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Revisiting the Third Mission of Universities: Toward a Renewed Categorization of University Activities?

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The aim of this article is to reflect upon the emergence of the 'third mission' of universities as a critical (but not new) dimension of university activities. It recalls the role of our changing understanding of knowledge diffusion and circulation in its growth. It then focuses on the four main lessons derived from the analysis of the different dimensions of the so-called 'third mission' to underline the tensions generated with the other missions. This leads us to suggest a move from three missions to three functions that articulate differently the three missions: mass tertiary education, professional specialized higher education and research and academic training. Each university is then characterized by the specific mix (inherited and/or constructed) of these three functions.
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Introduction

The aim of this article is to reflect upon the emergence of the 'third mission' of universities as a critical (but not new) dimension of university activities. It is neither a historical account, nor a comparative account about convergences and divergences between countries. It provides an interpretation of the underlying rationales and phenomena that are associated with the notion, the expectations it has raised and the tensions it generates.

There is a certain irony in discussing the need for universities to connect directly to the external world, and in particular to the economy. The central role of universities has long been to train students and to prepare them (directly or not) for the professional activities they will later undertake. Should we not understand this as the central means through which universities connect with society? Why then did such notions as 'valorization', 'transfer', 'third stream' or 'third mission', all linked with the research activities of universities, become central in most of the discussions that take place today on universities? Why has the notion of 'entrepreneurial university' been connected to this third mission and not, for instance, to the ability of scholars to develop new original research projects or teaching curricula?

In this overview, I shall first focus on the theoretical assumptions that underpin the growing importance given to direct connections between university research activities and the external economic and social worlds. The other sections only focus on university developments, not considering parallel developments within research institutions. The second section will review the different dimensions of this third mission focusing on the four main lessons I derive from these now largely established expectations from the 'stakeholder university' (see Bleiklie and Kogan, 2007). In turn, this will help identify the tensions between missions and the need for university differentiation. The article concludes with a proposal about the characterization of university activities, locating within each the dimensions corresponding to the notion of third mission.

The Starting Point: A Clear Divide

The notion of a 'third stream' of activities or third mission developed from research activities. It is thus important to understand the shift that took place in our analysis of research activities before analysing what is 'grasped today' under this terminology and how it can be analysed.

The starting point is the assimilation of fundamental research to codified knowledge and thus to information. This economic assimilation is critical as it tells that this 'good', once produced, is very difficult to appropriate. This view generated two consequences. The first one was that no economic actor would invest in fundamental research as he would not be able to recover its investment, thus the need for governments to invest in fundamental research. The second consequence, in this understanding, was that knowledge take-up and circulation were 'free' for interested economic actors. There was thus no need for specific mechanisms that helped knowledge flow from public sector to the economic and social worlds.

This notion was only theorized late in the process of establishment of R&D policies after the Second World War (Nelson, 1959; Arrow, 1962). It was a way to capture in economic and policy terms the prevailing situation that linked both the old tradition of autonomy of universities as a 'republic of scholars' (see Bleiklie and Kogan, 2007) and the post-world war paradigm of 'fundamental research', that is, both the need for a strong development (remember the title of the famous 1945 Vannevar Bush's report, 'Science the Endless Frontier') and the requirement of openness captured in Mertonian norms and in the organizational move of the 'Republic of Science'

(Merton, 1973). One can see the powerful alignment that shaped not only British, but even more so US universities: the university was the place for both educating the elite and preparing the future through fundamental research, and this professorial elite was the only one to be in a position to decide what to do and to judge the quality and relevance of what was done.

The first 'model' developed by OECD about *politiques scientifiques et techniques* (see the Piganiol report in 1963) thus did not consider 'universities' or 'higher education', but simply 'fundamental research'. Policies considered two ways for fulfilling this need: dedicated institutions for fundamental research (such as CNRS in France, Max Planck in Germany, CNR in Italy, CSIC in Spain or Riken in Japan), and university research supported through dedicated research agencies (the British research councils, the German DfG or the US National Science Foundation). In both cases, allocation of means is through disciplinary structures managed by peers. Thus, in both cases, the university scholarly based organization is reinforced by the role the same scholars play in the agencies or institutions for the allocation of resources.

Even this model recognized that reality 'out there' was not so simple, and that there were limitations to this open approach. In particular, there were sectors where actors were too small to be knowledgeable about the existing 'knowledge pool' and/or that required too important adaptations for individual actors within a given industry to undertake them alone. These pressures, however, were not on universities but on policies and the need to populate the system with adapted intermediary structures that would fill the gap between fundamental research and development. This gave rise in most countries to numerous structures, such as extension services for agriculture in the US as early as the late 19th century, multiple S&T information services for firms and industry collective research associations (notably in Germany and in France with *centres techniques*), all activities progressively captured under the term of 'applied research', and an OECD theorization of the 'three circles of research'.

Reconsidering Knowledge Production and Innovation Processes

What underpinned a progressive transformation of this clearly delineated situation was the change that occurred simultaneously (that is in a period of less than a decade — from the mid-1970s to the mid-1980s) in our understanding of knowledge and the process of innovation.

Polanyi (1966) demonstrated first that any knowledge was a combination of 'tacit' and 'explicit' dimensions. The impact on fundamental research was elegantly demonstrated by Collins (1974) when discussing the TEA set and analysing the conditions under which this very first laser experience could be reproduced: only those who worked in the lab who discovered it or went to it to be trained could achieve it. This meant that the nearer one is to the frontier, the more difficult it is to take up knowledge and make it circulate, or, as Latour said, to circulate knowledge you need to transport the lab. The implication was that in high-technology sectors, it was important for firms to develop strong connections with academic labs if they wished to be in a position to master new knowledge. The notion of 'absorptive capacity' (Cohen and Levinthal, 1990) translated this new understanding on the circulation of knowledge. This explains the exponential growth observed from the beginning of the 1980s in so-called 'industry–university collaborations' (or, stated more precisely, in joint research projects between public and private research actors). This also explains why progressively more and more doctoral students have been attracted by private sector R&D. This dual flow has given rise to two completely new streams of policy instruments: 'technological programmes', on the one hand (see Callon *et al.*, 1997 for a review), and 'triangular doctoral allocations' between a candidate, a university Ph.D. programme and a firm R&D department (e.g. the French CIFRE, the British CASE fellowships or the Danish Industrial Ph.D. Programme) on the other.

Simultaneously, our understanding of the innovation process changed. One of the consequences of the Second World War was the application to development in industry of the Taylorian approach to manufacturing. Innovation was thus seen as a sequential process that would gain in efficacy and speed (the famous 'time to market') if each activity (from testing the feasibility of concepts, to pilots and demonstrators, to prototypes and to industrialization) was optimized. Thus, the development of an approach to development that has been labelled *ex post* the 'linear model'. Again, scholars entered at the end of the 1970s into the black box of innovation (Rosenberg, 1982), demonstrated that innovation should be seen as a 'chain linked model' (Kline and Rosenberg, 1986) and that most innovations had faced a 'trial and error' process, the latter being thus 'iterative' or 'whirling'. They further demonstrated that what helped the process to stabilize was linked to the input at the R&D stage of actors external to the firm bringing their own 'core capabilities' (Leonard-Barton, 1992), 'lead users' (Von Hippel, 1988), sub-contractors and suppliers transformed into 'co-developers', and external researchers bringing their 'problem-solving capabilities'. This gave progressively rise to a 'network model of innovation' with such notions as 'techno-economic networks' (Callon, 1992; Larédo and Mustar, 1996) or more recently 'distributed innovation processes' (Coombs *et al.*, 2003) or 'open innovation' (Chesbrough, 2003).

Such an understanding of the role of the university in innovation processes has a strong impact on the nature of the knowledge produced by universities. It adds to the codified part that gives rise to publications and by tacit elements that are only accessed through direct collaboration, and if innovation processes cannot unfold without their inputs, knowledge is no longer a full public good, and universities should have the right to reap the benefits of such inputs. Although changes took place in parallel (at least in the US with the famous 1980 Bayh–Dole Act), patenting and technology transfer activities started to grow and be organized. It is not the purpose here to discuss the numerous solutions that have been developed; suffice it to say that this political understanding progressively placed on the agenda of all countries and universities the organization of 'transfer activities' (and their professionalization) and the establishment of rules about who should patent and how the benefits should be shared.

This was further reinforced by the emergence, with IT and biotech, of a new model for valorizing results obtained when faced with the reluctance of existing industries to invest, the growth of 'start-up' or 'spin-off' firms. The study piloted by OECD at the end of the 1990s demonstrated that nearly all OECD countries had developed specific policies to nurture the creation of such firms and promote their developments. Science or technology parks, incubators, fiscal incentives for business angels, multiple initiatives for providing or helping seed capital, policies for venture capital, incentives for academic staff to engage in such activities… the list is long of initiatives taken by both governments and universities that have focused and are focusing on such activities.

More widely, at the policy level, combining the importance of tacit dimensions in knowledge production with the heterogeneous composition of innovation networks drove towards a shift in the approach of the role of universities (and more broadly public sector research) in national innovation systems, a new conceptual framework proposed by Freeman (1987), Lundvall (1992), Nelson (1993) and Edquist (1997) and the revised OECD model since the beginning of the 1990s. The expectation is not only that universities produce new knowledge, but also that they do it with social and economic perspectives in mind. The notion of 'problem solving research' was central to the elaboration of the 'new production of knowledge' by Gibbons *et al.* (1994) and their now famous concept of 'mode 2' knowledge production. Mode 2 proponents thus see the drivers of new research efforts mostly in societal and economic problems, and the university as one among several knowledge-producing agents taken into wider innovation processes. Etzkowitz and Leydesdorff (1997) are even clearer when they propose their view of a triple helix of industry, government and university. Universities for them remain the central actor in new knowledge production, especially when dealing with 'frontier science' or 'Pasteur quadrant' science. (Stokes, 1997, proposes to replace the basic/applied dichotomy by a two-by-two matrix dealing with new understanding and new applications. Looking for new understanding only is Bohr's quadrant; aiming at developing new applications only is Edison's quadrant, while aiming at both is exemplified by Pasteur.) This understanding led us to considering these activities (often very old, think of the development of modern chemistry at the end of the 19th century) as a third mission of universities (after education and research), and to qualify universities that embrace the three missions as 'entrepreneurial universities' (e.g. Etzkowitz, 1997).

Enacting the Third Mission: Expectations from Universities

It is now more than two decades since these issues were openly raised, and one could easily argue that it is now more than one decade since they became 'naturalized' in the conventional wisdom about universities, whatever the country and the policymaker. One simple marker is the type of indicators that are asked for or produced by universities, beyond students trained and publications made: revenues from contracts, numbers of patents granted and number of spin-off firms are now standard elements found on most university reports or websites.

Many projects have been devoted to the identification, delineation and management of activities that are part of the third mission (in particular, Mollas-Gallart *et al.*, 2002), the main characteristic of which, as correctly underlined by Nedeva (2007), is to be 'relational'. There are active associations of universities and their knowledge transfer offices to develop a common framework and share good practice (e.g. Proton Europe and its 122 members, www.protoneurope.org). A recent review project (Schoen *et al.*, 2006) has proposed to gather third mission activities around eight dimensions: four economic and four societal. Relations with industry have been a major focus for policy-makers: contracts with industry (a lasting source) have been complemented and even superseded by patents taken directly by universities and the creation of new firms, spin-offs from the university. Similarly, more and more importance has been given to Ph.D. graduates going into industry (nearly half of Ph.D. recipients in particle physics and astronomy in the UK, PPARC, 2003). For a long time, the two main societal dimensions have been, and for many scientists still remain, to foster public understanding of science and expertive to governments. These dimensions are changing more and more: controversies (such as genetically modified crops or stem cell research) have shown that the 'public', now being educated, requires to be involved in the discussions, not only of research priorities but also on ethical ways to conduct research. Many public authorities have turned into 'plain' users that contract out research to universities. Finally, in most cities, universities play an important economic, social and cultural role, not withstanding their importance in urban planning. From the work carried out in this project about the forms and the relative importance of each of these eight dimensions (see Table 1), I derive four main conclusions.

Table 1 A categorization of third mission elements in eight dimensions

Issues	*Focus, main indicators and descriptors*
1. Human resources	*Focus*: transfer of embodied knowledge in Ph.D. students and graduates. *Comment*: This axis screens the transfer of 'competences trained through research' to industry and 'mission-oriented' public services. *Indicators*: the number and share of Ph.D. diploma going to industry and public services (distinguishing between R&D and non-R&D positions).
2. Intellectual property	*Focus*: codified knowledge produced by the university and its management (patents, copyright). *Indicators* concern not only patents owned by the university, but also university 'inventors' (whoever the grantee is). Patent numbers should be complemented by licences granted and fees received.
3. Spin-offs	*Focus*: knowledge transfer through entrepreneurship. *Indicators*: Simple counts are not enough, a typology of the relationships between spin-off firms and labs has to be considered (staff who have left, staff still involved, research contracts, licences granted, etc.). *Descriptors* are needed to characterize university involvement and support: dedicated teams, incubator, funds provided (in whatever form, including shareholding).
4. Contracts with industry	*Focus*: knowledge co-production and circulation to industry. This is taken as the main marker of the attractiveness of universities for existing economic actors. *Indicators*: Number of contracts, amount as a share of total resources, type of partners (global, large firms, SME) are the key aspects. Level of concentration (sectoral and/or on a few partners), types of contract (research, consultancy, services) and duration are important complementary aspects. Delineating in large labs the degree of concentration (thematic or on given teams) is also often of strategic interest. *Comment*: This is often complemented by a 'soft' dimension where account is taken of membership of professional associations (and the role played in given professional networks), professional publications, activities in continuous training, consultancy activities (often not paid to the lab) and internships (master students accepted in 'stages').
5. Contracts with public bodies	*Focus*: the 'public service' dimension of research activities. *Indicators*: similar aspects as for contract with industry apply, especially differentiating between co-research and services. *Comment*: It is important to complement contracts by non-market relations that are often critical when labs focus on social and cultural dimensions (this often has important implications for identity building but also for economic activities such as tourism). This is also very much present in health research (with clinical trials for new therapeutic protocols, etc.).

Table 1 *(Continued)*

Issues	*Focus, main indicators and descriptors*
6. Participation in policy making	*Focus*: involvement in the shaping and/or implementation of policies (at different levels). This is often captured under the wording of 'expertise', including policy studies, participation in the formulation of long-term programmes or to 'formalized' debates on ST&I policy, involvement in standard setting committees, into committees and work on safety rules, etc. *Descriptors*: The usual mode is to consider a description in the annual report in order to build an indicator of presence and 'relative importance' (number of different activities and entities, number of persons involved).
7. Involvement in social and cultural life	*Focus*: involvement of the university in 'societal' (mostly 'city') life. *Comments*: ● a number of universities have lasting 'facilities' that participate in the social and cultural life of the city (museums, orchestra, sport facilities, facilities like libraries open to schools or citizens, etc.). Some involve themselves in opening 'social services' (like law shops). ● Besides these 'structural' investments, a number of labs involve themselves in given social and cultural events (expos, concerts, urban development projects, etc.). *Descriptors*: there is little accumulated knowledge on how to account for such activities. Two approaches are being experimented: accounting for relative importance in all university investments and/or activities, positioning these within their own environment (as can be done for museums).
8. Public under-standing of science	*Focus*: interaction with society. *Comment*: the choice has been to focus here only on 'dissemination' and interaction with the 'general public'. All growing aspects upon involve-ment into public debates are considered to be part of dimension 6 (participation in policy making). *Descriptors*: follow sets of activities deployed (open days, involvement in scientific fairs and the like, involvement in general press and science journals for the public, involvement in the different media, construction of 'dissemination' and 'interactive' websites, involvement into activities directed towards children and secondary schools, etc.). Differentiate between individual initiatives and proactive policies of labs and of the university (as a whole or through its departments).

Source: Schoen *et al.*, 2006.

(1) There has been a strong emphasis on all aspects dealing not only with the private sector, but also with a limited focus on the manufacturing industry, that is, for our countries, constituting around 15% of the labour force. Analyses have been very poor at taking into account and focusing on social

and cultural problems. Some analysts might link this with the financial pressures on academic research and the need for researchers to find other sources of funding. But one could also argue that there is an issue of civil society as such: the experience with patient associations dealing with orphan diseases (and in particular neuromuscular dystrophy) has told us that by doing the job of fund raising themselves, they could have an important impact on knowledge production (Callon and Rabeharisoa, 1999). We also know the power of 'charities' and 'foundations' based on the initial donation of individuals: the Wellcome trust in the UK is as important an actor for supporting medical research as the publicly funded MRC; the Bill and Melinda Gates Foundation is the world's largest supporter of research on malaria, a truly orphan disease for decades that might find its pharmaceutical solution after only a few years of heavy targeted investments. The ability of universities to develop a wide spectrum of problem-solving activities does depend not only on public funding, but also on the overall institutional frames (including fiscal dimensions) that empower 'concerned groups' and other NGOs to invest in research for addressing the problems they care for.

(2) Patenting and activities supporting start-up firms have been at the core of most debates and work. For both, there are strong caveats that are most of the time vastly underestimated.

Mowery *et al.* (2001) demonstrated that only seven universities in the US had a net return from patenting (that is offsetting the costs incurred in preparing and getting patents), that over 90% of the returns were linked to a handful of patents (less than five for most universities) and that nearly all these patents were in human life sciences (linked to the pharmaceutical industry). These figures clearly indicate both that patenting is not relevant for many sectors (even if there has been an extension to software) and that it is a very risky business (the chance of getting a blockbuster is near to nil for most universities across the planet). There must thus be more than just financial motives to develop patenting policies at the national and/or at the university level.

One of these is that patenting is very important for building assets for spin-off firms. There has been a continuous growth of such firms, even if there are now discussions about the fact that there could be a levelling-off in creation, and that nano-related activities might lead to far fewer opportunities of creation (see the special issue of *Research Policy*, June 2007). Mustar *et al.* (2006, 2007) underline that spin-off firms very seldom grow large, but that they also very seldom disappear. For these authors, they are an important vehicle for transforming breakthrough knowledge into services, processes or products that firms can absorb, and thus play an important role in disseminating frontier science in the economy and society. But they also emphasize the portfolio of instruments that need to be developed both at the national and the university levels for such policies to be productive. Developing strategies and professional support services, developing incubators, science parks and seed capital funds thus require that universities be clear about what they aim at with such investments. All cases also show that this is a long-term policy that asks for continuity (Allen, 2007).

(3) Most relations with existing firms and sectors go through research contracts. From the numerous empirical works carried out on research labs (e.g. Larédo and Mustar, 2000; Larédo, 2001), there are two important conclusions. Firstly, contractual and financial flows are mostly with large firms, very seldom located in the same region and even less and less from the same country. It is important, however, to say that the few very successful areas (from route 128 to Cambridge or Grenoble, not to mention Silicon Valley) witness a dual agglomeration of public capabilities (not only with universities but also government/ national labs) and of private R&D (with the location in the vicinity of R&D capabilities of large firms, see also my fourth point below). The second conclusion deals with the central importance of 'non-financial' and/or 'non-research' flows in building trust and in nurturing the former flow. Involvement in professional associations and activities, continuous training activities (especially short dedicated courses), internships and consultancy activities go along with more formalized processes (technology resource centres, organized fora and networks and other intermediating processes) in enabling the 'local' buzz to take place, local meaning both geographical (such as clusters — Porter, 1998 — or creative cities — Florida, 2005) and/or sectoral (see Boschma, 2005 for a review of the different forms of proximity).

(4) However, more often than not, expectations about the third mission are linked with local development issues, and here one may be fully misled by the aspects most often emphasized. We have encountered numerous 'regional' policies focusing on technology parks and spin-off firms without considering that firms created from university are a very small part of the net creation of firms, and that in any case, and even if successful, it will take a long time before such firms are meaningful in terms of employment. Furthermore, P. Cooke *et al*. (2006) have demonstrated that if the local ecology is not rich enough, what happens most of the times is 'decapitation', that is, following the acquisition of the fast-growing firm by a large established firm, the location of most productive activities are moved near to markets with only research activities left on site.

Recent studies have shown that account starts to be taken of the role of the university as a major economic agent within the territory, both as an employer (through its staff), and as an attractor for the region. There are numerous ways in which this occurs. One growing aspect is the role of the academic visibility or excellence of the university for attracting R&D centres of large firms (Larédo and Sachwald, 2005; Zucker *et al.*, 2007) and since the work by Agrawal and Cockburn (2003) about the 'anchor tenant hypothesis', this is considered more and more important for research-led universities. Another aspect deals with specialized professional training: a recent study carried out in Angers, a French mid-size city (Technopolis, 2006), has highlighted the critical role of professional master's degrees as an indirect generator of economic activities through non-resident students. Furthermore, one should not forget the role that universities play in cities (especially when they are located within the city, and not 'outsourced' in a far-away campus) for urban planning, collective transport, leisure and cultural activities, not withstanding their direct role with their museums, their sports teams and arenas, and more and more their law shops or other activities in support of local citizens.

Finally, and probably the most important, the local economic dimension of higher education within a territory links undergraduates and vocational studies. Within the huge increase of the share of an age class going to higher education, the vast majority (around 70%, calculation based on Dubois and Grunfeld, 2007) remain at the undergraduate level. There, the university (when generalized) addresses mostly the local population and serves the local employment area, with more and more focus on employability and the adequate shaping of curricula. It is probably here that the territorial dimension of universities plays the most important role, and this is very seldom underlined as a key dimension of university third mission.

Articulating the Three Missions: Tensions on Universities

I hope to have shown how ambiguous this notion of the third mission is, and how differently it can be taken depending upon the configuration of university activities, upon its embedding in its geographical territory and upon the country's institutional framework. Furthermore, this is far from being the only expectation by stakeholders (see the notion of a stakeholder university put forward by Bleiklie and Kogan). The recent fashion for international rankings of universities (through the academic publications of their staff) and in particular the growing importance acquired by the Shanghai ranking is an illustration of another powerful expectation for the research activities of universities. These appear as contradictory expectations as long as we consider universities as 'universal' and 'generalized'. They are universal because they cover the whole spectrum of training activities and thus the range of diploma, and generalized because they are transversally covering the whole spectrum of disciplines. But *de facto*, we witness more and more vertical and horizontal specialization, far beyond the classical divide between teaching-only and research universities. This is visible when only looking at the periodic revision of the US Carnegie classification, and in particular at its most recent one. This is also exemplified by the recent proposal by a group of scholars (van Vught *et al.*, 2005) of principles and components for 'a typology of higher education institutions in Europe'.

From Three Missions to Three Main Functions

These approaches are very powerful, but they tend to develop long lists of 'components' without proposing any overarching analysis that can support university positioning and strategy. My hypothesis and proposal is that universities do not structure themselves along the three missions, but that they articulate differently these three missions depending on the 'functions' they fulfil. I see three central functions or activities that I have labelled: 'mass tertiary education' (with the bachelor degree as a central feature), 'professional specialized higher education and research' (with the professional master's as a central diploma, and 'problem solving research' as a central activity) and 'academic training and research' (with the Ph.D. as the central diploma and articles as the central output). While the first and the third activities are clearly located, respectively, at the local and world levels, the second is focused on professions and follows their internationalization. A further assumption is that comprehensive universities witness very different mixes of these three activities, and that this is a key explanatory variable of their position in any of the one-sided rankings we are familiar with. Let me present the three activities briefly, tapping into what has been said previously about the expectations for the third mission.

The first function is linked to the fact that today, half of an age class (or near to it) undertakes higher education studies and that over 70% of them stop at the 'bachelor' level. There are two aspects to this. It means that we face here mostly a 'local' situation. Students are mostly recruited locally at this stage and they will mostly look for employment locally. The central issue is then of 'employability'. It requires developing 'professional' degrees that are relevant to the local economy. They clearly build a first layer of interaction between the university, the region and the established representations of industry, based on the identification of the adequate universe of curricula and of the right balance between them. This also requires strong institutional articulation as significant changes can take place quite rapidly.

The second function is linked to the fact that most industries today require more than this first layer both in training (with the fast rise of professional master's degree) and in research (this being captured by 'mode 2' or 'problem solving research'). Recognition here goes far beyond the local level, at least at the national level and more and more at the European level. It is often based on the fact that the region is specialized in this industry. Such 'professional master's degrees' can be very important to regions as they attract a large number of students from outside the region. What is very important here is also the strong linkage that exists between these masters and industry-geared research (often including strong doctoral activities with a majority of Ph.D. students later employed in industry). The above-mentioned case of Angers demonstrates the growing importance of such activities in comprehensive universities that are not classified as 'research universities'. It also demonstrates that the types of classifications or rankings such as the Shanghai ranking can be highly counterproductive to take hold of these activities and that rankings produced by professions (such as those for business administration or engineering) are better suited to monitor the position of both curricula and research teams devoted to such activities. Typically (looking at French statistics), such activities represent on average one-fifth of total student enrolment. Linking back to the region in which the university is located, they are often central to its economic specializations, and to the clusters and/or industrial districts the region is supporting.

The third function is the one emphasized by most of the speeches about excellence, and that is academic training and research. These deal with the production of new knowledge recognized in peer communities and circulated through articles in the 'best' academic journals (typically those followed by databases such as the Web of Science or Scopus, looking at citations and impact factors). We often only consider them when we discuss university research and careers. They are no doubt a central part of university life and ethos. But any world position requires a critical mass, and thus a concentration of efforts, which makes it impossible for one university to be 'world class' in all its activities. Does it mean that the other departments or centres are poor? The answer is yes only in cases where the latter follow an academic only trajectory, but no if they follow (and this is more likely) one of the other two trajectories I have just mentioned. Such positioning requires from universities, and the territory that supports them, long-term investment. It also requires investment in all the complementary dimensions that will ensure the 'valorization' and the circulation of the knowledge produced, from patenting to all the infrastructures supporting spin-off activities. The recent history of successful clusters tells us that developing a high-tech industry requires prior investment in shaping a visible academic capability. Of course, this is a necessary condition but there are many other aspects for transforming it into a sufficient one! The Shanghai rankings can be considered as a proxy of the location of universities in this third function. It has, however, strong weaknesses as it discriminates only towards a very limited number of universities (recent discussions tend to indicate around 250; see Zitt and Filliatreau, 2007), and it is generalized (considering all fields at once) while new positions are also reflected through strong specializations (see for instance Grenoble in micro- and nano-electronics).

All universities are thus a specific and probably unique mix of these three functions: mass tertiary education, professional specialized higher education and research and academic training and research. The choice of this positioning is often mostly the result of contingent historical factors. Making it evolve, and turning it into a 'constructed' choice is key to the articulation of the university with its environment. In such an approach, the activities gathered under the third mission become the outcome of this positioning (whatever the conditions through which it has been arrived at). Such a view of university 'functions' also provides a different lens through which to look at connections with the external world, considering education and research on a similar footing.

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