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Toward a Third mission for Universities

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The objective of this presentation is less a review of what is grasped today under the term “third mission of universities” than to understand how this has emerged, what are the expectations behind the use of this terminology 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) to the professional activities they will later deploy. Should not we understand this as the central means through which universities connect with society? Why then did thus such notions as “valorisation”, “transfer”, “third stream” or “third mission”, all linked with the research activities of universities, turn 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 second part of this short overview will present the work recently done in a project to review the different dimensions of this third mission and the corresponding indicators. It will help propose four main lessons I derive from these now largely established expectations from the “stakeholder university” (see Bleiklie, 2007). In turn this will help identify the potentially contradicting tensions and the need for university differentiation. The presentation concludes with a proposal about the characterisation of university activities, locating within each the dimensions corresponding to the third mission.

The starting point: a clear divide

The notion of “third stream” of activities or third mission developed from research activities. It is thus important to understand the shift that took place 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 since it tells that this “good”, once produced, is very difficult to appropriate. It has two consequences. The first one is that no

economic actor will invest into fundamental research since he will not be able to recover its investment, thus the need for governments to invest in fundamental research. The second consequence is that its take-up and circulation are "free" for interested economic actors. There is thus no need of specific mechanisms that help knowledge flow from public sector to the economic and social worlds.

This notion was only theorised late in the process of establishment of R&D policies after the second world war (Nelson 1958 and Arrow 1962). It was a way to capture in economic and policy terms the prevailing situation which linked both the old tradition of autonomy of universities as a "republic of scholars" (see Kogan and Bleiklie) and the post-world war paradigm of "fundamental research", that is both the need for a strong development (remember the title of the famous Vannevar Bush's report, "science the endless frontier") and the requirement of openness captured in Mertonian CUDOS norms and in the organisational move of the "republic of science". One can see the powerful alignment which shaped British but even more 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 sole one to be in a position to decide what to do and to judge of 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" nor "higher education", but simply "fundamental research". And they considered two alleys for fulfilling this need: dedicated institutions for fundamental research (as CNRS in France, Max Planck in Germany, CNR in Italy, CSIC in Spain or Riken in Japan), university research supported through dedicated research agencies (the British research councils, the German DfG or the US NSF). In both cases, allocations of means is through disciplinary structures managed by peers. Thus, in both cases, the university scholarly based organisation is reinforced by the role the same scholars play in the agencies or institutions for the allocation of resources.

Still this model recognised that there were limitations to this open approach, because there were sectors where actors were too small to be knowledgeable about the existing "knowledge pool" and/or which required too important adaptations for individual actors within a given industry to undertake it alone. However these pressures 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 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 ("centres techniques" in France), all activities progressively captured under the term of "applied research", and an OECD theorisation 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 that a decade – from the mid 1970s to the mid 1980s) about the nature 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 beautifully 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 that discovered it or went to it to be trained could achieve it. It meant that the nearer to the frontier, the most 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, 1989) 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 said 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, Larédo and Mustar 1997 for a review) and "triangular doctoral allocations" between a candidate, a university PhD programme and a firm R&D department (see the French CIFRE or the British CASE fellowships).

Simultaneously our understanding of the innovation process changed. One of the consequences of WW2 was the application to development in industry of the taylorian approach to manufacturing[1]. Innovation was thus seen as a sequential process which 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 industrialisation) was optimised. 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 1979), 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 to process to stabilise was linked to the input at the R&D stage of actors external to the firm bringing their own "core capabilities" (Leonard Barton, 199x): "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, Laredo and Mustar, 1996) or more recently "distributed innovation processes" (Coombs et al., 2002) or "open innovation" (Chesbrough, 2003).

Such an understanding of the role of university in innovation processes has strong impact upon the nature of the knowledge produced by universities. It adds to the codified part which gives rise to publications and reputation, these tacit elements that are only accessed through

[1] We often forget that Vannevar Bush (whom we associate we fundamental research) was in charge within the US government of the industry war effort and thus a key actor in this move.

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. Though 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 organised. It is not the purpose here to discuss the numerous solutions that have been developed; it is here enough to say that this political understanding progressively put on the agenda of all countries and universities the organisation of "transfer activities" (and their professionalisation) 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 valorising 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 technological 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 both by 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 to 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 that they do it with social and economic perspectives in mind. The notion of "problem solving research" was central to the elaboration on the "new production of knowledge" by Gibbons et al. (1994) and their now famous "mode 2". Mode 2 proponents see thus the drivers of new research efforts mostly into societal and economic problems, and the university as one knowledge producing agent 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)[2]. This was seen by Etzkowitz (1997) as a third mission, and universities that embrace the three missions become 'entrepreneurial universities'.

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[2] Stokes 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.

Enacting the third mission: expectations from universities

It is now more than two decades since these issues have been raised. And one could easily argue that it is now more than one decade that they have been "naturalised" 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, number of spin-off firms are now banal elements found on most university reports or websites.

In a recent project (2004-2006), 12 European teams connected to as many universities decided to develop a framework for research activities, with a strong emphasis on the third mission[3]. They developed a "radar" of third mission elements made of 8 dimensions and proposing for each a core set of indicators and/or descriptors (see table, next page). They aim at characterising the involvement of universities in the third mission, and they gather what can be considered the expectations raised by most policymakers and summarised in numerous reports over the last 5 years, from national bodies and international organisations such as OECD or the EC[4].

From this review and work, I derive four mains conclusions:

1- There has been a strong emphasis on all aspects dealing not only with the private sector, but with a limited focus on manufacturing industry, that is for our countries, dealing with less than 15% of employment. We have been very poor at taking into account and focusing on the needs by collective actors (cities, NGOs speaking for 'orphan' problems…) and on social and cultural problems. Some analysts would link this with the financial pressures on academic research and the need for researchers to find other sources of funds. But one could also argue that there is an issue of the civil society as such: the experience with patient associations dealing with orphan diseases (and in particular neuromuscular dystrophy) have told us that by doing themselves the job of fund raising they could have an important impact on knowledge production (Callon et al, 2003). We also know the power of "charities" and "foundations" based upon the initial donation of individuals: the Welcome trust in the UK is as important an actor for supporting medical research as the publicly funded MRC; the Bill and Melinda Foundation is the world 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 not only depend on public funding, but on the overall institutional frames (including fiscal dimensions) which empower "concerned groups" and other NGOs to invest in research for addressing the problems they care for.

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[3] See the final report of the OEU project, developed within the framework of the PRIME network of excellence. For downloading the 250 pages report go to www.enid-europe.org or www.prime-noe.org.

[4] For a review, I send back the reader to the above mentioned report.

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 times vastly underestimated.
Mowery et al. (2001, 2004) demonstrated that only 7 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 5 for most universities) and that nearly all these patents were in human life sciences (linked to the pharmaceutical industry). These figures clearly tell that both 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 over the planet). There must thus be other than financial motives to develop patenting policies at national and/or at 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 plateau in creation, and that nano-related activities might drive to far less opportunities of creation (see special issue of Research Policy, expected early 2008). A recent project conducted within the PRIME network of excellence (Mustar et al., 2006, 2007) underlines that spin-off firms very seldom grow large, but that they also very seldom disappear. For these authors, they are an important vehicle to transform 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 national and 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 are clear about what they aim at with such investments. All cases also show that this is a long term policy which asks for continuity.

3- Most relations with existing firms and sectors go through research contracts. From the numerous empirical works made on research labs (e.g. Laredo et Mustar 2000 and Laredo 2001), there are two important conclusions. First 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 in each country witness a dual agglomeration of public capabilities (with universities but also government/ national labs) and of private R&D (with the location in the vicinity of RDI 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 formalised processes (technology resource centres, organised fora and networks and other intermediating processes) in enabling the “local” buzz to take place, local being here both geographical and/or sectoral (see Boschma 2005 for a review of the different forms of proximity).

4- More often than not, expectations about the third mission are linked with local development issues. And here one may be fully mislaid by the aspects most often emphasised. We have encountered numerous “regional” policies focusing on technology parks and spin-off firms without considering that first 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 term of employment. Furthermore P. Cooke has demonstrated (see EC report on constructing regional advantage, 2006) 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 incumbent, the localisation of most productive activities near to markets with only research activities left on site.

Recent work done has 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), but also as an attractor for the region. There are numerous ways in which this plays. One growing aspect is the role of the academic visibility or excellence of the university for attracting R&D centres of large firms (Zucker et al, 2006, Laredo et Sachwald, 2005) and since the work by Agrawal and Cockburn about the “anchor tenant hypothesis” (2002), this is more and more important for research led universities. Another aspect deals with specialised professional training: recent work done on Angers, a French mid-size city (Technopolis, 2006) has highlighted the critical role of professional masters[5] 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 sport teams and arenas, and more and more their law shops or other activities in support of local citizens.

Finally and probably the most important local economic dimension of higher education within a territory links with undergraduate and vocational studies. Within the huge increase of the share of an age class going to higher education (over half of it in Nordic countries or the Us, near to it in the UK), the vast majority (around 70%, my own calculation on French data) stays at undergraduate level. There the university (when generalist) addresses mostly the local population and serves the local employment area, with more and more issues expressed about employability and the adequate shaping of curricula. This is probably here that the territorial dimension of universities plays most, and this is very seldom underlined as a key dimension of the so-called “third mission” of universities.

[5] In this city they represent 31% of total student enrolment with over 80% coming from other regions.

The "radar" of third mission elements proposed by the PRIME –OEU Project

Issues	Focus, main indicators and descriptors
1. Human resources	*Focus*: transfer of embodied knowledge in PhD 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 PhD 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 university "inventors" (whatever 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 relationship between spin-off firms and labs has to be considered (staff that left, staff still involved, research contracts, licences granted...). *Descriptors* are needed to characterise 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 to professional associations (and 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 which are often critical when labs focus on social and cultural dimensions (this has often important implications for identity building but also for economic activities such as tourism). This is also very present in health research (with clinical trials for new therapeutic protocols...).
6. Participation into 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 'formalised' debates on S&T&I policy, involvement into standard setting committees, into committees and

	work on safety rules... *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 into social and cultural life	*Focus*: involvement of the university in "societal" (mostly "city") life. *Comments*: *a number of universities have lasting "facilities" that participate to the social and cultural life of the city (museums, orchestra, sport facilities, facilities like libraries open to schools or citizens...). Some involve themselves 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...) *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 understanding 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 involvement into public debates are considered to be part of dimension 6 (participation to policy making). *Descriptors*: follow sets of activities deployed (open days, involvement in scientific fairs and the like, involvement into 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...). Differentiate between individual initiatives and proactive policies of labs and of the university (as a whole or through its departments).

Articulating the three missions: tensions on universities

I hope to have shown how ambiguous is this notion of third mission, and how differently it can be taken depending upon the configuration of university activities and upon its embedding in its geographical territory. Furthermore, this is far to be the only expectation by stakeholders (see the notion of stakeholder university put forward by Bleiklie and Kogan). The recent fashion about international rankings of universities and in particular the growing importance taken by the Shanghai ranking is an illustration of another powerful expectation for research activities of universities. These appear as contradictory expectations as long as we do consider universities as "universal" and "generalists". Universal because they cover the whole spectrum of training activities and thus the range of diploma. Generalists because they are transversal covering the whole spectrum of disciplines. But de facto we witness more and more vertical and horizontal specialisation, 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 Mellon 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”[6].

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 upon the “functions” they fulfil. I see three central functions or activities which I have labelled: “mass tertiary education” (with the bachelor degree as a central feature), “professional specialised higher education and research” (with the professional master as a central diploma, and “problem solving research” as a central activity) and “academic training and research” (with the PhD 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 internationalisation. 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 on 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 high-education studies and that over 70% of them stop at the “bachelor” level (licence in French). There are two aspects to it. 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 to develop “professional” degrees that are relevant to the local economy. There clearly builds 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 since significant changes can take place quite rapidly.

- The second function is linked to the fact that most industries require today more than this first layer both in training (with the fast rise of professional masters) and in research (this being captured by “mode II” 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 specialised in this industry. Such “professional masters” can be very important to regions since they attract a large number of students from outside the region. What is very important here is also the strong linkage that exist between these professional masters and industry-geared research (often including strong doctoral activities with a majority of PhD students later employed in industry). The case of Angers (see reports on the research and higher education observatories by Angers Technopole) demonstrate the growing importance of such activities in comprehensive universities which are not classified as “research universities”. It also tells that the types of classifications or

[6] It also proposes a well documented review on on-going practices and attempts at developing classifications.

ranking such as the Shanghai's ranking can be highly counterproductive to take hold of these activities and that "professional" geared ones (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 regions, they are often central to all the priority areas of economic specialisation of the region in which the university is located, of the clusters and/or industrial districts it is supporting.

- The third function is the one emphasised by most of the speeches about excellence, that is academic training and research. These deal with the production of new knowledge recognised in peer communities and circulated through articles in the "best" academic journals (typically those followed by the Web of Science, its citations and impact factors). We often only consider them when we discuss university research and careers. They are no doubt a central part of the University life and ethos. But any world position requires a critical mass, thus a concentration of efforts, that makes it impossible for one university to be "world class" in all its activities. Does it mean that the others are poor? The answer is yes only in the case that the department and/or research group follows this trajectory, but no if it follows (and this is more likely) one of the other two I have just mentioned. Such positioning entail from the side of the university and the territory that supports it, to make long-term bets. It also requires to invest in all the complementary dimensions that will ensure the "valorisation" 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 to have invested beforehand in shaping a visible academic capability. Of course this is a necessary condition but there are many other aspects for transforming it in a sufficient one! The Shanghai ranking can be considered as a proxy of the location of universities in this third function. Its has however strong weaknesses since it discriminates only a very limited number of universities (recent discussions tend to say around 250, see Filliatreau and Zitt, 2006), and it is generalist (considering all fields at once) while new positions are also reflected through strong specialisations (see for instance Grenoble in micro and nano electronics).

All universities are thus a specific and probably unique mix of these three functions. 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). It also provides a different lens through which to look at connections with the external world, considering education and research on a similar footing.