What Is your PhD Worth? The Value of a PhD for Finding Employment outside of Academia

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This research investigates the value of a PhD for employment outside academia by showing how PhD holders create it through the help of intermediations during their thesis preparation. We analyse scientific practice through the use of Cultural Historical Activity Theory (CHAT) to better understand PhDs' employment outside academia. With CHAT, intermediation on labour markets is seen via the lens of activity. Using a qualitative methodology, we interviewed 20 students who completed PhDs at the University of Lyon in France and who now work for private companies. Our findings show how the value of these PhDs is shaped both by what they do during thesis and by what they seek to become in their professional careers. We contribute to the literature by providing a new theoretical stance on intermediation in labour markets, and offer reflections for universities across Europe to tailor their PhD programmes.

Keywords: Intermediation; PhDs; valuation; activity; CHAT; employment

Introduction

Is getting a PhD a good guarantor of finding employment outside academia? For example, the unemployment rate of PhD holders in France still on average 9.2% three years after completion.[1] The labour market context for PhD holders is somewhat different in France compared to other countries, and for several reasons (Harfi and Auriol, 2010). The unemployment rates of PhDs conceal two important discrepancies, the first one being between disciplines (e.g., philosophy and arts: 11.8% vs engineering sciences: 6.9%, three years after completion), and the second concerning the sectors in which employment is found, with a large majority working in the public sector (non-academic and academic) compared to the private sector[2] (see Appendix Table A1).

The public sector – both academic and non-academic – is the largest employer of PhDs. Only 12% of researchers in the non-academic private sector hold a PhD. A lack of effort in R&D is often blamed. Indeed, even though

between 2006 and 2016 average annual growth of domestic expenditure on R&D grew to 1.6% (twice the growth of GDP), much of which occurred within businesses, it remains below the EU target of 3% (2020 strategy), adopted as a national objective in many OECD countries.[3] Moreover, companies generally prefer trained engineers to PhD holders. Engineering degrees have more value on labour markets than doctorates (Calmand *et al.*, 2017), even when there is a combination of both degrees (Verdier *et al.*, 2001). This situation relates to a very French problem of training elites within Grandes Ecoles (Calmand *et al.*, 2009), which began under Napoleon and which has a huge impact on the perceived value of different types of education and leads to stereotypes (Calmand *et al.*, 2017). Consequently, the job market is as dual and unbalanced as the French education system.

In order to facilitate the flows of knowledge and to foster the recruitment of PhDs and subsequent innovation in companies (Buenstorf and Heinisch, 2020), the European Union and the French Government: (1) promote discourses and practices that emphasize the contribution of competences to employability, such as skills frameworks (Weber *et al.*, 2018); and (2) redefine doctoral training (European Commission, 2011). The question then

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[1]Compared to 14.7% one year after the viva. See Experimental survey IPDoc 2017 (MESRI-SIES) concerning graduates in France in 2014, looking at all nationalities and ages.

[2]The life sciences are an extreme case of this distribution: 75.2% work in the public sector (academic and non-academic) compared to 14.8% in the private sector.

[3]MESRI-DGESIP/DGRI-SIES, 'L'effort de recherche et développement en France'. See: https://publication.enseignementsup-recherche.gouv.fr/eesr/FR/T923/L_effort_de_recherche_et_developpement_en_france/.

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is how to convince employers that PhD holders do indeed possess transferable skills. Other types of actions have also been set up since the 1980s, including public/private thesis financing (CIFRE), tax-incentives (CIR), and specialized organizations dedicated to improving access to labour markets (ABG).[4] Overall, these actions seek to valorize PhDs on non-academic labour markets, reorienting the way they are valued by potential employers. In other terms, the valuation (Vatin, 2013) of PhDs is achieved in the same way that the competence of other types of workers is measured and evaluated.[5]

CIFRE 'The CIFRE scheme enables the ANRT to subsidize, on behalf of the Ministry in charge of research, any socio-economic structure operating in France that recruits a doctoral student to carry out a research mission'.[6] The CIFRE is a means of financing the thesis through a tripartite contract (doctoral student, university, company) to facilitate professional socialization within the company at the same time as the conditions for the transfer of knowledge outside academia. Two-third of CIFRE PhD students are hired by private companies.

CIR CIR (research tax credit) was implemented in France in 1983 as an incentive to increase R&D expenditures in private companies by reducing the cost of these activities.[7] Within this framework, the 'Dispositif Jeune Docteur' aimed at fostering the recruitments in innovative companies of PhDs who have never before been in a long-term contract (CDI). It covers personal expenditures related to R&D activities up to 30% of twice the real cost of recruiting a PhD. It has reduced the duration of access to employment after the viva, and favoured SMEs, but it mostly privileged PhDs with a former engineering degree. We have no information regarding the articulation CIR-CIFRE.

The role of these tools and organizations with respect to the labour market has thus far been overlooked by researchers. Some research has been conducted by French academics on the factors that determine employability, mainly focusing on doctoral training programmes (Mangematin *et al*., 2000; Calmand *et al*., 2017) and career choices made during doctoral study (Dany and Mangematin, 2004; Dany *et al*., 2011). But this research overlooks the core issue: how does the scientific activity

that shapes PhDs as professionals contribute to their value in non-academic labour markets? How are the tools created by the French government articulated with the scientific activity so as to reorient the value accorded to PhDs on labour markets? Considering the current situation of PhDs in the non-academic labour market, we argue that there is a strong need better to understand issues related to social relations, historical context, and concrete attempts to accord value to PhDs (valuation), such as those of the French government. Other management researchers seek to understand the influence of networks on employment. But they only focus on university–industry settings, either to highlight job openings created through university–industry collaborations (Lam, 2005; Lam and Marsden, 2017) or to show how relations between scientists and supervisors make it possible to profit from the capital of others, including their knowledge and networks (Lam and de Campos, 2015). Overall, we strongly need to understand interactions with humans and tools that occur during the thesis within the context of scientific practice during the thesis, while also evaluating how they act as intermediations of value creation for employment outside academia.

The overall aim of this research, then, is to show how PhDs create value from their thesis through intermediation that is of use for employment outside academia. To this end, we widen the perspective by looking at scientific practice from the PhDs' perspectives (their fluctuating motivations), considering their interactions with tools, people and the historically and socially created context and rules of one country.

We adopt a qualitative methodology derived from Cultural Historical Activity Theory (CHAT) in its third generation (Engeström, 1987). CHAT makes it possible to understand practice by taking different activities as units of analysis, thus making it possible to analyse what people do on a daily basis. The explanatory power of CHAT lies in its conceptualization of different processes occurring in the activity. To produce (material) and reach (motive) the object of activity, and to produce desirable outcomes with respect to the object, is to interact with mediators which may be either non-human or human (e.g. tools, signs, rules, communities). Appropriation of those mediators (mediation) orients behaviours and makes it possible to produce or transform the object, and to achieve desirable outcomes. It follows that activity, in CHAT, cannot be seen as something static and unchanging, but gives rise to a phenomenon of collective learning, which takes the form of a new transformation of the activity around a new shared object.

Using CHAT as our theoretical framework, we analyse the professional trajectories of 20 PhDs from the University of Lyon in France all of whom currently work in the non-academic private sector. To do this, we use activity system modelling (Yamagata-Lynch, 2010) to

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[4]CIFRE: Convention Industrielle de Formation par la Recherche (Industrial Convention for Training through Research); CIR: Crédit d'Impôt Recherche (Research tax credit); ABG: Association Bernard Grégory specialized in promoting tools for universities' action and enhancing PhDs' careers outside academia It was created by the French state in 1980.
[5]Hence tools such as MyDocPro from ABG or other institutional skills frameworks (see: Weber et al., 2018).
[6]See:'"Regards croisés doctorants, employeurs et directeurs de thèse sur 1,000 CIFRE. Evaluation en fin de CIFRE – année 2016', ANRT, MESRI, at http://www.anrt.asso.fr.
[7]See: 'L'impact du credit d'impôt recherche', France Stratégie at https://www.strategie.gouv.fr/publications/limpact-credit-dimpot-recherche

analyse how the value of the object of scientific practice is constructed over the course of a professional trajectory. Results show that PhDs are valued on non-academic labour markets on the basis of the thesis activity itself, even for those who have few connections with industry either from their funding scheme or from their university. We concentrate on four types of mediations that participate in value construction of the PhD and that occur within the thesis activity: first, the way instruments and communities often work together, with the former (e.g., types of funding) shaping the latter (interactions between supervisor, student, and industry); second, what individuals want to do with their thesis, which of course relates to their personal history and their perception of the nature and value of research; third what types of gratification individuals expect to arise from their thesis work; and fourth, any disappointments relating to how the thesis is carried out, and which may concern such things as available resources, types of research, or the nature of the supervision received. Overall, transitions towards private companies are mostly co-constructed within the context of thesis activity itself. The value of the PhD in non-academic labour markets depends on contingencies, groups involved in the doctoral research, as well as PhDs' conscious personal desires, the three dimensions being related to one another and undergoing dialectical transformations as the research evolves. When such interactions do not lead to a PhD that is sufficiently valued in labour markets, other instruments (e.g. CIR, EU funding) may step in to try to rectify the problem.

The article is organized as follows. We first outline the theoretical framework, namely CHAT, focusing on the concepts of object and mediation. Our methodology is then presented, and our findings described thematically. We conclude with a discussion, including: (1) contributions to the literature on intermediation in labour markets as participating in process of social valuation; (2) reflections for universities; and (3) propositions for new research avenues.

Conceptual framework: Cultural historical activity theory as a theoretical framework to understand the role of intermediation in labour markets

Cultural Historical Activity Theory (CHAT) is a theory of practice that seeks to understand and transform human productive activity (Engeström, 1987). Unlike Piaget, CHAT does not grasp theory as occurring within the human mind and hidden in mental scripts (or schemes), but as embedded within individual and social activities. Located within the 'material turn' that fiercely criticizes the representationalism often characteristic of 'linguistic turns' (Barad, 2003), CHAT depicts human consciousness

as a social phenomenon anchored in the material world. It thus has its main theoretical foundations in the works of Marx and Engels. Through the work of Vygotsky (1978) and Leontiev and Cole (1981), CHAT consolidates the Marxist heritage and endorses a situated account of action as structured and mediated multi-voiced activity. It rejects essentialist conceptions of the human. The human is first and foremost a social being, partaking in object-oriented collective activities the nature of whose interactions depend on the object in question. Analysis of the object of the activity reveals people's true motives for their involvement in the activity: the distinct motives explaining why they act and how they interact in the context of a division of labour. The object, from this perspective, is a moving, dynamic, and complex 'sensemaker', which, as such, 'gives meaning to and determines values of various entities and phenomena' (Kaptelinin, 2005, p. 5). This focus on the object of activity makes it possible to combine idealism, the goal or idea of the activity, and materialism, *praxis* in the sense of the activity itself (Adler, 2005), by means of a distinction between the concrete object of activity (*object*), which is what is under transformation/production, and the motives behind the activity (*predmet*), which may be conflicting (Kaptelinin, 2005). The division of labour objectivizes activity by distancing *object* and *predmet*, namely, by creating a constant disassembling of activity into individual operations. The latter are nevertheless related to a broader social connection (Leontiev and Cole, 1981). Activity, from this perspective, is both socially structured and instrumental, with instruments being inherent to operational tasks.

Within the third generation of CHAT (Engeström, 1987), it is necessary to portray human activity in its simplest and most original structural form, which makes it possible to grasp both its unity and its complexity. CHAT models human activities as the smallest units of analysis thanks to a system – the activity system (Figure 1) – on the basis of Leontiev's works.

The model depicted in figure 1 shows how activity system may be both explained and transformed. Further, the third generation of CHAT includes within the concept of the object of activity its potential *outcome*, that is, the longer-term results which the objects production or transformation may make it possible to achieve. One can only understand the object-outcome relation within the activity system that is mediated by instruments (signs and artefacts) and a regulating community. In this manner, the object comes to possess 'expansive power' (Engeström, 2016): a horizon of unknown possibilities playing out over a longer term than that of the simple production or transformation of the object.

Productive activities are permeated by dichotomies of values (exchange and use-value) that stem from an
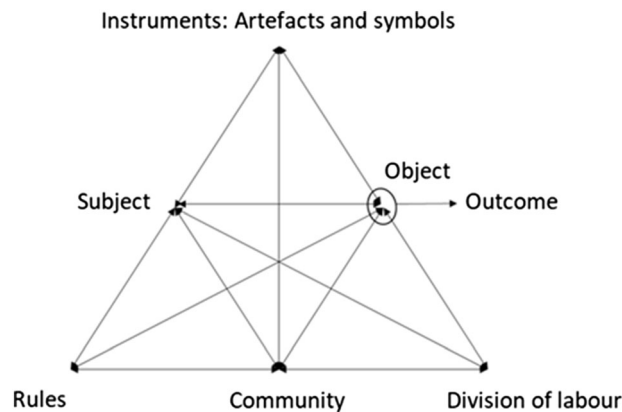
FIGURE 1   Triangle of activity system (Engeström, 1987)

asymmetry at the core of production relationships. In capitalism, contradictions occur when there is a discrepancy between use-value and exchange-value, which originate in cultural historical contradictions (Sannino and Engeström, 2018). A PhD may provide useful skills for private enterprise, but it only acquires exchange value once the PhD finds employment, and without the exchange-value the use-value will lie dormant. Use value, it follows, is dominated by exchange value (Marx, 1859). The resolution of the conflict occurs via a collective learning process (Engeström, 2016) involving the emergence of a new object that makes possible a correspondence between, for instance, supply (what the PhD can offer) and demand (what the market requires).

The object of activity cannot, therefore, be understood in the context of a static paradigm, but only, for third generation CHAT theorists, within an evolutionary and dialectical paradigm. Contradictions and mediations are the sources of transformations of the activities and people involved. As for mediations, CHAT models activity as mediated by tools and signs, following Vygotsky's works (Vygotsky, 1978), but also with reference to pragmatism. For Vygotsky, interaction between a subject and the environment occurs through mediation, which in turn refers to two distinct yet related instruments: (1) psychological instruments, seen as artificial and cultural historical constructions that orient behaviours in a mediated action; a knotted handkerchief, for example, is not only valued as lovely but also as a reminder to (re) orient my behaviour. Psychological instruments orient the analysis towards a historical perspective; and (2) technical instruments that transform an external object. In CHAT, signs and artefacts are related to all the poles of the activity system (rules, instruments, communities, division of labour, subject and object, see Figure 1).

The third generation of CHAT considers activity systems as open and interacting with others. For example, one activity system can interact with another one by diffusing new instruments considered as more advanced,

as occurred when successive governments diffused new instruments of research funding, with a view both to reorient behaviours and to bring about structural transformations that make it easier for universities to engage in collaborations with industry. CHAT thus moves away from seeing agency as distributed within a single activity system to being distributed within multiple interlinked networks of activities (Engeström, 2004). Agency emerges from interactions between activity systems, namely, from their cooperation and coordination around shared objects (Haapasaari *et al.*, 2016).

From this new perspective, the valuation processes of PhD holders in labour markets refers to the construction of use-values within the thesis activity and possibly also within other interacting activities. We thus want to understand how the way research is practised determines the value of the PhD on labour markets. The third generation of CHAT has not yet been used to explain how people access employment. Agency in CHAT focuses on how collectives are transformed through the co-construction of new shared instruments, work processes and meanings according to a reshaped object, but overlooks how people move from one activity systems to another, in our case, the intermediations between the PhD and the labour market. This is the principal theoretical innovation of our research.

Methodology and data collection process

In this research, we seek to understand how PhDs build value from their thesis through intermediation for employment outside academia. We use a qualitative methodology (Denzin and Lincoln, 2005) anchored in a CHAT framework (Vetoshkina *et al.*, 2017) so as to grasp forms of intermediations through interactions occurring over the course of the thesis. In our model, we depicted the thesis activity system as shown in Figure 2. The object of activity concerns the thesis itself (as a concrete production) and a related outcome concerning a desired
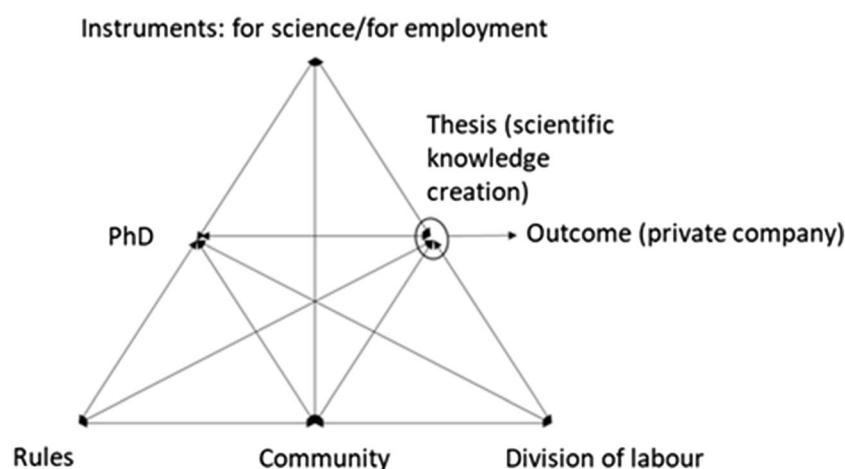
FIGURE 2 Thesis as an activity system

job. Instruments can be both tools and signs, which may be used for science or for employment. The division of labour corresponds to thesis supervision, the community of people engaged in the thesis activity around the object (e.g., the laboratory, other researchers, workshop or conference attendees), and rules for what is expected in the scientific activity (e.g., the ethos and rules of the laboratories or communities involved). Table 1 defines the poles of the thesis activity system (Yamagata-Lynch, 2010). The first author of this paper worked for a head-hunter specialized in recruiting (searching, selecting and interviewing) PhDs for innovative companies, while doing a privately financed thesis at the University of Lyon. The position of the first author is therefore that of a hybrid scientist (Lam, 2010) and insider researcher (Brannick and Coghlan, 2007). This position offered access to in-depth information, yet also called for a critical attitude towards the empirical, which was provided by the thesis supervisor, who is also the second author of the paper (with no links to the company), and by discussions with other scholars in management studies.

We investigated the professional trajectories of 20 PhDs, all of whom graduated from the University of Lyon and currently work for non-academic private organizations. We selected them without any prior knowledge of how they came to work for their current employer. They came from various academic backgrounds before beginning their doctoral study. Only three PhDs worked in a private company before the thesis and three during the thesis on a part-time basis (two social and human science PhDs without thesis funding). They worked during their thesis preparation in different fields of research, funded by a range of different funding bodies. We conducted interviews between February and March 2018. These were recorded and lasted 60 minutes on average. Appendix Table A2 provides further information about the data (criteria of selection and characteristics of the population interviewed). Interviews required significant levels of reflexivity on the part of the researcher (Alvesson, 2003) in order to understand the effects of their questions on the interviewees as well as their own relation to the topic of study. So as to cross-reference interviewees' discourses, we looked for LinkedIn profiles or other biographical accounts (e.g., from University of Lyon data).

Interview questions covered five themes including: (1) study both before and during the thesis (e.g., why the interviewee decided to study for a PhD, the major events

TABLE 1 Poles of activity system

Poles	Definition
Subject	*Who.*
	Individual who acts in the activity system, in relation to her life story and previous experience.
Instruments	*How.*
	How activity is carried out by means of instruments. What instruments enable transformation of the object and/or are related to outcomes.
Community	Who is involved within the community carrying out the activity: individuals or sub-groups sharing the same object.
Division of labour	Role that everyone plays in the system. Who is responsible for what. How roles are organized. Vertical and horizontal division of labour.
Rules	Tacit and explicit regulations, standards and conventions. What the usual conventions for doing things are. What is expected.
Object	Motives. These precede and motivate the activity. Why one engages in the activity system. What the shared and conflictual representations in the activity system are. How the object changes over time.
Outcome	What the activity system produces in a wider temporal horizon. What has changed when entering and leaving activity.

that took place during the thesis, what the initial career plan was, and what changed during the thesis and why); (2) the transition from thesis to current employment; (3) the current position; (4) any additional skills training and their perceived effects on subsequent professional activity. A further question was only asked at the end of the interview if the interviewees did not spontaneously raise it themselves; and (5) career planning (coherence of choices, perception of the utility of the thesis for later employment). We conducted interviews without limiting participants regarding their will to express themselves on other core issues. Questions started with: 'Could you tell me how you came to work in your company, starting from where you like?' Such questions, as detailed previously, are stimulations but not straightjackets; other relevant themes could then emerge (such as: other jobs of involvements during thesis, so as to highlight multiple interacting activity systems and their effects).

In our data collection, we captured biographical paths by focusing on the transformations of the object and its outcomes in the thesis activities of the interviewees (Vetoshkina *et al.*, 2017). Within this framework, our analysis looked for intermediations in professional trajectories, ithat is, what happens between two activity systems, the thesis and the company where the interviewees currently work (i.e., the outcome). In other words, our analysis focuses on dialectical movements within professional trajectories and thus also the social construction of the value of the PhD. We coded our data with Max QDA software, labelling segments of interviews the names given to the various poles of the activity system and other thematic categories. For instance: 'division of labour' relates to 'doctoral supervision', which is in turn connected to another segment heading, for instance 'network' or 'reorientation'.

Findings

Among the 20 PhDs studied, only three have joined a company specialized in a field far removed from their field of research and development. These students had the hardest time in their transition and had to request support from a public body (Pôle Emploi) or seek radical project changes. All the others are in a research and/or development context (research outside public higher education institutes, Higher Education and Research, research management). In the main, transitions to private companies occurred thanks to mediations provided by networks, and from the types of communities produced. The network connections depended on the type of thesis funding, relations with the thesis supervisor, and sometimes also from other post-thesis training programmes.

Scientific instruments shape the communities and consequent opportunities resulting from thesis activity

It was striking to hear the majority of interviewees (17 out of 20) spontaneously describe their professional integration in terms of network logic. The majority of PhDs who built useful professional networks during their doctoral research were either privately financed (CIFRE), working within a laboratory which worked closely with industry (for exchanges or mutualization of material and/or human resources), or immersed in a research context within industry. When privately financed or working within privately financed laboratories, PhDs built their networks within their organizations, teams, and at scientific conferences. When immersed in research within industry or other organizations, they kept close contacts that enabled them, whether actively or passively, to obtain a position afterwards. Network construction is thus strongly related to: (1) types of thesis funding; (2) research contexts; and (3) laboratory collaborations, as Figure 3 depicts.

For CIFRE financed research, relations with industry are prominent, often being constructed on a daily basis during or before the thesis preparation (2 cases for the latter), and this often leads to employment in the same company after completion of the thesis. Still, employment offers are only made when two other factors are present: (1) the research results possess either perceived or measured value; and (2) there is a desire on the part of the PhD holder to stay within the company:

> When I finished my thesis, well, the company that financed me was still interested in what I had discovered, and we had the impression that there was the possibility of patenting, and of going a little further. So eventually, when I finished my thesis, they offered me a permanent contract, and I stayed with them, for quite some time, eight years. Michel (CIFRE financed)[8]

> A few months before the end of my thesis, there was a position in the same department where I am now, and I went to see my department head and I asked him: 'I'm interested in this position, do you think'; [and he answered] 'well no, it's the musical chairs, this position will be taken by [Paul], but you are interested in this department, right?', I said 'yes, it's my subject, of course'. So, my manager invited my current supervisor to my thesis defence, because they knew they were looking for someone, that's it. Sofia (CIFRE financed)

> So, I said to myself, I will stay unemployed for one year, take a rest, recover from the thesis. Then I had

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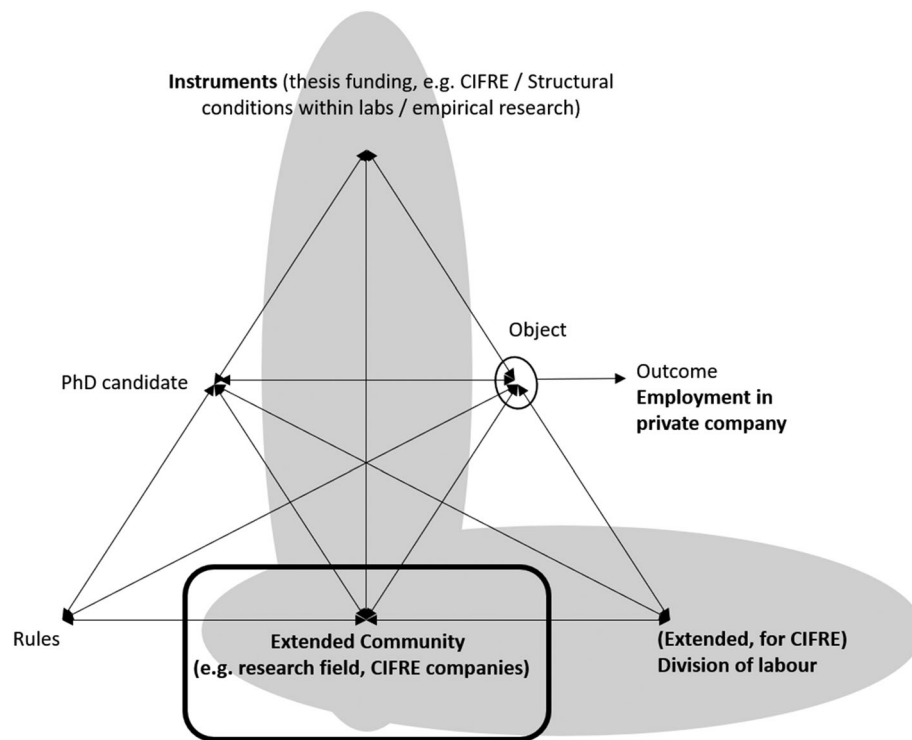[8]Interviews were conducted in French. We translated them for this paper.

FIGURE 3 Instruments shape communities within thesis activity and extend opportunities through networks

two calls. I was solicited on the one hand by the [X] with whom I already worked with a little and who had a part-time job to propose to me as a clinical research assistant, and on the other hand by Professor [X] at the Hospital who also offered me a part-time job, proofreading sleep tests, which I knew how to do. Likewise, I had already collaborated with her on my thesis. Morgane

Professionally, beneficial links may also be created by inviting key persons from a targeted company to attend the viva. The viva thus functions as a test of the use-value of the thesis: For publicly financed PhDs who happen to work in the context of a university–industry collaboration, either via their laboratories or within their research field, the professional network is enlarged. The network, it follows, is constructed according to relationships that can be based on such things as competence recognition, community membership, or a common scientific subject. In those cases, network links may be activated either passively (someone contacted the student) or actively (the student contacted someone else):

In every case, beyond thesis financing, communities were built during scientific conferences and other encounters that arose from the programme of doctoral study:

I went to an entrepreneur's fair to give a lecture on social status of business directors, such as the self-employed. There was an accountancy firm, a group that

is quite well known in Haute-Savoie. Actually, I was identified this way. Fifteen days later, I was hired. […] Besides, I began professionally at MEDEF [during the thesis], so the network – it's something I know well. We really got on well, on the same wavelength. I was hired on the 1st of July 2014 and defended my thesis on the 14th of October. Béatrice

Thesis supervisors (privately financed PhDs had two, one from the university and the other from the company on the management side) provided some of their students with access to wider communities outside the university or within university–industry collaborations:

Everything I have today is thanks to my network. That's why I insisted on the network I developed throughout my thesis. Everything I have today is thanks to my network. I finished my thesis contract on January 31st. At the end of December, just the month before, my thesis supervisor forwarded me an email from a colleague of hers who had also received an email from the director of a scientific communication agency in Paris. Her scientific manager resigned, they had ongoing projects and were looking for someone to write an article in January. So, my thesis supervisor proposed me for this little job. I accepted because I liked communicating, writing. Actually, it turned out that after talking to the director of the science communication agency, she hired me to replace the guy who left. Nathalie

Conflicts within thesis activity and their resolutions in the form of professional reorientation. Conflicts may arise during the thesis between the norms and rules of scientific activity and the personal history of the doctoral candidate or their representations and expectations of what a thesis involves. These account for transformations of the object of the thesis activity. Opportunities for a construction or reconstruction of a personal and professional project, some of which lead to employment opportunities, happen in three spheres of the thesis activity system that sometimes overlap (Figure 4).

Subject-object-community (12 cases). This relates to a possible use-value of what is produced. For instance, Paul went through a long reflection process after beginning his thesis, seeking out reading material that would help him reduce the dissonance he felt between his research ideals and the knowledge he formed in high school. During his thesis, his supervisor recommended for him not to take any decisions concerning his career choices:

> How did I go from 'I don't like business to business'? I realized that theoretically, I should enjoy the thesis more, that I should enjoy the academic world more given what I like, but in practice I realize I'd be better off with my mates in a startup! And so now I embrace it because I realize that it's more important to have a feasible application of your research that makes you happy than to be theoretically right. Paul

Subject-rules-community (9 cases). This relates to a sense of gratification deriving from what is produced during the thesis. This sense of gratification can come from collective involvement or it may be pecuniary. Disappointments can occur as a consequence of the rules one must follow to succeed in the activity (sacrifices, substantial personal or financial investments):

> So, I thought, in the private sector, the rules are clearer. We're here to make money. It's clearer for me, there's no: you'll see, maybe … work night and day and maybe one day you'll have a permanent contract because you're here for science. I found that after a while the pretext of we are here for science is … Is what we do really that important? Elisabeth.

Subject-instruments-object (7 cases). This relates to disappointments with respect to how research is done (too fundamental, inadequate or insufficient resources, changing nature of academia). For instance, Michael realized that the changing academic profession – calls for projects related to a change in types of research funding available in France – did not suit his initial representations and ideals:

> I realized that the academic world was not exactly what I expected. In other words, we have to respond to a lot of calls for projects, we're not sure whether they're going to come through. Plus, often responding to calls for projects also means being a bit *trendy* [used in this
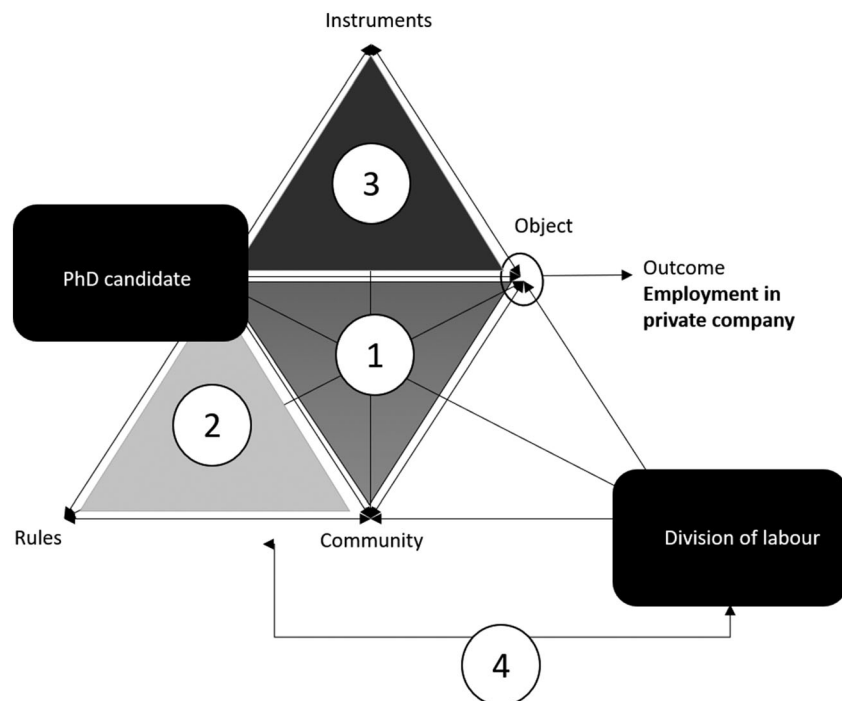

FIGURE 4 Four related patterns of mediation

exact term in the interview conducted in French] and doing what people expect you to research.Michael.

It's a kind of desert crossing, you get up in the morning [during the thesis], you have a few ideas of things to launch, in the evening, it didn't work. You think: 'well, here we go again for the next day'. It's not obvious, and so there it is … actually at that moment, I said to myself: 'well, it's clear that I won't do research all my life'. Maud

PhDs in the hard sciences who worked on fundamental research expressed their suffering when confronted with a loss of reference and meaning in the workplace (the lab) that could not be reduced by supervision during the doctoral research (4 cases):

Among the subject-instrument-object relations, training programmes in transferable skills are offered by the university yet are mostly provided by independent consultants (other activity systems) that function as intermediaries, their role being to help PhDs find employment and improve their efficiency at work. What their activity system shares with that of the thesis is not related to the object of activity (thesis) but to the institutionalized outcome. For instance, training programmes mentioned in interviews included job search techniques, skill development, networking, communication, career planning, stress management, team management, and fast reading. Yet training courses in transferable skills are ambivalent. Their reception is mainly negative (in 13 cases, even if only 6 participated in the trainings), though some are positive (7 cases), with some also seeing them as both negative and positive, according to their perceived use-value (4 cases). In almost all cases, student interest in these programmes lies mostly in the opportunities and space they offer for talking to others about managing tensions, meeting other PhD candidates, and achieving better understanding of one's own experience through contrasting it with that of others:

Stress management or teaching, stuff like that, is ok, but it's nice to meet other people have a slightly varied audience. The only thing I liked, by the way, was talking to PhD students about their thesis topics […] Seeing what can be done differently. Because out of your field, you always wonder what a researcher can do. Béatrice

Some also mention what they learnt about job search techniques, hoping that these would provide a kind of instruction manual for getting a job. A very small number also mentioned the utility of training programmes for their long-term career goals; what they learnt about managing teams, dealing with stress, or effective communication might be of help in the future.

It was overwhelmingly the case that training programmes in transferable skills did not account for any mediations between doctoral study and employment, whether because there was none (or at least none that was perceived) or because the student did not participate in such programmes (10 cases). Only one interviewee, Michael, showed awareness of a perceived discrepancy between the experience of studying for a thesis and how it was imagined beforehand. For him, this awareness helped him grasp network opportunities within thesis activity and other interacting activity systems.

Subject-division of labour. Thesis supervision can be involved in these three patterns of mediations and may lead either to conflicts with PhD candidates or to a reflection as to whether, or to what extent, the candidates desired job would follow or resemble that of their supervisor (4 cases). Maud and Aurore offer exemplary cases of such ruptures. In both cases, they could not count on any support from their supervisors for network building. On the contrary, they had to build networks on their own, either in the field or through participating in training programmes after the thesis:

It took me 4 years to do my thesis and at the end we were on the verge of a clash with my supervisor. It went really bad, the relationship disintegrated. You see, the lack of recognition, I was working weekends, evenings. I told myself it's okay, I'm done. […] I was so not pushed in the right direction. Morgane

Critical cases after the thesis. In a few cases, network building was seen as positive, but it did not help the PhD holder find employment. In those cases, PhD holders went down the classic path of searching for job advertisements and applying for positions. Some benefited after the thesis from tools created by other activity systems, such as types of research funding (e.g. EU funding for a post doc, which in turn made possible recruitment to a permanent position, in 1 case) or research tax incentives (3 cases). For the latter, it made it possible to change the recruiter's mind not about the utility of the PhD but about its perceived initial cost.

Elisabeth:
I did a year as a young researcher,[9] also promoting the research tax credit, which was never useful in the end, but it helped me to market myself in interviews.

Researcher:
Did you talk about it in interviews?

E:
Yes. It's not the first thing I put forward, but it's a little argument on its own.

[9]In the CIR meaning.

R:
How did you talk about it in the interview?

E:
Well, it's once they think that it can be interesting, that my skills can fit in and that my work can bring things to their company. I tell them, if not, there is the research tax credit that exists, it can be advantageous for you.

> I found it through my network. Colleagues who also did the ENS [Ecole Nationale Supérieure] and so they knew a little bit about the type of profile, and I contacted them, and they were interested in creating a position based on my skills. They proposed a position that was quite interesting and that's why I ended up at their place. Romain.

In some cases, PhD holders intentionally neglected their thesis activity in order to draw instead on past experiences that have a clear value in the labour market they seek to enter. Professional experiences and academic training prior to the thesis can therefore also act as complementary mediators or even substitutes for the PhD itself:

Discussion

This research focused on how PhDs create value from their thesis through intermediation that is of use for employment outside academia. We sought to understand intermediation from a practice-oriented perspective, as an activity that adds value. The concrete case we considered was the professional trajectories of PhD holders working in private companies.

A co-constructed use-value: coordination as collective and situated learning

Our research shows that practices embedded in social activity enable the value of PhDs to be recognized in the labour market. Value is constituted through practice. This approach revealed that valuation is not only a contingent product of the thesis activity itself, but also a matter of social interactions. Both dimensions must be appropriation by the subject, which requires an interiorization of the social context, including its tools and psychological instruments, in line with the object pursued. Patterns of mediation participating in the valuation of PhDs connect life stories of subjects through: (1) instruments of activity that can shape social interactions; (2) changing regulations of activity; (3) different forms of communities, including vertical divisions of labour. This process of mediated constitution of value operates at several levels, which we will now discuss.

At the individual level, mediations do not work if there is no awareness of the situation and if the individual is not included in collective learning around the constitution of the value of the PhD. This means that the object of the activity changes over the course of the thesis both from a scientific perspective (use-value for research) and from a professional perspective (use-value for employment) as subjects engage differently with instruments, communities, and changing rules of activity, depending on their career objectives. Therefore, awareness of what is happening during the thesis is also constitutive of use-value construction.

At the instrumental level, psychological instruments renegotiate the initial valuation schemes for workers. Yet these instruments are successful when they allow various actors to work collectively to achieve a desired outcome. This shows that value is collectively constituted: it is a negotiation that is helped with mediators that can only resonate (work) when the subject of activity (the PhD here) appropriates them. This appropriation is related to other dimensions of the thesis activity, such as rules, division of labour, and personal life story. This is an enlargement of Lam and de Campos's (2015) work that only focused on university–industry settings. By contrast, skills training programmes do not count as an additional use-value enabling the PhD to improve the exchange value of their skills. These programmes instead provide the PhD with reassurance with regard to their abilities, thus allowing them better to use the skills already acquired in the future.

Finally, management within activity systems is involved in all these patterns. It accounts for a specific level of mediation of value construction on a labour market and should, we argue, be at the center of the activity system as means to gather all the other levels together according to the moving object.

A critical case for research and practice

Management scholar have begun to investigate PhDs' careers outside or at the frontier of academia employing the concept of agency or psychological contract (Lam and de Campos, 2015) in the context of a new relational perspective that is, however, only partial, for it consider only relationship with the thesis supervisor(s). However, when young scientists take refuge in their thesis, making them blind to any other sort of valorization of their work, the result is that the object of scientific practice must be considered both in an idealist conception (the motive) and in its concrete aspects (tools and contingencies of the activity). If we do not take a meso perspective (between the ideal and the concrete), we take the risk of oscillating between a perspective centred on the individual, on the organization, or on the market, and may thus reify new categories. We need to adopt a

situated, relational and contingent perspective so as to stop considering the careers of scientists in the same way as everyone else's: the very object of their work, which, for science, dialogues with society in a historically and culturally complex way (changing according to the times) and with the individual in a sometimes fusional way (Knorr-Cetina, 2005), has to be taken seriously.

Therefore, the activity system proves relevant to analysing professional trajectories and transitions from one job to another from the point of view of value construction. Our case study is critical (Langley and Abdallah, 2011), since it tests a particular theory (CHAT) to explain professional trajectories of PhDs – knowledge workers – outside academia and how values of use for employment are built though intermediations. We chose CHAT because of its power to explain interactions from *within*, that is, in a situated, relation and contingent perspective. The concept of object is beneficial if we are to grasp the transformation of individuals in a professional trajectory according to mediating objects (tools) and humans third parties. Agency emerges from the way individuals make sense of what they do in interaction with what their activity is. The identified mechanisms may potentially make it possible to renew the approach to understanding access to employment through considering the way in which scientists construct their trajectory, i.e. their professionalization (Jeong and Leblebici, 2018).

The importance of history and contexts

The French case serves less as the central focus of the research than a pretext to show the importance of context in its historicity and constructed rules (regulations), from *within* the activity. Studying the trajectory of German PhDs would not work without taking into account their complete revamp of the doctorate over the past 20 years, which involves providing PhDs with transferable skills training and other sorts of courses: the result is that only "6% of PhD graduates in science eventually go into full-time academic positions" (Cyranoski *et al*., 2011, p. 278). This shows the change and intermediations available to governments to remediate negative judgments on the value of PhDs and their associated skills, while also reducing the anxiety of a PhD student wondering whether the *outcome* of the doctorate will be unemployment. Skills training could be built not from external frameworks but *with* the scientific practice to foster reflexivity skills and offer new structures to facilitate knowledge flows (Lam and Marsden, 2017) and to integrate new stakeholders in the innovation process (Buenstorf and Heinisch, 2020). On this issue, what has been done with the League of European Research Universities (LERU) warrants closer attention.

Finally, one cannot avoid asking whether the doctorate training should change according to employment market dynamics and the orientations of the economy. Without adopting an epistemological approach to knowledge, we would like emphasize that our research showed how particular funding schemes and interactions during the thesis can change the value of knowledge in the eyes of both PhDs themselves and for diverse stakeholders. The knowledge economy embraces by the European market drives new doctoral programs (Park, 2005; Bernstein *et al*., 2014) with hybrid and network-oriented innovative trainings so as to foster a new type of professional, which, our research shows, is not insignificant when considering the value of a PhD.

Conclusion

In this research, we sought to understand how intermediation participates in a social process of valuation of PhDs in non-academic private labour markets. We problematized intermediation using an activity-based theoretical stance, namely CHAT. We analysed intermediation on labour markets by focusing on the access of PhD holders to employment in the non-academic private sector. This analysis provided us with an in-depth explanation of how what PhD students do on a daily basis accounts for the value accorded to their PhDs in labour markets. We also showed how these activities led to successive transformations of the use-value of the thesis. As a general rule, finding work in non-academic private companies is mediated by facilitators (human and non-human such as communities and signs) that emerge from co-constructions mostly within an activity system or across activity systems, that is, as a product of different collective activities in which the candidate participates. The PhD, like any other line of work, has specific features that create different types of agency and different types of actions (Haapasaari *et al*., 2016). These are made possible by network constructions which coordinate these activities and in so doing generate use-value. As such, our research contributes to the literature on intermediation and intermediation on labour markets by providing a new theoretical stance rooted in activity. Intermediation participates in processes of social valuation. Further, we show that the peculiarity of the French case is secondary and serves rather as but one example among many in the variety of situations that can be found. Finally, we call for more research into intermediation on labour markets using an activity-based framework and critically about human and social sciences PhDs.

Our research does however have some limitations. First, we did not know before the interview if the PhD holder used a professional Labour Market Intermediary (LMI). A useful further study might compare the outcomes of PhD holders who used those LMIs with those

who did not, so as to evaluate their role and effectiveness in the employment process. Also, we did not ask about the wage when entering the private company. Yet, this theme never emerged spontaneously. The very fact they found a job outside academia seemed sufficient to ease a sense of injustice and a lack of gratification regarding one's own involvement during the thesis. However, more research is needed on the articulation of exchange-values, that is, between traditional economic dimensions (salary, and what a doctoral experience is worth paying) and others. Future research could potentially focus on the transformations of knowledge from one organization to another in the employment systems (Lam and Marsden, 2017) of knowledge workers, no longer from a knowledge perspective, but from a skills perspective (Sandberg *et al.*, 2017), thus taking into account the peculiarities of the activities (including people's intentions) and the heterogeneous judgments on skills made by different stakeholders.

REFERENCES

Adler, P. S., 2005, "The evolving object of software development". *Organization*, **3**: 401–435.

Alvesson, M., 2003, "Methodology for close up studies – struggling with closeness and closure". *Higher Education*, **46**: 167–193.

Barad, K., 2003, "Posthumanist performativity: Toward an understanding of how matter comes to matter". *Signs: Journal of Women in Culture and Society*, **3**: 801–831.

Bernstein, B., B. Evans, J. Fytte, N. Halai, F. Hall, H. Jensen, H. Marsh and S. Ortega, 2014, "The continuing evolution of the research doctorate". In Nerad M. and B. Evans (eds.), *Globalization and its impacts on the quality of PhD education*. Rotterdam: Sense Publishers, pp. 5–30.

Brannick, T. and D. Coghlan, 2007, "In defense of being "native": The case for insider academic research". *Organizational Research Methods*, **1**: 59–74.

Buenstorf, G. and D. P. Heinisch, 2020, When do firms get ideas from hiring PhDs?. *Research Policy*, **49(3)**: 103913.

Calmand, J., Giret, J.-F., Guégnard, C., and J.-J. Paul, 2009, "Why Grandes Écoles are so valued?", Paper presented at the 17th annual workshop of the European Research Network on Transitions in Youth IREDU, Burgundy University, "Youth transitions at risk? Insecurity, precarity and educational mismatch in the youth labour market".

Calmand, J., Prieur, M.-H., and O. Wolber, 2017, Les débuts de carrière des docteurs, Une Forte *Différenciation Des Trajectoires Professionnelles*. Céreq Bref, 4.

Cyranoski, D., N. Gilbert, H. Ledford, A. Nayar and M. Yahia, 2011, "Education: The PhD factory". *Nature*, **472**: 276–279.

Dany, F. and V. Mangematin, 2004, "Beyond the dualism between lifelong employment and job insecurity: Some new career promises for young scientists". *Higher Education Policy*, **2**: 201–219.

Dany, F., S. Louvel and A. Valette, 2011, "Academic careers: The limits of the 'boundaryless approach' and the power of promotion scripts". *Human Relations*, **7**: 971–996.

Denzin, N. K. and Y. S. Lincoln, 2005, *The Sage handbook of qualitative research*. Thousand Oaks: Sage Publications.

Engeström, Y., 1987, *Learning by expanding: An activity-theoretical approach to developmental research*. New York: Orienta-Konsultit Oy.

Engeström, Y., 2004, *Collaborative intentionality capital: Object-oriented interagency in multiorganizational fields*. San Diego, CA: University of California.

Engeström, Y., 2016, *Studies in expansive learning*. New York: Cambridge University Press.

European Commission, 2011, "Principles for innovative doctoral training". European Commission - Directorate-general for research and innovation. https://euraxess.ec.europa.eu/sites/default/files/policy_library/principles_for_innovative_doctoral_training.pdf

Haapasaari, A., Y. Engeström and H. Kerosuo, 2016, "The emergence of learners' transformative agency in a change lLaboratory intervention". *Journal of Education and Work*, **2**: 232–262.

Harfi, M., and L. Auriol, 2010, "The employability problems of doctorate holders: Explaining a 'French exception'". Centre d'Analyse Stratégique paper 189.

Jeong, Y. and H. Leblebici, 2018, "How professionalization and organizational diversity shape contemporary careers: Developing a typology and process model". *Human Relations*, **72**: 1–24.

Kaptelinin, V., 2005, "The object of activity: Making sense of the sense-maker". *Mind, Culture, and Activity*, **1**: 4–18.

Knorr-Cetina, K., 2005, "Objectual practice". In Cetina K. K., T. Schatzki and E. Von Savigny (eds.), *The practice turn in contemporary theory*. London: Routledge, pp. 175–188.

Lam, A., 2005, "Work roles and careers of R&D scientists in network organizations". *Industrial Relations: A Journal of Economy and Society*, **2**: 242–275.

Lam, A., 2010, "From 'ivory tower traditionalists' to 'entrepreneurial scientists'?: Academic scientists in Fuzzy University-industry boundaries". *Social Studies of Science*, **40**: 307–340.

Lam, A. and A. de Campos, 2015, "Content to be sad' or 'runaway apprentice'? The psychological contract and career Agency of Young Scientists in the Entrepreneurial University". *Human Relations*, **68**: 811–841.

Lam, A. and D. Marsden, 2017, "Employment systems, skills and knowledge". In Warhurst D., K. Mayhew, D. Finegold and J. Buchanan (eds.), *The Oxford handbook of skills and training*. Oxford: Oxford University Press, pp. 466–490.

Langley, A. and C. Abdallah, 2011, "Templates and turns in qualitative studies of strategy and management". In Bergh D. D. and D. J. Ketchen (eds.), *Building Methodological Bridges*. Research Methodology in Strategy and Management. Bingley: Emerald Group Publishing, **6**, pp. 201–235.

Leontiev, A. N. and M. Cole, 1981, *The development of mind. Selected Works of Aleksi Nikolaevich Leontyev*. Marxists Internet Archive Publications. https://www.marxists.org/admin/books/activity-theory/leontyev/development-mind.pdf

Mangematin, V., N. Mandran and A. Crozet, 2000, "The careers of social science doctoral graduates in France: The

influence of how the research was carried out". *European Journal of Education*, **35**: 111–124.

Marx, K., 1859, *A contribution to the critique of political economy.* Progress Publishers. https://www.marxists.org/archive/marx/works/1859/critique-pol-economy/index.htm

Park, C., 2005, "New variant PhD: The changing nature of the doctorate in the UK". *Journal of Higher Education Policy and Management*, **2**: 189–207.

Sandberg, J., L. Rouleau, A. Langley and H. Tsoukas, (2017), *Skillful Performance: Enacting Capabilities, Knowledge, Competence, and Expertise in Organizations.* Perspectives on process organization studies. **7**, Oxford: Oxford University Press.

Sannino, A. and Y. Engeström, 2018, "Cultural-historical activity theory: Founding insights and new challenges". *Cultural-Historical Psychology*, **3**: 43–56.

Vatin, F., 2013, "Valuation as evaluating and valorizing". *Valuation Studies*, **1**: 31–50.

Verdier, E., A. Lam, C. Buechtemann, H. Lopes, L. Lassnigg and J. M. Plassard, 2001, *Higher education systems and industrial innovation: Final Report of Contract N° SOE 1–1054 - Project N° 1297 Funded Under the Targeted Socio-Economic Research (TSER) Programme-Directorate General Science, Research and Development.* European Commission Directorate General for Research, p. 356.

Vetoshkina, L., Y. Engeström and A. Sannino, 2017, "On the power of the object: History-making through skilled performance in wooden boat building". In Sandberg J., L. Rouleau, A. Langley and H. Tsoukas (eds.), *Skillful performance: Enacting capabilities, knowledge, competence, and expertise in organizations.* Oxford: Oxford University Press, pp. 73–102.

Vygotsky, L., 1978, In Cole M., V. John-Steiner, S. Scribner and E. Souberman (eds.), *Mind in society: The development of higher psychological processes.* USA: Harvard University Press.

Weber, C. T., M. Borit, F. Canolle, E. Hnatkova, G. O'Neill, D. Pacitti and F. Parada, 2018, Identifying Transferable Skills and Competences to Enhance Early Career Researchers Employability and Competitiveness [Research Report], EURODOC

Yamagata-Lynch, L. C., 2010, *Activity systems analysis methods: Understanding complex learning environments.* New York: Springer US.

Appendix

TABLE A1 Distribution of PhDs in employment by discipline and occupation sector 36 (n + 3) months after the viva

	Academic sector	Non-academic public sector	Private R&D sector	Non-academic and non-R&D private sector
Total	48.8	18.5	16.2	16.6
Science and its interaction (e.g. math, physics, chemistry), engineer)	43.9	9.7	27.1	19.3
Life sciences	62.6	12.6	12.0	12.8
Human sciences and humanities (e.g. literature, philosophy, history, human sciences)	44.3	40.3	3.5	11.9
Social sciences (e.g. economics and management, legal and political sciences, sociology)	51.9	24.0	4.4	19.8

Source: Survey IPDoc 2017 – MESRI-SIES.

TABLE A2 Research sample

Name	Field of research	Defence	Before PhD	Other job in private company before thesis	Other job during thesis	Research activity	Types of employement	Thesis funding	Teaching during thesis	Lenght of interview
Béatrice	Hard sciences	2014	Research master degrees	No	No	Yes	Associate	Ministerial scholarship	Yes	38
Sofia	Hard sciences	2015	Engineering school	No	No	No	CDI (long term)	Short term contrat with IPFEN (semi public/private)	No	55
Morgane	Life sciences	2013	Research master degrees	No	No	Yes	CDD (short term) Autoentrepreneur CDD (short term) Autoentrepreneur	Ministerial scholarship	No	41
Christine	Human and social sciences	2016	Research master degrees	No	Yes (part-time)	No	Independant	None	Yes	66
Bastien	Hard sciences	2015	Research master degrees	No	No	Yes	CDI	CIFRE	Yes	38
Louise	Human and social sciences	2014	Professional master degree	Yes	No	Yes	CDI et vacations	CIFRE	Yes	67
Michel	Life sciences	2013	Engineering school	Yes	No	Yes	CDI	CIFRE	Yes	48
Nathalie	Life sciences	2017	Research master degrees	No	No	Yes	CDI	CIFRE	Yes	37
Camille	Life sciences	2015	Professional master degree	No	No	No	CDI	Labex	No	78
Pauline	Hard sciences	2017	Engineering school	No	No	Yes	CDI	Labex	Yes	40
Kenza	Hard sciences	2013	Other master degrees	No	No	Yes	CDI	Foreign scholarship	No	47
Alexandra	Human and social sciences	2015	Other master degrees	Yes	Yes (part-time)	No	CDI	Foreign scholarship	Yes	52
Maud	Hard sciences	2014	Engineering school	No	No	No	CDI	Ministerial scholarship	Yes	44
Michael	Hard sciences	2017	Professional master degree	No	No	Yes	CDI	ANR	Yes	41
Romain	Life sciences	2016	Research master degrees	No	No	No	CDI	Ministerial scholarship	Yes	52
Marine	Life sciences	2014	Engineering school	No	No	Yes	CDI	CIFRE	Yes	63
Elisabeth	Life sciences	2013	Research master degrees	No	No	No	CDI	Ministerial scholarship	Yes	58
Paul	Hard sciences	2017	Research master degrees	No	No	Yes	CDI	Labex	No	67
Clément	Life sciences	2013	Professional master degree	No	No	Yes	CDI	CIFRE	No	53
Benoît	Hard sciences	2015	Engineering school	No	No	Yes	CDI	CIFRE	Yes	50