BENCHMARKING OF RTD POLICIES IN EUROPE: RESEARCH COLLECTIVES AS AN ENTRY POINT FOR RENEWED COMPARATIVE ANALYSES

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ABSTRACT

The paper proposes, following results in science studies, another entry point to the international comparison of RDT policies, focusing on the productive entities in research, that is the research laboratories or collectives. However before going to comparison of performance, account must be taken of the vector of outputs constituting research activities and of the choices made by laboratories as witnessed by their effective activity profiles. This is illustrated by an experiment done on 400 labs in Human genetics in six European countries. It shows that the well known and striking differences between EU nations, in terms of institutional structures and access to resources, do not directly translate into different productive patterns of research collectives, thus emphasizing the self-dynamics of both given organisations and, more important, of their research collectives.

INTRODUCTION

To benchmark research performance at the European level, this paper proposes a dual shift. First it suggests focusing on productive entities. Second, before going to the measurement and de facto evaluation of performance, it advocates the adoption of an intermediary step: the characterisation of the research activities undertaken.

The first section of the paper based on results of science studies argues that the key locus of research performance is a "research collective" (whatever the local denomination —research group or unit, centre, institute or laboratory) which lies between the level of the individual researcher and the research institution. Then the paper describes a study drawing "activity profiles" of such collectives in the field of human genetics in six EU countries. Section 2 demonstrates that traditional identifiers and indicators of input confirm the wide differences known about the national innovation systems. Section 3 shifts from input indicators to the vector of outputs produced by labs along the lines developed by Lar do and Mustar (2000). It demonstrates that labs are not one-off constructions but can be grouped under a limited number of activity profiles . These profiles do not necessarily correspond to the stereotypical images of research labs.

Section 4 then analyses the links between the profiles and the national and institutional embedding of labs. It raises an issue well known in industrial economics: enterprises may share the same output profile (i.e. competing on similar markets and similar user groups) while having very different ways to access and mix inputs. In the field of research, the transformation process and the strategies deployed at the intermediary level of research collectives may play an equal role than other broader factors in the relative positioning of nations.

1- THE ENTRY POINT: RESEARCH COLLECTIVES AND THEIR CHARACTERISATION

Freeman (1987), Lundvall (1988) and Nelson (1993) have promoted the idea that research and innovation practices are heavily related to the institutional setting in which they develop and highly dependant on its past trajectory. National systems of innovation have turned into a major focus of international comparisons and a support to policy thinking and making. In parallel, the new economics of science have put the individual researcher at the core of the dynamics of scientific activities. This dual focus is quite striking when compared to the results arrived at in the sociology and anthropology of science. Neither the individual nor the institution seem representative of the practice of research. It has been one major result of science studies to highlight the collective dimension of science in the making (Callon 1994). We have gone from scientists surrounded by shadows to Laboratory life (Latour and Woolgar, 1979).

Policies towards new research centres have appeared in the US with the Engineering research centres, in Australia with the collaborative research centres programme, in the Netherlands with the top technology institutes, in Sweden with the centres of excellence, and in the UK with the initiatives of the Research Councils to support the establishment of research groups for up to three periods of five years. In other countries, different initiatives have promoted the idea of laboratories without walls (or of poles like in Belgium). In France the research unit (Unit de recherche) progressively became the standard entity, organising activities not only within research institutions but more and more within universities, where teaching departments are no longer the sole locus of research activities. Furthermore, most research units are mixed in two ways: first they are under the shared responsibility of two or more institutions (typically a university and the CNRS), and second they include university *enseignants-chercheurs* as well as full-time researchers from research institutions. Table 1 shows the average composition of labs linked to CNRS: it highlights the extent of the mixing. This phenomenon, which is also encountered in other countries such as Italy and Spain, entails a specific consideration of the entities mediating between the individuals and their institutions, which we propose to call research collectives .

Table 1 — The average composition of research units linked to CNRS
Source: Lar do and Mustar, 2001.

	Number	%
Enseignants-chercheurs (teacher researchers)	14	29
CNRS researchers	9	18
Researchers from other public research institutions	2	4
Ing nieurs de recherche (other research staff with postgraduate degrees)	4	8
Other technical personnel	10	20
Doctoral researchers and Postdoctoral researchers	10	21
Total	49	100

Considering a research collective as the appropriate unit of analysis, the next task is to characterise them in a meaningful way. An image will help in explaining the main hypotheses made: *Research collectives are to science what firms are to the economy, the basic unit of production*. To characterise research enterprises , it is thus not enough to only consider the inputs mobilised (human, technical and financial) as is usually done in quantitative studies on research. One has also to consider outputs. Numerous studies have addressed this issue focusing on articles, with controversial results as demonstrated by Barr (this issue). However science studies have demonstrated that laboratory production is not limited to certified knowledge , it covers a vector of outputs which cannot be summed-up in one quantitative indicator, which would be equivalent to money for firms. Science studies have identified five environments in which labs are or can be simultaneously embedded (see box 1). Involvement in each of them takes different forms and there are recognised markers, which help in measuring involvement and its importance. Aggregating involvement in the different environments (as opposed to summation) builds what we have called activity profiles .

How can such an approach promote inter-country benchmarking? Can it offer a base for mutual learning both for research collectives within different national systems, or for bigger actors such as institutions or public authorities? I propose to inquire these questions using the PSR project (Senker et al, 1999). The three following sections address these questions. Section 2 confirms the huge differences between countries when looking at traditional indicators of input and at average national situations. Section 3 delineates these average situations, showing that they correspond to a limited set of very differentiated activity profiles. Trying to relate these activity profiles with institutions and countries is done in Section 4.

Box 1: The five environments in which research is embedded
Source: Callon et al., 1997.

(i) The ability to exchange with colleagues and to gain credibility in one's own speciality remains whatever the model a central and first dimension: articles are the main channel for certified knowledge ;
(ii) The ability to embody knowledge for taking hold of the tacit dimensions relates to the conditions under which the knowledge created in one place can circulate: Training, and especially the production of PhDs is a major channel for this embodied circulation of knowledge.
(iii) The ability to participate in the creation of new public or collective goods has long been a major driver of research activities. Initially military reasons were more and more superseded by other public issues: prestige in space, national issues such as energy dependency which pushed towards nuclear research and later towards renewable resources, now health, food safety and the environment.

(iv) The involvement in the creation of competitive advantages takes hold of the growing demand for usefulness —whatever terminology it is referred to: valorisation or transfer being the most often cited - and thus gathers all the issues of the relations with economic actors.
(v) The participation in public debate and policy fora is the fifth and growing context. The quite contemptuous and cynical approach to society expressed in wordings like public understanding of science or popularisation has over time been substituted, especially in medical and biological research, by an active public debate on both research issues and research practices (or said otherwise, research ethics). This, in turn, requires renewed investments where expertise is no longer there only for selecting among colleagues the funds to allocate or telling to the powerful what to do in research, but more and more for entering hybrid fora where future activities and conditions of work are at stake, and where they are debated and shaped.

2- LABS IN HUMAN GENETICS: STRONG NATIONAL DIFFERENCES IN COMPOSITION AND INPUTS

Human Genetics was selected for a test case of our method for characterising research collectives because it corresponded to the new trends identified in public research (Gibbons et al, 1994). Through a bibliometric analysis some 1200 labs were identified as being involved in producing articles in Human Genetics in the 6 countries[1]. They were sent a postal questionnaire using traditional indicators of input as well as indicators and descriptors of activities performed. The questionnaire also included questions about the trajectory of the lab and some organisational/managerial aspects. About one third of the labs identified responded. I shall not discuss here the specific methodology developed (for a detailed account, see Lar do and al, 1999) but I will use the results of the analysis of the 392 answers received. In this first part, I shall consider traditional characteristics focusing on human and financial inputs, which, as expected, emphasise national differences and reflect the role of national systems in the shaping of lab resources.

Table 2 — Lab composition: Differences between countries
Source: Lar do and al, 1999 p.33.

Average composition	all	France	Germany	Italy	Spain	Sweden	UK
total senior	5,7	10,5	5,3	3,2	2,8	3,7	10,9
total junior	5,0	4,6	9,2	3,7	2,1	2,2	9,2
total clinicians	1,8	1,0	3,3	0,9	1,0	2,1	2,0
total technicians	4,5	8,1	6,3	2,7	2,3	3,0	4,5
total doctoral students	5,8	6,8	7,6	2,0	3,5	5,7	9,4
total	22,8	31,1	31,8	12,8	11,7	16,7	36,0
% senior/total staff	25%	34%	17%	25%	24%	22%	30%
%research staff in total staff	47%	48%	46%	54%	42%	35%	56%
% full time researchers in senior staff	29%	54%	23%	26%	21%	27%	32%
% permanent staff in research staff	58%	90%	32%	65%			25%

[1] Germany, UK, France, Spain, Italy, and Sweden

Strong differences in lab sizes and composition between countries

The average lab in Human Genetics has 23 people, equally split between senior research staff, junior research staff, technicians and clinicians, and doctoral students (table 2). In the three large countries (UK, France and Germany) the average size is about 30 people and less than 20 in the three smaller countries (Italy, Sweden and Spain). Though they share the same average number of staff, French, British and German labs differ widely in their internal composition. The share of senior staff is double in France and UK as compared with Germany. French Labs have far less junior researchers and far more technicians than their British and German counterparts. Their research staff (PhD students excluded) is mainly permanent, whilst permanent staff is only one third of lab staff in Germany and a quarter in the UK. There are indeed major national differences in the conditions under which labs gather their human capabilities.

Sources of funds

The same is true for funding sources (table 3). Institutional affiliation is not adequate to describe the financial situation of labs since long term core funding represents only 25% of their sources of funds. Labs in Human Genetics have to find the vast majority of their budget from competitive sources. Clearly national funds allocated on a project basis still play the main role (38%), but "other sources" are also prominent (39%). Within these other sources, foundations, charities and patient associations play an outstanding role (16%, featuring in labs sources of funds as often as core funding!). Industry (8%) is more important than EU programmes (6%) and Regional funds (5%). Once more, there are wide differences between national contexts. In France long term core funding is more important (44%) while national funds and foundations share the same relative importance (17% against 15%). Spain relies on national competitive funds (with very limited core funding) and on regional funds. In contrast, foundations have an outstanding role in the UK (35%) completely counterbalancing the weakness of national competitive funds and of regional ones. Foundations also play an important role in Sweden and Italy. Finally, German labs obtain 75% of their budgets through core funding and national funds (with a far more limited role both from regions, foundations and industry).

Table 3 — Lab sources of funding
Source: Lar do and al, 1999 p.38.

Average sources	%	France	Germany	Italy	Spain	Sweden	UK
Long term core funding	25	44	28	18	13	25	27
National funds (project basis)	38	17	47	36	55	35	19
Foundations	16	15	9	25	5	22	35
EU programmes	6	7	6	2	5	5	7
Regional funds	5	4	3	8	10	5	1
Contracts with industry & consultancy	8	12	7	9	8	6	11
other	2	ns	ns	1	3	2	ns
	100	100	100	100	100	100	100

Lab general characteristics: major differences linked to national context

The two central input elements in laboratory life —human and financial resources —cast light on the important differences in the national contexts in which labs operate. The labs' primary institutional affiliations are also very different. Let us consider France and Germany. In France, 80% of labs are linked to government research organisations (GRO). Exclusive affiliations of labs to universities or university hospitals are marginal in France (10%), while they stand at 70% for Germany. These figures must however be looked at more carefully. Germany and France share a similar percentage of labs depending only from GROs (around 20%), while labs located on university campuses and at least affiliated to one university are also similar in number (around two thirds of labs). Our appreciation of institutional differences might thus change when looking at the dual affiliation of labs. Similarly, the diversity of denominations used needs consideration. In France the term Department is seldom used. This reflects longstanding institutional choices: labs, units and teams have long been favoured both within GROs and Universities for organising and supporting research. In Germany, Institutes and Departments are often used while centres and research units are not. Whatever the country preference — research unit in France, Institute in Germany, Department in Sweden—it always remains relative, making up at most 40% of answers. One is then entitled to wonder whether we should assimilate differences in access to different inputs to differences in activities performed.

3- LABS IN HUMAN GENETICS: FOUR MAIN ACTIVITY PROFILES

Following the approach proposed in section 1 (see box 1), we selected for this experiment, four main activity domains entered into —academic production, research training, clinically oriented activities and industrially oriented activities — and considered the degree of involvement of each collective. By doing this, we measured the quantity of activity, leaving quality issues aside. The method followed starts with the investments made by labs in each of the four domains.

Each domain has its own mechanisms to define and qualify involvement: they provide as many markers / indicators of involvement. In most contexts there is not one best way to get involved but numerous channels. Thus, within each of these domains where norms (in the definition proposed by North, 1990) are shared, we could aggregate the different markers and indicators into one global index of involvement, the value of which is not absolute but relative, helping to position individual labs within the set of the 392 labs characterised. The main indicators used for each domain are presented in box 2.

Box 2: Indicators/descriptors used for measuring the degree of involvement of labs in the four domains
Source: Lar do and al, 1999 pp 49-64.

Academic involvement.
The central indicator is publications per research staff (on average 6 over a 3-year period) specified by a complementary academic index . The index is built around 3 sets of descriptors dealing with: (i) network dimensions (importance of co-authored articles, importance given to collaboration), (ii) recognition by

colleagues (award, etc), (iii) involvement in international scientific life (jounral editor, scientific associations) and/or in scientific management (scientific committees, programme committees, etc.). The average is 11 out of a theoretical amount of 30.

Research training involvement.
It is measured using 2 central ratios: the ratio of Ph.D. students to research staff (0.9 on average) and the number of Ph.D. theses delivered in the last three years (0.6 on average).

Industrial involvement.
The index is built using 3 main dimensions: contracts with industry (including consultancy and sales, on average 8%, present in 42% of labs); markers of industrial orientation (patents applied for, development of software and/or instruments, expertise for companies, clinical trials with firms, involvement in start-ups, role of new drugs in lab general activities); and relationships (existence and nature of industry relations, share of articles co-authored with industry, Ph.D. delivered employed in industry). The average is just over 6 out of a theoretical amount of 40.

Clinical involvement.
A similar index (out of 40, average: 10) is built for clinically oriented activities. The 3 dimensions are: clinicians in research staff (2 on average, present in 35% of labs); markers of clinical orientation (development of protocols, of cells/sample banks, of standards; expertise for health policy, epidemiological studies; clinical trials without industry); and relationships (affiliation and/or longstanding links with hospitals, foundations and/or health services, location).

The aggregate results are given in table 4. It clearly shows that, whatever the domain, involvement differs widely between labs. Academic involvement is for instance marginal in one lab out of four which indicates the limitations of analyses focusing only on publications in their ability to describe public-sector research. Relative to our sample, involvement can be considered as marked (regrouping important and strong positions) in almost 40% of cases, whatever dimension is concerned. The two extremes —no marked involvement in any of the domains and marked involvement in at least three domains —represent each a fifth of the total population under study, with the other 60% split quite evenly between the two intermediary positions (one or two important domains). These figures tell the story of the difficulty of being simultaneously importantly or strongly engaged in all four domains. Labs *de facto* make strategic choices.

Table 4 — Types of involvement in the four domains
Source: Lar do and al, 1999 p.78.
Notes: no answer or no treatable answers are considered as no involvement. Marked involvement includes important and strong involvement.

Level of involvement	training	academic	industrial	clinical
Marginal (& none)	26	28	43	16
Secondary	10	13	16	22
Significant	24	21	13	22
Important	22	13	16	17
Strong	18	24	12	22
	100%	100%	100%	100%

Labs and their marked involvement:		number	%
- No marked involvement	86	22%	
- Marked involvement in only 1 domain		129	33%
- Marked involvement in 2 domains		105	27%
- Marked involvement in at least 3 domains		72	18%
		392	100%

For characterising the choices made (formally or informally) by labs, we have analysed their patterns of involvement in the four domains (table 5). This has been done along two lines: (i) we have focused on specialisation , i.e. important or strong involvement. This highlighted a first configuration with no marked involvement of any type (22% of labs). (ii) Traditional dimensions of public research, i.e. training and academic visibility, were considered together and then connected to involvement in socio-economic affairs (i.e. involvement in clinical and/or industrial activities). This simple analysis helped in identifying three other profiles: labs focusing on traditional outputs, thus called scientific only labs (23% of the sample); labs centred on socio-economic relations, thus called socio-economic only labs (22% of the sample); and labs combining involvement in scientific and socio-economic domains, thus their denomination of all embracing labs (33% of the sample).

Table 5 - Activity profiles in Human Genetics
Source: Lar do and al, 1999 p.xiv.

Four main configurations		Labs number	Labs %
Config. 1	Labs with no marked involvement	86	22%
Config. 2	Scientific only labs i.e. with only important and/or strong academic and/or training involvement	91	23%
Config. 3	Socio-economic only labs i.e. with only important and/or strong clinical and/or industrial involvement	85	22%
Config. 4	all embracing labs i.e. with both scientific and socio-economic involvement (important and/or strong)	130	33%
		392	100%

Main indicators used for characterising involvements

Averages	All labs	Config 1	Config 2	Config 3	Config 4
Training involvement					
- ratio students/research staff	0,9	0,3	1,3	0,3	1,3
- ratio PhD/research staff	0,6	0,3	0,8	0,3	0,8
Academic involvement					
- Publication ratio	6,1	2,6	6,6	2,7	9,5
- Complementary index out of 30)	10,8	8,4	10,3	10,4	13,1
Industrial involvement index (out of 40)	6,4	2,7	2,9	8,6	9,9
Clinical involvement index (out of 40)	9,9	5,5	5,7	13,4	13,4

More detailed analysis could be undertaken, for instance differentiating all embracing labs depending upon their clinical or industrial orientation. But it was not felt necessary when looking at the wide differences in the average production patterns of each profile as witnessed by the key indicators of involvement used. In interpreting these results, mention should be made of the findings by Granovetter (1973): if strong ties are determining current strategies, weak ties should be accounted for since they are the main source of potential redeployment or strategic shifts.

Labs without any marked involvement (configuration 1) can be defined as having similar levels of involvement to the weak ties of specialised labs. Their academic involvement (2.7 publications per research staff over a three year period) as well as their training involvement (0.3 doctoral student per research staff) is equal to that of socio-economic only labs (configuration 3), while their clinical and industrial involvement mirror those of scientific only labs (configuration 2). All embracing labs (configuration 4) exhibit stronger involvement than specialised labs in two dimensions (academic & industrial) while the two others stand at similar level. There is a wide difference between weak and strong involvement in all indicators except in the complementary academic index . Involvement is on average four times stronger for research training, three times for publications and industrial activities and 2.5 times for clinical activities. We are witnessing such wide differences that it is not necessary to go into more details for relating back these profiles to more classical features.

4 - EXPLORING THE ROLE OF NATIONAL ARRANGEMENTS IN PUBLIC SECTOR RESEARCH

How do the activity profiles identified relate to institutional and national differences? This fourth section aims at testing the hypothesis that national differences highlighted by institutional and input indicators should be reflected in the relative specialisation of labs, and thus in the mix of activity profiles observed. I shall proceed in three steps. The first step deals with relations between the 4 activity profiles and the ways labs gather their human and financial resources. The second step questions lab trajectories and their circulation between activity profiles. We shall then climb back the ladder from the operational entities to their institutional grounding and their national embedding to consider the influence of national systems.

Do sources of funding play a major role in the orientation of labs? A first well-known issue concerns the role of funds from industry driving labs towards the short term and less risky side of the research agenda. Clearly industry only has an impact on labs with marked socio-economic involvement, but such impact remains limited providing less than 15% of their budget (table 6). The most important source by far remains national funds allocated to projects on a competitive basis (38% on average) along with core funding (25% on average). In all four configurations the aggregate level of these two sources varies only slightly around the average (63%). However, differences exist within the two profiles with no marked socio-economic involvement: academic only labs have far less core funding (18%) than labs with no marked involvement (35%) and far more competitive funds from national sources (48% against 38% on average). Finally it should be noted that Foundations, Charities and Patient Associations (16% of total average budgets) provide almost equal shares to all four configurations. Too simple notions about steering are clearly not at play here!

Table 6 - Average sources of funding of the four activity profiles
Source: Lar do and al, 1999 p.98.
Note: see table 5 for the denomination of configurations.

	Config 1	Config 2	Config 3	Config 4	Average
Long term core funding	**35**	18	28	23	25
National funds (project basis)	33	**48**	36	36	38
EU Programmes	4	9	3	6	6
Regional funds	4	6	5	6	5
Foundations	19	17	15	13	16
Industry	5	2	**12**	**14**	8
	100	100	100	100	100

Are different human resources required for different types of activity profiles?
Average size clearly differs depending upon configurations (table 7). From 13 people in academic only labs to 35 in socio-economic only labs, with the average (23) being shared by the two other configurations (labs with no marked involvement and all embracing labs). These differences are partly due to the process through which configurations were constructed, but only to a very limited extent. In "socio-economic only" labs, clinicians represent around 10% of total staff, thus accounting for less than 20% in the difference between academic only and socio-economic only labs. Doctoral students play an even lesser role in explaining this difference (7%). This is due to the fact that, strong involvement in research training is not related to higher numbers of doctoral students in labs, but relates to lower number of research staff. The average size of the research staff in academic only labs is one third of that in socio-economic only labs (6 against 19).
Thus differences in global size between activity profiles lie first and foremost with the size of the research staff, i.e. professors, lecturers and full time researchers (either permanent or under contract, senior and junior) and have little to do with doctoral students, clinicians or technicians. A central issue is then: how do labs access these research capabilities, and what is the role of their parent organisations in this process? Unfortunately, this conclusion was not anticipated and the questionnaire did not address the issue of the allocation of research staff by institutions. We are then left with this major result and the open issue about the possibly central role of institutions in the staffing of labs.

Table 7 - Average size and composition of the four activity profiles
Source: Lar do and al, 1999 p.94 and 96.
Note: see table 6 for the denomination of configurations.

	Config 1	Config 2	Config 3	Config 4	Average
Senior staff	6,4	3,3	9,2	4,8	5,7
Junior staff	5,0	2,2	9,8	3,8	5,0
Research staff	11,0	5,5	19,0	8,6	10,7
Doctoral students	3,5	4,6	6,0	8,0	5,8
Clinicians	0,4	0,2	4,2	2,2	1,8
Technicians	5,2	2,8	5,3	4,7	4,5
Total Staff	20,7	13,1	34,6	23,5	22,8
Share in total staff of	Config 1	Config 2	Config 3	Config 4	Average
- Doctoral students	17%	42%	17%	34%	25%
- Clinicians	minimal	minimal	12%	9%	8%

Does age matter? How can the relations between the dynamics of labs and their activity profiles be looked upon? Do labs start with no marked configuration and then slowly gain in involvement and recognition, progressively moving towards one and then more activity profiles or possibly towards a balanced coverage of the research domains? The figures do not indicate such trajectories. The average age of all embracing labs is greater than that of academic only labs (13 years against 9), but this is not the case for socio-economic only labs (14 years) and for labs with no marked involvement (13 years). These impressions are reinforced when looking at the age structure within each configuration. The only striking features are that we find significantly less very young labs (less than 5 years old) in all embracing labs, while there are far more old labs (more than 20 years) in socio-economic only labs. Thus we are driven to hypothesise that, as in innovation processes and in the dynamics of technological programmes (Rip, 1997) and for the growth of start-up firms (Mustar, 1997), initial phases are crucial and set labs in trajectories which are then difficult to change.

Do parent-organisations matter? Let us recapitulate where we stand before entering the more complex arena of institutional differences. My understanding of the above mentioned results is the following. Though there are clear differences between countries in the ways to access funds, by and large these differences are not reflected in the four configurations identified. Similarly relations between types of funding sources and activity profiles play only at a secondary level. There also does not seem to be any clearly established relation between age and type of activity profile. This means that, once labs enter into one trajectory, it appears difficult to shift. We would then face a typical case of irreversibility as put forward by analysts of innovation. Organisations when they establish a lab (voluntarily or not) *de facto* play an important role, especially through the allocation of permanent staff. Is there more than this? In our study we did not find any clear evidence of strong organisational impacts, despite including a set of questions about the ways lab relate to their parent institutions (evaluation, modes for allocating core funding, rules for applying for external funds, etc). Our conclusion was that parent organisations pose limited constraints on the behaviour of the labs, and this was a shared attribute between countries and activity profiles. As table 8 shows, there is however a difference between universities and university hospitals, in that hospital labs are more often involved in "socio-economic" activities than labs from universities. The effective location of labs, and the environment that it provides, might then build a third factor impacting upon the specialisation of labs, whatever the regulations at play and the corresponding differences between countries. However these quantitative differences should not hide the significant presence of all configurations in all institutional settings.

Table 8 - Institutional affiliations and activity profiles
Source: Lar do and al, 1999 p.89.
Note: see table 6 for the denomination of configurations.

	config 1	config 2	config 3	config 4	all
University	41	43	25	29	34
University hospital	22	20	45	45	34
GRO	24	24	17	15	20
other	13	13	13	11	12
	100	100	100	100	100

%	config 1	config 2	config 3	config 4	all
All labs	22	23	22	33	100
University	26	29	16	29	100
University hospital	14	14	29	41	100
GRO	27	29	18	26	100

Does nationality matter? Crossing 4 configurations with 6 countries having only 400 entities under study cannot bring but trends when major differences are identified. Table 9 highlights the presence of all types in the six countries. There is even no significant difference between average presence and most configurations. We only witness second order trends: UK and France have a slightly above average presence of the first activity profile with no marked involvement (28-29% against a 22% average). Spain has significantly more academic only labs (32% against 23% on average). Germany and Sweden have far less socio-economic only labs partly compensated for by more than average all embracing labs. Though less marked, it is the contrary for France, Spain, Italy and UK. Does this mean that we should, at least partly, question assumptions, which focus on national differences? The test on labs in Human Genetics, a very specific field indeed, would suggest so, since, once created (including the allocation of research staff), there do not seem to be major differences between countries in favouring one or another of the profiles.

Table 9 - Countries and activity profiles
Source: Lar do and al, 1999 p.88.
Note: see table 5 for the denomination of configurations.

	config 1	config 2	config 3	config 4	total
France	28	16	28	29	100
Germany	23	23	15	40	100
Italy	26	20	34	20	100
Spain	15	32	25	29	100
Sweden	19	21	10	50	100
UK	29	22	25	24	100
All labs	22	23	22	33	100

5- CONCLUSION

In this conclusion, I shall emphasise two aspects of the results arrived at thanks to the experiment done on Human Genetics. One is methodological, linked to the characterisation of research collectives as an entry for the benchmarking of public sector research. The other concerns the hypotheses that can be derived about the benchmarking of national systems of innovation.

The first aspect required to consider the possibility of documenting the activities of research entities, what sociologists of science have called laboratories but on which terminology varies widely (group, unit, department, centre, institute, etc). This issue is important for science policy analysts, especially when they are called upon by policy makers to help in the identification of centres of excellence . The study has shown that:

(i) it was possible to take into account other activities than simply academic production (and corresponding scientometrics);

(ii) this was important since these other activities played a large role in at least half of the labs surveyed;

(iii) one could dissociate involvement in given activities from performance, and characterisation from evaluation;

(iv) this made it possible to complement pre-established standards by a more empirical analysis of the relative involvement of labs surveyed, providing for relative and evolving criteria of involvement; and
(v) this enabled to highlight the de facto strategies of labs through the limited number of areas where they exhibit strong involvement and build up contrasting activity profiles . Characterisation , at least for the operational level of research collectives, offers one alley for comparative analyses and collaborative learning without pre-empting modes of evaluation, and without entering directly in the competitive dimensions entailed by traditional company benchmarking.

The second aspect involves considering whether the well known and striking differences between EU nations, in terms of institutional structures and access to resources, translate into different productive patterns of research collectives. The answer is of course neither fully positive nor fully negative, however it leans towards the latter. There are indications that research collectives, once created, behave as autonomous research enterprises, being flexible enough to adapt to the different national conditions for accessing their means of work (especially funding sources). There are, however, conditions and incentives that push research collectives towards one direction more than another. These lie in the milieu in which research collectives develop (being within a university hospital is different from being on a stand alone research campus), and their trajectories seem to rely heavily, as most innovations and start-up firms created by researchers (Mustar, 1997), on early events (the conditions of creation and especially with regard to their research staff). These conditions correspond less to types of institution or country, than to the ability of given organisations to organise and channel this bottom-up process. Taking hold of the fact that, by and large and for this field, institutions seem to accompany rather than direct, it shows more about the limited strategic capabilities of most existing institutions as a shared attribute than about national differences.

If these conclusions hold, the emphasis on the specificity of national environments should give way to focus on the self-dynamics of both given organisations and, more important, of research collectives. This conclusion is similar to those of analyses of national innovation systems, when they argue for the need for strong enterprises (Nelson, 1993). The transformation process of inputs and the strategies deployed at the intermediary level of research collectives play an equal role than other broader factors in the relative positioning of nations. This does not mean that the ways of pushing strong research collectives might be derived from the conclusions arrived at for firms. Addressing this issue requires however further work to be done, to see whether conclusions arrived at in a field such as Human Genetics can be generalised or whether account must be taken of field differences.

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