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Developmental University Systems: Empirical, Analytical and Normative Perspectives

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1. Introduction

It has become almost trivial to assert that in the knowledge society universities are important institutions. This consensus notwithstanding, questions like in what sense and for whom those institutions are important are far from receiving unanimous answers. Should the major function be to promote higher education in order to serve all sectors of society or should the emphasis be to engage in research and what are the relationships between the two types of activities? And what should a 'third mission' encompass: A broad interaction with society or just an interaction with the business sector aiming at promoting technical innovation in high technology. Debates are particularly entangled in developing countries, partly due to a strong presence of international advice alongside the positions held by local actors, partly due to the level of the challenges that such countries and their universities are facing.

Both in the developed and the developing countries the main emphasis is now on how universities may serve industry through direct flows of information from on-going research. To illustrate, in a recent book with the title 'How Universities Promote Economic Growth' edited by World Bank Economists (Yusuf and Nabeshima 2007) the only dimension covered is the formation of university-industry links related to research. But it is obvious that universities contribute to economic growth and development through other mechanisms, not least through the flow of graduates into the labor market. It is also important to see how universities share functions and responsibilities with other institutions involved in knowledge production and knowledge diffusion. This implies that the most relevant level of analysis may be, not the single university, but the 'university system' seen as an integrated element in a broader national innovation system.

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On the basis of a combination of our different research experiences (Brundenius and Goransson 2008; Lundvall 2002; Arocena and Sutz 2005a) this paper presents key elements of the current state of debates on university transformation or university reform, taking into account their empirical basis and their analytical assumptions. We try to answer the following questions:

1. What are the major quantitative trends in higher education and research efforts world-wide? Are developing countries closing the gap vis-à-vis the developed world in terms of supply of higher education?
2. Which are the major issues in national debates on universities in respectively the developed and the developing countries?
3. How do the trends toward privatization and global markets for education and educated labor affect university systems in the developing countries?
4. Why is the demand for highly trained scholars weak in some developing countries?
5. Through what mechanisms do universities contribute to economic and social development? What role do they play in the over all innovation system?

The ultimate aim of the paper is normative. We see this paper as a modest contribution to the design of developmental university systems that combine dynamic efficiency with equality and social justice.

2. Higher education in developing countries

Higher education (or tertiary education) is evolving rapidly worldwide, also in many developing countries. For several decades higher education was neglected in developing countries. The World Bank and many other donors not only neglected universities, they even discouraged developing countries from investing in higher education. This goes particularly for Sub-Saharan Africa where many existing Higher Education Institutions (HEI) were literally dismantled in the 1980s. Now that has come to a halt. One reason is that governments and donors are becoming increasingly conscious of the importance of science and technology for development, and hence also the role of higher education. This became evident not least from the experiences of the rise of the "tiger economies" in South East Asia.

A statistical snapshot

Table 1 below shows the development of Gross Enrolment Ratios (GER) in Tertiary (Higher) Education worldwide since 1970. As seen, enrolment rates were quite low in all developing countries in 1970 and did not increase much until the beginning of the 1990s. In the West (North America and Western Europe), however, tertiary GER continued to expand from already relatively high levels, until saturating at around 70% by 2004-06. The same took place in Central and Eastern Europe although stagnating in the 1980s.

Table 1 Tertiary Enrolment Ratios (GER) by Region, 1970-2006

Region	1970	1980	1991	1999	2004	2006
Arab States	3	10	11	19	21	22
Central & Eastern Europe	25	30	33	39	54	60
Central Asia	Na	Na	29	19	25	25
East Asia & Pacific	1	2	7	13	23	25
Latin America & Caribbean	6	13	17	21	28	31
North America & Western Europe	26	35	52	61	70	70
South & West Asia	3	4	6	10	11	11
Sub-Saharan Africa	1	1	3	4	5	5
WORLD	9	12	14	18	24	27

Source: data elaborated by authors based on UNESCO 2006, UNESCO 2007 and UNESCO 2008 (http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=175)

Gross enrolment ratios do not, however, reveal the whole picture. For instance it is difficult for countries with high population growth to rapidly increase enrolment ratios in spite of high tertiary enrolment growth. This goes especially for Sub-Saharan Africa while the opposite is true for Western Europe. During the last 15 years tertiary enrolments have expanded at an impressive rate of 7.8% in Sub-Saharan Africa (the highest growth rate after East Asia & the Pacific). But even so, tertiary GER is still very low (only 5% in 2006), as a result of low initial GER and high growth rate of the younger population. In contrast, GER in both North America and Western Europe increased from 52% to 70% between 1991 and 2006, although with considerably slower growth of tertiary enrolments.

Latin American tertiary enrolment ratios have since 1970 been the highest among the developing countries (with a GER of 31% in 2006). However, in general, the growth of Latin American enrolment ratios is somewhat slowing down but with two spectacular exceptions: Cuba and Venezuela. In Cuba GER actually went down from 22% to 21% between 1991 and 1999 but dramatically increased to 63% in 2006-2007 (Segrera et al, 2007), a reflection of Cuba's current drive to universalize higher education. Unesco's higher education statistics (http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=167) signals for Cuba 63% enrolment in HE in 2006 but 88% in 2007.

On the other hand, the gap is rapidly closing between Latin America and other developing regions, especially East Asia & the Pacific, particularly due to the rapid expansion of China. Chinese enrolment ratios increased from 6% to 22% in only seven years between 1999 and 2006. The Republic of Korea is another extreme case, with an expansion of enrolment ratios from 39% in 1991, to 66% in 1999 and to 93% in 2006.

Development of tertiary education in South and West Asia has been less impressive. Indian tertiary enrolment rates, for instance, only increased from 6% in 1991 to 12% in 2006. Iran has the highest tertiary GER in the region, increasing from 10% in 1991 to 27% in 2006. Many of the Sub-Sahara African countries have tertiary enrolment ratios below 2%, in

Mozambique, for instance, only 1%. In the Arab region Libya, Egypt and Tunisia stand out with 50%, 35% and 31%, respectively.

Tertiary enrolments worldwide more than doubled between 1991 and 2006, or from 67 million to 144 million students. But in spite of high growth in Sub-Saharan Africa and other developing countries, there was still in 2006 a high concentration to a few countries and regions. The highest number of tertiary students are found in China (24.5 million), followed by the United States (17.5 million), Central and Eastern Europe (20.1 million including Russia's 9.2 million students), Western Europe (14.9 million), India (12.9 million), Brazil (4.6 million), Japan (4.1 million), the Republic of Korea (3.2 million), and Mexico (2.4 million). These countries and regions (altogether 104.2 million) thus accounted for 72.4% of all tertiary enrolments in the world in 2006.

But to put the whole snapshot of higher education the world in perspective, a glance again at Table1 reveals that although tertiary enrolments have boomed in many, perhaps even most, developing countries since 1990, it is only now that even the most advanced developing regions are approaching the enrolment ratios that North America and Europe (both West and East) had in 1970. So there is still a long way ahead for most developing countries.

Nevertheless, the rapid expansion in the developing countries has raised many difficult issues for the finance and organization of higher education. In the next section we present original new research that makes it possible to compare both the patterns of expansion and the discourse on such issues between twelve more or less developed countries.

3. The UniDev Project

Preliminary results from the international research project, *Developing Universities – The Evolving Role of Academic Institutions in Innovation Systems and Development (UniDev)*, coordinated by the Research Policy Institute at Lund University, Sweden, gives additional insights both on the similarities and differences between university systems in developed and developing countries and on the issues that are raised in countries at different levels of development.[1] The project has been working with national teams in 12 countries (Denmark, Sweden, Germany, Latvia, Russian Federation, China, Vietnam, Brazil, Cuba, Uruguay, South Africa and Tanzania). It is interesting that in spite of different economic systems (ranging from liberal market economies to socialist economies), different levels of development and different roles in national innovation systems, not only is the role of higher education (and especially that of universities) a hot topic in all the countries, many of the specific issues that are raised in national debates are also the same.

[1] The following summary is based on Brundenius and Göransson (2008).

Table 2 Some Basic Data for the UniDev Countries around 2005

Country (ranked after GDP/cap. level)	GDP per capita (PPP)	Government Expenditure on Education as % of GDP		Government Expenditure on Education per capita (PPP)		Government Expenditure on Tertiary Education per capita (PPP)	
Denmark	33 973 (1)	8.5	(2)	2 888	(1)	866	(1)
Sweden	32 525 (2)	7.4	(3)	2 407	(2)	647	(2)
Germany	29 461 (3)	4.6	(7)	1 355	(3)	325	(3)
Latvia	13 646 (4)	5.4	(5)	723	(4)	(80)	(6)
South Africa	11 110 (5)	5.4	(4)	600	(6)	96	(5)
Russia	10 845 (6)	3.6	(9)	390	(7)	(76)	(7)
Uruguay	9 962 (7)	2.6	(10)	259	(10)	52	(9)
Brazil	8 402 (8)	4.4	(8)	370	(8)	37	(10)
Cuba	6 800 (9)	9.8	(1)	666	(5)	147	(4)
China	6 757 (10)	5.3	(6)	358	(9)	75	(8)
Vietnam	3 071 (11)	1.8	(12)	55?	(11)	(15)	(11)
Tanzania	744 (12)	2.2	(11)	16	(12)	(5)	(12)

*Share of tertiary enrolments Source: Brundenius-Göransson (2008)

In Table 2 the UniDev countries are listed according to GDP per capita level (PPP). UniDev includes three countries with high GDP per capita levels of living (Denmark, Sweden and Germany), three with upper medium income levels (Latvia, South Africa and Russia), four with medium income levels (Uruguay, Brazil, Cuba and China), and two low income countries (Vietnam and Tanzania).

The first group of countries stands out as regards the expenditure on education - with one exception Cuba spends most of the UniDev countries on education in general as percentage of GDP, and has also a high percentage of spending with respect Higher Education (5th place). China also has a relatively high ranking with respect to education in general.

However, if we translate this relative spending pattern into real terms (PPP per capita), we see a different pattern: The richer countries spend much more in real terms in spite of relatively small differences in percentage terms. While Denmark devotes 866 PPP per capita to higher education, the corresponding figure is only 96 in South Africa, 52 in Uruguay, 37 in Brazil, 15 in Vietnam and 1 in Tanzania. China and especially Cuba still rank higher in their commitment to education, including higher education, than corresponding to their income levels.

Table 3 compares tertiary enrolment ratios and the role of universities in research. These data can give some indication of the importance of universities in the national systems of innovation. Gross enrolment ratios (GER) are high, or very high, in Sweden, Denmark, Latvia, Russia, and Cuba; moderately high in Germany and Uruguay; low in Brazil, China, Vietnam and South Africa, while it is very low in Tanzania. If we look at GERD (Gross Expenditure on R&D we see a quite similar pattern with public expenditure on education (Table 2). GERD as a percentage of GDP ranges from 3.9 in Sweden to 0.1 percent in

Tanzania. China, however, has an exceptionally high GERD (1.3 %) in relation to its income level. The Chinese exception becomes especially noteworthy when we look at BERD (Business Expenditure on R&D), which accounts for 71% of all R&D in China, and places China in company with Sweden, Denmark, Germany and Russia.

Interesting new patterns appear when we look at University R&D (5th column). Here the situation is in many instances the reverse, for instance, Latvia, Brazil, Cuba and Uruguay all have higher shares of University R&D (as % of GERD) than the more developed countries, even if the causal relationship is far from clear. It might be that governments in many of the developing UniDev countries give high priority to university research – often as a means of building bridges to industry; on the other hand this perhaps rather reflects the weak BERD sector of these countries. University R&D is in contrast quite weak in Russia and China – both in relative terms and in terms of PPP per capita. The weak university research sector in these countries is a reflection of the past (centrally planned) system, where most research was carried out in specialized government research institutes.

Table 3 UniDev: Tertiary Enrolments and the Role of University R&D around 2005

Country (ranked after GDP per capita)	Tertiary Enrolment Ratios (GER)		GERD as % of GDP		BERD as % of GERD		University R&D as % of GERD		GERD per capita (PPP)		University R&D per capita (PPP)	
Denmark	80	(2)	2.45	(3)	67.0	(4)	26.3	(5)	822	(2)	216	(2)
Sweden	82	(1)	3.86	(1)	74.9	(1)	20.5	(7)	1239	(1)	254	(1)
Germany	50	(6)	2.51	(2)	69.6	(3)	16.5	(9)	764	(3)	126	(3)
Latvia	74	(3)	0.57	(8)	40.5	(8)	41.5	(1)	74	(8)	30	(4)
South Africa	15	(11)	0.87	(7)	58.1	(6)	21.6	(6)	97	(5)	21	(6)
Russia	71	(4)	1.07	(5)	66.4	(5)	6.3	(11)	128	(4)	8	(7)
Uruguay	41	(7)	0.26	(10)	48.0	(7)	32.0	(4)	25	(10)	8	(7)
Brazil	24	(8)	0.92	(6)	40.3	(9)	39.0	(2)	77	(7)	30	(5)
Cuba	61	(5)	0.56	(9)	29.4	(10)	35.3	(3)	34	(9)	8	(7)
China	20	(9)	1.34	(4)	70.9	(2)	9.1	(10)	91	(6)	8	(7)
Vietnam	16	(10)	0.19	(11)	20.0	(11)	21.0		5	(11)	1	(11)
Tanzania	1	(12)	0.10	(12)	n.a.		n.a.		1	(12)	n.a.	

Source: Brundenius-Göransson (2008)

Summing up we find that - with some exceptions, notably Cuba and China - the rate of investment in university activities reflects the level of economic development. In rich countries governments can afford to invest a bigger proportion of the GNP per capita in education and in R&D. This results in an enormous gap in the amount of real resources per capita allocated to universities between the richest countries and the least developed. In the next section we will show that despite such differences the most debated issues tend to overlap substantially across income levels as well as socio-economic formations.

Dominating issues in the national discourse in more and less developed countries

The country teams organized national workshops to discuss preliminary findings with various stakeholders: universities, government, policy makers, business representatives, and the research community at large. In some of these national workshops participants discussed the role of universities in society and were asked to rank the 4-5 most critical areas ("hottest issues") from a list, common for all the countries. The result is shown in Table 4 below (in some cases the ranking was made by the national teams). There are many common concerns but there are also interesting country differences.

Table 4 The Hottest Issues in the Current University Debate in 12 Countries

The hottest issues	Sweden	Denmark	Germany	Latvia	Russia	Brazil	Cuba	Uruguay	China	Vietnam	Tanzania	S. Africa
Funding	x	x	x	x	x	x	x	x	x	x	x	x
Allocation of resources		x	x									x
Governance		x	x									x
Low salaries					x		x	x				
Access to higher education		x										x
Private vs. public		x						x			x	
Relevance of university R&D	x		x		x	x		x		x		
Social inclusion/ relevance	x					x		x	x			
Gender/minorities	x										x	x
Quality	x						x			x	x	x
Integration of universities with research							x					
Technology transfer issues			x	x					x	x		
Declining interest in S&T				x							x	

Source: Brundenius-Göransson (2008)

On the top of the list in all countries is not surprisingly *financing*. Higher education usually depends upon the public budget and there are competing priorities, especially in developing countries. There are thus pressures on universities both to prove their social and economic relevance and to practice cost-efficiency in both education and research. The question of privatizing has in some instances been an option and establishing university-industry links has been another. Privatization, however, does not seem to be a big issue any longer, except in Denmark, Uruguay and Tanzania. In Uruguay there is only one university (public) and that might explain the interest in private complements.

The second hottest issue is not surprising the *relevance of university research*. This is a topic heatedly discussed in all parts of the UniDev spectrum: from Sweden and Germany to Russia, Brazil, Uruguay and Vietnam. It is interesting to note that this does appear to be a big issue in Latvia and Cuba, two countries with the highest share of University R&D (see Table 3).

The quality of education is the third hottest topic, ranging from Sweden to Cuba, Vietnam, Tanzania and South Africa. In Cuba the quality of education has lately become an increasing concern to the government. This reflects problems in connection with the massive surge in university enrolments since the beginning of 2000 in a drive towards the "universalization of higher education". There is for understandable reasons a serious lack of qualified university teachers in the initial period – before the system can supply a sufficient number of qualified teachers.

Low salaries may be related to the issue of quality of education since it might be difficult to recruit good teachers if salary levels are low (in relation to other occupations). This seems to be the case in Russia, Cuba and Uruguay.

Social inclusion and social relevance of universities is an issue that is being debated in Sweden, Brazil, Uruguay and China. However, it should be emphasized that "social inclusion" can be interpreted in different ways. For some people it refers to university enrolment policies, in other words it is almost synonymous with *access to higher education*.

4. Privatization and internationalization of higher education as challenges for national university systems

The trend to privatize higher education in developing countries

As we have seen the growth of tertiary education is impressive in several parts of the developing world. In several developing countries this phenomenon has been accompanied by a marked process of privatization of higher education without much quality control. The "market of university degrees" flourishes for instance in Latin America: in Mexico the offer of university diplomas increased by 528% between 1980 and 2003; Colombia had in 2001 almost 70% of all its university students enrolled in private universities. This trend shows some exceptions: Argentina, that doubled the number of university students between 1992 and 2003, continues to have almost 90% of such students in the public university sector. And it should be noted that the marked process of privatization of tertiary education, at least in Latin America does not reach Master and PhD courses. These continue to be granted overwhelmingly by public universities (Arocena and Sutz, 2005b, Sutz, 2008).

The mushrooming of what has been termed "garage universities" has become a main concern for Latin America's proposals around university reform. The issue of institutional accreditations and evaluation, is a concern also present in other places. The privatization process is not limited, however, to national borders. A growing phenomenon of university associations across borders, or by directly setting up branches of foreign based universities, accompanies such a process of privatization of higher education.

Concerns around quality and "cultural imperialism" pushed UNESCO and OECD to deliver guidelines on Quality Provision in Cross-Border Higher Education.[2] As UNESCO formulates

2 Guidelines can be accessed at (http://portal.unesco.org/education/en/ev.php-URL_ID=29228&URL_DO=DO_

it: "Though not binding, the guidelines can be seen as a critical element in the heated debates over the commercialization of higher education, triggered largely by negotiations over the World Trade Organization General Agreement on Trade in Services (GATS). While GATS encourages governments to view education as a service and liberalize this 'market', the guidelines clearly recognize the importance of national authority and the diversity of higher education systems. Indeed, higher education is considered a means for expressing a country's linguistic and cultural diversity and for nurturing its economic development and social cohesion" (UNESCO, 2006: 43).

The international mobility of students

The second issue that we want to address in this section relates to university students studying abroad. A new term has been proposed to label this growing phenomenon, "'internationally mobile students' defined as "those who study in foreign countries where they are not permanent residents" (UNESCO 2007: 33). UNESCO has tried to track students studying abroad since 1975. A clear pattern can be seen. In 2005 there were an estimated 2.7 million tertiary students abroad, an increase from 800 000 in 1975. There have been three notable surges, the first between 1975 and 1980 with an annual growth of 4.6%. The next wave was between 1989 and 1994 with a growth rate of 5.4%. Between 1999 and 2005 the rate of growth of mobile students increased to 6.1%.

While the growth of students studying abroad may appear impressive it should be taken into account that the volume of tertiary enrolments worldwide has increased with about the same rate. What makes the international flows an important issue for developing countries is the unevenness in terms of both destinations and origins. For instance, the concentration of destinations is remarkable. 67% of all mobile students are concentrated in 6 countries, 42% in English native speaking countries (USA, UK and Australia) and the rest in Germany, France (where many French speaking African students go) and Japan.

Table 5 also shows that the outflow also comes from some specific regions and countries. Sub-Saharan Africa has by far the highest *proportion* of its tertiary students abroad (5.5%). East Asia and the Pacific contribute with the highest number of mobile students. Western Europe has a fair proportion of its tertiary students abroad but on the other hand with a concentration to its own region, to some degree fostered by European Community Programs like Erasmus. Latin America shows a striking feature: it is the developing region with the smallest share of tertiary students abroad (1.0%). However, it scores high in terms of brain drain: World Bank data indicate that 50% of all Latin American migrants to the developed world have tertiary education (World Bank, 2002: 18).

TOPIC&URL_SECTION=201.html).

Table 5 International Mobility of Tertiary Students in 2005

Region	No. of students (000)	Students Abroad	Abroad %	Hosting foreign students	Hosting %	Balance (hosting-abroad)	Studying in own region %
Arab states	6 782	180 731	2.7	67 440	1.0	-113 291	15.2
Central & Eastern Europe	19 389	314 887	1.6	209 356	1.1	-105 531	23.2
Central Asia	2 060	83 832	4.3	40 993	2.0	-47 839	33.8
East Asia & Pacific	41 576	766 351	1.8	452 853	1.1	-313 498	42.4
Latin America & Caribbean	15 293	157 789	1.0	33 987	0.2	-123 802	14.8
North America	18 599	74 396	0.4	723 110	3.9	+648 714	42.0
Western Europe	14 823	398 211	2.7	1 127 036	7.6	728 825	78.0
South & West Asia	15 842	214 744	1.4	10 658	0.1	-204 086	1.5
Sub-Saharan Africa	3 506	192 877	5.5	52 175	1.8	-130 702	19.9
WORLD	**137 870**	**2 728 840***	**2.0**	**2 728 848***	**2.0**	**-**	**34.2**

* incl. unspecified (342 794)

Source: elaborated by authors based on UNESCO 2007

Given that *research universities* in Latin America are overwhelmingly public universities, we can hypothesize that what is occurring is that university graduates coming from public universities financed by public money and without fees, are actually subsidizing R&D and innovation activities in developed countries. It has been estimated that one out of four researchers in the South work in the North. (Pellegrino, 2004: 52-53).

It is easy to conclude from this type of data, and adding to other considerations already mentioned, that the relevance of universities in the South, from the point of view of the interests of the South, is quite problematic. Considering that universities in the developed countries are increasingly eager to make business providing higher education, even *in situ* in many developing countries, universities in the South risk becoming a "non issue", fading away by the winds of globalization.

5. Why is demand for highly educated low in some developing countries?

Policy makers and administrators with responsibility for higher education need to find arguments to convince ministries of finance to use scarce public money for higher education. As illustrated in the UniDev project the financial problems is an issue at the top of the agenda in all kinds of countries.

This may be especially difficult when there is an outflow of highly trained workers and when national rates of unemployment among graduates is high (World Bank 2002 quotes graduate unemployment rates of 35% in Sri Lanka and 22% in Nigeria). It is obvious that in such situation efforts to expand higher education may lead to disappointing results in terms of the impact on economic development.

Those who do find employment may do so in the public administration rather than in the business sector. In table 6 below we present some estimates of the proportion of researchers that work in business firms 2003.

Table 6 Percentage of Researchers Working in Business Firms in 2003

	European Union	USA	Japan	Argentina	Brazil	Mexico	Chile
% of researchers working in business firms	49,0	80,5	67,9	12,5	26,3	28,8	14,19 (2002)

Source: European Commission, Key Figures 2005; RICYT 2007.

While the proportion varies between 50% and 80% in the developed countries it varies between 10% and 30% in the four Latin American countries listed.

It is a fact that in many developing countries the demand for highly educated workers is low especially in the business sector. Why is it so low? To some degree low demand for graduates in the private sector reflects cultural barriers that restrict the hiring of graduates. But more important is stagnation in terms of technical and organizational change.

Nelson and Phelps (1966) present a simple growth model where people with higher education contribute to economic growth through two mechanisms. First they are able to pursue regular activities more efficiently than the average worker. Second, and here is the new insight brought by the paper, they are more competent when it comes to exploit new technical opportunities in the economy. To support their second assumption the authors refer to empirical data showing that highly educated farmers introduce new methods before and with better results than the average farmer.

The conclusion from the analysis is that the productivity and the demand for the highly educated will reflect the rate of technical change (exogenously given in the model). *In other words the rate of return on investment in higher education will be positively correlated with the rate of technical progress*. In a stationary economy we would expect the rate of return to be low while we would expect it to be high in an economy characterized by rapid technical change (Lundvall 2008) .

High national rates of unemployment among graduates in certain poor countries may thus be seen as reflecting economies where there is little technical progress. *A general conclusion is that the role of higher education needs to be assessed in the wider context of the national innovation system and that higher education policy needs to be coordinated with a wider set of innovation policies.*

6. Openness and Market orientation of University systems

Universities, loosely defined as institutions whose main aim is to perform teaching and research of high quality, are usually considered central to the dynamics of modern societies.

For almost 150 years, since the foundation of the University of Berlin that gave rise to a first academic revolution by linking academic teaching and research, universities have become the loci par excellence of academic science. Even if misleading, as all "ideal types", the Mertonian ethos of science, encapsulated in the acronym CUDOS (communalism, universalism, disinterest, organized skepticism), described acceptably the norms of university work in those times (Etzkowitz, 1990).

However, these features have changed to such an extent that some describe the situation that followed as "post-academic" science (Ziman, 2000), where the first and most paradigmatic of Mertonian's rules, to put in common the research findings, the C, was substituted by a P, "proprietary", referring to the vast trend towards the privatization of knowledge. If research is done not mainly because some researchers are interested in it, but more importantly because some non-academic actors are willing to pay for the research with the aim of having privileged access to its results, something is profoundly changing in university life.

"To what extent is it desirable to modify modern university institutions and operating rules to permit and encourage closer integration of academic and corporate research activities?" This question was raised in an influential paper by Dasgupta and David (1994: 489), entitled "The new economic of science". The negative answer was accompanied by a sharp conclusion: "short-run policies aiming to shift resources towards commercial applications of scientific knowledge (…) may seriously jeopardize a nation's capacity to benefit from a sustained flow of innovations based upon advances in scientific and technological knowledge" (Ibid: 493).

Over the last decades there has been a radical shift both in the discourse and in the practice around these issues in all parts of the world. The growing costs of university activities have raised the possibility that universities might operate in markets and sell proprietary knowledge to private firms. The increased focus on knowledge based competitiveness has raised the issue about how the knowledge produced at universities best can be 'transferred' to industry. Together these debates have resulted in organizational initiatives at universities where specialized liaison offices have been created together with science parks close to and sometimes administered by a university.

Linking universities closer to users is fundamental for enhancing their role in relation to economic development. Especially in countries where a significant proportion of the research effort is located at universities (according to table 3 more than 30% of total research is located at universities in Brasil, Cuba and Uruguay) it is important to find ways to enhance the interaction between the university and industry as well as with other users in society. The question is how best to do so.

The current emphasis on establishing organizational links between university research and industry and on universities engaging in patenting has been inspired by certain extreme experiences. The most important is the specific development in the field of biotechnology, and related life science fields, where there has been a dramatic shortening of the time from scientific breakthrough to commercial use in terms of patents that can be sold in the market. New developments in the US in these fields, sometimes resulting in major income to the universities in control of patents, have raised expectations that universities in the rest of the world can repeat this success.

Table 7 Innovative Firm Behaviour by Country (% of all firms)

Country	Innovative firms	Firms engaged in innovation expenditure activities			Sources of information for innovation		Innovative firms with cooperation arrangements on innovative activities
		Internal R&D	External R&D	Machinery and equipment	Internal to the firm	Universities	
Belgium	59	74	29	67	53	5	24
Denmark	52	71	37	55	26	5	-
Germany	66	61	25	77	37	7	18
Greece	27	53	14	79	58	6	-
Spain	37	38	15	62	33	3	10
France	46	66	24	43	61	3	33
Italy	40	37	12	68	27	2	8
Netherlands	55	61	30	44	53	3	24
Austria	53	-	-	-	50	5	19
Portugal	45	39	18	73	34	4	16
Finland	49	81	39	55	46	3	52
Sweden	47	-	-	-	49	4	34
United Kingdom	39	-	-	-	42	2	23
Iceland	54	26	18	14	23	2	22
Norway	39	62	35	38	50	4	37
New Zealand	79	35	17	61	-	5	21
South Africa	44	49	20	34	57	2	18
Brazil	32	34	8	77	51	5	11
Mexico	28	13	-	-	-	10	16
Argentina	42,6	9	2	67	78	-	-

Source: Arocena and Sutz, 2005a)

This discussion and the new initiatives it has resulted thus find inspiration in real phenomena, but there is a tendency to generalise from exceptions, and to use those exceptions as the basis for general strategies to change the universities. As we will show below it is neither realistic, nor sensible to try to make the 'whole industry' cooperate with the 'whole university'. There are certainly firms, especially within the pharmaceutical and software industry, that have a considerable interest in continuously cooperating with researchers at the university, but for most of the firms the most important link to university goes through recruitment of well educated graduates.

Table 7 shows that, regardless the level of innovativeness universities are consistently listed by the firms of all countries considered (that are widely diverse) as being less important than

other types of partners in innovation. This does not imply that research taking place at universities is irrelevant for business innovation, however.

Many firms draw upon scientific and engineering knowledge but they do so through the embodied knowledge of graduates. In an influential paper Rosenberg and Nelson, "American universities and technical advance in industry" (1994), the authors try to answer the question what does business value most from university activities?

Their analysis shows that while science is a strategic input for many industries it is not the on-going research at the university that matters most. It is rather the general scientific knowledge embodied in graduates coming out of the universities. Universities are important for business, especially in countries where the productive structure has reasons to value the economic role of knowledge, because they are factories of creative people. This is why von Humboldt, the founder of the University of Berlin in 1810, pushed towards the revolutionary merging of teaching and research under the same roof: research will lead to better and more creative teaching; young students will learn how to deal with solutions in the making and not only with reified results.

Moreover, more focused case studies confirm that the hiring of graduates have an impact on the innovativeness of firms. Studying the impact of graduates on the innovation propensity of a sample of 200 Danish small firms, initially with no academic staff, Nielsen (2007) analyzes the innovation performance in period t+1 distinguishing firms that hire a first graduate in period t from the rest. The analysis demonstrates – taking into account a series of relevant control variables – that the first-time hiring of a graduate with an engineering background has a significant positive impact on the propensity to introduce a new product and that the hiring of a graduate with a management training background has a significant impact upon the frequency of organizational change.

Both in developed and developing countries there are thus good reasons to give more attention to the education of graduates as skilful problem solvers. As demonstrated above the competence of highly educated employees is especially important in a context of technical and organizational change and their competences contribute to this kind of change. This may actually be especially important in developing countries where 'the absorptive capacity' in relation to new technology is a major bottle-neck.

"The import of technologies is very far from the costless diffusion of perfect information assumed in pure versions of neo-classical economic theory. Technologies cannot be taken 'off the shelf' and simply put into use anywhere. Without infra-structural investments in education, training, R&D, and other scientific and technological activities, very little can be accomplished by way of assimilation of imported technologies" (Freeman, 2002: 156).

Given the accumulated evidence around the "indirect" role of universities for business innovation, a question arises: why is it there is currently such a strong emphasis on the *direct economic impact of universities?*

It seems to reflect a bias in analytical perspectives. First there is a lop-sided interpretation of the concept 'the knowledge-based economy' and second the view of the innovation process is correspondingly narrow. Knowledge is seen mainly as 'scientific information' that first need to be protected by IPRs and then can be 'transferred' from one site to another through formal communication channels. The fact that the most crucial knowledge always has elements of tacit knowledge and therefore is embodied in people or embedded in organizations seems to be neglected. Innovation systems are narrowly defined and innovation is assumed to come more or less directly out of R&D efforts and there is a neglect of the importance of experience-based learning.

7. The role of universities in national innovation systems

As indicated above emphasis on how universities may contribute to national economic performance has become stronger. One way to understand this aspect is to analyze their role in national systems of innovation (NSI).

Actually, there is a close connection between how the national innovation system is defined and how the specific role of the national university system is understood. The modern version of the innovation system concept was developed in the eighties (Freeman, 1982 and Lundvall, 1985). At the core of the concept was the understanding of innovation as an interactive process and the fact that national economies differ in terms of institutions and patterns of specialization. There has been a certain distortion of the concept as it has become more widely spread and used and this distortion has affected the debate on the role of universities (Lundvall, 2007).

Originally the NSI-concept was intended to serve as an analytical framework alternative to standard economics and to criticize its assumption that knowledge equals information. When innovation systems were presented as framing interactive learning processes the underlying assumption was that knowledge combines codified with tacit elements and science-based with experience based learning (Lundvall 1992). This has been neglected by analysts and policy-makers who operate with narrow definitions of innovation systems where innovation is assumed to originate directly from science. In terms of policy it is reflected in a bias in favor of stimulating science-based innovation in high tech sectors and in problematic attempts to subordinate all academic scientific work to the logic of the market. The latter can be seen in developed and developing countries alike, expressing one of the "globalized" trends of "academic capitalism" (Slaughter and Rhoades, 2004).

Narrow definitions of national innovation systems lead to lop-sided policies with exaggerated expectations regarding what university research can contribute *directly* to innovation through university – industry relationships. The other side of this bias is a neglect of the fundamental importance of linking regular high quality research and higher education to social and economic development. Such a bias is especially problematic in developing countries where there is a need to stimulate innovation in low-tech sectors, to find ways to absorb graduates in industry and, moreover, to solve creatively idiosyncratic problems of populations immersed in different types of scarcity conditions (Srinivas and Sutz, 2008).

The role of universities in innovation has been approached from several viewpoints, each suggesting interesting perspectives and explanations to current trends. But when for instance the triple-helix approach presents itself, or is applied by policy makers, not as analyzing a subsystem within, but as a full-blown alternative to the innovation system approach it contributes to a narrow understanding of the innovation system (Etzkowitz and Leydesdorff 2000).

These perspectives usually capture *STI-learning* processes linking research and technology to innovation but they tend to neglect the importance of experience-based *DUI-learning* (Jensen et al 2007). The fact that science and codified knowledge become increasingly important for more and more firms in different industries – including so-called low-technology ones – *does not imply that experience-based learning and tacit knowledge have become less important* for innovation. To bring innovations, including science-based innovations to the market, organizational learning, industrial networks as well as employee participation and competence building are more important than ever. A double focus is needed where attention is given not

only to the science infrastructure, but also to institutions/organizations that support *competence building* in labor markets, education and working life.

The research by Jensen *et al* shows that the probability that firms develop a new product, or a new service, is slightly higher in STI oriented firms than in DUI oriented firms. But it also shows that the probability is significantly higher in firms that combine STI and DUI modes of innovation. This is a robust result that stands even when checked for a series of control variable such as size, sector and form of ownership. These results illustrate why narrow definitions of national innovation systems that focus only upon science-based innovation and codified knowledge are of little relevance for the economic performance of firms and national innovation systems. This is not least important when it comes to analyzing the barriers and opportunities for economic development in developing countries (Arocena and Sutz 2000; Cassiolato, Lastres and Maciel 2003).

Organisational learning in National innovation systems

In recent empirical work that includes the kind of complementary indicators referred to above, Lorenz and Valeyre have shown that there are dramatic differences between European national systems in terms of how and how much the average employee learns at her/his workplace (Lorenz and Valeyre 2006, Arundel et al 2007). While a majority of workers are engaged in 'discretionary learning' in Denmark and Netherlands, the majority of workers in countries such as Greece and Spain are engaged either in taylorist type of work, or in simple organization with much more limited opportunities for learning and/or with very little autonomy.[3] Combining the results of this research with other type of indicators, our former claim that universities should be understood in a systemic rather than in an isolated way becomes even clearer.

Table 8 National Differences in Organisational Models towards Learning at Work, Innovative Firms, Firms Performing R&D and Graduates in Sciences and Engineering

	Discretionary learning	**% of innovative firms**	**% of firms performing R&D**	**Graduates in sciences and engineering per 1000 inhabitants**
Netherlands	64,0	55	61	7,9
Denmark	60,0	52	71	13,8
Finland	47,8	49	81	17,4
Germany	44,3	66	61	9,0
Belgium	38,9	59	74	11,2
France	38,0	46	66	22,0

[3] In a follow-up to the analysis of these national patterns of workplace learning they have been combined with innovation indicators. The analysis shows, first, that on average countries that make intensive use of discretionary learning are most prone to engage in 'endogenous innovation' (defined as innovations that emanate from in-house R&D efforts and result in products new to the market). But, second, it shows that strong economic performance may emanate from quite different combinations of innovation and learning modes (Arundel, Lorenz, Lundvall and Valeyre 2007).

Italy	30,0	40	37	10,1
Portugal	26,1	45	39	11,0
Spain	20,1	37	38	12,5
Greece	18,7	27	53	7,9

Source : Lorenz and Valeyre (2006), European Commission (2004); European Scoreboard (2006), Lundvall, (2007).

It is interesting to look at the first three columns of Table 8. They show rather consistently that the first six countries - in the Northern part of Europe and France- "perform better" than the four last Southern countries. The proportion of firms in which the organizational mode tends to maximize creativity in the working place, the proportion of innovative firms, the proportion of firms performing R&D: all these three indicators are much better represented in the upper part than in the lower part of the table. This suggests that the national systems of innovation of the first six countries behave better than those of the four last ones.

However, when we consider the last column, where a proxy of the strength of the university system is taken into account (number of graduates in science and engineering per 1000 inhabitants) a different pattern occurs. Some of the innovative countries (such as Netherlands and Germany) are characterized by low proportions of graduates in engineering and science while some of the less performing countries (such as Italy, Portugal and Spain) are characterized by higher proportions.

There can be many explanations but it is worth noting that there is no correlation between the numbers in the third and fourth column. A high proportion of graduates in the over all economy is not correlated with a high proportion of firms performing R&D. This observation reinforces our argument that there is a need to focus on the demand for knowledge and for highly trained scholars in the context of the over all innovation system.

In particular, the national differences in patterns of what people do and learn at their workplace is a major factor structuring the national innovation system and affecting its performance: it might be argued that such differences reflect a long term working culture that is more difficult to change than, for instance, R&D intensity.

8. Toward developmental university systems

One conclusion from Table 8 is that national systems of innovation have a dominating structuring power in relation to university systems. This helps to explain why universities in developing countries, which often exhibit good research results and good quality graduates, are not able to mobilize this knowledge for developmental purposes. Universities in developing countries illustrate particularly well one of the fundamental assertions of the great scholar of development studies, Albert Hirschman: " Development depends not so much on finding optimal combinations for given resources and factors of productions as on calling forth and enlisting for development purposes resources and abilities that are hidden, scattered, or badly utilized" (Hirschman, 1958, p.5). Universities are, and for sure can be, an important source of such resources and abilities, that can be called forth and enlisted for development purposes. This is the main aim of what we call a "developmental university system".

From Entrepreneurial to Developmental Universities

It is worth noting that "the idea that university research should engage in direct interaction with external groups and interests" is not at all new. In the United States, the deservedly notorious land-grant universities were built around this idea. In Latin America, the Movement

of University Reform of 1918 incarnated this idea in a third university mission called *extension*, which consisted in committing the university to the work for bettering the quality of life of those left behind in very unequal and fragmented societies.

In the developed part of the world there has been a growing attention on *the entrepreneurial university* that is engaged in national and local problem solving – often with a short run focus on market-oriented interaction with industry. In this paper we will build upon the alternative idea of establishing *the developmental university.*[4] (Arocena and Sutz,2005a) The developmental university, as we define it here, is open and interacts with different groups in society, including industrialists but it is not operating according to the logic of making profit. Its major aim is to contribute to social and economic development while at the same time safeguarding a certain degree of autonomy.

While globalization processes make universities more 'universal' – they become more involved in global networks and exposed to global performance criteria such as frequency of international publications - the pressure on them to contribute to the society that feeds them is thus growing. It is therefore important to ask what tasks that universities in developing countries could and should fulfill. To answer this question we need to see universities as parts of the overall innovation system. Seen in this light it becomes clear that a *differentiation of functions* at different levels of the system may be the most adequate response to the complex challenges that universities in the South are confronted with today. There is a need to differentiate functions between universities and other knowledge institutions, as well as between and within universities. This is a promising way to respond to the contradictory requirements that universities are confronted with in the current era.

In the *'developmental university system'* some universities may become hubs in a global knowledge network while others might become hubs in national and regional developmental networks with a stronger emphasis on problem orientation both in research and education. To organize universities, including their mutual networking and interaction, so that they contribute to economic and social development is, following this logic, a difficult task. It will often call for radical reform in the basic functions of education and research as well as in the interface with external users of knowledge. Therefore the current debate, where the focus is almost exclusively upon reforms aiming at the commercialization of new discoveries, is misleading.

It is worth stressing some key characteristics that universities should foster in order to enhance a "developmental university system". First of all, higher education needs to contribute to general competences. One of the most important insights from innovation research is that the *innovation process is interactive* (Christensen and Lundvall 2004). Transforming a new idea into a marketable product involves teamwork and inter-organizational interaction with customers and knowledge institutions. In a context of accelerating change, general skills that support learning become increasingly important. What matters for the performance of a graduate is a combination of professional and specialized knowledge acquired through reading books and following lectures and a set of so called *general skills*, and especially the capacity to communicate, cooperate and interact with others, however different the cultural environment of "the others" might be.

Related to this appears the issue of how to perform it. Three aspects emerge here, one pointing to how to teach and to involve students in research at an early stage; the other

[4] This term was proposed, referring specifically to Africa, by Coleman, J. (1994).

pointing to the kind of cognitive directions best suited to achieve that aim; the last one referring to how to assess quality in such a wider context of reference for higher education. The first aspect has to do with preparing students to use the theory and methods in a real life context and to replicate the kind of learning that is required in a future professional life, where most learning takes place through problem solving, often in a context of collaboration with others with a different background. *Problem-based learning and combining theoretical work with periods of practical work is an obvious response.* The second aspect, present somehow everywhere but especially in developing countries, is the lack of relevance of the substance seen in relation to the concrete context in which students live. *Research focused on domestic problems attempting to adopt research methods and tools to the local context may be helpful to develop more relevant teaching material.*

The third issue implies that we need a concept and indicators of 'quality' with several dimensions when we evaluate education outcomes. PISA-tests in mathematics, physics and language capabilities need to be combined with tests of 'interactive capabilities'. A high level of the first type of capability is of limited value for innovation if the level for the second type is low. *A principal task for higher education is to contribute to general skills supporting an interaction with others resulting in innovation.*

Table 9 summarizes what we see as the most important features of developmental university systems:

Table 9 Features of a Developmental University System

Main features of a Developmental University System	**Main goal**	**Aspects related to the goal**
Generalization of lifelong advanced education	To redress the "enrolment gap"	a) How universities cooperate with other organisms to set a wide and diversified system of tertiary education that offers learning possibilities to the majority of the population; b) What efforts are being made, at practical and theoretical levels, to cope with the fundamental challenge, posed by life-long education, of offering advanced education to people of different ages and backgrounds; c) To what extent tertiary education employs the human and material resources available in the best sites of socially useful production.
Research related with development imperatives (for an example see Box xx)	To help orienting the university research agenda towards social inclusion concerns	a) How is the academic reward system operating both for students and for faculty; does it take into account efforts directed to get intimately in touch with social needs? b) How is the university system operating as information gathering and "midwife" for the development of socially

An expanded notion of extension	To foster student involvement in the solution of social and productive problems	inclusive research and technology design? c) Are extensions efforts well integrated with teaching and research? d) Are interactions with society as a whole correctly implemented? Are the specificities of different social actors taken correctly into account, business firms, vulnerable population, public hospitals, etc.? e) Problem Based Learning is an example of how teaching can foster the acquaintance of students with social and productive problems of the region where the university is located. Is PBL being developed to some extent as a main tool to relate teaching and extension? f) Are research in all areas of knowledge given sufficient attention, particularly in social sciences and the humanities?

Source: Based on Arocena and Sutz, 2007.

In recent words by Alice Amsden:

Economic development thus has two approaches. One, which supposedly is applicable to rich and poor countries alike, recommends free markets to maximize efficiency. The greater efficiency is, the greater development is. The other, a less formal body of thought, likens development to learning technological capabilities and getting institutions to work, including markets – themselves an institution. The better the institutional system in place, the faster the development. To break the chains of comparative advantage that for centuries bound them to mining minerals and manufacturing miniature dolls, developing countries must again be free to choose their own model. If this argument is right, and if giants fan out to the earth's four corners, the world will again tip toward the learning mode (Amsden, 2007: 163).

Such learning mode needs to be flexible, and paramount for it success in developmental terms is to avoid the "one size fits all" and to take the context carefully into account. A developmental university system can be seen as one in which the fostering of the learning mode, inside and outside the cloister, is given great importance. Respect for what different people know is a mark of such systems; the commitment to fight social exclusion with all its intellectual might is another. *Developmental university systems need to be conceived as tools for development, but they should not be restricted to developing countries.* In the troubled world of today, where the unspoken promise of knowledge and innovation for a better world for all has not (yet) been fulfilled, developmental university systems bear challenges and promises on a global scale.

9. Summary and conclusions

In this paper we have shown that the volume of activities (both education and research) at universities has been growing rapidly over the last couple of decades, especially in developing countries. This has not however eliminated the enrolment gap between the rich countries and the poor ones.

Universities in developing countries operate under very different circumstances than those in the developed world both on the supply and the demand side. On the supply side resources are scarce and often they are of low quality or badly adapted to the developmental context. On the demand side stagnation in innovation limits the effective demand for knowledge and

competence. Nonetheless some of the major issues dominating the domestic debates seem to overlap between more or less developed countries and even across differences in socio-economic systems. In all countries a major concern is the finance of activities and in many countries there is concern both about the quality of education and the linkages to the rest of society, including the business sector. This substantial overlap may to some degree reflect that developing countries adopt elements from a global discourse governed by international organizations such as OECD, the World Bank and Unesco.

Universities in developing countries are particularly vulnerable to current trends toward privatization of higher education that threaten the quality of training and to internationalization that may undermine the capacity to mobilize university systems for national developmental purposes. In certain developing countries and regions brain drain and high unemployment among graduates is a serious problem.

In a developing economy the problem with mobilizing resources for higher education and research may thus reflect the weak demand for knowledge and competence in industry and in other sectors of society. To understand how demand can be stimulated directly, for instance through *government initiatives to stimulate demand for 'first graduate hired'* in the firm, or indirectly by promoting innovation in the business sector is a major challenge for policy makers. While graduates contribute to innovation they will do so most successfully in a context where there is ongoing technical and organizational change.

The legitimate concern about the need to mobilize all national resources to support economic development has taken specific form in proposals to establish university-industry linkages (UILs) and in proposals that universities should produce proprietary knowledge to be sold in the market. In this paper we think that the focus on UIL and IPRs is to narrow and rooted in a biased and narrow understanding both of the knowledge society and the national innovation system. When it is realized that almost all knowledge relevant for innovation have tacit as well as codified elements it becomes obvious that the flow of graduates into industry is the most powerful mechanisms through which knowledge creation at universities can contribute to innovation in business.

On this basis we have pointed to a broader perspective on innovation systems than the one indicated by triple-helix perspectives and to the need to understand how science-based learning may be linked to and complement experience-based learning. It implies that university systems and not least higher education need to organize an interaction between academic teaching on the one hand and practical experience and formation of general skills among students. We have indicated that we see diversified 'developmental university' system as a possible response to the contradictory demands confronting universities in the current era. Such systems combine a capacity to respond in the short term to the needs of users with some degree of autonomy and long term commitment. They also aim at promoting innovation in such a way that it can be combined with social and global equality and justice.

After more than twenty years of a "mono-economy dominating thinking", as Hirschman would put it, the following of new exploratory roads have some chances of becoming legitimized. What was presented as bad behavior is now to some extent critically revisited, as well as what was indicated as the right path to follow. In particular, learning, with all its complexity, with the need to provide for studying and at the same time the need to provide for opportunities to apply creatively what has been learnt, is receiving a closer scrutiny. The state and its role in innovation through public procurement, an outspoken anathema a few years ago, is repositioned as an important developmental tool. (Rolfstam, 2008; Edler and Georghiou, 2007)

Promoting research in order to cooperate with development can be highly rewarding both in intellectual terms and in social terms. The conjecture that Developmental Universities may exist, as communities with some shared values and a specific role in society, is partly based on another conjecture: that many researchers really want to be as socially useful as possible. Studies of academic Diasporas have shown that the motives for returning to their home country for people able to get a very good university position abroad often relate to a feeling of social usefulness. Such a feeling is also valuable for university people that work in the hard conditions of developing countries. Social usefulness, though, is not only related to individual will but to the institutional building of conditions that allow people to put their knowledge at the service of social goals. This is a main justification as well as a major challenge for Developmental Universities. We actually see the formation and the flourishing of the Globelics community as an important indication that commitment and solidarity among university people may be global rather than national or local.

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