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Chapter 3

Between Change and Continuity

The Transformation of Doctoral Education in France

**Julien Calmand, Thierry Chevallier
and Jean-François Giret**

Today, doctoral education in France consists of ‘research training through research’ and provides access to employment in the research sector—either academic, public or private. Historically, the role of doctoral education used to be limited to training academic personnel. Its development over time is the result of many factors such as the transformations of French higher education, the evolution of the role of universities and employment constraints for PhD graduates.

The present organization of doctoral education in France can be explained by features acquired through time in the context of a distinctive higher education system, and by a convergence process that is forced on higher education and research by increasing competition at both the European and global levels. Since the Middle Ages, the doctorate has remained the highest qualification awarded by universities and the academic requirement to teach at the university level. Over the centuries, the progress of scientific research, the increasing specialization of knowledge and the expansion of access to higher education have fostered changes in the role and organization of this degree.

The last decades of the 19th century in France were marked by an attempt to restructure higher education, after the French defeat in the 1870 war against Germany was credited to the scientific superiority of German universities. Until then, doctoral education had been limited to a loosely regulated production of academic personnel for a slowly growing higher education system.

Due to recurrent difficulties for PhD graduates to enter the labour market and a reduction of employment opportunities in universities, the end of the 20th century saw the focus start shifting towards the necessity—in a world characterized by increasing competition—of producing a highly qualified workforce. The number of students exploded and, as a result, so did the need for qualified teachers, but the doctorate was no longer seen only as the requirement for an academic career, but also as a qualification for research and development (R&D) activities in national industries.

The changes brought to French doctoral education over more than a century reflected attempts to reassign its goals and rationalize its organization. This was partly achieved by a slow process of convergence at the European level. A glance at the historical development of doctoral studies can help to understand how peculiar organizational features or practices shaped this process.

A BRIEF HISTORY OF DOCTORAL STUDIES IN FRANCE

During the Middle Ages, different regulations and organizations existed depending on the disciplines in which the doctoral degree was granted. At that time, there were four historic ‘faculties’ (medicine, law, theology and arts), only three of which awarded doctoral degrees according to their own specific procedures (the faculty of arts awarded only bachelor’s and master’s degrees). These differences in regulations by discipline have shaped the transformations in doctoral education over time.

Soon after the French Revolution abolished universities, doctoral degrees reappeared in medicine and law (in 1803 and 1804). When the ‘Imperial University’ was founded by Napoleon in 1808, five doctoral degrees were offered, one in each of the five faculties (the

former faculty of arts was divided into two distinct institutions for sciences and humanities). Since the Napoleonic reform had created a state-controlled, centralized higher education system, the same regulations applied to each faculty across the country. Faculties were created in the main cities as branches of the ‘Imperial University’, with some variations among them. At that time, the doctorate was a ‘state degree’, awarded by universities on behalf of the state and guaranteed by it. Conditions of access, duration of preparation and examination regulations (number of theses, oral submission and composition of the examination panel) varied according to each faculty. The entrance requirement was the bachelor’s degree but, through the years, additional requirements were added.

Apart from minor adjustments, this organization remained basically unchanged until the second half of the 20th century. The main changes consisted of the introduction of a series of other doctoral degrees. This created a confusing situation of several degrees called doctorate but corresponding to different levels, duration of studies or entrance requirements. In 1897, after a significant reform of higher education (recreating distinct universities across the country by splitting the former ‘Imperial University’), a ‘university doctorate’ (*doctoratd’ université*) was created, which was less demanding than the ‘state doctorate’. In the first two decades of the 20th century, only 250 doctorates were awarded in France.

In 1923, an ‘engineering doctorate degree’ (*diplôme de docteur-ingénieur*) was introduced, specifically designed for graduates from engineering schools (which in the French higher education system are distinct from universities). In 1966, in an attempt to unify the various disciplines, a ‘third cycle doctorate’ (*doctorat de troisième cycle*) was introduced, based on a duration of one or two years after a specific year of preparation leading to a new degree, the ‘advanced studies diploma’ (*diplôme d’études approfondies*).

At that stage, the ‘original 1808’ doctorate (renamed ‘state doctorate’ [*doctoratd’ état*]) coexisted with three other types of doctoral degrees of shorter duration and lesser academic value. The state doctorate remained the access requirement to full-time academic positions in

universities and in national research agencies. The number of doctorates had remained fairly low during the 19th century and the first quarter of the 20th century, but exploded after the Second World War. From 10 to 20 a year in the humanities and around 20 in the sciences during the 19th century (two-thirds of them awarded in Paris), it went up to about 80 (humanities) and 300 (sciences) in the 1960s. Comparatively, the number of ‘third cycle doctorates’ reached more than 1,200 at the end of the 1960s.

This historical overview, however, does not include the medical doctorate. Medical studies have always been organized differently from the rest of the French higher education. There is no bachelor’s or master’s degree in medicine. The only degree awarded is called a ‘practice doctorate’ (*doctoratd’ exercice*), which entitles graduates to practice medicine. This is not a research degree. Instead, it marks the end of an eight-year theoretical and practical training programme, including numerous periods of work in hospitals. The situation is similar in dentistry and pharmacy.

From the 1970s until now, there has been a massive expansion of higher education; the number of students in universities has grown rapidly. The number of PhD graduates has also risen rapidly and universities have failed to absorb them in permanent faculty positions. Over time, several reports commissioned by the French education administration revealed tensions in the academic sector linked to professional career difficulties. At the same time, the number of non-permanent staff rose rapidly, and inequalities between non-permanent and permanent faculty became more pronounced. These problems, as well as the internationalization of higher education and research, led to ministerial orders that changed doctoral education. The reform of 1984 is a milestone for the transformation of the doctorate.

TOWARDS ALIGNMENT WITH INTERNATIONAL STANDARDS

A major reform of doctoral education took place in 1984. This ministerial order was part of a wider legislative reform, the so-called ‘Savary Act’. It replaced all existing doctorates with one single degree, the ‘doctorate’ (*doctorat*), with conditions of access, duration and type of

examination that were identical for all disciplines (except medicine). The doctorate was defined as the end result of a period of ‘research training through research’. Its organization was modelled on American PhD programmes, with access possible after special preparation at the master’s level, and three to four years of work on a thesis—defined as a ‘piece of original scientific work’—culminating with its submission. The degree was defined as a ‘national’ degree, meaning that it was guaranteed and recognized by the state, but it was awarded by universities under their own names. This unified organization included transitional provisions to cater to the rights of holders of former doctorates: they were granted some measure of recognition, while a new recruitment procedure for university academic personnel was devised.

The new doctorate became the requirement for recruitment of junior staff, both in universities and in national research agencies such as *Centre National de la Recherche Scientifique* (CNRS, the French National Centre for Scientific Research). To access senior positions, the ‘state doctorate’ was replaced by a ‘habilitation to direct research’ (*habilitation à diriger les recherches*, HDR), inspired by the German *habilitation*, which became a requirement for supervising PhD students. This organization has remained unchanged: the ‘habilitation to direct research’ is still required in order to access senior positions like ‘university professor’ (*professeur des universités*). During the following decades, a few adjustments were made, but the principles governing doctoral education and the recruitment of public, academic and research staff remained unchanged.

Teaching Assistantships

In 1998, teaching assistantships (*monitorats*) were created to complement the funding provided by existing doctoral grants (*allocations de recherche*) and to introduce some professional training for prospective academic staff. Among doctoral students, teaching assistants (*moniteurs*) were to be selected to teach for three years, carrying a third of the teaching load of regular university staff. Teaching assistant positions were part of the doctoral training and were offered to the more deserving students, who had been identified as capable of obtaining academic

positions. Teaching assistants had to attend specific training sessions called ‘introduction to higher education’ in regional training centres (*centres d’initiation à l’enseignement supérieur*). These training sessions were available to students of all disciplines and addressed both teaching methodology and general research methodology.

Doctoral Contracts

This scheme was discontinued in 2009 with the introduction of doctoral contracts between universities and doctoral students. Research grants (*allocations de recherche*), initially introduced in 1931 and greatly enlarged in 1976, had been turned in 1982 into three-year contracts between the recipients and the ministry of higher education, transforming the legal status of doctoral students into that of public employees, with related rights and duties, including unemployment benefits and salaries based on legal minimum wages. The responsibility of employing state-funded doctoral students was transferred to universities in 2009. Universities were free to add a limited amount of teaching duties to doctoral contracts. Not all doctoral students benefit from such contracts, however. The share of funded students varies from almost 100 per cent in some sectors of the sciences to less than one-third in the humanities and social sciences.

Creation of Doctoral Schools

A different organization of doctoral student supervision was experimented with in the early 1990s. A ministerial order in 1992 allowed universities to create formal structures to improve research training and the supervision of doctoral students with ‘doctoral schools’ (*écoles doctorales*). These schools were to be organized on a voluntary basis for broad fields of research, and were recognized and funded by the ministry of higher education in the framework of a contract negotiated with the universities. In 2002, a ministerial order made doctoral schools compulsory and allowed them to be jointly organized by several universities. To be allowed to run doctoral programmes and award doctoral degrees, universities had to undergo a formal state-accreditation process. Meanwhile, two additional ministerial orders took the doctoral

programme one step further by requiring each university to draw up a ‘thesis charter’ (*charte des thèses*) defining the rights and duties of doctoral students and organizing the ‘habilitation’ procedure (*Habilitation à Diriger des Recherches*, HDR), which was transferred to doctoral schools.

While French universities were free to cooperate with each other at the doctoral level by creating joint doctoral schools, there was no specific legislation for relations with foreign universities until 2002, when a ministerial order provided for ‘joint supervision’ (*cotutelle internationale*) of doctoral students through an agreement between two institutions located in different countries. There is no comprehensive data on the number of such agreements per year, but information available on university websites indicates that it may exceed 1,000 nationally, which corresponds to 8 per cent of PhDs overall.

The organization of doctoral studies was completed by an order in 2006, which broadened the role of doctoral schools in administrative and financial matters. It also clearly introduced, for the first time, their responsibility in facilitating the professional integration of graduates into the labour market.

PRESENT ORGANIZATION OF DOCTORAL EDUCATION

In 2016, a ministerial order defined a new national framework for doctoral studies. It was comprehensive, and in addition to confirming and clarifying the various legal adjustments that had been made since 1984, it introduced a few momentous provisions. It made it possible for universities to coordinate several doctoral schools by setting up a ‘doctoral college’ (*collège doctoral*). It reinforced the processes of quality assurance by enabling doctoral schools to set limits on the numbers of doctoral students a faculty member could advise, and by urging supervisors to regularly survey their students. The measure also introduced supervision committees to coordinate and supplement the duties of individual thesis advisors.

In 2016, more than 320,000 students graduated from French universities, of which 12,800 (4 %) were doctorates. Since the 2016 ministerial order, doctoral studies have been taking place in research units

that are grouped in doctoral schools for this purpose. These research units (*unités d'accueil*), which are part of a university or another higher education institution,¹ are frequently associated with one of the large national research agencies² in what is referred to as 'joint research units' (*unités mixtes de recherche*).

Greater Role of Doctoral Schools in Doctoral Education

As mentioned above, doctoral schools were introduced in the last decade of the 20th century with the aim of organizing the training of candidates, and improving their employability and access to various careers open to researchers. They brought together a number of research units attached to one or several higher education institutions operating in a broad scientific field. As of 2018, there are more than 250 doctoral schools in France, some of them focusing on a specific scientific field, others covering broader discipline areas. Doctoral schools can be jointly operated by several higher education institutions. *Grandes écoles* (France's elite, specialized institutions of higher education up to the master's level) may take part in doctoral schools in association with at least one public higher education institution. As the training itself takes place in research units, doctoral schools have been given a central role in coordinating doctoral education in French universities. They are in charge of selecting candidates for the doctoral programmes, giving them the grants made available by their university, and designing and implementing courses and training activities to help them acquire

¹ Among the *grandes écoles*, there are several institutions with a very high research profile. They operate by themselves or in association with national research agencies, research centres or units that may be grouped to form their own doctoral schools, or joint doctoral schools with universities. Although they are not formally universities, they are very similar to American research universities. The most prestigious are: École Normale Supérieure in Paris and Lyons; École Polytechnique; Institut d'Études Politiques de Paris.

² There is one large multidisciplinary agency, the Centre National de la Recherche Scientifique (CNRS), and a dozen of smaller specialised agencies in health, agronomy, informatics, etc.

research skills, scientific culture and knowledge of both scientific ethics and of the economic impact and organization of research. Although there is no administrative data available to confirm this, there is definitely an increase in the weight of courses in doctoral programmes, with significant differences between disciplines and doctoral schools. There is no documentation on student attendance or on their levels of satisfaction with the courses. However, in some doctoral schools, proof of attendance is required for the candidates to be allowed to defend their theses. As doctoral schools are completely free to determine the necessary conditions to obtain a doctoral degree, there are no common rules relative to course attendance in the overall system.

Doctoral schools are accredited for a period of five years by the Ministry of Higher Education, Research and Innovation, after an evaluation by the Higher Council for Evaluation of Higher Education and Research (HCERES), an independent state agency responsible for quality assurance in higher education. The schools are governed by a council elected by the members of the constituent research units, and a director appointed by the president of the university. They are expected to monitor the quality of doctoral work supervision and ensure that students have the materials and administrative support they need. Along with employers, organizations and specialized agencies, doctoral schools collect and distribute information on employment prospects and conduct surveys to monitor the employment of graduates.

Access and Registration

Students may apply for doctoral studies if they hold a national or foreign master's degree or an equivalent postgraduate diploma or qualification. When their degree qualification is not a 'research master', candidates need to obtain a specific authorization after examination of their records by the school council and the scientific council of the university to ensure that they have the necessary preparation for research. The director of the doctoral school decides on admission based on reports from the prospective supervisor or supervisory team and the head of the

research unit in which the doctoral work will take place. Admission is officially pronounced by the president of the university.

In 2017, about 75,000 students were enrolled as PhD students in French doctoral schools, and a little fewer than 15,000 graduated. As many as 40 per cent may be considered international students, which can be explained, to a certain extent, by the internationalization of higher education in Europe, but mainly by France's colonial history. In fact, African students are overrepresented in the share of international PhD students, and most of them are funded by their own country.

Subject Selection

Traditionally, the subject of the thesis was chosen by a candidate in agreement with a supervisor. Once the subject was identified, the candidate would write a research proposal that would be submitted to the supervisor and the research unit. Funding was allocated based on merit—the students' results at the master's level. Over the last two decades, this procedure has evolved towards a more competitive allocation of subjects linked with changes in funding allocations for doctoral students. In the majority of cases, the subjects and the funding that goes with them are advertised by research units, and candidates apply by submitting a detailed research proposal. A university panel set up by the doctoral school selects the candidates who seem best prepared to deal with each subject. Once the candidate is selected and the exact subject is specified, the candidate is allowed to enrol in the doctoral programme and the subject is recorded in a national registry. (The national registry of theses was created in order to give the doctoral student rights of intellectual property and avoid the duplication of research projects.)

Duration of Study

The regulations of doctoral studies set a duration of three years for the completion of the thesis by a full-time doctoral student. For part-time studies, the maximum duration is six years. Students may apply for a one-year extension granted by the head of their doctoral school, subject to the approval of the thesis committee, their thesis supervisor

and the head of their research unit. Whatever their status, all doctoral students must enrol and pay a yearly ‘registration fee’ (presently under EUR400). In late 2018, the government suggested an increase in PhD tuition fees for international candidates in order to improve the global attractiveness of French doctoral programmes, since low fees seemed to signal low quality. Doctoral schools have great autonomy in defining mandatory courses for doctoral students, either subject focused or more broadly relating to methods and skills. They may also require candidates to publish before graduation, with wide variations between the natural and the social sciences.

Supervision

The tradition of individual supervision of doctoral students by a single supervisor (*directeur de thèse*), in an exclusive and somewhat private relationship, has lost ground recently in favour of a more collective and structured supervision. Initiated in the sciences, ‘thesis committees’, comprising several researchers to whom the doctoral student reports periodically, have been made compulsory by the 2016 order in all scientific fields, including the social sciences and the humanities, where it used to be rather unusual. Doctoral schools organize regular public presentations by doctoral students on progress and results.

Dual supervision is explicitly mentioned in the case of joint doctoral programmes organized with a foreign university (*cotutelle de thèse*). Dual supervision is also used to enable junior researchers to gain supervising experience and prepare for the *habilitation*. The scientific committee of the university senate may exceptionally allow researchers without *habilitation* to take part in thesis supervision. Upon proposals from doctoral schools, scientific committees may set a limit to the number of doctoral students a thesis director is allowed to supervise.

Completion of Doctoral Studies

Once the thesis is completed, the director of the doctoral school submits it to two experts external to the university. If these experts report favourably, the director authorizes the oral presentation and

defence (*soutenance*) of the dissertation. An examination panel (*jury*) of three to eight members is selected and appointed by the president of the university. At least half of the members of this panel should be from outside of the university. Each doctoral school has its own rules. Some universities require a balanced gender representation, but this is not mandatory.

After the oral defence, the panel assesses the thesis and the defence. If successful, the candidate is declared admitted to the grade of doctor of the university. A report (*rapport de soutenance*) is then written by the panel. Since 2016, the supervisor, who used to be a full member of the panel, no longer takes part in the assessment of the thesis.

Funding of Doctoral Studies

There is a final point worth mentioning in this historical survey, since it contributes to shaping the working conditions of doctoral students. Heads of institutions where doctoral education takes place are responsible for the material condition of doctoral students during their thesis. Access to doctoral programmes frequently depends on the availability of sufficient resources for the candidates. The way public research is funded in France has undergone dramatic changes in recent decades, with an impact on the way doctoral studies are financed. Since 2005, recurrent funding of university research has been reduced in favour of competitive funding. An increasing proportion of research funds now comes from new agencies, set up to allocate resources to research projects for which research units submit bids. It is a new way of channelling research money to ‘research operators’. Such competitive funds are granted for a limited period of time (two to four years) and tend to be used for hiring postdoctoral researchers on contract and doctoral students. Increasingly, the funding of doctoral students is therefore linked to contractual arrangements entered into by universities. This, in turn, leads universities to treat doctoral students as contractual partners, with a specific type of employment contract similar to that of postdocs or other non-permanent research staff.

The development of research contracts between universities and various partners, research agencies and private firms has led to a

diversification of funding channels for doctoral studies. In the past, a majority of ‘funded’ doctoral students received three-year doctoral grants from the Ministry of Higher Education, Research and Innovation. Some were on paid training leave from their employers. Thanks to a scheme named CIFRE (*convention industrielle de formation par la recherche* or Industrial Conventions Training by Research), a growing number of doctoral students were jointly funded by the state and by companies in which they worked on research projects that had contracted with universities. Others relied on grants from local or regional authorities, foreign governments or international organizations. Still others received donations from charities and foundations in a form that was legally undetermined, known as ‘liberalities’ (*libéralités*).

This variety of sources meant large differences with respect to amounts and conditions of funding. This is the reason why new regulations on doctoral student funding, passed in 2009, state that irrespective of the source of funding, research students should sign contracts with the universities in which they are preparing their degrees. Universities collect the various funds and channel them along the same contractual conditions to all funded students, in order to increase equity and security. In a way, this new legislation has turned universities into employers and funded students into employees (e.g., as is formally the case in Nordic countries).

As mentioned earlier, the funding of doctoral studies may come from various sources: public subsidies (from national or local authorities), participation in research contracts, partial funding by industry like the CIFRE scheme, etc. Funded doctoral studies both improve the working conditions of the students and enhance the image of PhD graduates on the labour market. Beyond being a research experience, doctoral studies become a work experience that is valued by potential employers. Similarly, the transformation of research grants into doctoral contracts has greatly contributed to clarifying the status of doctoral students, who are regarded as salaried employees rather than students, transforming their studies into a valuable salaried work experience and changing the perception of companies likely to hire them.

In the humanities and the social sciences, the share of students who do not get funded is much higher than in other disciplines. The number

has remained stagnant between 2009 and 2016. The CIFRE funding scheme, which aims to support the integration of PhD graduates in private companies, finds it hard to expand outside of the engineering sector. Students who are not funded by public or private research grants are either self-funded or employed. Self-funded students, which make up 27 per cent of all PhD students, must cover their living expenses in addition to (limited) registration fees. They also pay the expenses related to their doctoral work that are not covered by the research unit or the doctoral school to which they belong. When they have the necessary financial resources (assistance from their family, their own savings or a bank loan), they may study full time. If they are employed, they may ask for part-time status, which enables them to complete their doctoral studies in six years.

One may question the efficiency of the reforms introduced since 2006. Not all are innovative, since many of them only generalized existing practices, especially in the formal and natural sciences. In those sectors, the prescription of funded doctoral studies and the collective management of thesis supervision existed long before 2006. The CIFRE scheme, which facilitated the integration of PhD candidates into the private sector, was introduced back in 1980 and was limited in scope. The 2006 reform was intended to homogenize doctoral programmes across the whole academic spectrum, but some sectors of the arts and humanities have found it hard to adopt practices that have originated in the formal and natural sciences, in particular the prescription of funded doctoral studies, for which one finds a very low proportion of doctoral contracts.

EMPLOYABILITY AND LABOUR MARKET PERSPECTIVES FOR PhD STUDENTS

Growing Attention to Preparation for Employment

In the last two decades, growing attention has been given in France to preparing doctoral students for various employment perspectives, in the both public and private sectors. Several events are organized locally or nationally, such as specific training sessions where researchers and

managers of companies, administrations and research agencies present their work and working conditions to doctoral students. Such events, known as *doctoriales*, are organized across the country with financial aid from the Ministry of Higher Education, Research and Innovation. The state also subsidizes organizations dedicated to supporting doctoral students and graduates in their search for employment. The best known among these organizations is the Association Bernard Gregory. It manages a website called ‘scientific employment in France’ (*Emploi Scientifique en France*), which has been created and is operated with public financial support and is meant to centralize and disseminate information useful to doctoral students and graduates in search of a job. The doctorate students’ guild (*guilde des doctorants*) and the confederation of young researchers (*Confédération des Jeunes Chercheurs*) are similarly active in providing information on work opportunities. Several discipline-based graduate associations cater more specialized services to new graduates within their field of research.

Recruiting to the Professoriate: Changes in the Academic Career

In France, access to a permanent job in the academic sector takes place early in one’s career, even if, in some scientific fields, the development of postdoctoral fellowships has lengthened the transition period from finishing the PhD to stable employment. Most academic staff are employed as permanent employees of the state (*fonctionnaires titulaires*) and benefit from civil service status (*statut de la fonction publique*), which provides for lifetime employment. This concerns staff employed in universities with teaching and research duties, as well as those employed by public research agencies in research-only careers, with possible, although not frequent, transfers between the two. As mentioned above, research agencies operate joint research units with universities so that very often both types of permanent employees work together.

In the early 2000s, the average recruitment age for a permanent position as lecturer (*maître de conférences*) was 31, which was also the age limit to apply for a position as a junior research officer (*chargé de recherche*). By 2015, the average age had increased to 34 for lecturers;

the age limit has been abolished for junior researchers. In parallel, the share of non-permanent staff has increased in universities, partly because of the development of postdoctoral fellowships. In 2015, every third lecturer was recruited after a postdoc.

High Unemployment of PhD Graduates in France

For the past three decades, youth unemployment has been a major issue in France. According to a survey from CEREQ (*Centre d'Études et de Recherche sur les Qualifications*, the French Centre for Research on Education, Training and Employment), in 2013, 20 per cent of young people were still unemployed three years after graduation. PhD holders face difficulties in the labour market, as do those with only bachelor's and master's degrees. In recent years, the transition to the labour market for PhD graduates, compared to that of master's degree graduates, has improved but remains difficult. Three years after graduation, 10 per cent of young doctoral degree holders aged 35 or younger and living in France at the time of the survey were unemployed, a share that is higher than that of graduates of '*grandes écoles*' of engineering and business (the elite sector of French higher education), who graduate at the master's level (Table 3.1). Their employment conditions vary according to field of study and type of financial support enjoyed during doctoral studies. The situation is particularly worrying for earth and life sciences graduates, where unemployment reaches 14 per cent. It is much better in computer science and engineering, where graduates have more opportunities in the private sector (Table 3.2). In the humanities and social sciences, the situation is improving, as PhD graduates can be recruited as teachers in secondary education institutions. However, compared to a master's-level degree graduate, the wage premium of a PhD graduate is generally low, except in engineering.

A distinctive feature in the early careers of PhD graduates is the relatively limited share of employment in the private research sector, especially in R&D activities (Table 3.2). Although doctoral studies are supposed to foster innovation and economic growth through transfers of skills and knowledge from the academic world to industry,

Table 3.1 *Unemployment Rate, Three Years After Graduation*

Degree	2004 (%)	2007 (%)	2010 (%)	2013 (%)	2016 (%)
PhD of which	11	10	10	9	10
Combined engineering and PhD	5	5	–	5	8
PhD in engineering	11	10	–	12	11
PhD in other fields	16	10	–	9	11
Engineering degree (master level)	6	4	5	4	7
Master	9	7	12	12	11

Source: French national surveys of graduates three years after graduation (Cereq Generations surveys 1998, 2001, 2004, 2007, 2010 and 2013).

Table 3.2 *Employment of PhD Graduates by Sector, Three Years After Graduation*

	2001 (%)	2004 (%)	2007 (%)	2010 (%)	2013 (%)	2016 (%)
Public research (universities, CNRS and other research agencies)	43	49	49	49	49	39
Public non-research sector	17	14	16	15	15	16
Private sector R&D	19	18	17	17	17	22
Private non-research sector	21	19	18	19	19	24

Source: French national surveys of graduates three years after graduation (Céreq Generations surveys 1998, 2001, 2004, 2007, 2010 and 2013).

the private research sector in France relies heavily on graduates of *grandes écoles*, where research is generally weaker than in universities. Even if their research production has improved under the pressure of international academic standards, the role of research in the training of *grandes écoles* students is rather limited, especially in their last year. Only a small proportion of *grandes écoles* graduates enter PhD programmes, a choice that is not likely to improve their conditions on the labour market (Bonnal, Bourdon, and Paul 2011).

However, when we consider the whole population of PhD graduates, as opposed to just recent graduates, their employment situation is roughly similar to that of graduates from engineering schools (Vourc'h and Inan 2017), and sometimes even better, depending on the discipline.

Competition between Engineers and PhD Graduates in R&D

The French higher education system is defined as a dual system. As described above, alongside universities, *grandes écoles* award engineering and business degrees at the master's level. Traditionally, employment in private R&D has been the territory of engineering schools graduates. There are many explanations for why the private research sector favours engineering school graduates. First, alumni networks have an impact on access to employment, especially in manufacturing industries where engineers are preferentially recruited for most functions, including R&D (Beltramo, Paul, and Perret 2001). Hiring often happens by replicating past practices. Also, a majority of vacancies are first channelled to schools through alumni networks. Through frequent and lengthy industrial placements, engineering graduates have a particularly good understanding of how companies and factories operate, which gives them a comparative advantage. The career structure of private companies also plays a part, as it encourages mobility among various functions: R&D is likely to be only one stage in the career of an employee, and therefore preference is given to applicants with more versatile profiles, which is a strength of French engineering graduates. Finally, there is a perception that doctoral education is too abstract and remote from business concerns, when compared to the training of engineers at the master's level (Duhaubois and Maublanc 2005; Grivilliers and Cassette

2014). Despite a clear government policy in favour of increasing the presence of PhD graduates in the private R&D sector, until 2013 their share remained below 20 per cent. However, the most recent tracking study (of 2013 graduates surveyed in 2016) reveals a sharp increase of the share of PhD graduates in the private sector, as well as in R&D jobs (5%) and in other private sector employment (5%).

THE ROLE OF DOCTORAL EDUCATION IN SOCIETY AND ITS CHALLENGES

Fostering the Employment of PhD Graduates through a Tax Credit Scheme for Research

In order to promote innovation and employment in the private sector, a tax credit scheme for research, ‘CIR’, was introduced in 1983. As the basic purpose of the scheme was to prompt investment in R&D, a component called ‘young doctors’, focusing on scientific employment and specifically on the employment of PhD graduates in the private sector, was added in 1999 and strengthened in 2006 and 2008. The efficiency of the scheme is debated and some consider it responsible for cuts in the funding of public research (Guyon 2012). In 2013, more than 1,500 companies received tax credits for hiring young PhD graduates, compared to 700 in 2008. As of 2008, companies were able to increase their tax credit from 30 per cent to 60 per cent of the salary cost when they offered a PhD graduate his or her first permanent employment in R&D. A report shows the positive impact of CIR on permanent employment in R&D (Margolis and Miotti 2017). Before 2008, CIR used to favour the employment of engineers rather than PhD graduates. After 2008, it showed a slight advantage for PhD graduates, especially in large companies.

Career Diversification and Professionalization of the Doctorate

Doctoral education reforms received a new impetus between the mid-2000s and 2016. In August 2006, a ministerial order marked a turning point in the history of doctoral education in France. First, it explicitly

made access of PhD graduates to the labour market a central issue of doctoral education. That point had never been mentioned in any of the numerous regulations passed since the 1970s. Second, it stated clearly that doctoral programmes do not prepare students exclusively for careers in the public sector of academic research, as was traditionally the case, but also for employment in the private sector. Consequently, doctoral schools were assigned a new mission of fostering the access of new PhD graduates to the labour market. They were asked to take steps to improve the employability of doctoral students and inform them about labour market outcomes on the basis of graduate tracking surveys. Such momentous changes were not specific to doctoral education, since the whole of higher education had been subjected to a long-term process of 'professionalization' that aimed at making programmes more relevant to the needs of the labour market (Rose 2014; Verdier 2001). The process took multiple forms, ranging from the creation or expansion of existing vocational tracks (higher technician diplomas, short technology programmes or bachelor's programmes) to the introduction into the curriculum of labour-related activities like sandwich courses, industrial placements or sessions on preparing to enter the labour market. The 2007 Law on Liberties and Responsibilities of Universities ratified this trend by making professional integration one of the missions of universities. In this general framework, the drive of doctoral programmes to include professional integration relied on a wide set of tools, some common to the whole of higher education, others specific to the PhD.

Tools common to all programmes are those providing students with information on labour outcomes for graduates, such as tracking surveys (Calmand 2016a) and job fairs; those improving the transition from graduation to employment, such as training for job interviews and assistance in writing resumes; and those easing integration into the labour market, like improving students' understanding of business or developing transferable skills. Tools that are specific to doctoral programmes focus on turning training into real work experience. The students' professionalization is supported by better supervision and guidance during their thesis writing, the monitoring of their progress by committees and contracts to fund their doctoral studies. The injunction of academic authorities to give priority to studies funded

through doctoral contracts has been a major step, since it has been clearly demonstrated that the material conditions of doctoral students is a determining factor of their professional success (Bonnal and Giret 2010; Bonnard, Calmand and Giret 2016).

Transformation of Doctoral Education

A succession of legal regulations reforming doctoral education has deeply affected doctoral schools in their mission, organization and operation. Nowadays, they have become much larger through mergers, and they are responsible for the whole curriculum of doctoral studies and professional integration of their students. In their application of the principles of new public management, universities and their doctoral schools are assessed based on indicators such as supervision, scientific production and the professional integration of their students.

Since 2006, doctoral schools play an essential part in doctoral education, owing to certification criteria for the doctoral degree and tighter supervision of students. The writing of the thesis is monitored in a more collegial fashion. In contrast to the personal nature that once marked the relationship between the supervisor and the supervisee, which was similar to that of craftsman and apprentice, doctoral supervision has turned into a process of collective management (Musselin 2009). This makes it possible for the student to escape painful situations like professional or sexual harassment, and to avoid loneliness and anxiety when supervision is inadequate or lacking. But it may also create tensions inside research laboratories, which explains why it is opposed by a fraction of the academic community.

As shown by a number of qualitative research papers, this new organization of doctoral education impacts the academic profession. Supervisors experience tensions between contradictory instructions: preparing doctoral students for academic careers and preparing them for the labour market, especially for employment in the private sector. Supervisors feel diverted from their initial function of training students for the practice of scientific research, and deprived of their professional identity (Dahan 2007). Collegial management of thesis

monitoring, which is the norm in many countries, is seen as a break from the tradition of individual supervision and a restriction of scientific autonomy.

Moreover, these reforms do not appear very successful in terms of harmonizing the conditions of doctoral education across disciplines. Based on “‘Generation’, a large survey on graduate integration into the labour market, one may observe that reforms have in fact reinforced a long-standing segmentation of doctoral studies and the differentiation of graduates’ careers according to discipline (Calmand, Prieur, and Wolber 2017).

Beyond the increased segmentation of doctoral studies and the remaining differentiation of practices according to discipline, some members of the academic community are concerned with a change in the nature of the doctorate. Since 2016, there has been increasing support for the possibility of obtaining a doctorate degree through recognition of previous professional experience (*validation des acquis de l’expérience*, VAE). This new pathway to the doctorate makes it possible for high-level professionals to build on experience acquired in their occupations and improve their employment perspectives, either with their own employer or on the labour market in general. In the early 2010s, only 15 PhD degrees on average had been awarded this way each year by French universities. The concept behind it being rather recent, it still appears to be an experiment, and raises concerns among the academic community about the potential of increasing the heterogeneity of quality criteria, and of lowering the conditions of access to the highest positions of academia and public research.

Similar concerns fuel the debate on the introduction of professional doctorates in the French higher education system, which will further increase fragmentation. Professional doctorates already exist in France in the health care sector. Medicine, pharmacy, dentistry and veterinary medicine are professions that require a doctoral degree, but as explained above, this degree is clearly distinct from the PhD. It is called a ‘practice doctorate’ (*doctorate’ exercice*). Professional organizations are trying to push for something similar in nursing and psychology, highlighting the need for recognition of a level higher than the master’s degree. A

university with a focus on business administration, Université Paris–Dauphine offers a programme entitled ‘Executive Doctorate in Business Administration’. Within some disciplines (education, law, business administration and others), there is a perception that the meaning of a doctorate differs according to its use and that it does not necessarily have to prepare for a research career.

CONCLUDING REMARKS

In 2018, doctoral studies, traditionally understood in France as writing a thesis, do not have much to do with what they were in the 1980s. After a long period of status quo, a new curriculum has been introduced and demands for scientific production have been raised. Before entering doctoral studies, students must secure funding. Once enrolled, they must anticipate their future professional life and train for an array of jobs while carrying on with their basic duty of producing a piece of original research. The impact of the transformation on doctoral education is difficult to measure, especially because it does not have the same intensity in every discipline. Fields with historical links to companies have been able to adapt doctoral education programmes more rapidly, in line with new state recommendations. At the individual level, these changes also have an impact on the activities of teaching staff, who have to organize doctoral courses on top of their research and teaching duties. In some ways, the differentiation between activities segments academic staff between those who have mainly research duties and those who do not. Notably, investing in teaching is not valued as much as scientific production. As for the students, there is no information on their degree of satisfaction about coursework implementation. However, access to these classes is uneven, depending on disciplines, universities and doctoral schools.

More importantly, doctoral education in France bears the impact of the dual structure of higher education with, on the one hand, universities and, on the other, the *grandes écoles*. *Grandes écoles* are the most selective segment of higher education and attract the brightest students, yet they rarely drive them towards doctoral programmes, which are only offered by research departments at universities. In recent times,

a government policy of driving institutions to merge or associate has increased the cooperation between universities and *grandes écoles* (Van Zanten and Maxwell 2015) and widened the access of graduates to doctoral studies. Still, cooperation structures are limited and their governance fragile.

This partly explains why the integration of doctoral graduates into the labour market is problematic. Despite data comparability problems, the comparison of French tracking studies with international statistics clearly shows that in this country, access to the labour market is harder for PhD graduates (Auriol 2010; Harfi and Auriol 2010). Moreover, labour market integration continues to be more difficult for doctoral graduates than for *grandes écoles* graduates, especially from engineering schools, despite the fact that the level of the *grandes écoles* degree (a master's) is lower. For the latter group, there is no obvious benefit of studying further and therefore little incentive to enter doctoral programmes.

The difficult integration of PhD graduates into academic research in France has urged public authorities and representative bodies of doctoral students to look for employment possibilities in other sectors. It looks as if efforts to increase the employability of PhD graduates in the R&D sector are beginning to deliver results. Other steps have been taken to widen the spectrum of employment by ensuring recognition of the doctorate degree in all sectors.

The Law on Higher Education and Research of July 2013 aims at improving the professional integration of PhD graduates by setting two objectives: easing the recruitment of PhD graduates in public administration and obtaining recognition for the doctorate as a professional qualification in collective employment agreements with the private sector. In the public sector, access to about 50 different occupations has been facilitated, mostly through the adaptation of competitive entrance examinations. In 2018, after negotiations between doctoral student associations and the ministry of labour, the doctorate was finally recorded in the National Register of Professional Certifications, which was created in 2002 as a directory of all professional qualifications recognized by the state. Recognition in collective employment agreements has not yet been entirely achieved, owing to the opposition

of employers' unions. Yet a few companies have individually signed agreements with some universities.

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