very different ways. As it is well known, in that period productive and technological "gaps" between countries grew quickly.

Coming back to present, there are no indications that a fair majority of people is able to fulfil its expectations regarding the improvement of its living standards and prospects. While witnessing a steady betterment of the average living conditions of the world population as measured by the UNDP Human Development Index, the last three decades have also witnessed a global increase of "plain" and extreme poverty. Quoting again Castells: "There is a polarisation in the distribution of wealth at the

global level, differential distribution of intra-country income inequality, and substantial growth of poverty and misery in the world at large, and in most countries, both developed and underdeveloped" (Castells, 1999, Vol. 3, p. 82)

What does the dynamics of this type of divergence look like in the midst of globalisation? Is it a temporal mismatch bound to slowly smooth away or, on the contrary, is it structural and in need of specific and strong actions -global as well as local- to be changed? This is an old question, posed each time that expanding trends give way to heterogeneity and not to convergence. In the same vein, in Latin America the nature of the "centre/periphery" divide, focused on industrialisation, was passionately debated in the fifties and sixties. Is that divide the expression of a temporal mismatch or is it built in the very dynamic of the world system, the centre being the centre partly because the periphery continued to be the periphery?

#### Learning as a new key issue defining divides

The key issues that define the divide between developed and underdeveloped regions and countries and between social groups within countries change over time. In the globalised knowledge-based and innovation-driven economy, key issues relate to learning. Two things must be clarified once made the above statement: one is why has learning acquired the lead in the divide, being the other in what sense is this situation new.

In the globalised economy nothing is secure or acquired for a reasonable period. One day some supply is highly priced and the other it is out of the market. The reasons can be related to prices, to quality, to new and perceived as better ways of delivering the same product or service. They can also relate to what firms or people have to offer, that could have been driven obsolete or redundant by a totally new galaxy of products or services -or skills-. Innovation is one of the names of this new and ill-defined game, in the most pure schumpeterian sense of creative destruction. Innovation is hardly any more the outcome of isolated entrepreneurial genius: it is a systemic and complex social process involving people in different roles, including economic roles but also social, cultural and political roles. Innovation is nowadays deeply rooted in "knowledge demanding" activities, both on the producers side and on the users side. In international exchanges, producers and users perform these knowledge-demanding activities most of the time in rather independent and isolated

ways; at local level, though, these activities take sometimes the form of close user-producer relationships.

The point at stake is that to become and stay as a player it is necessary to participate, in a way or another, in knowledge demanding activities where learning capabilities are crucial. This does not mean that a successful outcome is assured, particularly because many other things are needed. But it does mean that without fulfilling this requisite firms and people are out of the game, they are excluded from the new forms of the international economy and, probably, they will face growing difficulties to find a niche to play in the national or local economy.

#### On "knowledge demanding" activities, "learning societies" and "innovation gaps"

What is included in the concept "knowledge demanding" activities? Formal and informal R&D, formal and informal training, different forms of keeping updated with the most relevant information, different forms of gathering people to engage them in solving problems. In these kind of activities both explicit and tacit knowledge is shared, exchanged and also created.

Who must be performing knowledge demanding activities if a whole society is to be able to play the knowledge-based and innovation-driven globalised economy game? Innovation being systemic, the easier answer is, in different ways, everybody. Those, wherever their location, who do not upgrade their training and who are not offered the opportunity to participate in solving problems undertakings will not be cooperative when facing changes and, even worst, will not have collaborated in their definition. This means that changes could be ill adapted or resisted, both situations leading to slowness in adopting them: this is, nowadays, equivalent to be ruled out of the game, given the frantic pace of changes and, particularly, of technical changes.

In some societies, a fair proportion of the population and of the social and economic organisations permanently perform knowledge demanding activities where many actors need to and are able to upgrade systematically their skills. Those societies can be named "learning societies".

"Learning" is the preferred term for it conveys accurately the idea of knowledge acquisition, both formalised and tacit, and of finding out solutions to different sort of problems. Learning also conveys the idea of the ultimately "non transferable" condition of the solving problems activities: without the capabilities that

can only be acquired through learning processes, the receptors of the intended solutions will not be able to implement and incorporate them as truly solutions. This is valid for individuals, for firms and for any type of social organisation: the "learning society" concept goes then a bit further than the "learning economy" one.

We can justify now why the new divide between development and underdevelopment -in regional or national terms –, and between social groups, is related to learning. The newness derives from the fact that the capability to impose the "rule of changes" everywhere and instantaneously is brand new: nobody heralded our present globalised economy thirty years ago. The divide is indeed centred around learning, because what is paramount to be and to stay in the "good side" is to master uncertainty and destabilisation with creativity plus ability to make the most of knowledge, including the ability to search for new knowledge.

As in the case of the "industrial society" concept, the "learning society" one reflects what is happening in some parts of the world, being afterwards projected to the whole globe. Our main assertion is that the patterns followed by this highly complex social process are far from converging: in the "South", most nations are not evolving towards learning societies even if, as it happened with industrialisation, they are deeply affected by the trends of the globalised new order. A new divide then establishes between nations, a "learning divide", that is partially built, as it was pointed out earlier, in the world expansion of the knowledge-based and innovation-driven economy.

One of the learning divide consequences is the "innovation gap" that can be detected between regions and countries: this gap refers to the kind of differences that consolidate when some regions and countries are able to improve substantially their problem solving capabilities while others lag behind. Innovation gaps are a main consequence of weaknesses in the formal and informal learning processes, as well as in the relations between them. Innovation gaps are different from technology gaps, the well-known consequence of the industrialisation divide. Technology gaps were conceptualised fundamentally as "differences in access", something that was thought to be reasonably manageable when changes were not so rapid -although this was very unevenly achieved-. Innovation gaps reflect not so much differences in access but differences in capabilities and in learning, something even more difficult to bridge, as recent trends seem to show.

### On interactive learning spaces

Relevant learning processes related with problem solving include the capacity to recognise the useful existing knowledge, to detect the missing knowledge needed, to organise the search process to acquire it, to integrate new knowledge into the previous base and the whole into current practices. However, learning is bounded to having opportunities to learn. The situations in which different actors are able to strength their capacities to learn while interacting in the search for the solution to a given problem, are learning opportunities of utmost importance. We propose to call them interactive learning spaces.

Different types of economic growth have very different consequences concerning the generation of such spaces. Conversely, the latter greatly influence the former: the type of economic growth and, particularly, to what extent it is knowledge-based and innovation-driven, is heavily shaped by the diversity and strength of interactive learning spaces. Its scarcity and weakness is a main obstacle for development in Latin America.

Interactive learning places are not bound to appear in any particular type of organisation. They are indeed "opportunities" for problem solving -different types of problems involving knowledge creation in different stages, from fundamental science to development, in natural sciences and engineering as well as in social sciences and the humanities-. They can be located everywhere, in well defined organisations, like firms or university research teams, in ad-hoc groups created to tackle with specific difficulties or needs which are not expected to last as such, in hybrid groups gathering firms, faculty and social and political actors.

In conceptualisations of innovation and competitiveness as the one proposed by the German Development Institute, four levels of actions are outlined: the meta, macro, meso and micro levels. (Esser *et al*, 1996) The interactive learning places are located at the micro level, the one that involves direct interaction between people and organisations. They are, though, greatly influenced by specific policies at meso level - regarding industry, science and technology, innovation, environment, taxation, and the like-, by macro policies as the general orientation of the economic policy, and also by "meta issues" related with broader social goals and value considerations.

To understand the dynamics of divergence between nations, it is useful to identify issues that when taking some shape make nations able to cope with changes while staying in the "good side" and when taking other shape prevent them from reaching the threshold to this good side. We suggest that "interactive learning spaces" are one of these issues. Developed countries and dynamically integrated social groups everywhere are "interactive learning spaces rich"; underdeveloped countries and disfavoured social groups everywhere are "interactive learning spaces poor". If this is the case, the concept could be a useful analytical tool to go on looking into problems of knowledge, learning, innovation and development with a "Southern head". (Arocena and Sutz, 1999)

## **2.- One aspect of the “learning divide”: educational and R&D trends**

The role of education in the level of “human development” as defined by UNDP is well known. The Latin American countries are mainly concentrated in the middle level, given that fourteen of them are considered as nations of medium human development level, while only four –Argentina, Chile, Costa Rica and Uruguay– belong to the high human development level. It is striking that some of the former have the highest levels in the indicator “group of children not having finished primary school as a percentage of children in school age”: 14% for Mexico, 15% for Ecuador, 27% for Colombia, 29% for Brazil and Paraguay, 40% for Honduras, 46% for Nicaragua. (PNUD, 1999). Being these figures negligible in the industrialised countries, the long ago acknowledged role of education is more relevant than ever to differentiate development and underdevelopment.

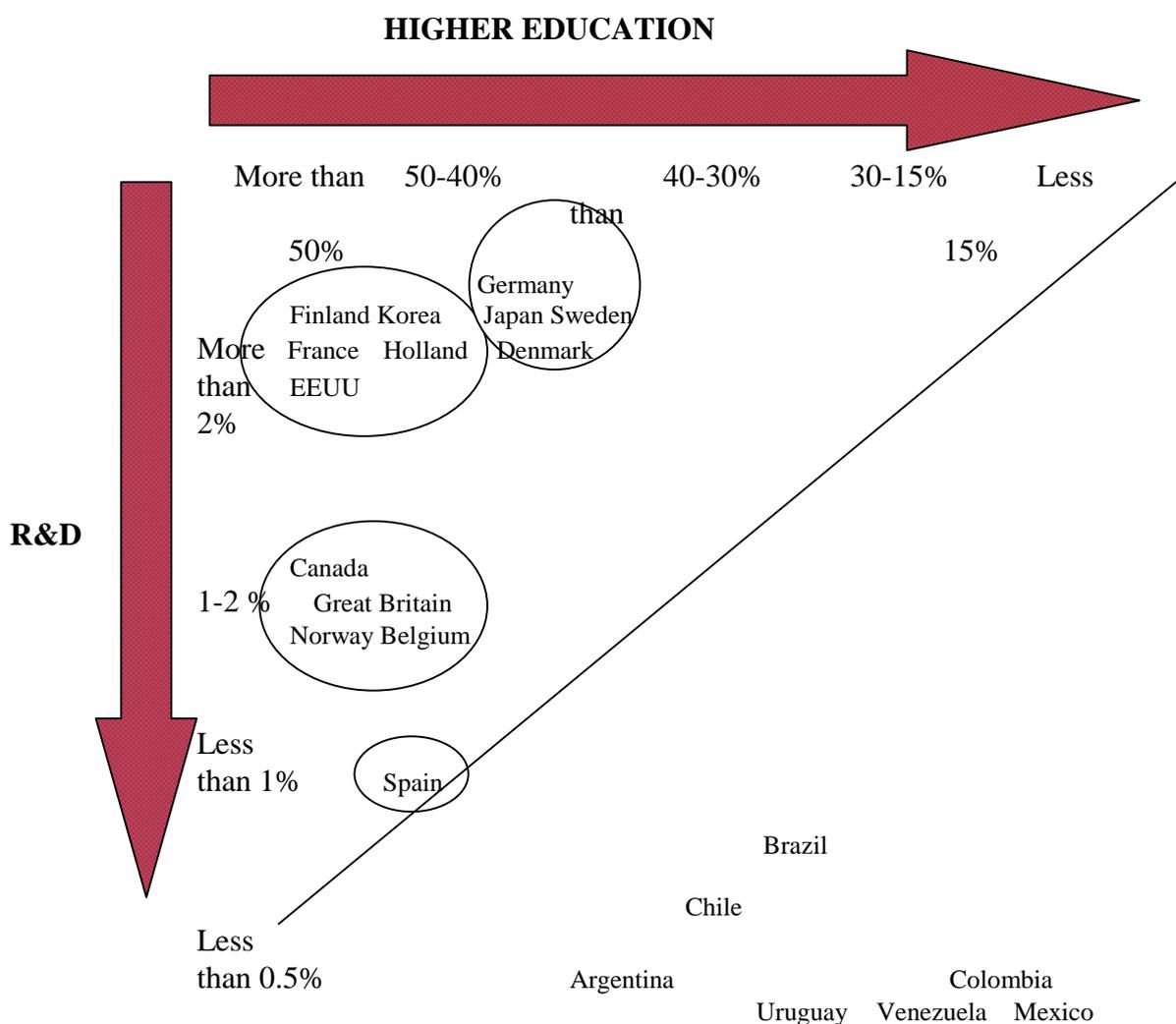
However, in order to assess economic performance, it is better to consider jointly education and the opportunity to apply the skills obtained through education, the combination of which is fundamental for the analysis of the “learning divide”. Opportunity is a key issue here: what if a country has a fair proportion of its corresponding age cohort following higher education but more than a half of the graduate are unemployed or are working in low skill jobs? Given the type of international information available, an acceptable proxy for the compound concept “skills plus opportunity to use skills creatively” can be achieved by considering together percentages of higher education enrolment and proportions of R&D in GDP.

This proxy is not very precise. Much better would have been, for instance, the combination of the percentage of higher education enrolment and the proportion of scientists and engineers working in the productive sector. Regrettably, this last statistic is available only in a few underdeveloped countries.

	1975		1985		1997	
<b>COUNTRY</b>	% of higher education	R&D as % GDP	% of higher education	R&D as % GDP	% of higher education	R&D as % GDP
<b>South Korea</b>	10,3	0,4	34,0	1,3	60,3	2,89
<b>Japan</b>	30,5	2,1	27,8	2,6	42,7	2,92
<b>EEU</b>	55,5	2,4	60,2	2,9	80,6	2,71
<b>Canada</b>	57,1	1,3	69,6	1,5	90,1	1,6
<b>France</b>	25,3	2,0	29,8	2,3	52,2	2,23
<b>UK</b>	19,1	2,4	21,7	2,2	50,4	1,87
<b>Germany</b>	27,0	2,4	29,5	2,7	45,3	2,31
<b>Spain</b>	23,2	0,4	28,5	0,6	51,1	0,86
<b>Finland</b>					71,1	2,9
<b>Sweden</b>					46,7	3,8
<b>Norway</b>					61,9	1,7
<b>Denmark</b>					46,3	2,1
<b>Holland</b>					50,2	2,1
<b>Belgium</b>					57,4	1,6
<b>Argentina</b>	21,8 <sub>(1975)</sub>		35,7		41,8	0,38
<b>Brazil</b>	11,1 <sub>(1975)</sub>		10,5		11,7	0,76
<b>Mexico</b>	14,3 <sub>(1975)</sub>		15,9		16,1	0,31
<b>Chile</b>	12,3 <sub>(1975)</sub>		15,6		30,3	0,64
<b>Colombia</b>	9,1 <sub>(1975)</sub>		11,3		18,6	0,41
<b>Uruguay</b>	16,7 <sub>(1975)</sub>		28,7		29,4	0,30
<b>Venezuela</b>	20,6 <sub>(1975)</sub>		25,3		25,4	0,33

Source: *L'Etat du Monde*, 2000, 1999; UNESCO Statistics, 1999, Principales indicadores de Ciencia y Tecnología Iberoamericanos/Interamericanos 1990-1997.

From this table the following picture emerges (taking into account the 1997 figures):



The above sketched diagram provides some support for the idea of a “learning divide” affecting economic performance. It provides also an illustration of what Christopher Freeman wrote regarding divergences in East Asian and Latin American national systems of innovation in the 1980s (Freeman, 1996). Two of the differences he mentioned were expanding education systems with high participation of tertiary education versus deteriorating education systems, and development of strong science and technology infrastructure versus weakening of science and technology infrastructure.

The diagram depicts a moment in time, in this case 1997. However, even more telling is to observe the dynamics of the divide. To do this, comparisons must be established between countries with similar departing points and wide differentiation afterwards: the cases of South Korea and Brazil are well suited for this exercise.

COUNTRY	1975		1985		1997	
	% of higher education	R&D as %GDP	% of higher education	R&D as %GDP	% of higher education	R&D as %GDP
<b>South Korea</b>	10,3	0,4	34,0	1,3	60,3	2,89
<b>Brazil</b>	11,1 <sub>(1975)</sub>		10,5		11,7	0,76

The comparison is particularly interesting because Brazil is the leading industrial country in Latin America while South Korea has been presented as the paradigmatic example of very fast industrialisation and catching up.

The role of education in the modernisation of South Korea cannot be overstated. In 1953, the illiteracy rate was almost 80%, but in the period 1950-1980, enrolment in elementary school increased more than five times, in secondary school by approximately thirty times, and enrolment in colleges and universities increased by almost a hundred and fifty times. In the seventeen years from 1953 to 1970 almost 62 thousands people graduated in science and engineering; in the following seventeen years, from 1970 to 1987, the number rose to almost 300 thousands. (Kim, 1993, pp. 358-360)

The situation has been quite different in Brazil, as the figures show: "Brazil's education system is one of the main obstacles to the country's modernisation and technological upgrading." (Dahlman and Frischtak, 1993, pp. 439-440)

More can be said. In the 1970s both countries showed similar and impressive rates of economic growth, while some aspects of their educational situation and the attention paid to R&D were also strikingly similar. But in the following years educational inequality diminished quickly in South Korea and remained unusually high in Brazil and spending on R&D began to diverge; in the 1980s growth rates were completely different.

### The comparison departure: 1970-1980

	Education annual enrolment 12-17 <u>1970-</u>	Higher education enrolment	R&D spending	GDP growth <u>1980</u>
Brazil	58,9 %	11,1 %	<1 %	9%
South Korea %	59,2 %	10,3 %	< 1 %	9,7

### The following decades: 1980 - 1994

	Education enrolment 12-17 <u>1980-</u>	Higher education enrolment	R&D spending	GDP growth <u>1995</u>
Brazil	69,1 % (1985)	11,2 % (1985) 11, 5 % (1995)	<1 % (1985) <1% (1995)	2 %
South Korea %	83,7 % (1985)	34,0 % (1985) 50,8 % (1995)	1,6 % (1985) 2,89 % (1997)	8.8

Source: *L'Etat du Monde*, 2000, 1999

Nothing of the sort of a single explanation for divergence is insinuated here. The historical backgrounds of both countries are sufficiently different to avoid such temptation. However, the figures strongly support the idea that the “learning divide” has an expression in economic terms.

Even if taken together into account, education enrolment -particularly higher education enrolment- and R&D spending measure different type of things. R&D spending measures the science and technology national effort, while the education enrolment measures the way the money spent on education is socially shared. If the national spending on education is compared between Brazil and South Korea, the striking conclusion is that both figures are quite similar. In fact, the public spending in education as a percentage of the GDP was in 1975 3% in Brazil and 2,2% in South Korea, in 1985 3,8% and 4,9% respectively, and in 1995 4,6% and 4,2%. (*L'Etat du Monde*, 2000). The huge differences in higher education enrolment between both countries are not primarily related to spending, but to social equality: in the jargon of higher education studies, Brazil continues to have elite access to higher education

while South Korea has since long passed the threshold of universal access.

Coming back to a general comparison, the good side of the “learning divide” can be characterised as the combination of a strong national effort on education and on R&D, the former accompanied by a sustained widening of the population accessing higher education, not to mention the eradication of illiteracy. The bad side, on the contrary, can be characterised as the combination of low R&D spending and either low spending on education or adequate spending but highly concentrated, the illiteracy continuing to be a flaw.

### **3.- Interactive learning spaces and the Triple Helix of university-industry-government relations in Latin America**

#### The general framework

Learning societies, that is, societies where interactive learning spaces are easily created, are bound to have well-articulated relationships between universities, industry and government or, in other words, following Etzkowitz and Leydesdorf (1997), a well functioning “Triple Helix”. This is partly so because of explicit policies. The aim of some of these policies is to foster closer relations between universities and firms; other type of explicit policies aim to strength innovation or the capabilities to innovate, indirectly affecting positively the encounters between faculty and firms. However, also less explicit situations help understanding why some societies are “interactive learning spaces rich”. The first of these situations is the coherence between the “science, technology and innovation” discourse and the concrete policies implemented in the country or region. The specific spending levels, the systematic information gathering about key factors, the policy design based on this information, the academic background and the experience of the people in charge of policy making, are all clues to evaluate the coherence between discourse and practice.

Another “tacit” situation of the sort is the national common sense about the quality of the products and services delivered in the country. If this common sense is favourable, the possibility of good relations between universities and firms are higher, because the local search for solutions can be easier perceived as worthy. In a similar vein, is it also important to have firms that recognise the importance of

knowledge and innovation for its economic performance: when the part of the R&D spending that comes from firms is over 50%, as in almost any OECD country, this recognition can be granted.

The last “tacit” situation to be mentioned has to do with universities and its relations with governments and firms. In some occasions the auto-perceived role of the universities is close to what other actors- particularly, firms and the government- want them to do. When the level and scope of this coincidence is high or, if this is not the case, when mechanisms to handle efficiently the possible conflicts exist, a relatively harmonious “triple helix” of relationships is in place, providing for trust and common language between the partners.

### The Latin American situation

In Latin America, Triple Helixes are not well articulated. There is a lack of coherence between the generalised discourse about the importance of science, technology and innovation for development and the current practices. The general landscape is one of low spending levels, of poor and unreliable information gathering, of specific policies not located in important decision bodies of the government and of decision makers usually not having the necessary professional skills. Firms make a marginal contribution to the R&D spending, a trend that has not changed in decades. Moreover, a long tradition of technology imports and scarce local production of technology based products does not favour a shared common sense prone to visualise the local space as a good provider for solutions to complex problems.

The relationships between universities, enterprises and government are complicated. Many are the reasons that explain the uneasiness of these relations. An important one is the social unrest long-standing tradition of Latin American universities. Since the second decade of the XX century, when the upheaval of the Argentinean Cordoba’s students occurred and their Reform Manifesto became a source of university students continental identity, Latin American universities were pushed to a twin struggle for internal democratisation and for social change. The first struggle ended with some success, for public universities enjoy a high degree of autonomy and university government follows democratic rules that include the students as part of the citizenry. The other struggle, that engaged some faculty and a

fair proportion of students, was associated with the fight against underdevelopment, understood as a structural consequence of capitalism. This is why so many strikes and massive demonstration all over Latin America were organised by university students being fairly accompanied by faculty in the fifties, sixties, and seventies. The motives were to support workers demands, to reject foreign military invasions, to demonstrate against organisations like IMF. In the sixties and in the seventies, with the spreading of authoritarian rules, many university students joined the guerrilla movement. Since the middle of the eighties, alongside with re-democratisation processes all along the continent and with a new perception of universities as partners in the economic life, the triadic relationships began to change towards negotiation. However, many decades of structural and bitter confrontations structured a milieu where mistrust is present, even nowadays, making difficult to achieve a general climate of common purpose between universities, firms and government.

Regarding the explicit policies to foster university – industry – government relations, they always face as a first obstacle the weak industry willingness to put some money of their own in R&D projects. This is an obstacle that persists after more than twenty years of international loans for S&T where funds were explicitly reserved to foster industry participation, showing that even if these loans have in many cases achieved punctual good results, they have been unable to redress long standing trends. In this case, as well as in the less direct case of innovation policies, a main difficulty to obtain better results is the tendency towards an a-critical copy of policy designs made and tested elsewhere.

### Roles and problems of public Latin American universities

Public universities in Latin America share with universities all over the world the problem of how to change towards a more direct involvement in economic life. This problem is actively addressed both by the university authorities and by faculty; as it follows from the many studies of university-enterprise relations made in the region, the actor that starts searching for a partnership is usually the university one. Universities have also actively built organisational arrangements to foster university-industry relations. Moreover, public universities are fundamental for the interactive learning places that might develop in Latin America. Given that public universities usually concentrate more than 60% of all the national research activities, any firm

where the productive process faces some intellectual difficulties and needs to call for fresh research, will visualise public universities as one of the few local options for partnership.

In fact, many experiences of interactive learning spaces involving faculty and firms have been identified and studied in the region. They have frequently been established between universities and public enterprises, being the participation of private firms a more recent phenomenon. Very interesting results came out of these experiences, which can be called the “micro-strengths” of university-industry relations. (Sutz, 2000) The problem is that even if able to exhibit robust technological successes, they were not able to redress the historical low demand for knowledge that characterises Latin American industry. These micro-strengths usually remind encapsulated, not being able to rise virtuous circles of diffusion and of expanding new demands.

Latin American universities tend to be blamed for this situation, both by governments and by regional and international financial organisations. The accusations and recommendations are manifold, including the following. University researchers continue to live in an ivory tower doing what they like to, without engaging in the search for economic applicable results. Research, particularly basic research, is a luxury that no developing country needs to finance. Universities receive too much attention while children plain illiteracy has not yet been solved. University teaching must allow for a much more direct market influence in their contents and methodology.

Partly because of this, public university budgets are stagnant and its research function is under heavy strain. The search for legitimacy –and for money- pushes faculty to desperately look for productive partners, but, as we saw, there are not plenty of them. Given the fragile structures of knowledge production in Latin America and its overwhelming concentration in public universities, a too strong push towards “practical ends” could have serious consequences, including some unattended ones, like the migration of gifted researchers and the propensity to migrate of the most promising young ones.

Problems come also from inside universities. A double discourse is comfortably installed within the cloisters: faculty must perform applied research for industry, following the logic of communication of this type of research, but their

academic promotion will depend almost entirely on the number of published papers in main stream journals. Moreover, these journals are not particularly interested in the kind of problems that are of practical importance in the region, and so the evaluation system rewards the setting of research agendas moulded in the “North” matrix and punishes own defined research agendas.

There are not easy solutions for these difficulties. The “science for the people” motto can be used –and has been used- to allow mediocrity. The “science for the country” motto tend to privilege short-term applied research, not to mention that it is highly debatable why and in whose opinion some topics are or are not of national interest.

The point is that if Latin American nations were to evolve towards learning societies, one of the things they would need is stronger research universities, with fairly diversified research interests and with multiple type of interactions with productive sectors. This cannot be fostered by pushing only from one side: in the absence of sound innovation policies, the current recommendations regarding universities are jeopardising and not encouraging the opportunities of appearance of interactive learning spaces.

#### **4.- Structural reforms and opportunities for productive learning in Latin America**

The 1980s witnessed a strong opening of Latin American economies, consolidating the end of the so-called period of Industrialisation by Imports Substitution (IIS). The 1990s added to this trend the de-regulation of several markets –including the labour and the educational markets-, the privatisation of public assets, and the retirement of the state from “non-essential” activities.

A general balance of the ongoing situation is unattainable. Even the most evident facts have not clear-cut explanations. Telecommunications, for instance, have undergo dramatic improvements during the nineties, alongside with the privatisation processes that occurred in almost all Latin American countries. A reasonable inference could be then that through privatisation the old and bureaucratic public white elephants were substituted by modern and dynamic state of the art enterprises

able to transform within a few years the face of the continent. But one of the most successful “telecom” enterprises in terms of number of phone lines per inhabitant installed, times of connection and of repair, etc., is the Uruguayan one, one of the few in the region that is still a public enterprise.

A general balance is also unattainable because the outcomes are contradictory. Some macroeconomic indicators like industrial output growth and productivity seem to have improved and there has been a rapid pace of equipment modernisation all along the productive sectors driven by the trend towards the “computerisation” of capital goods. At the same time, the rate of enterprise mortality in the nineties was very high, the level of unemployment rose, the inequality in the distribution of income was accentuated, the absolute level of poor and indigent people was in the late nineties the highest in Latin American history.

What can recent structural changes tell us about the Latin American opportunities to open interactive learning places and to evolve towards learning societies? We shall follow here a recent paper by Jorge Katz, from the Economic Commission for Latin America and the Caribbean (ECLA) adding to his arguments evidence from the Argentinean case (Schvartzer, 1999). A synthetic resume of Katz presentation is depicted in the following table:

**Structural change****Effect****Trade liberalisation**

- \* Substitution of locally produced equipment by imported capital goods
- \* Weakening of the in-house engineering efforts aiming to extend the life cycle of equipment
- \* Strong setback suffered by the capital goods industry as well as by the engineering departments of many industrial firms
- \* De-verticalisation of many industrial processes and cutting down of the number of parts and components locally produced, a sort of spread out of a “maquila effect” (this is specially notorious in the automobile industry where this trend implied the dismantling of previously healthy industries of components and parts)
- \* Changes in the productive behaviour of multinational enterprises, that diminished its “adaptive” efforts, no longer needed in the global networks

**Privatisation**

- \* Dismantling of the R&D laboratories of public enterprises and “the contraction, and, in many cases, the physical elimination altogether, of the R&D infrastructure which state enterprises developed...”

Katz’s paper concludes that we are probably witnessing a less ‘domestic intensive’ style of technological development (if compared with the IIS period).

Many of the above assertions are confirmed in the Argentinean case. If the behaviour of different industrial sectors in 1984-1988 and in 1994-1998 are compared, the most dramatic downfall between the two periods was registered by the capital good sector, with a loss of 77% (Schvartzler, 1999, p. 16). The common knowledge about the industrial tendency during the nineties to substitute locally produced components and parts by imported ones were confirmed in Argentina through the figures of the Industrial Census: between 1984 and 1993, the value added

by each unit of industrial output suffered a downfall of 16%. (ibid, p. 31) This type of results can also be confirmed through Brazilian studies (Cassiolato y Lastres, 1997).

However, globalisation and Internet can open opportunities for local firms to enter in new ways into the world market. Success cases of this type shows, though, that in-house learning processes continue to be necessary. To be visualised from abroad through Internet as a suitable partner in a globalised entrepreneurial venture, a substantial productive record must be detailed in the local enterprise web page, and this record must have been constructed locally. On the other side, expectations that globalisation could have meant a wealth of international joint-ventures for small and medium knowledge intensive Latin American firms, thus helping to build the fabric of productive modernisation, has not yet received empirical support. The Uruguayan experience is that once a high-tech firm enters international collaboration, the proposals come, but to buy it and not to build together a new joint firm. As reported also in Brazil and Argentina, what seems to be internationally valuable in these firms is the door they open to the Mercosur (Common Market of the South, a big market indeed) for the international firm products by using the local firm commercial experience.

The recent structural trends show alongside with the retreat from industrial diversification and the push towards a productive “commodification”, a lower technological content of production, and a renewed intensity as well as a relatively careless utilisation of natural resources. If compared with the type of production that inspired ECLA in the fifties to label Latin American insertion in the world economy as “peripheral”, the present situation deserves to be labelled as “neo-peripheral”. A paradox appears here: at the same time that an explosion of possibilities for technological innovation stem from new technologies, the initiatives for innovation seem to be driven out from Latin America and to be more concentrated than ever in the “North”.

The structural conditions just depicted do not encourage the opening and strengthening of interactive learning spaces. They will be opened, certainly, as “micro-strengths” of university-industry relations or under other organisational arrangements. However, they will probably find many difficulties to overcome fragility and even more so to avoid remaining encapsulated. The roads towards a learning society does not seem to be clearly traced in the new map of Latin American

economic and productive international insertion.

### **5.- "De-learning" by closing interactive learning spaces: an example**

The above depicted situation stems mainly from economic statistics. The qualitative consequences are, however, not less impressive. One in particular is especially worrying, for it implies losing accumulated capabilities for solving problems that are at the very heart of the development process: it is the process of de-learning that occurs when relatively successful interactive learning places come to a close..

It is important to rapidly state that the concept of de-learning has nothing in common with that of forgetting, in the way Johnson presents it:

“It is possible that the role of forgetting in the development of new knowledge has been underestimated. The enormous power of habits of thought in the economy constitutes a permanent risk for blocking potentially fertile learning processes.” (Johnson, 1992, p. 29). De-learning is not a way of forgetting, understood as a way to make room for new thoughts. Nor is it to be confounded with the concept of unlearning, as Loasby puts it:

“Successful change may not be easy. There are always costs of switching to a new cognitive system, especially when the switching entails the creation of new linkages with other people’s cognitive systems that are simultaneously being restructured; every well-established organisation has its own familiar institutions, which may have become almost part of its identity. Unlearning can be both cognitive and emotionally difficult.” (Loasby, 2000, p.13)

De-learning is a “pure loss”: it is not intended to anything, it is just made to happen, without even giving a second thought about its consequences. De-learning is the Sisyphus legend of the development process, a phenomenon hard to recognise in the “centre” but nevertheless real, and serious indeed. An example will perhaps illustrate the point just made.

#### The case

In Uruguay, as well as in the southern part of Brazil, in vast Argentinean territories and to a lesser extent in many other Latin American countries, cattle play a very important economic role. The meat industry in particular is an old industry in the

region and a fairly outward oriented one. However, its exports circuits are frequently restricted to countries with not very high sanitary requirements: the wealthy USA and European markets were closed for a long time to Latin American meat due to the "mouth and foot disease", a well known epizootic disease for which vaccines were developed decades ago. Vaccination campaigns are in place since long ago in Latin America, but the disease has not been eradicated and frequent epidemic upsurges appear.

One of the reasons why this disease has been so difficult to tackle is that it is very contagious and so, when some animals remain ill, the vaccination efforts become severely jeopardised. The problem has two sides, one technical and the other socio-economic. With the vaccine used until fifteen years ago, three annual inoculations were needed to achieve a total immunisation, so cattle remained half immunised for long periods. Poor cattle owners usually could not afford the total vaccination plan costs and so their animals remained ill: when these animals crossed their land borders, they found not totally immunised cattle and infection again appeared. The technical solution to cope with these features was to develop a vaccine able to immunise with only one inoculation, a solution that was first found in European laboratories. Nevertheless, given the many biological and environmental variables that act in the immunisation process, vaccines can fairly improve their performance if modified and adapted to local conditions.

#### The building of a interactive learning space

An Uruguayan laboratory dedicated to the production of veterinarian specialities and with a fairly well established internal market, decided in the mid-eighties to profit from new biotechnological techniques to develop an ambitious industrial project to produce the "one inoculation" type vaccine for the mouth and foot disease. The local branches of some important multinational laboratories imported and produced this vaccine. But the market being so big and having the national laboratory a good and well tested marketing system covering the whole country, they decided to go ahead with the project, pushed forward by the hypothesis that they could deliver a product with a better biological performance.

The development of the project describes accurately the idea of the building of an interactive learning place. Five main interactive learning moments can be detected during the process.

i) Learning about infrastructure: the project needed a new and sophisticated building, for it implied the manipulation of living viruses. The bio-safety system of the whole production layout should be very accurate. A first interactive relationship was established with local electronic enterprises to design and build the needed devices: if the laboratory owners would have obliged to import the whole control system, all the money available would have been spent on that issue alone.

ii) Learning about training and working practices: this "high-tech" biotechnological project needed a careful training of old employees as well as the hiring of new technical staff; the full harmonisation of the productive team was done through an intensive and planned learning process.

iii) Learning from academic contacts: a "technical periphery" was established, with the aim of exchanging information and having access to high level technical advice. This was done through formal and informal relations with biotechnology research centres in Brazil as well as with the Pan-American Centre for Epizootic Diseases, located in Brazil, and with veterinarian researchers in Uruguay.

iv) Learning from user-producer interactions: continuing an ongoing tradition, interactive relationships were established with users, getting from them precious information about how the new product worked on the field. This relationship operated also as a learning experience for the users that were trained to apply the product by the extensionist circuits organised by the laboratory.

v) Learning to cope with exports: once the product was fairly accepted in the local market, relations were established with foreign private and public organisations willing to import the vaccine. In this case the technical point at stake was the volume and weight of the vaccine glass container, that made transportation very expensive: to overcome this problem the laboratory developed a dried version of the vaccine packed in a small envelope that recovered its full biological proprieties once humidified.

This project implied a learning opportunity even in a broader sense. Uruguay, as so many Latin American countries, is mainly visualised as a raw material producer. The road towards an economic development based more on knowledge and innovation must rely partially in the country natural endowment, not only for its commercial

value, but because it is around these raw materials that historical learning was built in industrial production, quality control, packaging, marketing, transportation, foreign trade. However, this road must also be increasingly based on knowledge and innovation, for plain raw materials, even the most valuable ones, are a dead end. This is nothing new: Denmark and Finland are two examples of nations now visualised as fairly good high-tech producers that arrived at this status by adding knowledge and innovation to their main raw material production. The mouth and foot disease vaccine project could have been a step towards a new way of visualising Uruguay: a country with very good and healthy meat and with an interesting biotechnological industry specialised in the production of some high quality veterinarian products aimed at warranting cattle health.

#### The de-learning process

The national effort made in Uruguay to eradicate the mouth and feet disease was successful. In 1991, the International Council of Epizootic Diseases declared the country the first one in the world “free of the virus with vaccination”. Moreover, after 1991, the country did not report any further case of the disease, demonstrating the effectiveness of the vaccine and the vaccination campaign. This was an important distinction, but it proved less efficient than expected in terms of markets: the wealthy circuits continue to be reluctant to import meat from Uruguay.

The distinction implied, though, that a difficult task was accomplished. Many actors participated: the producers, the producer’s organisations, the Ministry of Agricultural Affairs, the laboratories that provided the vaccine and last but not least, the vaccine itself, being the locally produced the one with the higher biological power, as corroborated by the controls made by the Ministry’s technicians.

The national laboratory that produced the vaccine received another important distinction. The High Risk Laboratory of Madrid certified its bio-safety arrangements as suitable, alongside with other two laboratories in Argentina and Brazil, both of them branches of multinational firms; that certification was the outcome of an inspection of more than twenty laboratories in the Latin American Southern Cone

Everything seemed to be in place for the national laboratory to begin a full exploitation of its facilities and to honour its first international contract: an assessment requested by the Bolivian government to design a strategy to eradicate the mouth and

feet disease, accompanied by the export of its vaccine. It was at this moment that the de-learning process unchained.

The concrete situation was as follows: in the late 1930s, a law was passed indicating that no living agent of any disease that did not exist in the country could be manipulated, neither by public nor by private organisations. This law was slightly actualised ten years later, but it remained substantially unchanged for sixty years, even if the progress in bio-safety would have called for its change. In 1994, on behalf of this law, and given that the country was declared free of the mouth and feet disease in 1991, a decree was passed forbidding further virus manipulation. For the multinational laboratories producing the vaccine in the country this decree was not important: they had not invested in bio-safety facilities and the regional strategy of its “mother” firms was to re-locate production in South Brazil and in Argentina. However, for the national laboratory the decree was the end of the success story and the abortion of any possibility of exports: they were obliged to stop producing the vaccine and the new building became deserted.

The reasons behind the decision to pass this decree were many and intertwined. The year 1994 was an election year, and the government was willing to exhibit what would appear to be a great success: the declaration of “free of mouth and feet disease without vaccination” status, the real status of free of the virus. After three years without the disease, Uruguay would have been able to apply for this qualification. Nevertheless, it was feared that if the country continued to produce vaccines, that is, manipulating living viruses, the “developed world” would remain dubious about the elimination of the virus. Even with the Spanish laboratory certification in terms of bio-safety, government thought that Uruguay would not be seen from abroad as a country able to do risky biotechnological operations properly.

Other reasons could have been the pressures excerpted by the multinationals firms that were closing their Uruguayan facilities to move to the two big countries of Mercosur. A more subtle reason could also have been the mistrust of the technicians of the Ministry of Agrarian Affairs vis-à-vis the private laboratories –regardless if they were national or foreign-. They shared the idea of a State monopoly in terms of vaccine production and they had obtained an international loan to build their own facilities, but they were not able to succeed. (Bortagaray, 1997)

Almost nobody in the country called for protecting the experience of the national laboratory that was able to produce a high-tech product with high quality, both in terms of processes and of products. The isolated voices of the scientific community were easily disregarded. The possibility of new upsurges of the illness carried by contaminated cattle from the south of Brazil and from Argentina was said to be addressed through imported vaccines, the imports coming from countries – developed countries- without the disease, like Uruguay.

This is an example of de-learning. The sophisticated building was closed, the skilled people were fired or moved to other production lines where their new abilities were of little use, the export initiative could not be fulfilled. This is why it is worth to stress the idea that for a society to be able to learn, opportunities to learn must be open and kept open.

The story could have ended here. However, the nightmare situation of a new illness upsurge stroke Uruguay in September 2000. The problem came, as expected, from the Brazilian border, having a disastrous effect on the Uruguayan economy. The local aspect is, however, only a part of the issue. It is obvious by now that the “foot and mouth disease” is highly endemic and that vaccination will continue to be a major tool in preserving cattle health. This is why the process of de-learning that took place in Uruguay implied also that an opportunity for dynamic specialisation was lost.

## **6.- On policies**

Nowadays it is more difficult than fifty years ago to visualise clear-cut roads towards development. Substituting industrialisation by “Internetisation”, as some visionaries advocates, is, in the best case, only half of the story, for Internet and ITCs in general do not substitute technological efforts and learning experiences. Such a password could act as an alibi for local inaction, thus neglecting once more the building of own technological capabilities. The attention given to this issue is one of the most striking differences between the success cases in East Asia and the Latin American industrialisation process.

Policy recommendations should not forget a minimum principle of reality: if they are mainly an expression of the writer’s good will, their connection with possible

actions will be weak, to say the least. This is why our reflection on policies will be modest and rather general.

If the existence of a new learning divide and of innovation gaps between the “South” and the “North” is acknowledged, the main policy recommendation should be: “take care of the divide and of the gaps, watch their evolution, devise policies to avoid further widening, include these issues in the country policy bench-marking”. However, given the structural trends that the Latin American economy actually presents, the search for roads towards a learning economy and a learning society will need to follow specific lines, not necessarily identical to the ones that can be discerned in the North. This suggests to be particularly careful to avoid giving for granted things that are present “there” – for instance, a strong awareness of the need to have solid local learning capabilities to be able to cope creatively with change – but can possibly not be present “here”.

Any “learning policy” will probably be the “poor sister” in the Latin American political concerto in any foreseeable future, squeezed by short-term worries, and so recommendations must strongly point to changes in the quality of policies, besides the unavoidable claim for more resources for science, technology, innovation and education. Changes in quality should include the identification, fostering and protection of “interactive learning places”. The ways to do this are manifold, depending on the problems and the actors around which the learning places are constituted. However, the important thing is the principle, to be consecrated, that opportunities to search for knowledge and to apply knowledge must receive great attention and should be considered a legitimate policy issue.

## References

- Arocena, R. and Sutz, J., "Looking at National Systems of Innovation from the South", *Industry and Innovation*, Volume 7, Number 1, 55-75, June 2000.
- Bortagaray, I. "Tecnología y Política en el Uruguay. El caso de la erradicación de la fiebre aftosa", *Sociology Thesis*, Catholic University, Montevideo, mimeo, 1997.
- Cassiolato, J. and Lastres H., "Innovación y Competitividad en la industria brasileña de los años 90", in Sutz, J. (Ed.) *Innovación y Desarrollo en América Latina*, Nueva Sociedad, Caracas, 1997, pp. 163,182.
- Castells, M., *The Information Age: Economy, Society and Culture. Vol.1. The Rise of the Network Society*, Blackwell Publishers, Great Britain, 1999.
- Castells, M., *The Information Age: Economy, Society and Culture. Vol.3. End of Milenium*, Blackwell Publishers, Great Britain, 1999.
- Chesnais, F., "National Systems of Innovation, Foreign Direct Investment and the Operation of Multinational Enterprises", in Lundvall, B.A. (Ed.) *National Systems of Innovation. Towards a Theory of Innovation and Interactive Learning*, Pinter, London, 1992, pp. 265,295.
- Dahlman, C. and Frischtak, C., "National Systems Supporting Technical Advance in Industry: the Brazilian Experience", in Nelson, R. (Ed.) *National Innovation Systems. A Comparative Analysis*, Oxford University Press, New York, 1993, pp. 414,450.
- de la Mothe, J. and Paquet, G., "Evolution and Inter-creation: the Government-Business-Society Nexus, in de la Mothe, J. And Paquet, G. (Eds.) *Evolutionary Economics and The New International Political Economy*, Pinter, London, 1996, pp. 9, 34.
- Esser, K., Hillebrand, W., Messner, D. and Meyer-Stamer, G., *Systemic Competitiveness-New Governance Patterns for Industrial Development*, Frank Cass-German Development Institute, London, 1996.
- Etzkowitz, H. And Leydesdorff, L. (Eds.) *Universities and the Global Knowledge Economy. A Triple Helix of University-Industry-Government Relations*, Pinter, London, 1997.
- Freeman, Ch., "Catching Up and Falling Behind: the Case of Asia and Latin America", in de la Mothe, J. And Paquet, G. (Eds.) *Evolutionary Economics and The New International Political Economy*, Pinter, London, 1996, pp. 160, 182.
- Katz, J., "Structural Reform and Technological Behaviour. The sources and nature of technological change in Latin America in the 1990s", *ECLA working paper*, Santiago de Chile, 1999.
- Kim, L. "National Systems of Industrial Innovation. Dynamics of capability Building in Korea", in Nelson, R. (Ed.) *National Innovation Systems. A Comparative Analysis*, Oxford University Press, New York, 1993, pp. 357,383.
- L'Etat du Monde. *Annuaire Economique Geographique Mondiale*, 2000, LA Découverte, Paris, 1999.
- Lundvall, B.A. and Borrás, S., "The globalising learning economy: Implications for innovation policies", *Science Research Development*, European Commission, December, 1997.
- PNUD, *Rapport Mondiale sur le Développement Humain*, 1999.
- Red Iberoamericana de Indicadores de Ciencia y Tecnología, RICYT, Principales Indicadores de Ciencia y Tcnología, Iberoamericanos/Interamericanos, Buenos Aires, 1999.
- Schvartzter, J., "Indicadores industriales y diagnósticos de coyuntura en la Argentina.Precauciones de uso y elementos para un balance actualizado. Documento de Trabajo N° 3, Centro de Estudios Económicos de la Empresa, Universidad de Buenos Aires, December, 1999.
- Sutz, J., "The University-Industry-Government Relations in Latin America", *Research Policy* 29, 2000, pp. 279,290.
- UNESCO, *Statistiques*, UNESCO web page, 1999.



# Danish Research Unit for Industrial Dynamics

## *The Research Programme*

The DRUID-research programme is organised in 3 different research themes:

- *The firm as a learning organisation*
- *Competence building and inter-firm dynamics*
- *The learning economy and the competitiveness of systems of innovation*

In each of the three areas there is one strategic theoretical and one central empirical and policy oriented orientation.

### ***Theme A: The firm as a learning organisation***

The theoretical perspective confronts and combines the resource-based view (Penrose, 1959) with recent approaches where the focus is on learning and the dynamic capabilities of the firm (Dosi, Teece and Winter, 1992). The aim of this theoretical work is to develop an analytical understanding of the firm as a learning organisation.

The empirical and policy issues relate to the nexus technology, productivity, organisational change and human resources. More insight in the dynamic interplay between these factors at the level of the firm is crucial to understand international differences in performance at the macro level in terms of economic growth and employment.

### ***Theme B: Competence building and inter-firm dynamics***

The theoretical perspective relates to the dynamics of the inter-firm division of labour and the formation of network relationships between firms. An attempt will be made to develop evolutionary models with Schumpeterian innovations as the motor driving a Marshallian evolution of the division of labour.

The empirical and policy issues relate the formation of knowledge-intensive regional and sectoral networks of firms to competitiveness and structural change. Data on the structure of production will be combined with indicators of knowledge and learning. IO-matrixes which include flows of knowledge and new technologies will be developed and supplemented by data from case-studies and questionnaires.

### ***Theme C: The learning economy and the competitiveness of systems of innovation.***

The third theme aims at a stronger conceptual and theoretical base for new concepts such as 'systems of innovation' and 'the learning economy' and to link these concepts to the ecological dimension. The focus is on the interaction between institutional and technical change in a specified geographical space. An attempt will be made to synthesise theories of economic development emphasising the role of science based-sectors with those emphasising learning-by-producing and the growing knowledge-intensity of all economic activities.

The main empirical and policy issues are related to changes in the local dimensions of innovation and learning. What remains of the relative autonomy of national systems of innovation? Is there a tendency towards convergence or divergence in the specialisation in trade, production, innovation and in the knowledge base itself when we compare regions and nations?

### **The Ph.D.-programme**

There are at present more than 10 Ph.D.-students working in close connection to the DRUID research programme. DRUID organises regularly specific Ph.D-activities such as workshops, seminars and courses, often in a co-operation with other Danish or international institutes. Also important is the role of DRUID as an environment which stimulates the Ph.D.-students to become creative and effective. This involves several elements:

- access to the international network in the form of visiting fellows and visits at the sister institutions
- participation in research projects
- access to supervision of theses
- access to databases

Each year DRUID welcomes a limited number of foreign Ph.D.-students who want to work on subjects and projects close to the core of the DRUID-research programme.

### **External projects**

DRUID-members are involved in projects with external support. One major project which covers several of the elements of the research programme is DISKO; a comparative analysis of the Danish Innovation System; and there are several projects involving international co-operation within EU's 4th Framework Programme. DRUID is open to host other projects as far as they fall within its research profile. Special attention is given to the communication of research results from such projects to a wide set of social actors and policy makers.

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