The Rationalisation of Academic Work and Careers: Ongoing Transformations of the Profession and Policy Challenges

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During the last two decades, the reforms led by national governments across Europe and the policies developed at the European level have transformed the organization of universities and their relations to public authorities. But they have also deeply affected the situation of the academic profession. This paper aims at looking at these transformations and is organized into two parts. The first one deals with the key features of the academic profession in Europe and presents the main results which have been highlighted by different research and approaches. The second part identifies some potential developments between 2010 and 2020 and the main issues which will have to be dealt with.

While this paper is about the academic profession in Europe, most empirical evidence is drawn from national studies. It is not a choice, but a limitation imposed on us by the existing literature and the relatively low numbers of international comparisons on work processes and careers at the European level. Therefore, the aim of the paper is to identify common trends at the European level from a set of mainly national-based studies.

1. Key features about the academic profession in Europe

In terms of change, two main domains have to be distinguished. First we will look at the transformations of academic work and the increase in organisational control. Then, we will turn to the evolutions experienced by academic labor markets. In a last point, the relationships between these changes will be discussed.

1.1. De-professionalization or rationalization of the academic profession?

Since the early 1990s, higher education and research have experienced far-reaching changes in terms of governance, organization and funding. These changes have affected the organization of academic work. However, they cannot be equated with de-professionalization, but rather by a formalization of the division of labor and new forms of control among peers.

1.1.1. The changing conditions of academic work

Among the multiple evolutions faced by universities, four have most significantly contributed to change academic work conditions.

First, facing rising financial constraints, governments have diminished the share of block grants and core funding in the budgets of academic institutions, and have implemented competitive project or performance-based formula funding in universities. These pressures developed market-like mechanisms in the competition for resources, what Slaughter and Leslie (1997) refer to as "academic capitalism". In this more competitive environment, academics develop new practices to attract resources. For instance, in the US, distant education – and especially online programmes – is becoming a major source of revenue for universities and course materials are copyrighted (Rhoades and Slaughter, 2004). Academics engage in entrepreneurial activities, such as contracting with industry, and transform their teams into "quasi-firms" (Etzkowitz, 1992, 2003) competing for external collaborations and funding opportunities to produce science. Of course, the effects of academic capitalism on work may be less salient in disciplines removed from immediate market opportunities, like the humanities, but the latter are also concerned by this evolution (Ylijoki, 2003). Thus, academic capitalism means more competition, but also changes in the contents of work.

A second, overlapping dimension of change in the conditions of academic work has to do with the rise of managerialism, i.e. the introduction of management discourses and instruments from the for-profit sector (Deem, 2001, p.8). The UK system represents an exemplary case. Since the late 1980s, the British government has developed a set of evaluation tools under the framework of the *Research Assessment Exercise* in order to allocate core funding selectively to departments on the basis of their performance. In parallel, universities started to monitor the costs of teaching and research units, while departments adopted strategic plans to attract prospective students and professors. Managerialism prompts academics to formalize and to report on the distribution, costs and outputs of their

professional practices. Such reforms pushes towards the specialization of academics and the differentiation between professionalized “manager academics” and rank-and-file “knowledge workers” (Deem et al. 2007).

The third dimension of change concerns more specifically research activities. It lies in the growing hybridization of institutions producing knowledge, such as universities, government labs and industrial R&D centres (Gibbons et al., 1994; Etzkowitz and Leydesdorff, 1998). Since the 1980s, it has been progressively assumed that fostering collaborations across different institutional settings was critical to the performance of innovation and research systems. Subsequently, science policies have promoted new regulations for intellectual property, boosted research contracts with industry, and encouraged the development of science parks and technology transfer offices. These evolutions have been accelerated by the emergence of new fields, i.e. computer science or nanotechnology, radically different from older disciplines: these new sciences “require the mobilization of cognitively heterogeneous teams and of formalized collaboration between academia and other institutions, such as hospitals, government laboratories, regulatory agencies, or industry” (Bonaccorsi, 2007, p.309). The involvement of scientists in such “heterogeneous networks” is nothing but new (Latour, 1987), but the management and the design of such networks has become an objective of science policy.

Fourth, the internationalization of higher education has urged universities to develop new institutional strategies to attract international students and follow international standards. The proper effects of internationalization on academic work are still ambiguous (Enders, 2004, p. 376), and recent studies suggest that internationalization may mostly amplify existing national trends. Nevertheless, getting involved in international arenas is growingly critical to compete for funds, collaborations and students. Likewise, in the exemplary case of business education and research, international standards have been diffused and enforced by accreditation agencies, but their direct effects on the day-to-day activities of academics are uncertain (Muller-Camen and Salzgeber 2005, Cret, 2007).

1.1.2. More constraints on academic work, yet an enduring professional autonomy

Beyond changes in the conditions of academic work, authors like Ziman (1994) announce a radical shift in the very *nature* of academic work, corresponding to the rise of new norms: profit-oriented behaviours, private appropriation of knowledge and managerial control over professionals. However, sound empirical evidence suggests to relativize the notion of radical change (Deem, 2001). We argue that the core values of academics remain stable, but that changes increase differentiation in practices and values.

First, the profession is much more diverse and fragmented than it used to be, thus raising inequalities and conflicts among faculty members. Under academic capitalism, the hierarchy of disciplines is partly redefined according to their relative position to the market, prestige being associated to external market resources, whether they are drawn from research, teaching or consulting (Slaughter and Leslie, 1997, Rhoades and Slaughter, 2004). Market forces may accentuate the unequal distribution of resources among individuals as exemplified by science-industry relations. Indeed, industrial relations and contracts do not automatically have a skewing effect on scientific output (Gulbrandsen and Smeby, 2005): Van Looy et al. (2004) even demonstrate that academics who have more industrial contracts may also display higher publication records, which amplifies the traditional "Matthew effect" in science (Merton, 1968)[1]. Commercialization also contributes to the emergent differentiation of practices, career orientation and professional values (Owen-Smith and Powell, 2001). Whereas some professors interpret commercialization opportunities as threats, others consider them as resources to advance research and provide a better access to graduate students on the job market. The coexistence of traditional "mertonian" academics with "entrepreneurial" professors might raise diverging interpretations about professional roles and expectations, and end up in internal conflicts.

However, it should not be concluded that academics passively accept external changes. These changes are mediated by organizational structures and enduring professional values, as illustrated by the resistances encountered by managerialism in the UK. Managerialism embodies a severe threat to the professional autonomy, for instance in the allocation of their time or their ability to define their research agendas. Nonetheless, several studies indicate that

[1] The Matthew effect initially refers to the fact that scientists who already have a high credit are more likely to be credited for discoveries than others, so "the rich get richer at a rate that make the poor become relatively poorer" (Merton, 1968, p.62)

academics in the UK have managed to protect their autonomy, even though their working conditions have deteriorated (Bryson, 2004). Morris and Rip (2006) show how UK life scientists have developed strategies to fit with national priorities and funding programmes without altering the core of their scientific agenda. Similarly, Cohen et al. (1999) show that the accountability measures introduced in UK public research institutes did not radically affect work processes: researchers turned their previously informal agenda-setting processes into "mission statements" documents, to facilitate negotiation with patrons and prevent modifications in research-planning.

Eventually, several studies indicate that although academics have unquestionably changed their management practices, they have not embraced managerialist values (Henkel, 2000, 2005; Bryson, 2004). They remain loyal to the mertonian ideals of open science and their identity as teachers and researchers is still deeply anchored in the traditional disciplinary system. In a study of research activities in Finland, Ylijoki (2003) draws very similar conclusions. The changes are mediated by local conditions and disciplinary cultures. Academics might engage in entrepreneurial ventures, yet they still adhere to traditional norms and strive to protect them. Has nothing changed then? The answer is negative: while the basics of academic identity have remained largely untouched, autonomy is not taken for granted any longer. Autonomy has to be defended and constantly redefined in the relations between academics, external audiences (Henkel, 2005, p.173). Therefore, claims that academics are being "de-professionalized" might be slightly overstated.

1.1.3. Academic work rationalized

In spite of the numerous challenges, we argue that academic work has not been de-professionalized, drawing on the framework developed by Freidson (1994). Freidson contends that the growing integration of professionals into organizational structures means the demise of professional power. Since substantial evidence indicates that professionals in a large number of sectors still enjoy high levels of autonomy, power and expertise, Freidson argues that the issue is not about de-professionalization, but about the changing nature of professional control. According to Freidson, there is a growing formalization and differentiation of relations among peers: professions are not likely to disappear, but they might become more stratified with the emergence of a specialized, distinct "professional

elite", controlling the work of other professionals. Following Freidson, we argue that the main transformation of academic work concerns the formalization of tasks and the increasing division of labor.

First, academic activities have diversified and are more formalized into evaluation criteria and organizational rules. Since the Humboldtian revolution, academic work has traditionally been distributed between teaching and research. With the growth and bureaucratization of higher education systems since the 1960s, administrative and managerial tasks have expanded. Since the mid 1990s, academics are also more and more expected to contribute to economic development, innovation and diffusion of knowledge. Even if academics have engaged in a variety of entrepreneurial activities well before the emergence of debate about the "third mission" (Shinn, 2000; Auger, 2004), what is new is that these activities are now integrated in the formal mission of universities, with a shift from individual to organizational responsibility (Krücken and Meier, 2006, p.250). Similarly, expanding activities related to research and teaching – such as developing contracts, finding internships for students, elaborating e-learning programmes – are no longer considered as peripheral.

These changes bear consequences for academic careers and the internal segmentation within disciplines has amplified. Traditionally, the role of an academic in the division of labor depends highly on career stage and position in the internal hierarchy of the discipline (Shinn, 1988; Etzkowitz, 1992), but when the specialization of tasks augments, the differentiation among academics performing those tasks is likely to increase. In a study of work patterns in physics and life sciences in French universities, Becquet and Musselin (2004) show that experiments are generally carried out by doctoral students and post-docs under the supervision of junior professors, while seniors raise funds, develop contacts, and write project proposals. This increasing share in project management, administrative responsibilities, and maintenance of partnerships to secure external resources which comes with seniority is again not new, but it has become more explicit.

Second, academic work has become more and more embedded in complex organizational arrangements spanning institutions and disciplines, as exemplified by the evolution of research. Bibliometric studies reveal a striking rise in multi-authored papers as well as multi-institutional and international collaborations in the last 30 years. These results indicate a vast increase in the specialization and division of scientific labor. In the US, Adams et al. (2005)

found out that the average size of research teams in a set of 12 scientific fields, as reflected by the number of authors in publications, rose by 50% between 1981 and 1999. During the same period, the rate of domestic inter-institutional collaborations has doubled, while the rate of international collaborations was multiplied by 5. While the humanities lag well behind this trend, it significantly affects both the natural and the social sciences (Larivière et al., 2006). Despite the absence of an equivalent, systematic study, the literature points to similar conclusions for European countries, confirming the growth of the size of teams and the expansion of inter-institutional and interdisciplinary collaborations (Hicks and Katz, 1996a; Grossetti and Milard, 2003; Sandström and Wadskog, 2005).

Because collaboration between universities, government labs, and industry develop, the articulation of multi-institutional projects and networks results in higher coordination costs (Cummings and Kiesler, 2005). In addition to funding programmes supporting collaborative networks (Corley et al. 2006), universities have set up structures to optimize collaborations across organizations, institutional sectors and/or disciplines. These changes go beyond the creation of interface structures, such as technology transfer offices, and affect the core organization of academic work: the departments. Problem-oriented organized research units, have been created to supplement traditional discipline-oriented departments (Geiger, 1990, Boardman and Bozeman, 2003). In some cases, research centres may represent little more than a strategy to attract funds from external sponsors (Groenewegen et Peters, 2002; Mignot-Gérard, 2003). However, research centres correspond to a “collectivization of research” that allows for economies of scale in experimental work. They also encourage the specialization of academics, a dynamic reinforced by the capacity of centres to hire technical and administrative personnel or casual contract researchers (Etzkowitz and Kemelgor, 1998).

1.2. The transformations of careers and employment agreements

The transformation of work goes hand in hand with a transformation of academic labor markets. First, the relationships between permanent and casual occupations are moving as the later are increasing. Secondly, recruitment procedures and practices are evolving. Finally the link between academics and their institution has been transformed and internal labor markets developed.

A strongly grounded assessment of these transformations would require studies based on empirical data which are not always available today. Moreover, the still rather high diversity in career patterns and procedures among European countries makes general assessments very fragile. Nevertheless, some general trends seem to develop over European nations and more broadly over industrialized countries.

1.2.1. The expansion of secondary labor markets

Following the seminal work of Piore (1969 and 1975), it is useful to distinguish between primary and secondary markets in order to account for the on-going transformations. Primary labor markets are characterized by long-term employment relationships and organizational career while on secondary labor markets short-term employment and market-like mechanisms prevail. Tenured, on tenure track[2] and civil-servant positions in higher education institutions characterize the academic primary market, while assistantships, doctoral and post-doctoral positions, part-time and adjuncts jobs are typical for the secondary market.

In many countries the latter is expanding to the detriment of the former. This a well documented trend in the United States for instance. In the recent years, only about 40% of the positions opened were tenured or on tenure track positions. As a result the share of fulltime faculty members holding such positions steadily decreases: in 1969, it reaches 96,8%, against 85,5 in 1998 and 65,2% in 2003. Simultaneously, the share of part-timers increases: within the research institutions, they represented 15% of all positions in 1969, against 25% in 1998 and 46% in 2003 (Schuster et Finkelstein 2006, p. 44-45).

Such a trend is also observable in Europe. In the United Kingdom for instance, the fixed-term contracts represented 39% of the academic staff in 1994 (Court, 1998) and 44.8% in 2003, while part-timers reached 12% in 1995 and rose to nearly 18% in 2002. In France, a similar evolution can be observed: the fixed-term staff among university teachers reached 9.4% in 1994 (Note d'information 95-40) but 15% in 2006 (Note d'information 07-46). But this only reflects one part of the reality as post-doctoral positions also developed during the same

[2] Because the chance to get a tenure is very high when one is on a tenure track position, we will consider "on tenure track" positions as part of the primary market.

period of time but are not included in the official data on faculty members produced by the ministry because they have no teaching duties.

In Germany, according to Janson, Schomburg and Teichler (2007, p. 53), the share of the professors (who are almost always on long-tem contracts) reached almost 25% in 1995 but only 23% in 2004 among the academic staff of German higher education institutions. While on this period of time the number of professors rose from 2%, the number of fixed-terms assistants rose from 10%.

An important element to add to this panorama concerns the worsening possibilities for access to the primary market. The traditional career path which consisted in waiting a period of time[3] on the secondary market before accessing to the primary one does not work as well as it used to. An increasing share of the academic staff remains part of the academic profession but never succeeds in getting access to the primary market. In the USA, Erhenberg (2005) observed that some institutions began developing specific career path for their not on tenure track academic staff while Schuster and Finkelstein (2006) remark that 61% of the *part-timers* holding a doctorate have always been part-timers and only 14% of the fulltime staff previously were part-timers. We unfortunately miss comparative figures on European countries, but similar trends as in the USA are expected to be observed.

1.2.2. Shifting norms and practices in recruitment

While access to the primary market seems to become more difficult und uncertain, it is at the same time more standardized. The criteria to meet in order to have a chance of getting a permanent job have been more precisely defined. In Europe for instance holding a PhD has become the rule. But this is a minimal pre-requisite. In order to get a *maître de conférences* position in France, or a lecturer in the United Kingdom it is also often required to have some teaching experience, to publish papers in peer-reviewed journals and participate to international conferences.

[3] The length of this period of time may vary a lot from one country to another. It is rather short in France (the average age of access to a first tenured assistant position is 33). In Germany by contrast the average age of access to a tenured position was 42 (Mayer 2000) !

This also impacts recruitment procedures. For permanent staff, the information provided the applicants are always more numerous. Nowadays, they may be asked to prepare synopsis for specific courses in order to test their teaching capacities. The candidates invited for a visit on campus are not only interviewed by the hiring committee, they may also be asked to give a seminar or a lecture. Some universities even introduce psychological tests and interviews with the person in charge of the human resources department. This increasing investment in procedures is also observable for the non permanent academic staff. It is not rare to launch a recruitment procedure for post-doctoral positions where networking previously often prevailed.

This rising formalization reflects a more general shift. In some European countries the access to a position depended on a national competition aimed at identifying “the bests”. It increasingly becomes a recruitment, i.e. a procedure which is specific to each institution and by which the specific needs of this institution have to be met. The job advertisements featured by universities show they are looking for multi-sided profiles: almost none is solely defined by scientific objectives and they all provide information about the teaching duties which will be expected, about the classes to teach and about whom and what subjects they will address. They even often ask for managerial skills or capacity in getting grants, managing research contracts etc.

A final shift concerns the disqualification of inbreeding. Such practices were rather common in many European countries. In French Belgian universities, most teachers were promoted where they are recruited. This was also usual in Portugal, Spain, Norway, etc. and rather frequent in France. Inbreeding in these countries was seen as normal and satisfying: there was less uncertainty about the quality of the recruited colleagues as he/she was already known and had proven his/her capacities, their loyalty to the group is expected to be higher, etc. Countries like Germany and Austria where professors cannot get a position where they passed their *Habilitation* were rather exceptional. This is no more the case. Inbreeding is now considered as a threat for scientific quality and institutional mobility is becoming the norm. The same holds true for international mobility: in evaluation procedures or activity reports, indicators on the number of international staff are more and more important and are convincing incentives to recruit externally and even abroad.

1.2.3. The development of internal labor markets

A last point documenting the transformation of academic labor markets, deals with the increase in instruments developed at the national or institutional level to assist higher education institutions in managing their staff.

In many European countries, with the exception of the United Kingdom and Belgium for instance, academic positions and/or staff were managed at a national or regional levels. During the last two decades, the management of positions and/or staff have been delegated to the institutions in countries where it was not the case yet. This affected the nature of the relationships between each academic and his/her institution and pushed towards more employer-employee like relationships. It also transformed the relationships between academics and academic leaders, as the latter could no longer behave as pure *primus inter pares* and have to endorse rather hierarchical and managerialist attitudes.

Because they now are responsible for their staff and/or positions, higher education institutions developed instruments aimed at creating or reinforcing internal labor markets (Doeringer and Piore, 1971). In other words, they introduced tools, devices, procedures or rules enabling them to manage their academic careers by themselves (Musselin, 2005). In some cases, they rely on the results of national procedures in order to make their own decisions. In the United Kingdom for instance, the Research Assessment Exercise provides the institutions with information they can use to reward their staff, to allocate reduction in teaching duties, etc. In this country too, getting grants from external bodies such as the research councils is used as an indicator for academic quality. All this is reinforced by the local devices institutions may develop themselves in order to evaluate their own staff on a regular basis. Academics may be regularly asked to provide reports about their activities, or even in some cases to fulfil time-sheets.

Such evaluation devices are used as a basis for decisions about promotion, salary increase, allocation of work. They provide institutions with capacities to manage their human resources. What happened in Germany by the beginning of the 2000s is typical for this evolution: merit-salary have been introduced, thus allowing universities to define objectives and indicators during the recruitment of professors and then to reward them (or not) according

to their performances. By the same token, the resources[4] negotiated by the professors when they are recruited are no longer allocated for ever but for a fixed period of time at the end of which they can be renewed or not[5].

As the increase in casual employment and the increasing formalisation of recruitment procedures, the creation and expansion of internal labor markets deeply transform the academic labor markets and career developments.

1.3. How the transformations of work and the transformation of careers work together

The transformation of academic work and the transformation of the academic labor market described in the previous section are coupled processes. The specialization of individual academics is paralleled by a differentiation in statuses and career tracks, so that specific activities are allocated to particular types of manpower.

The increasing share of academics belonging to the secondary labor market are not only employed on fixed-term contracts: they are also mostly allocated on specialized tasks. It is thus frequent for post-doctoral staff to achieve only research activities, while adjuncts and part-timers often concentrate on teaching to large classes of undergraduate students. The increasing number of contingent staff allows for a specialised distribution of activities as well as for flexibility in an uncertain and moving environment. The remarkable increase in post-docs in the US (Ehrenberg, 2005) and in many other countries (with regards to Australia, see Robinson, 2005) is not only a consequence of a depressed job market for PhD graduates, but also a response to the needs of senior scientists to develop their team in order to apply to competitive grants. It allows to adjust to the research as well as to the teaching workload. It furthermore reintroduces more hierarchical relationships, while horizontal relationships mostly prevail among peers[6]. This allows for more direct control on work while performances are easier to evaluate because the tasks are more specialized.

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[4] A certain number of assistant positions, budget for books, the acquisition of equipment, etc.

[5] This is also the case in the United Kingdom.

[6] In France for instance, the maîtres de conférences are tenured and not the subordinate of the professors while in Germany the assistants are not permanent and are dependent on “their” professors.

On the primary academic labor market, simultaneous evolution of work and careers are leading to more differentiation among peers. While teaching and research were considered as the core tasks of academics in most European universities, the development of evaluation and the equipment of universities as internal labor markets are challenging these traditional representations. Distinct groups of academics achieving different tasks are emerging and are always more formally identified. On the one hand academics elected or appointed on management positions (chairs, deans, presidents…) belong to the specific group of academic managers which is characterized by the tension they experience between their academic identity and their managerial activities. On the other hand, the ever stronger distinction introduced between publishing and not-publishing staff sustains the recognition of different ways of being an academic, different allocation of work, different career paths. In some countries (such as the United States, the United Kingdom, the Netherlands and Germany recently), the trend towards specialisation leads to a reconsideration of the link between research and teaching and to the segmentation of the permanent professoriate between those specialized in research and holding a position as research professors, and the others.

2. Key public policy challenges for the academic profession in the European Research Area

The transformations of the academic profession imply new challenges for policy making in the European Research Area. Drawing on the analysis of ongoing changes, we have identified four issues that may prove critical for national governments and European institutions in the management of academic work and the regulation of careers. First, the problems raised by the ongoing transformations of the control and the evaluation of academic work. Second, the challenge of heightened pressures on academic work in the context of further institutional hybridization. The third issue concerns the growing role of universities are employers. The fourth challenge is the construction of a European academic labor market.

2.1. The challenges of control and evaluation of academic work: effectiveness, efficiency and legitimacy

Although academics are not likely to be de-professionalized, the rationalization of academic work is expected to progress in the next decade. Systems of control and evaluation of

academic work shall continue to expand and refine. However, if professional power is to remain robust, one may wonder about the possibly ever-increasing discrepancies between attempts at control on the one hand and unintended consequences due to professional resilience on the other hand. This problem raises three challenges: the effectiveness, the efficiency and the legitimacy of control and evaluation systems.

The first challenge concerns *effectiveness*, i.e the ability of institutions and governments to monitor, assess and control and academic work. Formal organizational structures and processes can be good tracer of the new forms of the division of scientific labor, but they may also prove ineffective and have little grasp on actual practices. A first example can be drawn from university technology transfer policies. Specialized offices dedicated to this function in universities have been generalized worldwide to provide help in the negotiation of intellectual property rights and diffuse entrepreneurial norms. However, it is not clear whether they have deeply affected the views and practices of academics on technology transfer, which depend less on organizational incentives than on individual experience (D'Este and Patel, 2007; Bercovitz and Feldman, 2008). Academics may also prefer to rely on their personal informal networks with industry rather than resorting to a university office to set up a collaboration (Krücken, 2003). A second example is provided by quality assurance processes. Hoecht (2006) argues that quality assurance often result in procedural, self-referential "rituals of verification" (Power, 1997), that do not actually enhance the control of external stakeholders on academics nor guarantee substantive quality. Thus, the potential development of formal compliance strategies may hinder the effective control over academic work.

The second challenge has to do with the *efficiency* of the evaluation of academic outputs, i.e. the direct and indirect costs of these processes in regard to their benefits. Direct costs mainly concerns the time spent by academics on assessment-related work (e.g. filling out evaluation forms, writing proposals or peer-reviewing the work of others). Academics in Europe complain less about accountability than about the efficiency of assessment procedures. In the UK for example, voices are raising to complain that at the aggregate level the time spent in preparing and carrying out of the Research Assessment Exercise might be out of proportion to its benefits (House of Commons, 2004). The same sort of critiques is often addressed to quality assurance for teaching and learning (Hoecht, 2006; see also Bornmann et al., 2006, p. 688-689). For this reason, one may expect the further rationalization of assessment processes in order to lower their direct costs. For instance, the assessment of management-related costs,

e.g. the time spent by experts peer-reviewing a programme, might be improved. Standardizing peer-review and relying more on quantitative indicators to lower costs has also been one of the reasons for the recent reform of the Research Assesment Exercise in the UK, (House of Commons, 2004; DfES, 2006). However, the rationalization of evaluation procedures may not be free of indirect costs through unintended effects. Evaluation criteria can impact the measurable practices of academics, e.g. publication outputs, at the detriment of non measurable dimensions of work, e.g. the involvement in collegial tasks or what Losego (2004) labels "invisible work". The generalization of scientometric methods in the evaluation of scientific productivity in the context of *Evaluation Based Funding* (i.e. formulas to calculate funding according to indicators) may have inadvertent, detrimental consequences on research: "under a regime of evaluation-based funding scientists have been found to publish more but less riskful, mainstream rather than borderline papers and try to place them in lower quality journals as long as they are in the ISI journal index" (Weingart, 2005, p. 126). Subsequently, hot debates are expected to emerge around the production and the use of performance indicators, especially if policy makers uncritically rely on them.

One last question can be asked regarding evaluation and control: the legitimacy of both performance criteria and assessors. The creation of new intermediate positions in evaluation and control might blur the boundaries between administrators and academics, and thus raise legitimacy issues. And yet legitimacy is a central issue in the acceptance and diffusion of standards of evaluation, especially when several standards are in competition (Durand and McGuire, 2005). Then, how to guarantee the quality of standards, or to put it more sharply, who is going to watch the watchmen? The competition between national traditions, accreditation agencies, quality insurance systems and definition of performance might represent a major challenge to the construction of the European Research Area.

2.2. A continuing institutional hybridization resulting in pressures on individuals and differentiation among academics

The rise of multi-institutional collaborations, the hybridization of higher education and research and the resulting differentiation between academics involved in diverse social networks and sharing different systems of value – exemplified earlier by the divergences in careers and practices among life scientists – should continue and expand in the next decade. These evolutions raises at least two challenges in terms of management of academic work.

First, one can wonder how much institutional diversity and hybridization can universities absorb as organizations. As stakeholders (e.g. charities, industrial firms, local governments) and intermediary organizations (e.g. funding agencies, quality assurance and evaluation bodies) will expand in numbers and diversify in the field, tensions may arise between actors pursuing divergent rationales and strategic objectives. From a principal-agent perspective on science and higher education policy (Van der Meulen, 1998; Braun and Guston, 2003), stakeholders and intermediary organizations can be seen as principals in competition for the control of academics. Thus, more principals means more coordination work on the side of the agents between their multiple, potentially conflicting demands. Consequently, administrators and academic leaders at the university level might have to intervene more frequently to solve emerging conflicts, at least on a punctual basis (e.g. intellectual property litigations with industry), and to participate more actively in the building of coalitions to minimize divergences among stakeholders (e.g. initiatives to create centers of excellence in teaching and research). Nevertheless, one might expect them to relay a large share of external pressures on individual academics and departments, because administrators and academic leaders mostly deal with external stakeholders on general matters or to formalize projects which have been already initiated at the departmental or the individual level. Moreover, they often act as diffusers of "management fads" within academia, as illustrated by the introduction of industrial or business-inspired governance methods (Kleinman and Vallas, 2001). In other words, one might expect the rising "coordination costs" of the system to be borne by individual academics.

A second related question concerns the experience of growing external pressures on the academic profession. To protect from these pressures, academics might engage in a variety of tactics. The first type of response deals with adaptation at the individual level. According to the principal-agent perspective, one may expect learning effects to occur as academics develop coping strategies to resist the agendas of their principals and policy schemes. For instance, Morris and Rip (2006) point out academics can engage in industrial relations to comply with government innovation policy, but actually carry out non-innovative, routine research with industry in order to fund basic research in parallel. In a sense, a higher number of stakeholders and more collaborative practices across institutions and sectors can undermine the ability of institutions to master their agenda (Hicks and Katz, 1996b). However, the ability to retain autonomy will probably not be equally distributed among academics. On the

contrary, inequalities are likely to expand with the specialization of academic into particular tasks: the generalization of casual workers would allow for a quicker adaptation to policy changes and institutional priorities. A second type of response could lie in the further development of "buffer" organizational structures to mediate the demands of their principals. This trend is already visible in the growing role of departments in the UK (Morris, 2002) or research centers in the US (Bozeman and Boardman, 2007) : although they relay managerial pressures on individuals, they simultaneously play a supportive role. These organizational arrangements provide collective resources (e.g. information or strategic positioning) increasing the bargaining power of individual academics vis-à-vis external audiences. They may also allow facilitate decoupling between formal structures and actual work practices (Meyer and Rowan, 1977). Similar remarks can be made about intermediary organizations in research and higher education, such as funding councils or quality assurance agencies. Because of their simultaneous position as agents of the government and emanation of the academic community, they can be used by academics to push their own agenda and defend their interests (Morris and Rip, 2006; King et al., 2007). In consequence, conflicts and tensions resulting from changes in the institutional environment are likely to manifest at the organizational level, within departments, research centers and intermediary organizations, accelerating the ongoing division of the profession.

2.3. Universities as employers

These reconfigurations in the internal balance of power of academic organisations are developing at the very moment when these organisations are increasingly engaging into employers-employees" relationships with their faculty members and developing more individualised forms of career management. Thus, they have to deal with the tension raised by the management of a group of autonomous professionals who have a status of employees. This further challenges the internal balance in power as it affects both the role of academic and administrative leaders and the relationships between academics and their university.

The delegation of the management of academic staff and positions to the university level first confronts academic leaders with major decisions, which were previously in the hand of public authorities. From a rather technical point of view, it requires a profound evolution of the administrative staff in universities, for them to acquire the skills needed by the management

of human resources at the institutional level. From a more strategic point of view, it means that choices such as where should positions be cut or developed, have to be handled by universities themselves. These are very complex decisions because an internal consensus among the different disciplines seems difficult to obtain – each and everyone trying to get more and refusing to give positions back. Academic leaders are never considered as legitimate to make such choices. One may therefore expect them to increasingly rely on external assessments (scientific evaluation of a department for instance) or environmental pressures ("demands from the students") to argument and legitimize their strategies. This means that the role and the impact of evaluation bodies will probably grow. If they remain in the hand of the peers, they will become very central levels of professional regulation. Rather than a regression of professional power, one might expect an increasing professional influence exercised by the academics who participate to these evaluation bodies, allowing for interfaces between professional and institutional forms of control.

Second, one can expect some paradoxical transformations in the university/academics relationships. On the one hand, the development of contractual agreements closer to employer-employees relationships, increases the commitment expected from academics. The latter must display a stronger institutional affiliation and feel concerned by the strategic statement of their institution. This results from the construction of universities into organizations (Brunsson and Sahlin-Anderson, 2000; Musselin, 2006). According to Brunsson and Sahlin-Anderson this process first relies on the construction of stronger frontiers and identity to which academics are expected to adhere. Following the two authors, this process also relies on the construction of hierarchy. This implies a transformation in the nature of the relationships between each academic and its institution: they are now regulated by employment arrangements and work relationships. But, on the other hand, institutional affiliation is challenged by the increased pressure in favour of institutional and international mobility and the construction of research networks bypassing the organizational frontiers university are trying to build. In a way, academics are asked to behave at the same time as cosmopolitans and as locals (Gouldner; 1958a and 1958b) and to manage the internal contradiction between these two different roles.

2.4. Towards a European academic labor market?

A last point to address deals with the potential emergence of a European labor market. Up to now, academic trajectories still remain mostly national. Despite the different devices promoting mobility and the overall discourses in favour of internationalisation, the weigh of foreign academics in most European higher education institutions remain rather low. Among them the share of foreigners coming from European countries is not very high either.

Many reasons may explain this phenomenon. First the rules regulating the academic profession are still very national. Career paths, status and recruitment procedures remain different from one country to another. Second because of the informal implementation of national rules, looking at the latter is not enough for an applicant to discover what is expected from him/her: many implicit rules and practices are better known by the national candidates than by the others, unless the foreign applicants previously spent sometimes in the concerned country. A further reason comes from the varying social security and pensioning regimes. Going from one country to another with a family is still an administrative challenge. Last but not least, national actors may give a preference to national candidates because they better trust their national degrees or because of the language used by teaching.

Despite these rather pessimistic conclusions, some factors plea for the development of a more international academic labor market. First recruiting international staff has become a positive criteria in many countries and higher education institutions try to meet it. Moreover, the development of an international market for doctors and post-docs has clearly expanded. In some disciplines (like life sciences) a post-doc abroad has become the norm. It thus may be expected that an increasing number of young academics will know about the national rules and implicit norms of other countries, thus improving their chances to be recruited. The other way round, this should help the diffusion of information about each systems and push towards more coherence.

Nevertheless, will this expected increase in foreign recruitments be European or international? In other words, will a global academic labor market prevail or will a European academic labor market comparable to the US develop, i.e. a territorial space (the US / the EU) sharing rather similar norms and rules and considered by the applicants has the “natural place” where to apply?

This raises at least two further range of questions. First: what conditions should be achieved for Europe to become the relevant academic marketplace? Can this conditions be achieved? Is the emergence of this is European labor market a necessary condition for the existence of the EHEA and ERA or, one the contrary should the EHEA and the ERA first become a reality for this European labor market to be predominant over the nation-states?

But, and secondly, should a European marketplace be favoured to a global labor market? In very concrete terms, what will be the consequences of predominantly recruiting within the EU borders *versus* predominantly recruiting from everywhere? Answering these questions go far beyond the scope of this paper as they are closely linked to the construction of the European Union as a legitimate supra-national political entity.

Conclusion

Rationalization of work as well as the differentiation and the formalization of career tracks are expected to continue and generalize. Policy makers should recognize the challenges raised by the differentiation of work and careers, especially in terms of growing inequalities and tensions. They could pay closer attention to the design of reward systems in order to limit negative effects, for instance in pushing forward evaluation criteria that would better fit the ever growing diversity of academic tasks and career paths (e.g. recognizing the involvement in collegial tasks or "invisible work"). Changes have been thorough, yet incremental in most cases, so the academic profession in Europe is not likely to experience a radical shift in the next decade. Change may instead derive from the addition and combination of evolutions that have already been set in motion within national systems of higher education and research. Future changes in the profession may still be rather dependent on national institutional trajectories, policies and reforms than on European initiatives.

That is not to say that European-level institutions and policies will not play a role in the evolution of the academic profession, or that there will not be similar developments between countries. Parallel or at least comparable changes in EU countries could be indirectly induced or accelerated by European institutions and policies, for instance through research funding instruments or education policy schemes carrying implicit or explicit rationales and organizational arrangements. Evolutions may also occur indirectly through international

exchanges: the internationalization of careers might foster the transfer of management practices or career schemes from one country to another. Similarly, countries might emulate reforms implemented abroad, as New Public Management in the UK has inspired the reorganization of academic institutions in other EU countries. In order to grasp these evolutions, research on academic work, following the studies already at hand in the United Kingdom, should develop in all other European countries.

REFERENCES

ADAMS, James D., BLACK, Grant C., CLEMMONS, J. Roger and STEPHAN, Paula E., (2005), "Scientific teams and institutional collaborations: Evidence from U.S. universities, 1981-1999", *Research Policy*, vol. 34, No 3, p. 259-285.

AUGER, Jean-François (2004), "Le régime de recherche utilitaire du professeur-consultant au cours de la Seconde Révolution industrielle », *Annals of Science*, vol. 61, n°3, p. 351 - 374.

BECQUET, Valérie and MUSSELIN, Christine (2004), *Variations autour du travail des universitaires*. Ministère de l'Enseignement Supérieur et de la Recherche, Rapport pour l'Action Concertée Incitative Travail.

BERCOVITZ, Janet and FELDMAN, Maryann (2008), "Academic Entrepreneurs: Organizational Change at the Individual Level".,*Organization Science*, vol.19, p. 69-89.

BOARDMAN, Craig and BOZEMAN, Barry (2007), "Role strain in university research centers", *The Journal of Higher Education*, Vol. 78, n° 4, p. 430-463

BONACCORSI, Andrea (2007), "Explaining poor performance of European science: institutions versus policies", *Science and Public Policy*, vol. 34, n°5, p. 303-316.

BORNMANN, Lutz, MITTAG, Sandra and DANIEL, Hans-Dieter (2006),"Quality assurance in higher education - meta-evaluation of multi-stage evaluation procedures in Germany", *Higher Education*, vol.52, n°4, pp. 687-709

BRAUN, Dietmar and GUSTON, David H. (2003), "Principal-agent theory and research policy: An introduction", *Science and Public Policy*, vol. 30, n°5, p. 302-308.

BRUNSSON, Nils and SAHLIN-ANDERSSON, Kerstin (2000), "Constructing Organizations: The Example of Public Sector Reform", *Organization Studies*, Vol. 21, n° 4, p. 721-746.

BRYSON, Colin (2004), “What about the workers? The expansion of higher education and the transformation of academic work”, *Industrial Relations Journal*, Vol. 35, n°2, p.38-57.

COHEN, Laurie, DUBERLEY, Joanne and MCAULEY, John (1999), “Fueling Discovery or Monitoring Productivity: Research Scientists' Changing Perceptions of Management”, *Organization*, vol. 6, n°3, p. 473-497.

CORLEY, Elizabeth A., BOARDMAN, Craig and BOZEMAN, Barry (2006), “Design and the management of multi-institutional research collaborations: Theoretical implications from two case studies”, *Research Policy*, vol. 35, p. 975–993

COURT, Stephen (1998), “Academic Tenure and Employment in the UK”, *Sociological Perspectives* Vol. 41, p. 767-774.

CRET, Benoît (2007), *L’Émergence des accréditations : origine et efficacité d’un label*, Thèse de doctorat en sociologie de l’Institut d’Etudes Politiques de Paris.

CUMMINGS, Jonathon N., Sara KIESLER (2005), “Collaborative Research Across Disciplinary and Organizational Boundaries”, *Social Studies of Science*, 5, p. 703–722

D’ESTE, Pablo and PATEL, Parimal (2007), “University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry?”, *Research Policy*, vol. 36 n° 9, p. 1295-1313

DEEM, Rosemary (2001), “Globalisation, New Managerialism, Academic Capitalism and Entrepreneurialism in Universities: Is the Local Dimension Still Important?”, *Comparative Education*, Vol. 37, n°1, p. 7-20

DfES (2006), *Reform of higher education research assessment and funding: Summary of results*, UK Department for Education and Skills, last accessed online on 03/19/2008 at http://www.dfes.gov.uk/consultations/conResults.cfm?consultationId=1404

DOERINGER Peter D. and PIORE, Michael J. (1971), *Internal Labour Markets and Manpower Analysis*, Heath: Lexington Books.

DURAND, Rodolphe and MCGUIRE Jean (2005), “Legitimating agencies facing selection: the case of AACSB”, *Organization Studies*, vol. 26, n°2, p.113-142.

EHRENBERG, Ronald G. (2005), “The changing nature of the faculty and faculty employment practices”, working paper, Cornell Higher Education Research Institute.

ENDERS, Jürgen (2004), “Higher education, internationalisation, and the nation-state: Recent developments and challenges to governance theory”, *Higher Education*, vol. 47 n° 3, pp. 361-382.

ETZKOWITZ, H. (2003): Research groups as ‘quasi-firms’: the invention of the entrepreneurial university. Research Policy, vol. 32, n°1, p.109-121

ETZKOWITZ, Henry (1992), « Individual Investigators and their Research Groups », *Minerva*, Vol. 30 n° 1, Spring, pp. 28-50.

ETZKOWITZ, Henry and LEYDESDORFF, Loet (1998), “The Endless Transition: A ‘Triple Helix’ of University-Industry-Government Relations” Introduction to a Theme Issue, *Minerva vol.* 36, p.203-208.

FREIDSON, Eliot (1994), *Professionalism Reborn: Theory, Prophecy, and Policy*, Chicago: University of Chicago Press

GEIGER, Roger (1990), “Organized Research Units: Their Role in the Development of University Research, *The Journal of Higher Education*, Vol. 61, No. 1, p. 1-19.

GEIGER, Roger L. (1990), “Organized Research Units - Their Role in the Development of University Research”, *Journal of Higher Education*, vol. 61, n°1, p.1-20.

GIBBONS, Michael, LIMOGES, Camille, NOWOTNY, Helga, SCHWARTZMAN, Simon Schwartzman, SCOTT, Peter and TROW Martin (1994), *The new production of knowledge: the dynamics of science and research in contemporary societies*. London: Sage.

GOULDNER, Alvin W. (1958a), “Cosmopolitans and Locals : Toward an Analysis of Latent Social Roles 1”, *Administrative Science Quarterly*, vol. 2, pp. 281-306.

GOULDNER, Alvin W. (1958b), “Cosmopolitans and Locals : Toward an Analysis of Latent Social Roles 2”, *Administrative Science Quarterly*, vol. 2, pp. 440-480.

GROENEWEGEN, Peter and PETERS, Lois (2002), “The Emergence and Change of Materials Science and Engineering in the United States”, *Science Technology and Human Values*, vol. 27, n°1, p.112-133

GROSSETTI Michel and MILARD Béatrice (2003), « Les évolutions du champ scientifique en France à travers les publications et les contrats de recherche », *Actes de la recherche en sciences sociales*, n°148, pp.47-56.

GULBRANDSEN, Magnus and SMEBY, Jens-Christian (2005), “Industry funding and university professors' research performance”, *Research Policy*, vol. 34, n°6, p. 932-950.

HANNEY, Steve, HENKEL, Mary, von WALDEN LAING, Dagmar (2001), “Making and implementing foresight policy to engage the academic community: health and life scientists’ involvement in, and response to, development of the UK’s technology foresight programme”, *Research Policy*, vol. 30 n° 8 pp. 1203–1219.

HENKEL, Mary (2000), *Academic Identities and Policy Change in Higher Education*, London : Jessica Kingsley

HENKEL, Mary (2005), “Academic identity and autonomy in a changing policy environment”, *Higher Education*, vol. 49, n° 1-2, p. 155-176.

HICKS, Diana M. and KATZ, J. Sylvan (1996a), “Where Is Science Going?”, *Science, Technology and Human Values.* Vol. 21: 379-406.

HICKS, Diana M. and KATZ, J. Sylvan (1996b), “Science Policy for a Highly Collaborative Science System”, *Science and Public Policy*, vol. 23, n°1 pp. 39-44.

HOECHT, Andreas (2006), “Quality assurance in UK higher education: Issues of trust, control, professional autonomy and accountability”, *Higher Education*, Vol. 51, no4, pp. 541-563.

HOUSE OF COMMONS (2004), *Research Assessment Exercise: A re-assessment*, report of the Science and Technology Committee, London: The Stationery Office.

JANSON Kerstin, SCHOMBURG Harald and TEICHLER Ulrich (2007), *Wissenschaftliche Wege zur Professur oder ins Abseits? Strukturinformationen zu Arbeitsmarkt und Beschäftigung an Hochschulen in Deutschland und den USA*, Munster, Waxmann.

KING, Roger, GRIFFITHS, Paul and WILLIAMS, Ruth (2007), “Regulatory intermediation and quality assurance in higher education: the case of the auditors”, *Oxford Review of Education*, vol. 33, no 2, pp. 161-174.

KRÜCKEN, Georg (2003), “Learning the `New, New Thing': On the role of path dependency in university structures”, *Higher Education*, vol. 46, n°3, p. 315-339.

KRÜCKEN, Georg and MEIER, Frank (2006), “Turning the University into an Organizational Actor”, in Gili Drori, John Meyer, and Hokyu Hwang (Eds), *Globalization and Organization: World Society and Organizational Change*, Oxford University Press, Oxford, pp. 241-257.

LARIVIÈRE, Vincent, GINGRAS, Yves, ARCHAMBAULT, Eric (2006), "Canadian collaboration networks: A comparative analysis of the natural sciences, social sciences and the humanities", *Scientometrics*, Vol. 68, n° 3, pp. 519–533.

LATOUR, Bruno (1987), *Science In Action: How to Follow Scientists and Engineers through Society*, Cambridge, MA: Harvard University Press.

LOSEGO Philippe (2004), « Le travail invisible à l'université : le cas des antennes universitaires », *Sociologie du travail*, vol. 46, pp. 184-204.

MAYER, Karl-Ulrich (2000), « Wissenschaft als Beruf oder Karriere? », contribution presented at the conference "*Wissenschaft zwischen Geld und Geist*", Max-Planck-Institut für Wissenschaftsgeschichte, Berlin, 16 – 18 november, 2000.

MERTON, Robert K. (1968), "The Matthew Effect in Science", *Science*, vol. 159, n°3810, p. 56-63.

MEYER, John W. & ROWAN, Brian (1977), Institutionalized Organizations: Formal Structure as Myth and Ceremony, *American Journal of Sociology*, vol. 83, n°2, p.340-363.

MORRIS, Norma (2002), "The Developing Role of Departments", *Research Policy*, vol. 31, n°5, pp. 817-833.

MORRIS, Norma (2002), "The developing role of departments". *Research Policy*, vol. 31, no 5, pp. 817–833.

MORRIS, Norma and RIP, Arie (2006), "Scientists' coping strategies in an evolving research system: the case of life scientists in the UK", *Science and Public Policy*, vol. 33, n°4, pp. 253-263.

MULLER-CAMEN, Michael and SALZGEBER, Stefan (2005), "Changes in Academic Work and the Chair Regime: The Case of German Business Administration Academics", *Organization Studies*, vol. 26, n°2, pp. 271-290.

MUSSELIN, Christine (2005), "European academic labor markets in transition", *Higher Education*, 49, p. 135-154.

MUSSELIN, Christine (2006), "Are Universities specific organisations ?", in KRÜCKEN G., KOSMÜTZKY A. and TORKA M. (ed.), *Towards a Multiversity? Universities between Global Trends and national Traditions*, Bielefeld: Transcript Verlag, p. 63-84.

OWEN-SMITH, Jason Walter W. POWELL (2001), “Careers and Contradictions: Faculty Responses to the Transformation of Knowledge and its Uses in the Life Sciences”, *Research in the Sociology of Work*, vol. 10 pp. 109-40.

PIORE, Michael J. (1969), “On-the-Job Training in a Dual Labor Market”, *in* WEBER, A.R., CASSELL, F. H. and GINSBERG, W. L. (Ed.), *Public-Private Manpower Policies*, Madison: Industrial Relations Research Association.

PIORE, Michael J. (1975), “Notes for a Theory of Labor Market Stratification”, *in* REICH M., GORDON D. and EDWARDS R. (Ed.) *Labor Market Segmentation*, Heath: Lexington Books.p.125-150.

POWER, Michael (1997), The Audit Society: Rituals of Verification, Oxford: Oxford University Press.

RHOADES, Gary and SLAUGHTER, Sheila (2004), *Academic Capitalism and the New Economy: Markets, State and Higher Education*,. Baltimore: The Johns Hopkins University Press.

RIP, Arie et VAN DER MEULEN, Barend (1996), « The post-modern research system », *Science and Public Policy*, vol. 23, n°6, p. 343-352.

ROBINSON, David (2005) “The Status of Higher Education Teaching Personnel in Australia, Canada, New Zealand, the United Kingdom and the United States”, (paper presented at the International Higher Education and Research Conference, Melbourne, December 2005).

SANDSTRÖM, Ulf and WADSKOG, Daniel (2005), “A Decade after Hicks and Katz: Interdisciplinary Research Re-Examined”, *Paper presented at the ISSI Conference, Stockholm*.

SCHUSTER, Jack H. and FINKELSTEIN, Martin J. (2006), *The American Faculty: The Restructuring of Academic Work and Careers*, Baltimore: Johns Hopkins University Press

SHINN, Terry (1988), “Hiérarchie des chercheurs et formes des recherches”, *Actes de la recherche en sciences sociales*, n°74, p. 2-22.

SHINN, Terry (2000), « Formes de division du travail scientifique et convergence intellectuelle. La recherche technico-instrumentale », *Revue française de sociologie*, vol. 41 n°3, p. 447-73.

SLAUGHTER, Sheila and LESLIE, Larry (1997) *Academic capitalism: politics, policies and the entrepreneurial university*, Baltimore: The Johns Hopkins University Press.

VAN DER MEULEN, Barend (1998), "Science Policies as principal-agent games: Institutionalization and path dependency in the relation between government and science", Research Policy, vol. 27, p. 397-414.

VAN LOOY, B. RANGA, M. CALLAERT, J. DEBACKERE ,K. and ZIMMERMAN, E. (2004), "Combining Entrepreneurial and Scientific Performance in Academia: Towards a compound Matthew Effect encompassing both activity realms?", *Research Policy*, vol. 33, n°3, p. 425-441.

WEINGART, Peter (2005), "Impact of bibliometrics upon the science system: Inadvertent consequences?", *Scientometrics*, vol. 62, n°1, p. 117-131.

YLIJOKI, Oili-Helena (2003), "Entangled in academic capitalism? A case-study on changing ideals and practices of university research", Higher Education, vol. 45, n°3, p.307-335.

ZIMAN, John (1994), *Prometheus Bound: Science in a Dynamic Steady State*, Cambridge University Press, Cambridge.