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Postgraduate Research Training in France. Policy paper.

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POSTGRADUATE RESEARCH TRAINING IN FRANCE

1. The system of higher education in France

French higher education falls into three segments:

1. the "grandes écoles"
2. the universities
3. the "institutes universitaires de Technologie (IUT)"

About 180 establishments fall into the grandes écoles category. They range different fields of study like engineering, business studies and business administration. Some examples are the Ecole des Hautes Etudes Commerciales, Ecole Polytechnique et Ecole Nationale d'Administration. These establishments are highly specialized and highly selective, drawing from selective grade twelve classes in certain secondary schools. They stand as the elite sector in French higher education.

On the other hand, there are about 76 universities, which are mostly state-controlled and state-financed. Entry to the university is open to all those holding the Baccalauréat, an upper secondary school-leaving examination.

The third sector, the University Institutes of Technology, is composed of some 56 institutes. These institutes are selective and based on a vocational curriculum. They offer fields of study which are not found at universities.

It is clear from this description that the French higher education system is segmented along two dimensions namely the duration of the study course and the degree of selectivity. This brings us to the following division:

1. Long duration (about 5 years) and selective: Grandes écoles
2. Long duration and open (4 years): Universities (except for some disciplines like medicine, dentistry and pharmacy)
3. Short duration (2 years) and selective: IUT's

At universities, higher education is organized into three cycles:

* The first cycle leads, in two years, to the *Diplôme d'études universitaires générales (DEUG).*

* The second cycle also lasts two years, the first leading to the *license*, the second to the *maîtrise*.

Both the first and the second cycle are ofted called 'pre-advanced'[1] training in order to correspond with the British and American systems.

* The third cycle includes:

  - a one year professional cours of study leading to a *diplôme d'études supérieure spécialisées (DESS)*

  or

  - a one-year initiation to research leading to the *diplôme d'études approfondis (DEA).*

From a structural perspective, advanced training begins with admission to the DEA programme. Access to the DEA, which is organized in universities is also open to students with a final diploma of the grandes écoles. In the IUT's, studies lead to the Diplôme Universitaire de Technologie (DUT), which is a terminal degree. If students want to go further, they usually take a first cycle university programme.

2. Postgraduate research training in France.

[1] The terms preadvanced and advanced have been chosen in the text of Neave (1993a) in order to describe the French case. Obviously there are conceptual differences with terminology in other countries.

* Higher education, consisting of two cycles (DEUG, license, Maîtrise), is called the preadvanced level.

* From the DEA on (the third cycle) we speak of advanced level.

What we call "postgraduate research training", begins with the DEA-programme.

As stated above, students who obtained the maîtrise or a final diploma from a grande école, can enter the DEA which is formally conceived as a preparation for the PhD. Third cycle studies are regulated nationwide. The ministerial order of 30 March 1992 defines the conditions of access, the organization and the composition of thesis committees and the conditions to be met in order to earn the doctor's degree (Kouptsov, 1994: 72). In the following chapter we first describe the DEA. Second, we give a brief outline of the organization and financing of the PhD in France. Finally, some problems of the system and the labour market situation of PhD ‘s in France are discussed.

2.1. The DEA

Concerning access, a rigorous policy of selection operates to control the quality of those admitted to the route that eventually may lead to a research career. Selection is made on the basis of the results obtained at the preadvanced level.[2] Not only previous results are important, but also the kind of courses one followed. This requires from students a detailed career-planning, already at the preadvanced level in order to obtain access.

The DEA, which takes 1 year, is devoted to an introduction to research. The programme does not exceed 200 houres per year. The students receive especially theoretical and methodological training as well as an initiation to research techniques. If students succeed in the following tasks, they got a degree:

- presentation of a short thesis;
- success on preparations of reports on theoretical and methodological issues;
- oral examinations evaluating the knowledge in the field.

2.2. The doctoral training after the DEA

[2] A relatively new phenomenon is the existence of "Ecoles doctorales" (Vercruysse, 1995). These schools are meant to offer a multidisciplinary DEA-programme combined with doctoral training programmes. However, in reality these schools did not change the existing system (CSHOB, 1994: 8)

In order to understand the French doctoral training system, we need to make a clear distinction between the period before 1984 and the period after 1984 (Neave, 1993a: 167-168). Therefore we first describe the situation before and since 1984.

2.2.1. An important historical development: the July 5, 1984 act.

Before 1984, there were four doctoral types:

1. The *"Doctorat d'état"*: a nationally recognized diploma, apart from specific fields of study. This was the highest achievement in France and the writing of the dissertation could take 15 to 20 years.
2. The *"Doctorat d'Université"*: this was no nationally recognized diploma and only took about 2 years. Consequently it was bereft of academic gravitas.
3. The *"Doctorat d'Ingenieur"*: this type was reserved for graduates from engineering schools, lasted no longer than 2 years and as the Doctorat d'Université was not nationally recognized.
4. *"Doctorat de Troisième Cycle"*: this was a short-cycle doctorate after the DEA which functionned for many as a preliminary phase to the Doctorat d'Etat.

Training for research was carried out in universities and sanctionned by the award of the third-cycle doctorate. The real initiation into "being a researcher", was the task of the research system. The Doctorat d'état was often defended while employed in one of the research teams. Thus, this duality of doctorates corresponded to a functional duality between advanced training and full-time research systems. Moreover the research system was only partly under the controle of the universities, but especially in physics and exact sciences, came largely under the controle of the CNRS[3]. The following schema presents the situation:

TRAINING FOR RESEARCH	**DOING RESEARCH**

[3] CNRS = Centre National de la Recherche Scientifique. The CNRS embraces research agencies, operating outside the university (but mostly located in universities).
We will discuss the system of CNRS later on in this paper.

Where?	**Degree?**	**Where?**	**Degree?**
Universities	Doctorat de troisième cycle	- Universities -CNRS+other institutes	Doctorat d'Etat

This structure of multiple doctorats was abolished by the law of July 5, 1984. Since then, a single doctoral degree the *"Doctorat unique"* exists in France. This can be earned in three to five years. This degree can possibly be followed by the *"Habilitation"*. This diploma enables promotion to a full university professorship (the ability to supervise research).

This research policy aimed at linking research training with the research system itself and it puts an end to the monopoly over initial research training which historically had been vested in the university (cfr. Doctorat de troisième cycle) (Neave, 1993a: 182-184). The merging of the four doctoral degrees led to an expansion of the horizontal base of advanced education: research teams (mainly CNRS-institutes) had the official responsibility for advanced student training. This reveales the clear intent of the government to extend the institutional base of advanced student training beyond the university. We will discuss the problems of this process later on.

2.2.2. Organization of doctoral training after the DEA.

Research training in France takes place in three different bodies:

1. Universities
2. CNRS-institutes
3. Grandes écoles

This last category is very small and directed toward specific vocational groups. We will not take it into account for the further writing of this text. Almost all research training takes place at universities and CNRS-institutes[4] These institutes are mostly located within a

[4]In some specific disciplines, other institutes than the CNRS can play an important role. Some examples:

- INSERM: Institut National de la Santé Médicale.

- INRA: Institut National de la Recherche Agronomique.

university, but operate independently of universities. Furthermore, there are important differences between disciplines:

* social sciences, language and culture are mainly located into universities
* exact and technical sciences are mainly located into CNRS-institutes

The different settings (institutional and organizational) in which disciplines operate (universities - CNRS) affect the way the individual is inducted into and passed along the path from student to fully fledged researcher (Neave, 1993b: 193-194). Differences and inequalities between disciplines will be discussed later.

The CNRS is organized along horizontal and vertical axes. Horizontally, there are some 49 disciplinary sections, e.g., plasma physics, classical antiquity, etc. The vertical axis brings together a number of interdisciplinary research programmes and unites experts from different specializations, e.g., the environment.

Research agencies linked to the CNRS, can be divided into two groups:

1. Laboratoires propres
2. Laboratoires associés

The "laboratoires propres" are fully integrated in the CNRS, though mostly physically located in the universities. This type of research unit employes a full-time research staff. The “laboratoires associés”, which are far more numerous, are located in universities, engineering schools or specialist institutes. They employ full-time research staff, paid by CNRS, but also university colleagues. Both laboratoires only form a part of institutionalized research in the public sector. There still is a residual group of institutes with less status and not funded by the CNRS. This leads to the following classification in France:

* B1 research units: “laboratoires propres” and “laboratoires associés”
* B1* research units:”laboratoires recommandés” (recognized research units)
* B2 research units: this category covers a lot of unrecognized units with a low status.

Still, these institutes usually work in close partnership with the CNRS and an important amount of their researchers may belong to the CNRS (Reillier, 1995).

Although all universities at the preadvanced level are legally on equal footing, this does not apply to the research system itself. The laboratoires are build up in a formal hierarchy.

2.2.3. Some characteristics of the training after the DEA

As already stated above, the DEA-programme is a formal programme. Students attend specialized courses in theory and methodology and write a small paper. At the end, they have to pass exams. After this year, the training in universities and CNRS institutes has a more informal character (CSHOB, 1994: 8-9; Kouptsov, 1994: 75-76).

Each doctoral candidate conducts research under the supervision and the responsibility of his or her promotor (= learning by doing model). The work can be individual or collective. Students have the opportunity to attend seminars and specialized courses but are not obliged. Training varies between different fields of study. Supervision and training at universities, e.g., within social sciences, literature and culture is rather limited (one promotor often has to supervise 35 students). In the exact sciences and technical sciences in the CNRS-institutes, training and supervision proceed more structured due to the collective work in laboratories.

Training for the Doctorat unique, usually takes 3 to 4 years, but again, duration varies along different fields of study, e.g., students in history often take 6 years to complete their PhD.

This has to do with the nature of the science and the contract. Students in history often work individually with a limited supervision. Moreover, if they work at a university, they have to spend time for educational tasks. Nevertheless, most history students often have a job outside university (e.g., teacher in a secondary school).

The final stage is the presentation of the doctoral thesis. The results of the research are examined by at least two "rapporteurs" who express their opinion in a written report. They are chosen by the head of the institution, but may not belong to the institution attended by the candidate. Besides these rapporteurs, there is also a thesis committee appointed. Participants are chosen for their competence in the subject. The presentation itself is public unless the topic is confidential. After the presentation, the committee decides whether the Doctor's

Degree is awarded or not. The candidate can succeed with the following mentions: *honorable, très honorable, très honorable avec félicitations.*

2.2.4. The doctorate in Medicine, Pharmacy and Odontology

The so-called 'Doctorats d'exercise' (professional doctorates), which are required in order to practice medicine, pharmacy, dental surgery, or veterinary medicine do not require the award of a DEA but take much longer to obtain (Kouptsov, 1994: 77). In Medicine, after about 6 years a State medical diploma is awarded with qualifications in general medicine. The holders of a general practice degree who wish to go into research may prepare a DEA if they have already earned, for instance, a maîtrise in biology or in medical science. Within Pharmacy and Odontology, the same conditions exist.

2.3. Financing doctoral students in France

Higher edcuation in France is a low-cost enterprise. On the one hand enrollment fees are low and other facilities are subsidized. But on the other hand, a system of grants does not exist. Participants in the DEA-programme are fee-paying students. After the DEA, the system is not uniform at all. Again a disciplinary differentiation emerges.

* In the CNRS institutes, one has the statute of a full-time researcher with a contract of a limited period of time (*attachés de recherche*).

* At universities, participants are fee-paying students who have to draw on money from outside the university. There are different possibilities:

- A job outside university
- Money from parents/family
- An appointment as part-time researcher/ teacher at university (*Attaché Temporaire d'Enseignement et de Recherche = ATER*)
- A grant from the Ministère de l'Enseignement Supérieur et de la Recherche (*allocation de recherche*)

A one or two-years contract as an ATER mostly is offered by the universities to students in the last phase of their promotion in order to fill up temporary shortages in the university

lecturers staff. An ‘allocation de recherche’ is given for a period of two to three years. The candidate must apply during his or her year of DEA studies, be less than 25 years old, be a citizen of one of the European Union countries, or have completed an entire programme of studies in France. These students may benefit from a complementary grant when they teach one third of their workloads in the first cycle. This programme is called the monitorat system. In general, the wages for these researchers in training are lower than the wages in industry: an ATER earns about 9000 FFR. a month, an “allocataire” earns 7000 FFR. a month, and the additional grant from the monitorat system comes to 1700 FFR. each month.

An important characteristic of the French system of financial support is the fact that financial means are not paid to the individual but immediately to the programme (laboratory, institute). Consequently the French system is characterised by two levels of competition.

* The institutes/laboratories themselves compete for money
* Within the institute/laboratories the students compete for a grant

Those students who do not obtain the money (about 80%), are entirely committed to their parents or, e.g., a job outside university.

2.4. Problems of the system

What problems have to be faced by the French system? The literature mentions a lot, but we will only briefly discuss those seeming important to us.

First, the new policy in the eigthies concerning research was an important answer to the problem of the organization of the doctoral training. The reprofiling of the structure of the doctoral-level study in France (the merging of four doctoral degrees) came as a specific response to the need to forge closer links between the research system on the one hand and the research training system on the other hand (Neave, 1993a, 167-168). The expansion of the horizontal base of advanced education into the research system itself, seriously undermined the university’s monopoly over advanced education. A fundamental question is what responsibility would remain in the universities.?

Furthermore, the CNRS-institutes exercise a lot of power over the unversity system at the institutional level because about 70% of the CNRS workers are physically located within the universities. Indeed, prestigeous CNRS laboratories located within a university, give extra status to that specific university. Consequently, there is a difference between prestigeous research universities and other universities where research is rather limited.

This situation is crossed by a geographical dimension, namely the distinction drawn by French academics between Paris and the provincial universities. Size and the centre-perifery division are stratifying factors. The universities can be assigned to one of three groupings:

* the larger specialized universities of the Paris region;
* the specialized universities in the provinces;
* the comprehensive universities in the provinces.

The number of research students tends to be greater in the metropolitan area. There is a concentration of money and prestige in the Paris region. But on the other hand, smaller provincial universities are able to offer closer attention and supervision, more pleasant working conditions, and are less crowded and less expensive than the capital. Moreover the professor-student ratio is much better.

Besides size and the centre-perifery dimension, also the disciplinary context is a stratifying factor. We give the example of physics and history (Neave, 1993b).

* Physics, especially fundamental physics is entirely managed by the CNRS. They have a centralized decision making structure and a well organized system of resources.
* In history on the other hand, research is located in the university sector. Resources are poor and there is no clear organizational structure (which is probably a consequence of poor resources).

The paradigm, underpinning the organization of the CNRS, is one derived from the physical and natural sciences, rather than from the social sciences or the humanities. In physics, the greater part of research is financed and carried out under the auspices of the CNRS. History is almost detached from the CNRS and firmly located in the educational structure of the universities.

Linked to this differentiation, is the existence of two types of researchers: the teacher-researcher (e.g., in history) who, as a member of university, is expected to devote time to lecturing, and the professional researcher (e.g., in physics), whose days are taken up with research.
Another dimension, crossing the research training system and the research system, is a social one. Already at the preadvanced level, privileged students attend more grandes écoles instead of universities. Within advanced education, these students are more found within the prestigeous laboratories of the CNRS. Institutional origin of students is a key issue in the hierarchy of the research system.

All these differences naturally exist on the financial level. There is more money available in the prestigious CNRS institutes (see previous classification B1, B1* and B2). The most superior gain funds from the CNRS while the least reputable rely on the crumbs handed out within university. It follows that competition to transform B2 research units into B1* and, eventually to full B1 status is fierce. And, the higher the standing of a unit , the greater the opportunities it has to detach itself from the university (Neave, 1993a: 172).
Moreover, there is a concentration of money and jobs in the Paris region, although recent developments pose a challenge to the overwhelming hegemony of the Paris universities. The rise of high technology industry (e.g., Rhône-valley, Toulouse etc.) has created other specialist poles of excellence to rival the capital (Neave, 1993a).

Finally, the system of competition at two levels (individually and between laboratories) is a problem for the mobility of students. Gratitude to one's patron is not a minor virtue in the French student support system. Before the grant is obtained, students seek to bring themselves to the attention of the director of the laboratory, called "the battle of sponsorship". But this demands time, one has to know the system quite well. But not only this competition obliges the students to immobility. There is another financial aspect: it is less expensive to live at home and to study at one's local university than to move elsewhere and rent rooms (higher education = low cost operation).

2.5. Labour market opportunities of PhD's in France

Generally, PhD's in France are confronted with a growing uncertainty about a permanent job. This situation differs between the disciplines and is partly caused by a process of slow employment in industry and a low employment ratio in the public sector. In the following part, we briefly look at the employment situation after the defense of the dissertation, the recruting of lectors and the recruitment of PhD's outside higer education.

The situation after the defense is characterized by the following trends (Commission Consultative des Allocation de Recherche: 1993):

* generally there is a slight growth in unemployment;
* a growing amount of post-docs (esp. in physics, chemistry);
* growth of employment in higher education (as a lecturer of ATER);
* declining employment in industry.

The most important conclusion is the strong growth in temporary work. But as the situation of PhD's of the academic year 1992 is much better (more permanent jobs). This is expected to be a consolidation effect. The functions of ATER and postdocs operate as interval-solutions. There are too many candidates for the available jobs. Even, if employment opportunities improve, the growth in the number of PhD's still has to be compensated.

There are, of course, sectorial differences in the employment situation. Concerning the recruitment of PhD's as lecturers at universities, the group of potential candidates is too large which creates files and the so-called post-doc effect. This means that if there are places open, first the post-docs are recruited. Consequently the opportunities for the most recent cohort decline. There are disciplinary differences which can be specified if we need it for the project. It is more difficult to judge the situation outside higher education. However in general too few jobs are offered to PhD's.

3. Basic data on postgraduate research students in France

In the following part of the text, we analyze some basic data on postgraduate research students in France. However, there still are important gaps in the information, e.g., numbers of PhD's in universities and in CNRS institutes, numbers of PhD's in Paris and in the

Provinces, etc. (we are still waiting for other information from the Ministère de l'Education Supérieure et de la Recherche). Most of the data we offer, are linked to the employment situation of PhD's.

The first table shows the number of PhD's who defended their dissertation in 1993. First, they are divided by the nature of the funding during the preparation of their dissertation and second they are divided by their working situation in 1994. The meaning of the figures is:

1. Post-docs
2. ATER
3. Maîtres de Conférences
4. Research organisms
5. Industry
6. Administration
7. Secondary education
8. National service
9. Unemployed

Table 1: The number of PhD's who defended their dissertation in 1993, according to the nature of the funding and the employment situation after the dissertation (February 1994)

	Allocataires MESR[5]	Other Funds[6]	Funds for foreigners	No Funds	Totale
Post-doc	497 29%	488 21.3%	120 38.6%	213 12.70%	1318 22%
ATER	454 26.50%	298 13%	54 17.4%	239 14.30%	1045 17.40%
Maître de Conférence	240 14%	328 14.3%	26 8.4%	396 23.60%	990 16.50%
Research organisms	117 6.80%	265 11.6%	20 6.4%	134 8%	536 8.95%
Industry	121 7.10%	445 19.4%	30 9.6%	157 9.40%	753 12.60%
Administr.	36 2.20%	85 3.7%	4 1.3%	153 9.10%	280 4.65%
Secondary education	24 1.40%	90 3.9%	22 7.1%	215 12.80%	351 5.90%
Civil Service	46 2.70%	41 1.8%		9 0.60%	96 1.60%
Unemployed	176 10.30%	254 11.1%	35 11.3%	160 9.50%	625 10.40%
Totale	1713 100%	2294 100%	311 100%	1676 100%	5994 100%

[5]Ministère de l'éducation supérieure et de la recherche.

[6]Some other funds are: CIFRE (Conventions Industrielles de Formation pour la Recherche); CNRS (Centre Nationale de la Recherche Scientifique); INRA (Institut National de la Recherche Agronomique); INSERM (Institut National de la Santé et de la Recherche Médicale) et des Collectivités locales.

When we look at all the PhD's who defended their dissertation in 1993, a remarkable amount is found in the categories post-doc and ATER. This shows the already mentionned lack of stable jobs within the academic system. Only 16.50% has been appointed as 'Maître de Conférence'. The functions of post-doc and Ater operate as interval solutions. Within the categories 'allocataires MESR', 'other funds' and 'funds for strangers', the biggest part of the PhD's becomes a post-doc after the defense (29%, 21.3%, 38.6%). Employment in industry, administration and secondary education is rather low. A relatively big amount of PhD's is unemployed (10%). From the 5994 PhD's, the biggest part (2294) felt during the preparation of the dissertation under the category 'other funds'. A quite large amount made their dissertation without any kind of funding (1676) which means they had a job outside universitiy or were depending on their parents/family.

If necessary for the project, we can give the same table, but according to the field of study.

Table 2: The number of PhD's succeeded, per discipline in 1989 and 1993 in France

Discipline	**1989**	**1993**
Mathematics	198	340
Physics, Chemistry, Materials	1267	1827
Natural Environments	328	355
Automatics, Electronics, Computer Science	871	1080
Sciences of Life and Health	1214	1738
Sciences of Man and Society	1024	1913
Law, Ecoomics, Political Science, Business Studies	538	825
Mechanics, Energy	523	710
Total	**5963**	**8788**

Source: Reillier, F. (1995) *'Feasability Study on the Internationalisation of Research Training in Europe. The French Report.'* Paris: OSC.

There is an increase in the number of PhD's from 1989 to 1993 in each discipline. Especially within the disciplines Physics, Chemistry, Materials; Sciences of Life and Health and Siences

of Man and Society, high numbers of PhD's are registered. Rather low numbers are noted in Mathematics and Natural Environment.

Table 3: Number of PhD's succeeded and jobs offered in Public Research in France

Year	**1991**	**1992**	**1993**
Number of PhD's succeeded	7161	8539	8788
Jobs offered at Universities	1875	1424	2222
Jobs offered at CNRS and other research organisms	562	555	449
Difference between the number of PhD's and vacancies	**4724**	**6650**	**6117**

Source: Reillier, F. (1995) *'Feasability Study on the Internationalisation of Research Training. The French Report.'* Paris: OSC.

The table above shows that there is a structural problem in the research student's population: students are encouraged to make a PhD (The number of Research Allocations has been raised from 1900 in 1988 to 4060 in 1993) but the recruitment does not follow.The difference between the amount of PhD's succeeded and the employment possibilities within the research system is 6117 in 1993. Of course, we immediately have to add that not all PhD's search for a job within the research system. Table 1 already showed an employement of 24.85% in industry, administration, secondary education and national services. Nevertheless, a growing amount of PhD's find themselves in a precarious situation. Going abroad in this situation often is used as a strategy to avoid unemployment (Reillier, 1995: 2).

Table 4: Recruitment of 'Maîtres de Conférences' in 1994 from the 1994 cohort of PhD's.

Group	PhD's in 1994	Recruited Maître de C. in 1994	Replacement index
1.	205	131	1.56
2.	223	128	1.74
3.	586	185	3.17
4.	738	173	4.27
5.	684	201	3.40
6.	569	67	8.49
7.	988	72	13.72
8.	308	19	16.21
9.	1013	224	4.52
10.	1326	86	15.41
11.	352	39	9.03
12.	185	52	3.56
Total	7176	1377	5.21

Source: Commission Consultative des Allocations de Recherche (1995) '*Réflexions sur le marché de l'emploi des docteurs.* Paris: MESR.

Each group consists of a number of sections:

Group 1: Law, Notary and Criminology, History of law and institutions, Public law; Political Sciences

Group 2: Behavioural Sciences, Economics

Group 3: Linguistics and literature: English and Anglo-Saxon, German and Scandinavian, Slavonic, French, Arabic, Chinese, Japanese, Hebrew, Romance languages, classical languages, comparative literature, linguistics and phonetics.

Group 4: Psychology; Human Geography, History and Archeology; Sociology and Demography, Philosophy; Arts, Antropology.

Group 5: Mathematics and Applied Mathematics, Information theory.

Group 6: Dilute and optical elements, Elementary constituents, Consistent elements and materials.

Group 7: Chemistry of materials, Organic, Mineral and Industrial Chemistry, Theoretical Chemistry.

Group 8: Physics, Geology and Paleontology, Metereology, Oceanography and Environmental Physics, Astronomy.

Group 9: Electronics, Optronics and systems, Mecanics and civil engineering, Energetics.

Group 10: Neuro-sciences, Biology of organisms, Biology of populations and ecology, Physiology, Cellular Biology, Bio-chemistry and Molecular Biology.

Group 11: Pharmacy, Biology.

Group 12: Physical education, Communication sciences, Education sciences, Epistemology, Theology.

This table gives an interesting index, showing the amount of possible candidates for a vacancy of ‘maître de conférence’. This gives an indication of imbalances between the labour supply and the number of positions to be filled up. Especially in the groups 7, 8, 10 and 11, high replacement indexes are noted: they are confronted with a surplus of suitable candidates. Extremely high indexes, which are not in the table, can be found in the disciplines antropology (64) and astronomy (47).

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