CHAPTER 13

Research and Innovation in Latin America

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ECONOMIC OVERVIEW

While Latin America has achieved relative economic stability and growth over the past decade (37.7% for 1998-2008), as the global financial struck the productive sectors of the economy through a drop in demand from the industrialized countries, declining remittances from abroad and falling commodities prices, in 2008 it grew 4.3%.

Latin America is a very diverse region. Some countries have entered the crisis in a relatively favourable position, whereas others are suffering more from the external shock. Whatever outcomes at country level, overall GDP will decline this year.

In any case, despite prudent fiscal policies and reduction of macroeconomic vulnerabilities in recent years, its economy has not been without problems. Volatility, inflation and policy reversals in various countries explain, at least to some extent, their unequal development.

From a global perspective, Latin America is not only not catching up; it is falling relatively further behind. In 1996-2006 it grew 34.6%, lower than East and North-East Asia (62.5%), South and South-West Asia (73.5%) and even Africa (57.8%) (The World Bank, 2008).

In a highly competitive global environment that is increasingly driven by knowledge and innovation, Latin America lags behind. This paper reviews some of the reasons why, particularly those related to education as well as R&D, and suggests some ideas for taking remedial action.

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Twelve Latin American countries were selected, together with Spain and Portugal (to be able to talk of Iberoamerica, when appropriate) as well as four countries from other regions: Canada, Korea, Australia and the United Kingdom, for international comparisons to provide a context for framing some of the analysed variables, and to follow the methodology from previous works published in Spanish that used these countries for similar analyses (CINDA, 2007).

GROWTH AND INNOVATION

Jamil Salmi from the World Bank has suggested that the technological change residual, often referred to as "the residual of our ignorance", the problem-solving "mystery variable" would explain why economies such as Brazil, Chile or Mexico, when compared with the Republic of Korea's, which had roughly similar endowments of capital and labour 30 years ago, subsequently grew at very different rates (Rodríguez, 2008). However, the linkage between innovation indicators and economic performance is not all that clear.

Innovation has typically been analysed as a determinant of productivity growth, but not so much as a determinant of overall growth. Thecentral question is what the effect of innovation on long-term development is. Classic innovation-related variables refer to expenditures on research and development, patents, foreign investment, technology licensing, etc., whereas labour has been measured usually through education, skills and experience.

How is it that the equation composed by capital, labour and innovation determines development?

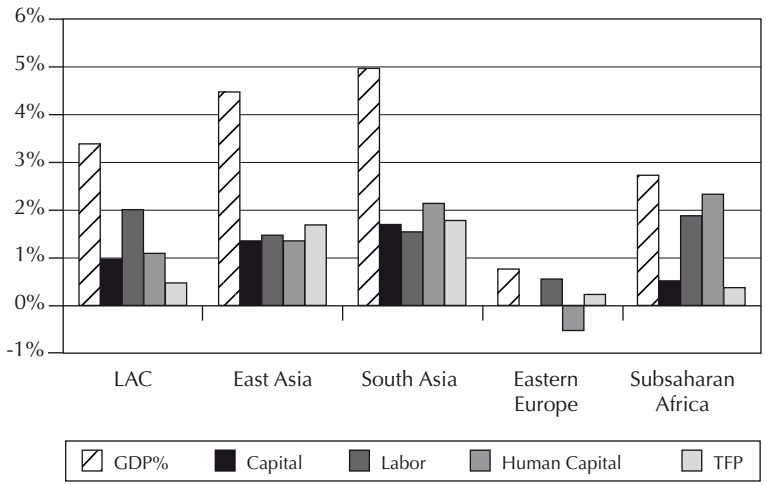
Rapid-growth economies have invested heavily in research and development — India, for example, relying more on publicly financed R&D, and China relying more on acquiring technology developed elsewhere. By contrast, Latin America clearly has done neither, and the investment gaps caused by these lags are important in explaining the relative differences in economic growth and mid-class prosperity.

How does innovation improve productivity that leads to economic growth? A variable defined as total factor productivity (TFP) which can be understood as the factors beyond capital and labour that enable an economy to increase production output, focuses on changes in productivity related to education, training and technology, among others (Baier, 2006).

Compared with other regions, how does Latin America fare in the strength of TFP? The most obvious comparison is with East Asia. Evidence has been found that as much as half the growth in Korea or Taiwan, for example, was due to TFP. And by making comparisons with Latin America, it has been sug-

gested that TFP is a significant factor in the East Asian Tigers' much-better performance (Figure 1). Over the past 25 years, Latin America experienced lower growth rates than them.

Figure 1: Growth and TFP Š Latin America compared with orher regions



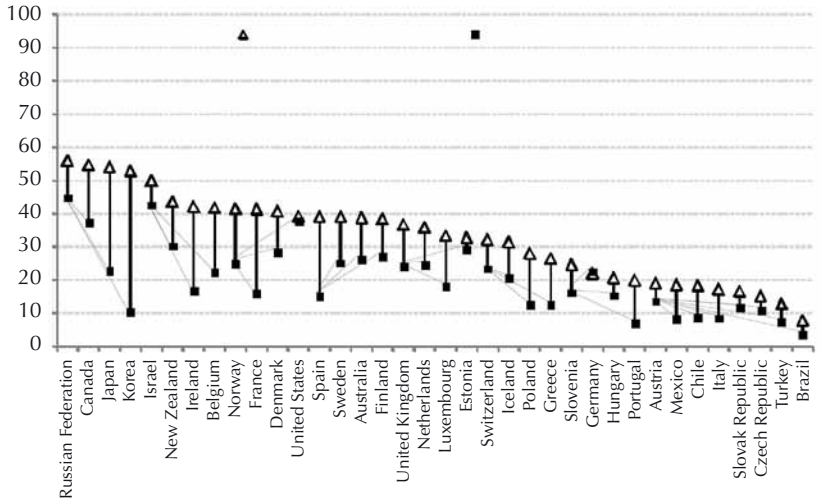
Source: IDB, 2006.

While the lower growth in Latin America can be explained by several factors, the poor contribution of human capital seems to be a shackling of growth potential in the region.

There is also evidence that having a more educated workforce leads to higher growth. While recent research that focuses on quality rather than quantity of education gives support to the complex and sometimes controversial relationship between human capital and economic growth, population with at least tertiary education in countries such as Mexico, Chile and Brazil is significantly lower than in most OECD countries (Figure 2).

Higher education enrolment between 2000 and 2005 grew faster in Brazil (12%), Venezuela, Chile and Colombia (6-8%) than in other countries. However if one looks at public expenditure in tertiary education, as well as R&D expenditure as percentage of GDP, it is clearly less than that of other countries that have achieved a higher Human Development Index as defined by UNDP (Table 1). In fact, it reflects as well in the number of researchers by country, patents granted and what has been described as global competitiveness measured by variables such as infrastructure and technological readiness (Figures 3-5).

Figure 2: Population that has attained at least tertiary education (% by age group)



Source: OECD, 2008.

Table 1

UNDP, 2007 Š 2008							
COUNTRY	GDP per capita (PPP US$)	Public expenditure in education (% GDP)	% of Public expenditure in tertiary education	R&D expenditure (% GDP)	Researchers per 1 million inhab.	Patents granted per 1 million inhab.	Human Development Index
AUSTRA	31.794	4,7	25	1,7	3.759	31	0,962
CAN	33.375	5,2	34	1,9	3.597	35	0,961
SPA	27.169	4,3	20	1,1	2.195	53	0,949
UK	33.238	5,4	..	1,9	2.706	62	0,946
KOR	22.029	4,6	13	2,6	3.187	1113	0,921
POR	20.410	5,7	6	0,8	1.949	14	0,897
ARG	14.280	3,8	17	0,4	720	4	0,869
CHI	12.027	3,5	15	0,6	444	1	0,867
URU	9.962	2,6	20	0,3	366	1	0,852
CRC	10.180	4,9	..	0,4	..	..	0,846
MEX	10.751	5,4	17	0,4	268	1	0,829
PAN	7.605	3,8	26	0,3	97	..	0,812
BRA	8.402	4,4	19	1,0	344	1	0,800
VEN	6.632	..	..	0,3	..	1	0,792
COL	7.304	4,8	13	0,2	109	..	0,791
DOM	8.217	1,8	..	..	..	..	0,779
PER	6.039	2,4	11	0,1	226	..	0,773
ECU	4.341	1,0	..	0,1	50	0	0,772
BOL	2.819	6,4	23	0,3	120	..	0,695

Figure 3

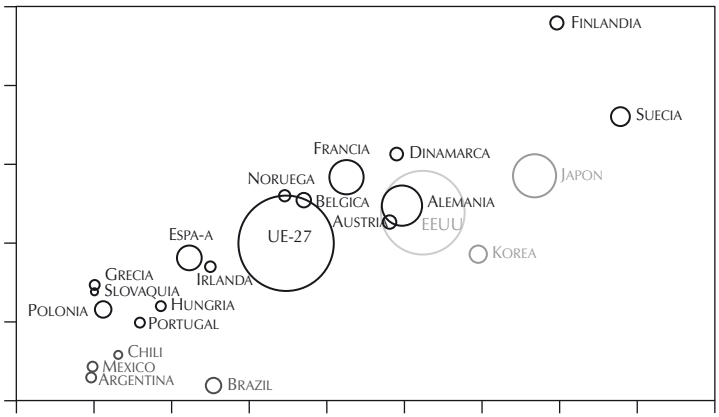
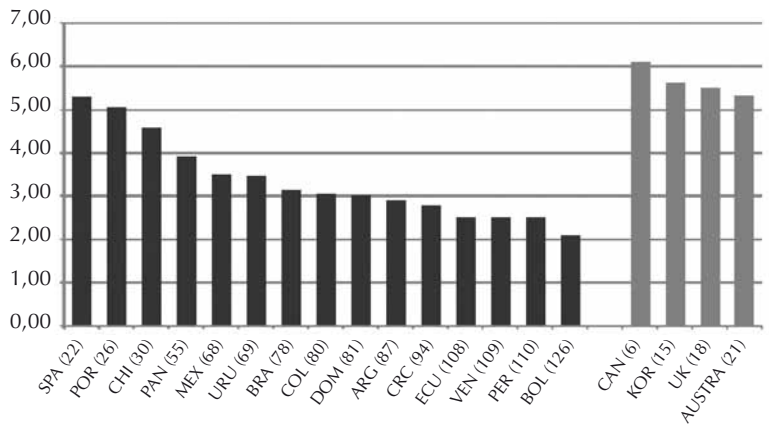
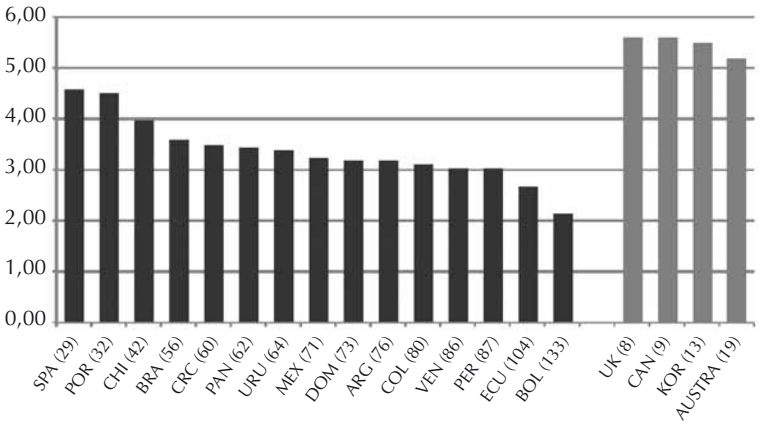


Figure 4



Source: World Economic Forum, 2008.

Figure 5: Global Competitiveness: Technological Readiness



Source: World Economic Forum, 2008.

TECHNOLOGY AND RESEARCH

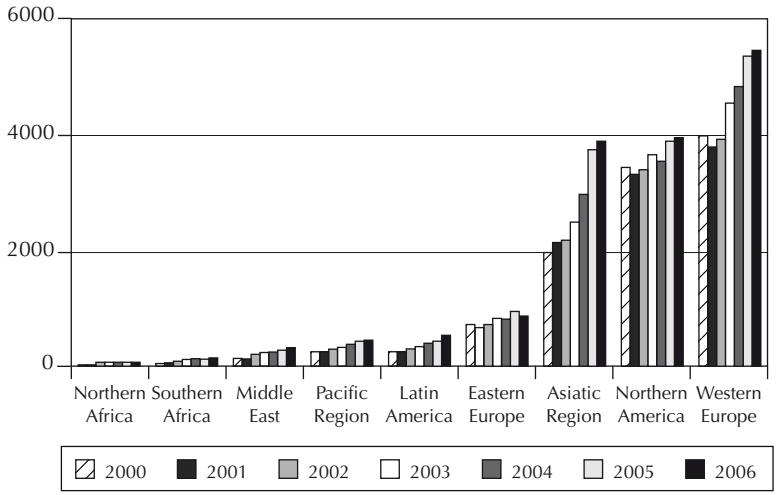
Technology by itself provides no magic. Successful countries at the times of "knowledge economy" are those that have proved able not only to produce knowledge and use technology efficiently, but to have long-term public policies to strengthen higher education and research.

Productive workers have been defined as the "missing link" between innovation and productivity since not just highly trained scientists and engineers are needed for innovation. For this reason, Latin America is a region to be called upon to innovate on how it educates approximately 100 million young people (15-24 years old) who are enrolled in its school systems and will demand further education in the next years (IESALC/UNESCO, 2008).

The formation of human capital at the primary, the secondary and tertiary levels remains a central and critical issue in the region.

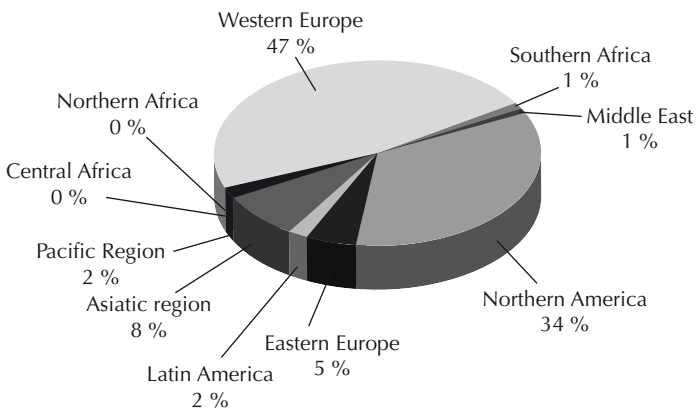
As previously mentioned, innovation is by no means limited to formal R&D efforts. Knowledge creation also comes by constantly trying to improve hands-on productivity. However, research is the first step in innovation. Discoveries in basic knowledge are often first published in scientific and technical journals. It is therefore useful to compare Latin America's output of scientific journal articles with the outputs of other regions and countries (Figure 6). Another long-term problem has been the lack of international visibility of Latin American journals and the fact that relatively few scientists in the region publish their results in higher impact journals (Figure 7).

Figure 6



Source: SCIlago, 2008.

Figure 7: International visibility of scientific journals by region of publication



Source: SCImago, 2008.

Patent-related culture is also limited and there is little experience in development work required to convert discoveries into practical applications and finding concrete marketable opportunities.

In summary, Latin America is behind the global technological frontier and that is a reason why some believe that it can therefore obtain greater economic benefit if using knowledge that already exists rather than trying to cre-

ate new knowledge. But this assumption may be misleading. To create new knowledge may have many indirect positives externalities in addition to the direct economic benefits and, in any case, it is compatible with the notion that it is also important to acquire and use new knowledge created elsewhere.

Innovate or abdicate seems to be the dilemma for less-advanced economies that aspire to become part of knowledge-based growth dynamics. Thus, basic research cannot be eluded if national innovation systems are to be developed (Salmi, 2009).

UNIVERSITIES AND PRODUCTIVE PROCESS

Some Latin American universities are the main incubators of created knowledge and thus, constitute the fundamental components of those incipient national innovation systems. Government and university research labs are the main actors of the process of creating knowledge in Latin America and although productive enterprises are becoming an increasingly important segment and it is very desirable as they are the main appliers of new knowledge, company spending on R&D remains largely insufficient (Table 2).

Table 2: Company spending on R&D*

Place	Country	Punctutation**
1	Switzerland	6.0
2	Japan	5.8
3	E.U.	5.8
31	Brasil	3.9
39	Spain	3.7
53	Portugal	3.3
64	Chile	3.1
66	Colombia	3.1
71	Mexico	3.0
81	Argentina	2.9

* World Economic Forum, The Globla Competitiveness Report 2008-2009
** X 139 countries = 3.4

At the global level, multinational corporations typically drive the creation and dissemination of applying knowledge, and it is now estimated that these corporations carry out more than half of all global R&D.

Functional links between universities and private firms are another issue that contributes to explain large differences in growth and innovation between Latin America and other regions. Some of the most productive and best ranked universities, such as those in México (UNAM), Sao Paulo (USP) and Buenos Aires (UBA), have both high research productivity and growing links with industry.

Nevertheless a related issue, on which Latin America has also lagged behind, has to do with the process and prospects for commercialization of knowledge. Some purists still believe it is not a good idea to think about patents and commercialization, as basic research is conceptualized and undertaken where the creation of new scientific and technical knowledge is financed primarily trough public expenditure. However this perspective is no longer the dominant viewpoint. University autonomy is not threatened but strengthened by alliances with productive sectors, provided there are appropriate legal frameworks.

Public policies to promote mechanisms ranging from tax incentives to the construction of science parks are very much needed, as is the creation of incubators to encourage interactions between publicly funded scientists and the private sector. This interaction benefits societies at large. Where scientists lack experience or business acumen, instruments and policies are needed to provide social benefits by translating ideas into valuable enterprises. That is what knowledge economy is all about.

Publicly funded incubators can serve a wide range of roles, from matching scientists with businessmen who can help develop business plans to helping them to get permits, find employees, and obtain financing support for start-up operations. Many other regions are doing precisely that, and it also explains why they are steadily forging far ahead.

THE NEXT STEPS

In an innovation-driven global society, to become a major player, Latin America has a long but not unachievable agenda to pursue.

Much dedication needs to be focused at enhancing basic and secondary education, but also on advanced skills and tertiary education as well; and clear, long term policies to create, transfer and acquire knowledge are very much in need to develop better environments for both public and private sectors spending on R&D.

Countries such as Argentina, Brazil, Chile, Costa Rica, México and Uruguay with strongest universities, higher scientific productivity and better infrastructure must continue to lead the way and, despite economic recession, investments in these critical issues must continue.

Further finance and transfer policies to enhance collaboration with industry and private companies are also in order.

Internationalization of higher education institutions must be actively promoted, as is networking with other universities and research institutions. High-quality joint degree programs in specific fields are promising strategies as well.

In the end, national policies for such a diverse set of countries will be needed, but general guidelines based on successful experiences elsewhere and some of the concepts discussed hereby may be helpful.

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