Research and Research-Training Systems: Towards a Typology

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Introduction.

At the Experts' Meeting, held at UNESCO Headquarters in June 2001, the bases of the Forum on Higher Education, Research and Knowledge were laid down and proposals made for a future programme of work. From a substantive point of view, considerable progress was achieved, therefore. A number of regional case studies were presented with the purpose of identifying the status, structures, methods of steering, performance, output and general underlying dynamic within the various national R&D systems present within their respective regions. The results of this Meeting have been reported in the quarterly journal of the International Association of Universities, Higher Education Policy vol.14. No.3 September 2001.

From a methodological standpoint, the accounts presented brought very different disciplinary perspectives to bear on the central issue – namely, the development of research and research training systems as a point of intervention for policies of national capacity-building. Some examined them from the standpoint of the Sociology of Knowledge, others from the perspective of Science and Technology Policy, whilst a third strand analysed the current state of play from what a broadly managerial viewpoint. Such variation is both natural – given the topic - and very certainly desirable since each perspective brings a very real complementarity to the others. Such an approach opens the way up for a high level of synergy and constructive working together between the different services within UNESCO. It also allows the Forum to draw upon a very broad range of expertise, interests and experience which have accumulated over the years in the different Inter and Non Governmental Organisations, which represent the various interests of higher education - regional, disciplinary, administrative, linguistic or leadership. Or, alternatively they have a long-term interest in higher education as an instrument of policy, whether economic, social or cultural.

The conclusion (Braddock & Neave, 2002) brought out a number of common features and characteristics across regional research systems that could be construed as points of blockage in the push towards the development of research as a vehicle for capacity building. Within this general setting, the purpose of this exploratory typology is:

- To permit a greater level of disaggregation in our future work on both research and research training systems.
- To permit a systematic comparison between different research and research training systems at the national level.
- To provide a coherent framework for the gathering of data appropriate to increasing our understanding of the current workings of research and research training systems at the national level.
- If possible, to suggest a developmental path, trajectory or dynamic development as a means of situating individual national research systems along it.
- Finally, to provide a common basis grounded in what is the current profile of individual research systems on which the work programme of the Forum may develop.

The Uses of Typologies.

Typologies have many uses, the prime of which is heuristic. Essentially, typologies are a means of summarising complex data into a parsimonious form – often graphic - in a way that allows comparison across a large number of different units. Broadly speaking they may

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fall into two broad categories – ideal type and 'grounded'. Though both aspects are present in all typologies, the difference between the two resides in the purpose they may serve. The former may act as a 'prospective instrument' inasmuch as its general purpose is to set out the desirable condition towards which the object under analysis ought to move. In other words, the purpose of an ideal type is first, to set a target and then to ascertain the extent to which individual cases approach, or alternatively, are moving away from the desired End State. By the same token, it may also give us further insight into the various theoretical pathways along which different units – in this case national research systems and research training systems – may move to attain the goal specified. By contrast, the 'grounded typology,' as its name implies, builds out from the current 'state of play' in which the object under analysis finds itself. Its purpose focuses less upon the distance or proximity that have yet to be overcome for the 'ideal condition' to be achieved so much as the variety, divergence and difference that are to be found across the different units as they are at a broadly similar moment. The 'grounded typology' may give us insight into the developmental trajectory of the individual units. It main purpose however is not to be 'prospective' so much as to explore the status of individual units as they now are and to plot them along a series of comparable dimensions, features or characteristics. The grounded typology is then an 'explorative' instrument.

The typology which is developed in this paper falls clearly into the second category. Its purpose is to advance the work of the Forum on Higher Education, Research and Knowledge by providing it with a means of further "sensitisation" to the differences of condition within individual national research and research training systems. This may be justified on the common sense grounds that whilst the task of building up research capacity through better management is one point of departure of the future work the Forum will undertake, it is highly unlikely that this objective can be applied in a homogeneous manner. Moreover, it is equally unlikely that developing a research management capacity will itself be a homogenous task. On the contrary, it is likely to entail considerable variation in keeping with national context and the condition of both the research training and research systems on which it is brought to bear.

We need then to disaggregate down from the regional setting to the individual research and advanced research-training systems as they currently exist at national level. We may subsequently build back to the regional level in formulating recommendations, proposals and overall strategy. Such recommendations, as well as the strategy for bringing them about, may be more robust if grounded firmly upon the known current status of individual national systems. If, in law, 'circumstances alter cases' so in higher education policy, contexts are distressingly apt to alter strategy.

Changing Perspectives on and in, Higher Education.

Before entering into the details of the typology, a number of riders should be born in mind. The first is the particular perspective from which the typology is developed. The study of higher education is an exceedingly eclectic field. A recent estimate [Becher, 1998] points to some 20 or more perspectives, ranging from Anthropology through to Women's Studies *en passant par* Public Administration, Economics, Sociology and Politics, all of which contribute to scholarly enquiry in this domain. Such variety is also present in the Forum and for this reason it is well, as far as possible, to take such a broad range of perspectives into account. A further development, underlined in many of the regional studies, involved the rapid extension of the research function to the private sector. This trend is growing, very particularly in those areas that constitute the cutting edge of present-day technology and are themselves part of the transition towards the Knowledge Economy, amongst them medicine, pharmacology, bio-technology, biology and information and communications technologies. All of them are heavily research driven. It is an important trend since it entails what many regard as ending the monopoly the university exercised over fundamental research and the dispersion of the research function into other sectors of the economy.

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This is a complex process, involving as it does the permeation and breaking down within the university of that traditional form of organisation by which knowledge, its generation, transmission and its conservation were brought together around coherent and cognate areas called disciplines. Since 'disciplines' are the basic units around which the university is organised, academic careers are built, individual fortunes, performance, repute and reward are conferred and acknowledged, clearly this change is of the utmost importance. It is crucial as much to the individual members of the academic estate as it is to the individual university. If excellence and standing are the 'gold coin' of the university world, [Clark, 1983] then it is not exaggerated to say that the 'disciplines' are the Mint where the prime currency of academia and its public creditworthiness are smelted and struck.

Though the exact dimensions of this process – often alluded to as the transition from Mode One in the organisation of academic work towards Mode Two – [Gibbons, Trow, Nowotny, Limoges & Scott, 1994] have yet to be empirically verified, it is nevertheless held to be a strategic development of the highest importance. The breaking down of disciplinary boundaries, the emergence of research networks that reach out beyond the confines of the individual discipline – inter or transdisciplinarity – and beyond the individual institution, make research a prime vehicle in the creation of what some scholars characterise as the 'Network Society' [Castells, 1998] Most assuredly, the expansion of 'the Network Society' may be advanced by deft policies of research management. However, the forces that drive these trends are deeply rooted within the intellectual dynamic of research and enquiry itself. They emerge in the continual fragmentation, hiving off and re-coalescence of sub-fields and domains within and across faculties. [Clark, 1994] Moreover, this re-alignment and re-configuration within and across long-established categories of knowledge has accelerated – and continues to accelerate - as the means of communicating, disseminating and producing such knowledge achieve greater levels of technical sophistication, capacity, intensity and efficiency. Thus the knowledge economy is driven on under the dual impulse of the communications revolution and the advance in both fundamental knowledge and its application.

The significance of this development has been explored in the first round of papers presented to the Forum. It was seen as a pointer to the degree of 'maturity' attained by research systems [Nabeh, 2002] and, (more by inference than by direct statement,)as an absence of maturity or stagnation in those where it stands in default. Mode Two was applied as an explanatory device. There are few indications as to how the transition from Mode One to Mode Two is effected. Nor were any examples provided of organisational forms which may be said to correspond to it, though the presence of cross or multi-disciplinary project or research teams appears to be one of the prior conditions to its emerging. Still, if we assume that Mode Two forms of academic work – and research in particular – are an essential feature in the evolution of research capacity amongst those systems reckoned to be at the 'cutting edge', then it may also provide us with a species of operational benchmark – an ideal type objective, to revert to the discussion above – against which to plot the position of individual systems.

Higher Education and Research Training Systems.

There remains one final rider to be added. Though the research function in the advanced economies of the North is moving very rapidly beyond the groves of academe, it remains a fact that, by and large, higher education still retains its monopoly over research training. That it does so is one of the reasons why higher education also retains its strategic centrality in the Knowledge Economy just as it did for its predecessor, the advanced industrial economy. From this it follows that any strategy which seeks to enhance a nation's research capacity has first of all to turn its attention to that part of the research system which involves the conversion of graduates into qualified and capable researchers. There is little point in devising ways to make research more relevant, more in line with national requirements and priorities and perhaps even more cost efficient, if there are no researchers to manage or if the ability of the research system to draw the Nation's talented young people towards this calling is devastatingly feeble or non existent. Management without an appropriately qualified – and continually renewed - body of researchers is little more than an exercise in re-arranging the symbolic and a further stage in what has been alluded to

unkindly as 'administrative bloat'.

Research management involves the 'optimising of human resources' or the optimising of investment in human capital. Arguably, the task applies equally well to the process of adding value to that capital. This is what advanced research training systems effectively do. They undertake that initial investment which converts the graduate student into the young qualified researcher. However, researcher training is essentially pedagogic, about learning and the acquisition of techniques, methods and the induction into those intellectual values and special mind-set that rule the particular domain of inquiry where the future researcher will exercise his – or her – talents. That the first round of presentations developed perspectives which deliberately left aside the 'educational dimension' is doubtless one explanation for the fact that only passing attention was made to the research-training system as such. The meeting concentrated on the management of research systems, though certainly mention was made of training programmes. These, however, were designed more to instil management skills into academic staff than aimed at the system of initial induction into research itself [Benneh, 2002]

Yet, the elaboration of research management strategies that focus only on research without attending to research training – that is, the inflow into the research system *stricto sensu* – are at best involve only a tactical reform rather than a strategic innovation. They attend to the immediate situation rather than to its outcome in the long or the medium term. If we are to attend to the build up of research capacity over time, then it is self-evident that not only ought we to attend both to improving current managerial practices and operations. We ought, at the same time, to attend to the very central issues that arise and are present precisely in that area of the research system where capacity for research is created and new blood injected. For these reasons, this analysis will not extend to the research system broadly defined. Rather it will focus on that part of it which exists within the framework of higher education and very particularly upon that sub sector of the research system located within higher education which is concerned with advanced graduate training. It is, however, useful to recall the broad lines that identify what might be termed the 'generic' varieties of research systems in which the advanced training sub system is set.

Research Systems: models and types.

Though research **training** systems have their being in higher education where their concentration serves to set apart the Nation's leading establishments – research universities – from the remainder of tertiary education, the research systems which they supply, show considerable variety and there are many ways they may be classified. [Clark, 1993; Bartelse, 1998] One way of classifying research systems employed in the literature on higher education systems, though not necessarily endorsed by the literature on Science Policy or Technology Policy, turns around the relationship and the degree of organisational separation from the higher education system itself. Seen from a purely empirical standpoint, research systems until relatively recently, followed three main variations. These may be illustrated by referring to the Soviet, the French and the American models, respectively

- those where research is carried out in the appropriate national academy, effectively separate from the higher education system, with its own budget and in institutes directly affiliated to it. Such a pattern existed in the Soviet Union and its satellites and has been undergoing root and branch revision, designed in the main, to relocate the research function back into the universities. [Rabkin, 1998] It is a centrally controlled and segmented research system – segmented in the sense that fundamental research was sited in institutions, separate from the university and financed by a money stream that flowed direct from the appropriate academies. We will call this the State co-ordinated research model.

- those where research is organised around a central national agency, funded by the national budget and carried out in operational research units, recognised and directly funded by the central agency, though often such operational research units are physically located in universities. Research staff are employees of the national agency, have a statute and conditions of service different from university faculty and whilst they undertake

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teaching, formally, they are researchers full time. The French model of research organisation, revolving around the Central National de la Recherche Scientifique (CNRS) is an example of such an arrangement. (Neave & Edelstein, 1993) It is best qualified as a system running in parallel to higher education. Research is organisationally separate from research training. This we will call the parallel model of research system.

- those where research is funded from multiple sources, public as well as private and through a mixed system of direct governmental funding to universities, by project based grants from Federal Research Councils, National Academies, sub-national region or municipal authorities and private foundations. The majority of the Operational Research Units, as too their staff, are located in universities. Research staff are employed by the individual university and, as faculty members, have the formal responsibility to teach. This profile, best seen in the USA, is a mixed, multi-source system in which research and research training coexist in the same institution. The admixture of public and private financing as too its multiple ties with the private sector place this type of research system fairly in the realm of being market driven.

From these three archetypes alone, it is clear that research systems display considerable variation and difference in the organisational distance between the research system defined stricto sensu and the research training system that feeds into it. And whilst the Soviet model, as one would expect, is an arrangement whose time is past, it is nevertheless a useful construct inasmuch as it demonstrates the degree to which it is possible to separate almost entirely, the research system from the research training system. One should, however, note that current developments, above all in the Czech Republic and Hungary (Sebkova, 1998, Davas, 1998) involve repatriating the research system back from Academies to the university – that amounts effectively, to foreshortening the organisational separation which hitherto predominated. There is, however, another dimension within these three models and it has to do with the degree of control and co-ordination present in each.

Co-ordination and Control.

Control and co-ordination are, not surprisingly, issues which are both constant in higher education systems and moreover are of extreme sensitivity. Indeed, much of the current policy agenda in higher education turns around shifting the balance between the forces that determine the basic relationship between government, society and higher education. The general thrust of recent reform in Europe has involved both a formal stepping back by the State from the various historic forms of close and detailed government oversight and their replacement by what has variously been termed 'remote steering', by state 'surveillance'. The essential justification for less intervention by central government turned around the need to enhance institutional initiative and more particularly to develop more flexible responses to changes in the labour market and, generally to make higher education more 'market centred'. (Neave & van Vught, 1991) An analysis similar to that carried out for Western Europe was subsequently brought to bear on Latin America, Africa and Asia. (Neave & van Vught, 1994) There, it suggested that whilst the push towards a less interventionist relationship between government and universities was discernible, exceptions were present, notably in Africa.

Such analyses, however, did not focus explicitly on the research function. Rather they concentrated on the overall institutional relationship between State, Academic Oligarchy and the Market, a schema originally developed in the early 1980s by the American sociologist of organisations, Burton Clark. (Clark, 1983) Even so, it is possible to apply this 'triangle of co-ordination' with due revision, to the research function in higher education, though in effect it has rarely, if ever, been applied to this particular setting.

As Clark applied it to higher education generally, the 'triangle of co-ordination' is shaped by three constellations or sets of interests. It is a summary instrument that allows us to answer the question 'What are the forces that co-ordinate a particular system of higher education? What is their relative influence in this particular function?' Clark identified these driving forces in terms of the State, of Academic Oligarchy and finally, the Market. Clearly, the same constellation of interests is also present in, just as it also shapes, the

research system inside higher education. In the research domain, however, this nexus of co-ordination will not necessarily assume an identical configuration as it does, for instance, in higher education generally. There are a number of reasons for this assertion: for example, the relatively powerful influence of Academic Oligarchy when working through disciplinary ties - above all in the various discipline-related National Research Councils and Academies - is in all likelihood more telling in shaping the research domain than it is in the overall shaping of higher education. It is likely to be more telling for the plain and obvious reason that such agencies are the founthead from whence flows the bulk of national research funding. In his original development of this 'classificatory instrument', Clark was at pains to point out that in those systems of higher education where national co-ordination tended by and large, to rest in the hands of senior academics, the locus of their power resided in precisely such agencies. (Clark, 1983. Pp.)

In adapting this schema to the research function, we seek to answer a slightly different question. This question has to do with the policy orientation and the forces that drive the research system. To do this, we redraw the triangle around three loci: the State, Academia and the Market and allows us to set the mission or public orientation of the research system against the various modes of co-ordination.

Co-ordination of the research system	Mission/ orientation of research.	Model
State	undertake research as defined in national plans or in relation to government/ministry demands	Explicit State Service.
Academia	To advance knowledge as determined by the internal dynamic of disciplines	Internally driven, presumed Public Service.
Market	To generate advanced knowledge in keeping with direct demands coming from the Economy, more particularly from the private sector.	Explicit Public Service

Self evidently, the influence of the State in shaping the research system in higher education remains indisputable, even in research systems which, in the advanced economies, accord a greater place to market forces. In developing economies, it is likely that the role of the State is even more prominent in the explicit shaping of the research system and its priorities relative to the other two elements of Academia and the Market. However, the location of individual countries within the 'triangle of orientation; of their research systems is very especially necessary since this perspective has yet systematically to be applied.

The influence of 'market forces' in shaping the research system, whether as an objective or as part of an 'on going strategy' of adjusting to the demands of the emerging 'Knowledge Society', its strengthening in both the research domain and in the research training system has been at the heart of national research policies in Western Europe for more than a decade and a half. Under this latter rubric one may group such reforms as the introduction of variations upon the American Graduate School[1] – though very often more closely tied to

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[1] Amongst the specific examples of this general trend one may note the development in France of Écoles doctorales', in the Netherlands of their functional counterparts the 'Onderzoeksschoolen' and in the German Federal Republic of the 'Graduierten Kollegen'. Whilst having some outward similarity in concept to the American Graduate School, they are in point of fact more narrowly defined and tend to be far smaller than their American counterparts. Their common feature lies in their virtually exclusive focus upon researcher training. For a wider discussion see Guy Neave, "Research and the making of frames", in

research training than its American counterpart which also includes professional training (Neave, 2000) – the growth in the numbers of industry-based placement periods for young researchers under training, the opening of the public research system to contracts with private firms – or alternatively, its expansion. And, last but not least, the development of alternative sources of funding outside the usual money streams from public sources.

Whilst the triangle of research orientation and co-ordination allows us to plot the current condition of different research systems along three dimensions, it may also be used as a dynamic instrument. Acting in this mode, it allows us to plot the general **direction** in which individual systems appear to be headed. Or, by using similar data from a previous moment and compared with the situation as it is today, it is possible to ascertain whether any change or progress has been **achieved**. Both perspectives, the projective and the retrospective, may be illustrated by taking the three 'referential' systems mentioned earlier. The figure below has no claim to precision. It is offered simply to show some of the uses to which this instrument may be put.
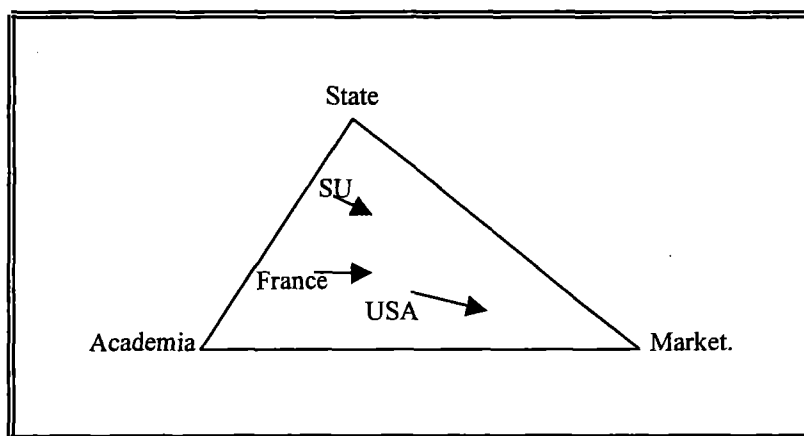

Figure One.
Co-ordination and mission patterns in certain Research Systems:
A dynamic representation. 1990 – 1995

Complexity.

The triangle of co-ordination and mission patterns presents one facet of research systems. There are, not surprisingly, others. They relate to the degree of complexity of the organisational arrangements that come together to form the research system on the one hand and the ways by which it is funded on the other. Whilst the typology separates these two dimensions, in real life they are very obviously closely related. Thus, for example, a highly complex research system serving and supported by multiple agencies, Ministries as well as interests in the private sector will have a correspondingly complex funding system. Furthermore, the issue of size of the research system also enters into the equation as does the length of time an identifiable 'research system' has been in existence for the equally obvious reason that the drive towards complexity is both a function of the multiplying responsibilities research is asked to assume and the ways by which it is organised to take them into account.

Complexity then emerges from the steady build up and differentiation of agencies engaged in commissioning research, intermediary bodies representing the professional expertise of

researchers organised around cognate disciplines and the creation of specific units, Centres and Institutes – some permanent, others task defined and temporary, some located in institutes of higher education, others self-standing. Clearly, this too is a dynamic process and in this sense, the task of capacity building is to accelerate such a dynamic to a pace beyond that which an individual country can achieve acting on its own. If this interpretation of capacity building is accepted, the purpose of this dimension in the typology is to allow us to situate the current organisation of individual research systems along a continuum ranging from the embryonic through to the complex.

Formal responsibility for Research Policy	Embryonic	Simple	Multiple	Complex
	Not specified	Ministry of Education	Shared between different Ministries	Shared between different Ministries
Resourcing	Ad hoc	One main authority	Sectoral Agencies in National Administration	Sectoral Agencies in National Administration, private sector contracts, foundations etc.
Intermediary Bodies	Personal negotiation	Branch in Ministry	Research Councils	Research Councils, Foundations, Firms
Base Units carrying out research.	Ad hoc groupings within university	Permanent project teams organised in Faculties	Centres,Institutes, Permanent research units in Faculties	Centres, Institutes Permanent research units, contract based research teams on cross faculty basis.

Figure Two. Dimensions of Complexity.

Figure Two sets out four stages through which research systems pass as they move along the path towards complexity. These stages are the Embryonic, the Simple, the Multiple and the Complex. For each stage, Figure Two sets out the corresponding shift in both administrative responsibility and organisational elaboration with reference to four dimensions. Those dimensions are operationalised in terms of : first, how far oversight for research policy is formally set down in national legislation and to which agency or Ministry this formal responsibility is attributed; second, how far the general resourcing of research figures in the national budget and whether, on balance such resourcing comes under the ambit of a single authority or is shared amongst a number of sectoral agencies; third, the development of bodies responsible for negotiating support for, and operationalising research priorities with the appropriate Ministry and those responsible for carrying out the substantive aspect of research; finally, the drive to complexity reflected in the changing status of the basic units which 'do research'.

For sake of clarity, the attendant characteristic of each dimension in the four stages is presented as discrete. In point of fact, each discrete category accumulates within it the form it had assumed at an earlier stage in the march from simplicity to complexity. It inherits the earlier form even as it embraces the new procedure. Research systems like universities reach complexity less by radical change – though its absence is never guaranteed - so much as by adding new practices to those already in place. Complexity is also accumulation. If we apply this notion, for instance, to the evolution of intermediary bodies, we may readily appreciate that earlier modes of negotiating over substance and support do not disappear as they move beyond the 'simple' research system and are taken over by Research Councils

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in systems characterised by their organisational multiplicity. Around Research Councils, earlier modes and channels of negotiation continue to exist and operate. The Ministry is still here. And personal ties continue. (Mshigeni, 1992] In other words, as the research system moves on towards complexity, it often carries earlier procedures in its wake.

Funding and Financing.

Organisational complexity is the result of a number of forces acting together. Within the 'disciplines', knowledge advances, as was noted earlier, by the splitting aside of sub domains and specialisms, their hiving off and breaking out from the 'parent' discipline, developing particular techniques, lines of approach and, by so doing, forging for themselves a specific and separate intellectual identity. Eventually, they re-coalesce and in doing so, form new and self standing fields. Disciplines once deemed coherent, fragment. It is a process both unpredictable and, despite all that governments may do to channel it, it remains largely uncontrollable, driven as it is by the inner logic of inquiry. [Clark, 1994] But the inner logic of disciplined inquiry does not always correspond to the external logic of public demand and national interest. And, just as the public interest may be perceived differently depending on the domain on which it is brought to bear, so the process of negotiation which is the rational way of reconciling the two, becomes more complex and permanently so. To deal with this condition in turn requires the setting up of new arenas where a balance may be struck between public interest and scholarship. Considerations such as these account for the rise of Research Councils as the crossing point between government and the world of research.

Still, as Figure Two pointed out, resourcing which is not completely coterminous with funding, (it can also embrace human resources) is a basic dimension in shaping the research system. If money is the sinew of war, it is also the thew of research. In this section we turn our attention to the deceptively simple questions: How much is provided? Who provides it? How is it allocated? First we concentrate on the comparative aspect of funding and financing so that individual systems may be set in broader context. Then we focus on funding sources available to the research and research training systems and finally, we examine the different 'money streams', from the standpoint of their potential leverage in raising capacity.

ii.   The Comparative Aspect.

Indicators for comparing higher education expenditure across different countries are a usual part of the statistical information gathered by such bodies as UNESCO, the World Bank and the OECD. They are variously based – either as a percentage of GNP, or as a percentage of overall public expenditure. Whilst such items serve to place the individual system with the overall funding map, they should permit the identification of those with limited resources available, just as they ought to allow the identification of systems where expenditure on research is particularly burdensome. The items which may serve as the basis for comparison are included in Table One.

Comparative Aspect by Country	Higher Education Expenditure as a proportion of GNP
	Higher Education Budget as percentage of Public Expenditure(in Year X)
	Proportion of Higher Education Budget set aside for research in the higher education system (in Year X)
	Proportion of Higher Education Budget set aside for research student scholarships/ study grants.

Table One Indicators of Comparison.

iii. *Providers.*

One of the features accompanying the move of research and research training systems towards complexity is their ability to draw upon multiple sources of funding. Yet, it does not always follow that systems relying on a narrow funding base for that reason risk being in a situation of difficulty. Nevertheless, it is not misplaced to suggest that a major element in raising the capacity of research systems in developing economies as part of a wider strategy in alleviating poverty, lies very precisely in the funding base. And most particularly so, when public expenditure is under severe pressure from other claims upon it, not least of which public health. To know how far research systems and research training systems are dependent on public expenditure or, alternatively have begun to move towards a diversified funding base, often seen as the sine qua non of university innovation (Clark, 1998) we need to know both the source of that funding and have an indication of its contribution relative to government sources. In short, who is paying and how do they contribute to the support of these two components of a nation's current research complex.? The type of data that may provide insight to these questions, is set out in Table II.

	Funding within the Nation		Funding from International Sources	
	Government sources	Private sources	International Agencies	Private Foundations
% of research system expenditure paid by				
% of research training system expenditure paid by				
% of Higher education expenditure paid by				

NB: To sum to 100 across each row.

Table Two: Funding Sources for the Nation's higher education, research training and research systems. (Year X)

In drawing up a profile of the funding sources of the research system, a basic distinction is made between those which lie outside the country and those which the country itself contributes. There are two good reasons for making this division. First, capacity – building implies that one builds on what already exists which is to say, one goes beyond the situation as it is currently. Second, if international funding is a relatively recent development in advanced economies, it has long been part and parcel of higher education in the economies of the South. What proportion of the expenditure incurred by the systems of research and research training comes from international agencies and private foundations?

By including higher education expenditure in general, some indication can be had about the current pattern of support and assistance afforded by different funding sources to the different levels of higher education in a given system. Such data provide an essential basis on which any proposal for capacity building in the research nexus has to be considered.

iv.   Funding as Leverage: a foundation for capacity building.

Earlier it was argued that one of the driving forces towards complexity resided in the rising expectations – above all in the so called 'Age of Globalisation' (van Damme, in press) – that society has of the Knowledge Economy and very especially that part of higher education engaged in creating new knowledge, namely the research complex. Expectations breed new tasks. In their turn, new tasks place a particular premium on the capacity of the research system to adapt itself to meet them.

If one examines higher education policy in Western Europe over the past ten to fifteen years, one feature stands out. That feature is the emphasis governments place on forcing the pace of change and very certainly so in both spheres of the research nexus. Agreed, the strategies employed are not restricted to changes in funding patterns.[2] Even so, redefining the criteria for allocation of funds and indeed, changes to the various 'money streams' which flow from the public purse to the laboratory or research project are very powerful levers indeed in the hands of government. Whilst changes introduced in such systems as the British, Dutch and Swedish entail considerable revision to funding modes and financial allocation, which will be addressed later, their significance lies elsewhere. Changes in funding criteria can fulfil many purposes: to reduce expenditure, to enforce better usage of resources, to tie the research system more closely to those priorities government deems vital to the national interest. In addition, they also contain in varying degrees of explicitness, a very different understanding of the role that research in general and research systems very specifically ought to play in contributing to the wellbeing of society.

The tensions between the technical details of reform as against its consequences upon the ethic and the operational purpose of research, less obvious though they might be in the mature systems of Western Europe, are most assuredly present, though doubtless to a different degree, in most capacity-building exercises. Certainly, one may argue that circumstances alter cases. Capacity-building directed towards complex systems of research and research training is a very different matter from its equivalent applied to their counterparts at an earlier stage in their evolution. What is sauce for the Northern goose is not necessarily sauce for the gander in the South. However, precisely because technical changes to the research funding system may have direct impact on the social and ethical dimensions of research, it is better to be aware of them than not.

iii . b. Two Modes of Funding

At a broad level of generalisation, and working with the wisdom of hindsight, one may argue that two modes of funding exist for both research and research training systems. What might conceivably be seen as the 'historic' mode upheld a very specific view of the place of research in the Nation, of how it was 'driven', and by whom. Such a view underwrote the notion of knowledge as a human right and the obligation to advance it in terms of a 'gift relationship' incumbent upon academia. In return, academia was granted the freedom of inquiry – that is, to pursue knowledge wheresoever it lead without let or hindrance.   The purpose of funding research was facilitatory, that is to say, to allow research to be undertaken and especially that which was held meritorious by those working in the appropriate field. Since research was held to develop in the long term, the funding had a second purpose – namely, to ensure both continuity and stability. Such considerations underpinned the particular weight governments attached to what is termed the first and second 'money streams'.

Succinctly stated, some students of higher education finance distinguish between three 'money streams': the first two derive from public resources, the third from the institution's competitive tendering and sales of its 'services' and derives mainly from the private sector, though not exclusively so. The first 'money stream' funds the institution, its equipment, staff and teaching. The second supports research on a competitive basis and is usually channelled through Research Councils.

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[2] For structural changes in the research training system and its organisation see for instance p.6 above.

The thrust of change to funding patterns, seen from the perspective of these money streams, has been to hold constant, where not to reduce, the first whilst in some cases tying it to institutional performance. In the case of the second stream, reform involved making research funding and the funding of research training more directly dependent on performance and output criteria, elaborated by government and injected through Research Councils. Finally, constraints on the first two streams serve to encourage institutions to seek financial salvation by devoting more effort to generating 'third stream' income.

iii. c. ...and some of their consequences.

What is the upshot of the 'funding revolution'? Certainly, it recognises – just as its emphasises – the centrality of research and the pressing need to increase capacity amongst the mature research systems. But public authorities appear no longer prepared to see research as a human right to which academia is committed. Rather, research is conceived as a service, as a vehicle to ensure income and, whilst not pushing the analogy too far, as a commodity to be hawked about to those who are willing and able to pay for it. Thus, the 'gift relationship' is replaced by the cash nexus; facilitatory ethic of funding by conditionality and contractualisation, the whole accompanied by a degree of reinforced oversight and intervention to 'steer' research and research training which stands in bemusing contrast with the apparent loosening of close oversight at the undergraduate level.. In short, once a 'public good', research is in process of mutating into a 'private benefit'.

We have spent some time in exploring the consequences – be they intended or perverse – of the shifts in funding in complex research systems. We have done so to give us a better purchase over some of the broader issues that lie behind an instrumentality which possesses immense power to determine how institutions behave and perform, as too the ethical price that might have to be paid.

iii.d. Funding Allocation Systems: a typology.

Be that as it may, funding provides leverage. As we have seen, the key to capacity building, at least in the Western European experience, seems to lie there. Obviously, this is not to imply that such an experience is a template. But if one is to have the option of considering what alternatives are most appropriate to raise the capacity of evolving research systems, we need to group the ways in which funding is allocated.

Different ways in which funding is allocated in relation to the three 'money streams' is set out in Table Three below.

	Allocated by	Government	Private sources
1st Money Stream (*Institutional support*)	**In the form of a** Lump sum with research element included Lump sum with research separate. Lump sum with no research element Line item budget with research Line item budget with research separate Line item with no research element.		
2nd Money Stream (*research funding*) competitive by merit.	Research programmes Research projects		
3rd Money Stream (*sale of services*) competitve by tendering.	Contract research. Contract teaching Sale of services		

Table Three.
Typology of Allocation Systems for Higher Education and Research
In the Higher Education System.

Clearly, this schematic representation of allocation systems is not concerned with how much is distributed by each stream so much as how research is supported and under what conditions. Including a research element into the overall budget of an institution to be allocated by internal negotiation has been one of the earliest ways of stimulating the research effort, though the one country which has long practised it – Britain – is now engaged in separating out this 'internal research' item and making it subject to performance evaluation – in other words, bringing it into the arena of public competition.

As the typology shows, streams 2 and 3 also constitute the heart of the competition driven element in the higher education system. And whilst some may care to point out that competition forms the touch stone of capacity building in the North, it may well be that their counterparts in the South, at least in respect of allocation methods, operate on a different basis. If this is so, such a typology should permit us to detect this difference just as it should also enable us to find out which systems are moving towards competitive allocation methods.

Research systems: training, retaining and sustaining.

If we are to build up a nation's research capacity, it is as well to know the state of its current system for training graduates and how it functions, be it ever so vestigial; whom it manages to attract and draw in; how efficient it is in producing trained researchers. In the research training system just as in the research system itself, capacity – in its minimal form – is the ability to carry out three functions:

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v.   To train,
vi.   To retain and
vii. To sustain

talented individuals in their path towards those of the nation's institutions formally engaged in the further generation, application and dissemination of knowledge. The capacity to fulfil all three at the same time is the hallmark of a 'mature' and functional research system.

If we are to build such capacity, clearly we need to know which are the reasonable points of intervention on which policy should focus. [Widstrand, 1992] They are many. Is the size of the research system in place considered adequate for the needs of the country? Is the level of qualification amongst those currently active and employed in it appropriate for current and future priorities? Is the profile of expertise – the subject balance, the disciplinary background – amongst those currently active in that part of the research system, which is located in higher education – in keeping with currently perceived priorities?

Questions such as these force us to consider ways by which mismatch in respect of any one of them may be alleviated at a minimum or eliminated at a maximum. It is, of course, very far from being axiomatic that sure and certain remedy lies wholly and solely in the Research training system. Much depends on the degree of urgency and the rapidity with which research capacity can be raised. And this in turn depends to a large extent on the level of infrastructural investment that has already been undertaken in developing, supporting and equipping the research system itself, just as it also depends on the degree of stability in the financial support a Nation is able to provide its research system.

Nevertheless, irrespective of whether enhancing a country's research capacity is a matter of pressing urgency, as opposed to the merely desirable, whether the undertaking is viewed in the medium or the long term, capacity building without the ability to sustain it is at best illusory and at worst carries an enormous opportunity cost, and very particularly so as the Knowledge Economy advances elsewhere. The ability to sustain the research system rests closely upon the concomitant development of the research **training** system at the same time as we seek, through aligning whatever capacity exists in that part of higher education which has responsibility for knowledge generation with national priorities, to activate that research capacity in the short term. What precisely the measures might be for the immediate strengthening of the research system – as opposed to the research **training** system – we will deal with later. Given the strategic importance the latter has for sustaining capacity building in the former, we will first of all concentrate on those dimensions that determine the viability of the research training system.

Place and Priority of Life Long Learning.

Though the importance of life-long education, *education permanente* and mid-life upskilling is universally recognised as one of the key elements in meeting the changing and largely unpredictable demands of the Knowledge Economy, it could be argued that the situation in developing economies is such that other priorities are more pressing. Furthermore, it should not escape our attention that those systems of higher education where importance is attached to life-long education are, in the main, those where both the research system and research training systems tend to be both mature and complex. In other words, whilst not denying the necessity of life-long learning as a buttress to sustaining national competitivity. From the perspective of their historical development, growth of research systems in advanced economies tends to have preceded the push towards *'formation continue'*, quite apart from the fact that within its specific confines, research is itself a form of life-long learning.

That said, there are other reasons, which justify putting particular emphasis upon the development of the research training system as a priority prior to life long learning - at least in the first instance.

First amongst these is the observation that the updating of high level skills draws more directly on the research training system than upon undergraduate education. From this it

follows that any policy that envisages strengthening research training ought at the same time to strengthen the base upon which life-long learning may later be grounded.

Second, there is the issue of creating an 'awareness' – and thus the demand for – such retraining. And whilst such awareness may certainly form one of the ancillary tasks of undergraduate education, the importance of maintaining the competitive edge amongst the Nation's key resource – human capital - in its path towards the Knowledge Economy, cannot be underestimated.

Third, there is the consideration of what one might term the 'productive trajectory' amongst those moving on from being researchers under training to becoming researchers *tout court*. Leaving aside the question of how many and in what fields a Nation's economy may permit it to recruit and support (another aspect of research sustainability) there are certain fields of enquiry where an individual's best work is often achieved under the age of 35, particularly in such areas as Mathematics and bio technology. Agreed, national priorities may not necessarily lie in these specific domains - above all in economies that seek to rely on the development of research capacity to make the double leap from an economy based on agriculture and the extractive industries into the Knowledge Economy.
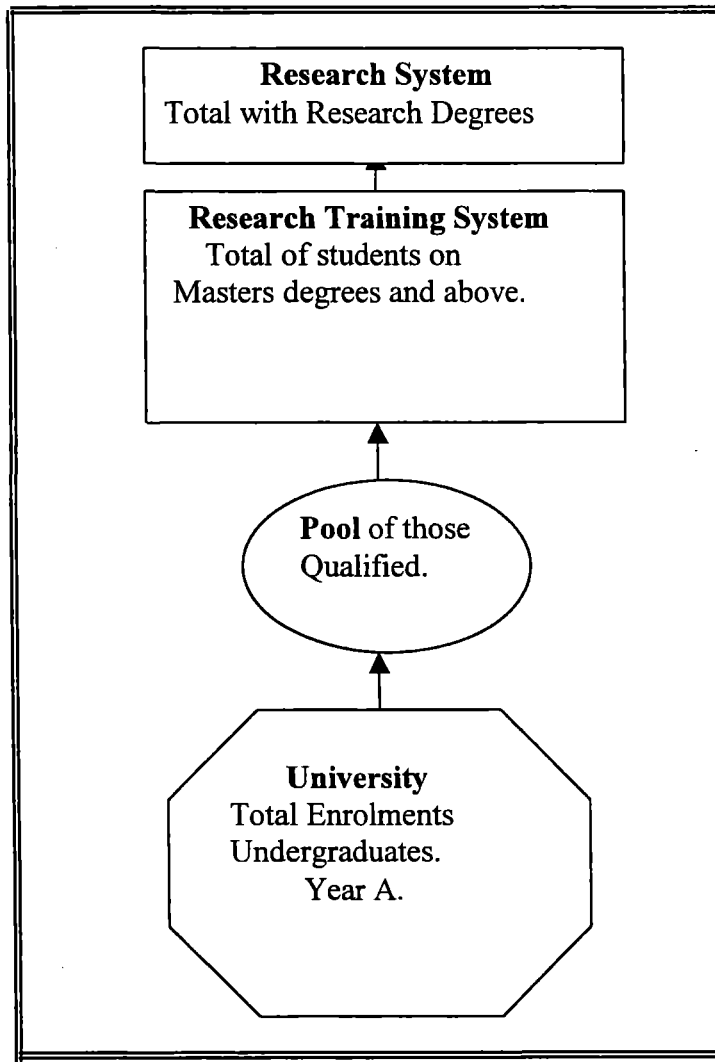
This strategy is held to be one of high promise in alleviating poverty by enhancing and diversifying the nation's economy. However, it involves an unprecedented step. In its essence, such a strategy seeks to by-pass the prior stage of transiting through an advanced industrial economy. It assumes going beyond a developmental trajectory that in the Northern economies both justified the thrust towards mass higher education, forced the pace of change and immeasurably enlarged the pool of young people on which, ultimately, the growth in the research system itself rests. One consequence of mass higher education in the advanced economies has been precisely to bring more young people up to the point where graduate education interfaces with advanced graduate training systems. Effectively, capacity-building for the research system illustrates a basic condition, almost a structural feature of higher education policy in developing economies. That feature is the necessity to carry out in parallel reforms which in advanced economies were achieved successively

Finally, the demographic profile of developing economies, above all in Africa, should be born in mind. The fundamental fact that a very high proportion of the population in developing countries is under the age of 18 years means that the greatest reserves of talent lie in these age groups. Such a consideration serves merely to underline the central and strategic significance of concentrating on reinforcing the research training system.

The Research Training system: aspects of internal efficiency.

Irrespective of whether the Research system itself may be characterised as State directed, as shaped by academia or as driven by market forces, the Research training system is essentially an 'in- put/output' model. To be sure, both structure of degrees, their formal duration as too the formal procedures that individuals have to undergo on their path towards the 'glittering prizes', vary immensely from system to system. In some, the frontiers of the research training system are coterminous with the post graduate arena. In others, the effective point of entry to research training begins after the Master's course or its equivalent. Be that as it may, a basic measure of efficiency is the proportion of those entering who finally emerge with a higher research degree.

Figure Three: Research Training System as Flow Diagram.


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Research System
Total with Research Degrees

Research Training System
Total of students on
Masters degrees and above.

Pool of those
Qualified.

University
Total Enrolments
Undergraduates.
Year A.
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This is a basic indicator and one often held by governments as a measure of the research training system's 'internal efficiency', the result of which have shaped policy in Britain, France and the Netherlands. There is, however, no small difficulty associated with it. For study duration as decreed either by national legislation or by university regulation is one thing. The time effectively taken by students is another. Moreover, 'student time' tends to vary considerably between different fields and disciplines. Thus, for example, the formal time set aside for a PhD in American universities is set at three years. The average time required by History students to attain the PhD is around 7.4 years. In short, though throughput ratios may provide us with a rough and ready means of comparing internal efficiency across research training systems, it is very likely to be an underestimate, above all when the exit point is based on the formal definition of study duration as laid down by legislation or institutional regulations.

External Parameters.

A further aspect that has direct bearing on internal efficiency lies not at the point of output so much as the point of input. To this there are a number of dimensions which have to do with the volume of those admitted, the size of the 'pool of those qualified', how and by

whom, they are selected to pass into the research training system. And, last but not least, whether the numbers that are admitted are determined, all other things being equal, by the individual university in the light of the applicants' suitability. Or, on the contrary, whether the individual university is set a quota by the appropriate national Ministry, Research Council. A final possibility, though it is no more than theoretical pending verification, is that selection for research training is carried out by the appropriate Ministry and is guided, in the main, by national priorities. This procedure may well be present in States where the research system is in its infancy. Or, alternatively, where the provision of higher education is relatively concentrated around one or two establishments in or around the national capital.

i. Determining the 'pool' of future research talent.

The size of the 'pool' of those qualified is an important dimension, not simply as a pointer to the subsequent take up and inflow into the research system. It ought also to allow some indication of the numerical basis on which the research training system may draw. Obviously, the total of those qualified in any one year is at best a crude indication. It may, however, be made more realistic by focussing uniquely on those qualifying in the areas of the natural, exact, engineering and medical sciences on the grounds that it is in these disciplines that the need to expand research capacity in developing countries is at its most pressing. This is not to say that those qualified in the social sciences or humanities are any the less important in modernising the services of government, local administration or the teaching profession, for instance. However, they are unlikely to need research training to do so.

Self evidently, the smaller the number of students in a system of higher education, the smaller the size of the graduate pool on which research training may draw. However, the size of the potential 'pool' on which the research training system rests is directly affected as systems of higher education grow and embark on policies of institutional diversification and stratification.

i.b. System diversification: effects on the 'training system'.

Policies of system diversification have direct repercussions in two ways, depending on the particular strategy for which government opts. Much depends on whether such policies bring undergraduate students into the 'zone of articulation' (Neave, 1993) of the research training system. It depends also on whether qualifications awarded in the non-university sector are recognised as valid to undertake further study and research training. A strategy of diversification that creates a non-university sector where qualifications are 'terminal' – that is, they lead only onto the labour market and their holders are debarred from further study without further 'academic' qualifications - is clearly restrictive. It may increase both the numbers of students graduating and the variety of their qualifications. It contributes in no way to expanding the pool of those qualified for research training. Quite on the contrary, policies based on such a binary principle often have, as their explicit purpose, to 'protect' the 'thin stream of academic excellence' by explicitly diverting students into tracks 'end on' to the labour market, not the research training system. Examples are to be found in the French University Institutes of Technology and, 20 years ago, in the non-university sectors of Belgium (Woitrin, 1992) the Netherlands (Frijhoff, 1992) and Denmark. (Conrad, 1992) Viewed from the perspective of the potential 'pool' on which the research system draws, this variant of diversification restricts, where it does not reduce, the pool's outer limits.

There is, however, another variant within policies of diversification. And whilst it too adds to both the institutional variety and thus to the complexity of the higher education system, its potential lies in the opposite direction – namely to increase the size of the 'pool' of those eligible for research training. This it does by policies of 'systemic integration', by conferring university status upon institutional types hitherto cut off from graduate study. An alternative tactic is to create new curricular pathways, new in content or new in duration, that are sited 'end on' to the research training system. Recent examples of systemic integration in developed economies may be seen in Australia with the creation of the Unified National System of higher education, (Meek and Wood, 1993 check) Britain

with the upgrading of the polytechnics to university status in 1992 and the creation in Sweden of University Colleges in the early 1990's. (Dahllöf & Selander 1996) Amongst those systems of higher education which have recently had recourse to 'bridge-building' across the university- non university divide by constructing cross sector curricular pathways are the Netherlands and Flanders, (van Heffen., Verhoeven & de Wit 1998*) entre autres.*

It is important to distinguish between 'institutional integration' and curricular 'bridge building'. For whilst both have capacity building potential for the research training system, that capacity acts upon the latter in very different ways. Capacity building through strategies of 'system integration' certainly serves to bring more young people up to the point at which they may be eligible for further research training. In that sense systems integration fulfils a quantitative purpose. Curricular bridge building, however, by dint of opening up new curricular pathways reinforces the curricular diversity on which the research training system rests. Though it remains to be seen whether such curricular diversity in turn serves to reinforce the innovative capacity of the research training system, one may argue from a negative point of view by suggesting that the probability of its so being is certainly not reduced.

i.c. System diversification: effects on the research system.

As we have seen, the consequences of strategies of diversification and integration at systems level for capacity building within research training systems are very different in their potential outcomes. They may serve to 'protect' the 'the training of excellence' at the very moment when the higher education system is subject to the agonies of transition in its status from elite to mass. And conversely, they may serve to expand the pool from which 'excellence' is drawn.

There is, however, another dimension and it has implications for capacity building less in the research training system, so much as in the higher education research system. Policies involving 'system integration' often go hand in hand with extending the research system back into the newly elevated institutions. This they do by conferring upon their academic staff the right, obligation or responsibility to undertake research. To be sure, what tends to be involved is more akin to a *de jure* recognition of a situation that has long existed *de facto.* But it is a significant tactic and very far from being wholly symbolic inasmuch as it has the effect of expanding the numbers of those involved on the edges of the research system at the same time as it expands the research training system's student pool. Seen within the particular focus of the range of tactics available in the capacity-builder's tool-box, this simultaneous opening up of both research training and research systems through systems integration is well worth our attention. Relatively inexpensive though such a tactic might be in higher education systems with a well-established infrastructure and fabric, such an advantage is not likely to be available in those where both higher education and a fortiori research systems are relatively embryonic.

i.d Diversification and the private sector in higher education.

The rise of 'private' universities is a marked feature in the current provision of higher education in some developing countries. However, the consequences it may have for capacity building in research and research training systems, are essentially no different from those already examined in the broader context of policies of diversification and integration. From this standpoint, private universities are simply another sector. Account may be taken of their possible contribution to the inflow of students to research training in exactly the same way as public sector universities. Where, however, private sector establishments may differ is in the proportion of their student intake reaching graduation. On a purely intuitive basis, and assuming both better resourcing and equipment and the fact that as students paying for their education they are likely to come from relatively well-off families, it is not unreasonable to suggest their graduation rates may be higher. Whether they are higher in those disciplines usually associated with the transition to a Knowledge Economy, is a point to be elucidated.

ii.   *Cross system comparisons.*

If the volume of students graduating from a particular system of higher education is numerically small – or large for that matter – sheer volume does not allow us to make cross system comparison. What is important in determining capacity and its current condition is the transition from graduate to research student under training. The difficulty that such a statistic poses lies, of course, in explaining the findings. And, moreover, there is the knotty question of datum – that is, the benchmark against which such findings would be set and compared. Two possibilities may be envisaged.

The first would entail trichotomising – that is, dividing different systems into three categories around the percentage transition rate with the cut off point of each category corresponding to one third of the total cases under review. Such an approach ought to allow the identification of those systems with a low, a middle and a high transition rate. Whilst it would certainly allow some distinction to be drawn, such a method would merely allow us to identify the worst off and the best off amongst those already facing difficulties since by definition, the general focus is upon developing research capacity in developing systems of higher education.

A second possibility that could be envisaged is the use of an external datum based on a similar statistic drawn from the higher education system of a developed economy. The advantage of an external 'referent system' would be to show up the general disparity between developed and developing research training systems and their 'drawing capacity' as well as revealing those which are the least fortunate along this dimension. However, caution is needed here. The use of a referential system to provide a datum against which to set a broader context of comparison does not imply that such a referent is either a template or a model for the future development of those systems with which it is compared. The choice of referent system is, not surprisingly, a matter delicate above all.

iii.   *Output and take up.*

Earlier, it was pointed out that raising research capacity turns around enhancing the ability of both the research training an d research systems to retain those qualifying from the former as the prime vehicle for raising the viability of the latter – and sustaining it.   In effect, the analysis of 'transfer 'and 'take up' in respect of the research training system ought to be replicated at the point of articulation between research training system and the research system itself.   Are systems that are efficient in transferring students into the training system also those which are efficient in graduating them? Are those that are weak in bringing students into training also those which are weak in generating qualified output? The implications this has for informing capacity-building strategies are obvious.

Such an analysis, rather than relying on a trichotomisation of qualifying and take up ratios – the former being the percent of those gaining a research degree X years after entering the training system, the latter the proportion of those qualified subsequently taking up post in the public research system – would be more useful if conceived in terms of a dichotomous division.   Dividing national systems into those where the transfer and take up ratio are lower than average and those that are higher, would allow a better purchase on the attendant variables – principally the model of national research system involved.

This method is justified because it may allow us to ascertain whether the capacity of the research system to absorb the qualified output from the research training system is related to the particular way in which the research system itself is organised.   Is take up more efficient in research systems that structurally are largely separated from higher education and under direct governmental control, in those organised in parallel to the research training system or in research systems that are placed 'end on' and sited within higher education?

'Take up ratios', as earlier comments have made plain, form only the initial penetration into the more general *problematique* of capacity building. They have then to be explored

further in order to see under what conditions they appear, relatively speaking, to work in an optimal fashion. And, conversely, those conditions that may account for situations less than optimal. Very particularly, attention ought to be paid to those 'qualified human resources' that are **not** taken up by the research system. In other words, we need to account for 'wastage rates'. We need to do so for the evident reason that such 'wastage' may lie at the heart of the inability to develop research capacity. Alternatively, that one of the blockages in the system as it currently functions, is to be found here. By the same token, 'wastage' also stands as one of the central aspects that ought to be mastered if a nation's research capacity is to reach sustainability. In short, the interface between research training and the research system constitutes one point of intervention and in all probability a highly sensitive one where future strategies of capacity building may be shaped and brought to bear.

iv.   *Wastage Rates: a central issue.*

Accounting for high wastage rates is no easy matter. On the one hand, they may well be explained by the inability of the research system to absorb the outflow from the research training domain. This in turn may be due to the sheer inability of governments in the case of state controlled research systems to recruit, to appoint and in oligarchic systems, to the lack of finances, to rigidities in the ability to reassign – rapidly – such resources as are already available, to other priorities. Or, which comes to much the same thing, that the resources set aside for research are already committed. Impasses such as these are likely to weigh heavily in those research systems where finance is wholly and exclusively provided from the public domain.

Another variant on this particular theme which, within the context of research policy is the equivalent to the phenomenon of 'government failure', well-known to students of Public Administration, is the instability in the research budget itself and indirectly, the desirability of the status of the researcher. It is at this point that we come up against a more fundamental issue and one which has strategic implications of a very high order indeed for the 'connectedness' between research training and the research system. More particularly, it has to do with the research function and its place at the crossing point between national development and the general thrust of that loose, all-pervasive but imprecise *Weltanschaaung* that parades under the flag of 'globalisation'.

Globalisation: a dialectical process.

i. Globalisation as a Threat.

Though both higher education and research systems have hitherto been conceived as part of the overall process of modernising political elites (de Sola Price, 1968) and creating the administrative and economic infrastructure on which the modern State rests, such a purpose is itself undergoing radical reassessment in the light of increasing trans-national flows in financial capital, information – held to be the symbolic capital of the Knowledge Economy – images and people. (Marginson, 2000; McBurnie, 2001) Under this new and powerful perspective – which is also the ideological expression of Neo-Liberalism – the research system is both the main channel by which individual Nations link into the emerging World Order as well as being the prime institution for ensuring its place in the sun – or outer darkness. In fine, the research complex – whether engaged in training or in generating new knowledge – now has two faces like Janus, the old Roman God of Fortune. It serves the condition of national viability on the one hand and also acts as an extension of that World Order reaching down and into the Nation State, on the other. This fundamental duality of purpose – as the internal instrument of modernity and as one channel of penetration of the World Order into developing economies – has direct implications for both for strategies of capacity building and on the possible efficiency of operation in research training and research systems.

Amongst the students of globalisation, with the exception of those who interpret it wholly as the outcome of technological change, (van der Wende, 2002) there is a wide consensus which holds its prime impact as accelerating trends already present before the global perspective emerged in the forefront of intellectual fashion. In higher education, the acceleration of demand is one of the more obvious instances. (van Damme, 2002) Though empirical evidence has yet to be provided in a systematic manner, the possibility cannot be ruled out that globalisation may have a similar effect in accelerating further that phenomenon well-known amongst developing countries – namely, the brain drain. (Higher Ed Pol circa, 1994 China conference)

ii. Brain Drain.

Viewed from the perspective of generating research capacity, the hypothesis that globalisation accelerates brain drain stands as a major threat. It is a threat because globalisation acting upon the process of certification – that is certifying the formal possession and mastery by an individual of a particular field of knowledge – involves extending the 'market' in which such skills may be rewarded, beyond the confines of one's country of origin. Indeed, the higher the level at which an individual is certified, the larger the potential market on which his – or her – knowledge may be employed. Thus, policies that aim to increase say, the output of a country's PhD's – or their functional equivalents – also open up the world market for those individuals so qualified and very especially so in the case of high level manpower qualified in those areas outwith the Social Sciences and Humanities.

iii. Push and Pull Factors and their Consequences.

It remains unclear whether 'wastage' as we have defined it – to wit, those qualified who do not make the transition to the research training system and those who, duly trained, do not find employment in the research system – is the result of what the economists would term 'push' or 'pull' factors. Common sense would suggest that both are present. Amongst the push factors would be the absence of openings, the cost of further study to be born by individuals – which serves to underline the importance of modes of student financing at the research training level – and finally, the possible lack of incentives to enter research or academia. Arguably, one effect of globalisation is to strengthen the 'pull' factors that operate beyond the confines of the Nation: better opportunities for training in well equipped laboratories, higher levels of student support and, depending on the individual's special field, better conditions of employment and reward once qualified Such incentives are not new. The effect of global communications is, however, to make more people aware of them with the possible outcome that such knowledge, now readily available, contributes mightily in creating a sense of relative deprivation amongst potential research trainees and trained researchers in developing countries. [3]

Should such be the situation, then the implications it presents for the research complex are dire indeed. In effect, globalisation working within the general framework of wastage, weakens the links between the two components of the research complex at the same time as it would appear, intuitively, if not to cut the research complex off from its 'reservoir of talent', then at the very least to undermine that articulation. In short, as an element operating beneath the surface of 'wastage' the pull of the market beyond the nation serves increasingly to accentuate the segmentation between the research system and the research training system.

For the notion of relative deprivation see W.G Runciman [1968] **Relative Deprivation and social justice, essays in poverty,** London, Routledge & Kegan Paul.

iv. Globalisation as Opportunity.

Though globalisation may have its threatening aspects that, potentially at least, may serve to weaken small scale and/or embryonic research systems in some developing countries, one cannot entirely ignore the argument that it may equally present unprecedented opportunities for others. Nor does it necessarily follow that those 'lost to the Nation' are necessarily lost to the region as well. Though the 'traffic' within the individual nation of those qualified to undertake research may be unbalanced inasmuch as the outflow from the home training system may be greater than the inflow to the research system from abroad, nevertheless the presence of an inflow at this level ought not to be ignored. Such an inflow emerges in the persons of those individuals, already part of the research system, who gained their qualifications abroad and who have returned to posts in their country of origin. The importance of the return of 'expatriates' as an element contributing to the stock of intellectual capital has been noted by Nabeh in connection with the development of research systems in the Arab region. (Nabeh, 2002)

iv b. Complementarity between research systems and communications technology.

It remains to be seen how far the decision to 'return' is related, if at all, to the conditions present in the 'home research system'. The presence of such individuals, however minimal, casts a very different light on the relationship between research training and research systems acting qua research networks. Though the concept of a network is not particularly precise, nor for that matter particularly new, one consequence of their intensification is to place external research and research training systems in a position of potential complementarity with each other. Thus, resources and specialisms available and developed in one may be made available, through modern communications technology, to another. Indeed, the notion of complementarity lies at the heart of most of the student and researcher exchange schemes put in place over the last decade between the mature systems of the European Union. (van Damme, 2002)

Provided the technical infrastructure is up to the task, there is no reason why, given distance training techniques and the intensification of exchange such technology permits, shortages in say, one field of speciality deemed key to the future viability of a Nation's research system, should not be 'compensated' by drawing on the strengths of neighbouring research and training systems – or for that matter, further field. If 'trans-national education' is a developing feature at the undergraduate level, in principle it ought to have application at the level of the research training system as well.

iv c. Complementarity, the digital divide and the research gap.

Still, other considerations have to be born in mind if complementarity between regionally based research and research training systems or, for that matter inter-regional linkages, is to have the positive impact that many hope. The first of these considerations involves the level of investment needed to bring the communications and information infrastructure up to a level at which such interchange can be sustained. Where are resources to come from? From international funding agencies, aid programmes, from donors, from multi-nationals that lie at the heart of the communications revolution? What is the opportunity cost of investing in the means of communication rather than devoting similar sums to research scholarships, developing new research training programmes or consolidating those already established in key fields? As many have pointed out, the digital divide between North and South is growing. (Rajaoson, in press) So is the gap between the mature research and research training systems in the North and their nascent counterparts in the South.

In truth, the dilemma stands starkly revealed. Can investment in the communications infrastructure help to increase the capacity of the research training system and its output? This option would seem to demand a strategy, which tackles the digital divide as a first priority. The success of such a strategy rests, of course, on the presumption that there will be places available in the research system for the qualified once they emerge from the research training system. In this scenario, putting the communications infrastructure in place has the purpose of strengthening the research training system. Complementarity

serves first to raise the output of the training system. As a strategy, it presumes that such additional capacity will feed into the research system. It is, in point of fact, a bottom up approach and seeks to reinforce the articulation between training system and research system by acting in first instance on the former. The alternative course is no less delicate. Rather than concentrating on expanding the communications infrastructure, the focus of this second scenario is fixed first of all on priming the research system. Its purpose is to put in place those conditions that improve what we have termed 'the drawing power' of the research system. In essence, it is concerned with improving its 'retentive capacity ' as the first step on the path towards a 'sustainable' system of research.

Such choices become more acute when one bears in mind that much of the education developments in distance knowledge diffusion either presume a substantial level of supporting equipment in the receiving system or concentrates on those areas – business studies, economics, administration, management – where investment in equipment poses a minimal burden. Whether distance learning offers an effective solution for increasing the numbers coming through the research training system in areas which demand a heavy investment in equipment remains an open issue.

Conclusion.

This paper set out to provide a series of concepts and some indicators to operationalise them with the purpose of developing a classification of research systems and more particularly their ties with the research training system. To do so, it has drawn on models and indicators, both quantitative and qualitative, some of which are current in the literature on higher education systems, though not necessarily in Science or Technology Policy. Some have been applied to other areas of higher education or to the higher education system overall. These have been modified to provide a better fit to the both components of that part of the research complex, which is located in establishments of higher education.

The development of indicators and categories of classification often passes as a technical exercise. However one may try to embrace such neutrality, the dimensions selected are always based on certain assumptions, not least being the type of society that should emerge from their application. Where the issues posed are unclear or where they may support interpretations that appear to depart from the basic purpose that UNESCO sets upon capacity-building in the research systems of developing countries, we have attempted to set them in context. The fundamental value that nurtures the decision to develop research capacity is one grounded in collective effort and solidarity. This ethic is not always to the fore in the policies and in the trends which result from them in more advanced systems. For this reason and in those instances where the application of an instrumentality may lead in directions other than advancing the common good, we have attempted to establish the context of their development. We have also discussed the tensions that may result from different strategies to deal with them.

In the long run, strategy – and capacity- building in research systems because it is long term – is only as good as the information and the intelligence on which it is founded. This analytic tool is offered by the International Association of Universities with this single, overriding purpose in mind.

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