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7. TRANSFORMATION OR SYSTEMS CONVERGENCE?

The Research Profile of Universities of Applied Sciences in Europe

7.1 INTRODUCTION

In many European countries, the distinction between universities and other types of higher education institutions has been a key characteristic of national systems. Although there are overlaps between these main sectors, government maintains a basic distinction as a guarantee of systemic differentiation. The slogan 'equal but different' gained the widest currency in typifying binary systems. In most countries, other types – for example polytechnics (Finland, Portugal and formerly in the UK), Fachhochschulen (Germany, Switzerland, Austria), institutes of technology (Ireland), hogescholen (The Netherlands, Belgium) or university colleges (Norway) – have been established to provide vocational programmes at degree and sub-degree level. In order to distinguish it from universities, the higher vocational sector has commonly been termed the 'non-university sector' (Lepori, 2008), 'higher education institutions outside the university sector' (Kyvik & Lepori, 2010), 'alternatives to universities' or 'second type institutions' (Teichler, 2007), 'the other institutions' or 'dual arrangement of theoretical and vocational studies' (Meek & Davies 2009). Most of these terms are derogatory, as they do not do justice to the important place these institutions occupy in national higher education systems and the changing environment in which they function. The sector itself perceives that it is not punching its weight or achieving adequate recognition internationally and therefore have joined forces by establishing a European Network (UASNET) and adopted the name 'Universities of Applied Sciences', a term that will also be used in this text.

Universities of Applied Sciences (UAS) have been assigned a special role by tuning their educational provision to the requirements and needs of the world of work. Compared to universities, the education they offer is more interdisciplinary and prepares students for a variety of professional areas. In recent years, research has been playing an increasingly important role alongside their teaching obligations. In many countries across Europe, the UAS see it as their professional education mission to accommodate societal demands by linking professional practice and education through innovative practically-oriented research. Many institutions have developed a variety of research activities in order to contribute to regional innovation and improve professional practice.

J. Enders et al. (eds.), Reform of Higher Education in Europe, 103–122.

At the national level, governments in several countries are following the Bologna Process and more particularly the Lisbon agreement which focuses on a strengthening of professional higher education by:

– acknowledging the important role of these institutions in knowledge transfer, knowledge circulation, and innovation; and
– broadening the research activities, mainly in applied research.

These developments may suggest a further blurring of boundaries and an undisputable move towards what Guy Neave once called ‘the blessed state of integration’ (Neave, 1983). This is endorsed by the view that the distinction between graduates with a first cycle degree from UAS and from universities has diminished compared to the pre-Bologna era. For many, the binary higher education system is waning and will shift towards seeing higher education as a comprehensive collection of heterogeneous institutions, rather than as divided into two binary camps.

In several policy documents, however, it has been stressed over and over again that it is critical to preserve the differentiation of mission between the university and the UAS sector. In several national thematic reviews of tertiary education, OECD applauds the strengths of systemic diversity in countries with a binary structure, arguing that this framework should be maintained and if necessary strengthened. For example, in the *Review of Tertiary Education in Ireland*, OECD advocates reforms in areas of funding, governance, human resources, quality and accreditation to ‘create a policy environment in which professionally orientated polytechnics can create a sustainable future that is distinct from traditional universities’ (OECD, 2006). The success of the UAS-sector needs to be nurtured so that its differentiation from the university sector is not seen as conferring lower status, but defining it as an equal partner in a dynamic higher education system which covers a diverse range of functions. In a similar vein, the Dutch Committee on the future of the Dutch higher education system (Committee Veerman, 2010) considers the binary divide as a first-order diversification and profiling of institutions in the university and the UAS sectors as a second one. At the same time, the Committee recommends strengthening the research function of UAS as a quality boost to professional education. This may put pressure on the binary system. The challenging question arises of how to foster diversity by preventing institutions from converging in a single preconceived ‘golden standard’ of what is proper higher education.

This contribution aims to examine whether the growing research function of UAS leads to a further blurring of boundaries or whether it would justify a preservation of the binary system. This depends on the extent to which research being shaped in the UAS sector can be delineated from university research. Are we talking about a distinctive profile of research activities in UAS and, if so, in which conditions will it be maintained? Would this require, as Donald Schön puts it in *The Reflective Practitioner* (1991), a specific ‘epistemology of practice’ based on the ways in which knowledge is constructed when one is engaged in the activities of professional service or practice? If there is a distinctive profile, how can this research be directed towards a transformation process of professional education that leads to a greater rather than a lesser diversified higher education system as a whole? It is not our aim to give a blueprint for the future, but to explore current practices in several countries which are indicative for future developments.

The structure of this chapter is as follows. First, we will touch upon both some general characteristics of the UAS sector in Europe as the contexts in which the research function evolves and some experiences in the past. Next, attention will be paid to the forces that are driving the UAS research ambition across Europe, followed by an overview of the nature of the research framework in several countries on the basis of which a distinctive profile research can be denoted. Finally, we discuss how such a profile can be instrumental in strengthening the components that constitute the core identities of the UAS sector.

7.2 STRUCTURAL DIFFERENCES AND CONVERGENCES ACROSS EUROPE

A comparison of research at UAS in the European context cannot ignore the large structural differences that exist across countries, differences that must be taken into account to compare its nature and scope. In most countries, the sector has a long history with established values and identities, mostly originating from an upgrading of vocational colleges and an amalgamation into larger institutions. Elsewhere, the sector has a much shorter history with the foundation of new institutions. Examples are Finland and Switzerland where the UAS have developed very rapidly and have become firmly established in the national system. Some countries with a predominantly unified system are in the process of upgrading vocational education by establishing vocational higher education institutions (e.g. Sweden and some East European countries).

According to OECD, ‘a highly developed model of binary system’ can be found in The Netherlands where 65% of students are enrolled in the UAS sector, against 35% in universities. In most other countries, the balance is the opposite. In Germany, the UAS sector comprises 29% of the students, in Austria 12%, and in Switzerland 34%. Also, the number of students per institution differs considerably both between and within countries. In Austria, the mean number of students is rather low, Finland, Germany and Portugal have a general mean and The Netherlands have a high average. In the latter, the number of students varies from 2,000 to over 30,000 in comprehensive institutions.

Related to the size of the sector are the provision of subject areas and the variety of study programmes. There are no general rules or schemes as to what belongs to what sector. This gives the binary divide a rather arbitrary character in an international perspective. In some countries, the UAS are more narrowly based, with a high concentration on engineering and technology fields that have high potentialities for research and development activities. In other countries, the sector encompasses a broad range of subject areas. In the Irish institutes of technology—originally regional colleges of technology—engineering is the largest area, although several other fields such as health, social sciences, economics, law, humanities and arts are well represented. Moreover, subjects like teacher training, nursing, paramedics, and fine arts are part of the UAS in some countries, whereas in others they belong to the university sector or constitute a type in its own right, such as art colleges.

Another important feature is that access policies differ from a widening access with different routes of secondary education to more selective entrance. Switzerland, Austria and France have entrance thresholds and sometimes apply very strict selection mechanisms. In some cases, only a third at most of the applicants has been admitted. Hence, the number of students can be kept small, mainly because of labour market considerations, whilst universities must accommodate the mass of students. Elsewhere, the sector has an open admission system with different access routes from secondary and vocational streams and a focus on maximal participation. The Dutch committee on the future of higher education (Committee Veerman 2010, p. 31) would welcome a smaller and more selective research university sector, expecting Dutch UASs to accommodate an ever growing number of students.

A last notable feature is the relative closeness or affiliation with the universities. In some countries, there is increasing collaboration between both sectors, such as in the knowledge centers in Denmark, the associations in Belgium and more particularly in France where the Instituts Universitaires de Technology (IUT)—which are part of the UAS network—are in the university. Their research agenda is mainly determined by the affiliated laboratories or research teams who work at the same time in the IUTs.

These structural differences between and within countries are important when comparing the nature and scope of research in UAS across Europe. It matters for research whether an institution has to absorb a large and very heterogeneous group of students or a selective group of high quality students.

However, some convergent trends also become apparent. Mainly because of the Bologna Process, the length of the programmes has been harmonised, with the first degree varying between three and four years, generally the standard qualification for the labour market. The Bologna Process elicited much debate whether the two-cycle structure could also apply to the UAS sector, thereby creating an equivalence point in the grade structure. In the meantime, several UASs have been entitled to award (professional) masters degrees in addition to the bachelor degree, often on an experimental basis but, in principle, eligible for public funding (Beerkens-Soo et al., 2010). Compared to university masters, UAS masters are usually not consecutive and candidates must have a minimum of three years of work experience before being admitted to them. When the cycles are consecutive, the total study duration normally does not exceed five years. The fact that some institutions have been permitted to award masters degree has stimulated others to seek similar powers and the sector as a whole is engaged in fostering studies to the doctoral (PhD) level and granting faculty the *ius promovendi*. Doctoral programmes in the Fine and Performing Arts have already been recognised in some European countries and it is expected that they will follow in other areas in due course. This movement towards masters and PhD programmes in the UAS sector goes along with the evolving research function. The creation of a 'research mindedness' in the UAS requires research being carried out at higher levels. The Bologna Process has apparently boosted this process.

7.3 ACADEMIC OR POLICY DRIFT?

This upward movement towards higher levels of education and the endeavour to expand the research ambitions have been criticised from various directions. It is often seen as an incremental and mutually reinforcing policy process between the sector itself and the policy environment. A critical issue is that the sector is so obsessed with the higher levels of learning that this ambition may neglect its primary mission, which is to prepare a diversity of students in the bachelor phase for a genuine labour market qualification. This critique also comes from the employment sector stressing the importance of qualifications below degree level including work-based learning (Arthur, Brennan & De Weert, 2007).

Traditional universities react skeptically, as this would imply that available resources for research should be allocated to a larger number of institutions. Moreover, there is concern with nomenclature and titles and a feeling that there is not a parity of esteem between the two sectors of higher education. In order to qualify for research funds, criteria would apply that would make it difficult, if not impossible, for them to compete with the university sector in terms of research infrastructure and the research qualifications of UAS staff.

From a sociological point of view, the increasing educational levels can be interpreted as the outcome of an ever raising of requirements to obtain a job. Randall Collins and Pierre Bourdieu are among the scholars who emphasised the dynamics of the 'credentialing of society' whereby professional groups struggle to redefine the world of work in order for titles and degrees to ensure the 'professionalism' of their interests. As educational attainment has expanded, the social distinctiveness of that degree and its value in the labour market have declined. This, in turn, increases demand for still higher levels of education. For Collins (2002), credential inflation is 'the dirty secret of modern education' which, together with educational expansion, could go on endlessly until janitors need PhDs and household workers will be required to hold advanced degrees in household appliances.

Higher education researchers conceive this process of degrees and titles as academic drift, where the UAS sector emulates the university model and tends to become a university sector, thereby undermining the binary divide. The views expressed by Pratt & Burgess in the 1970s about the British polytechnics have dominated the tone of the debate ever since. Among the original reasons for setting up polytechnics were the expansion of cheaper higher education, greater access to a wider community of students and meeting the demand for courses that were vocational and professional in character and industrially based. Another was the fact that the international competitiveness of England demanded that the non-university sector be given a boost to increase its effectiveness (Pratt & Burgess 1974). Although the policy papers at that time identified the importance of accepting a wide student body, including students seeking a qualification below degree level and those requiring part-time courses, the share of these students rapidly dropped. This major shift towards degree courses and a substantial expansion at postgraduate level were, for Pratt and Burgess, a clear evidence of academic drift. The shedding of full-time non-degree and part-time courses reflected the self-elevation whereby the polytechnics sought to emulate universities by concentrating on degree level work.

Other views on the British polytechnics are more positive. Whitburn, for example, stated that polytechnics have succeeded in creating a genuine expansion of opportunity. They have succeeded in extending their academic potential without sacrificing any group of students (Whitburn, 1976, p. 176). In other words, the inclusion of degree-level courses are less a symptom of academic drift, than an opening up of new opportunities to students who, hitherto, would have had little possibility to study at degree level.

Much can be learned from the rise and fall of the British polytechnics for the current position of UAS in Europe. It offers lessons for the maintenance of systemic diversity. Possibly, the UAS sector in continental European countries is in a similar position and its postgraduate degree level and research aspirations may be judged accordingly. It is interesting to add that the British polytechnics had a research mandate from the start and increased their commitment to research, if only as the necessary underpinning of the taught programmes or in order to obtain additional resources. The validation council for the polytechnics (CNAA) took the view that research was 'one of the essential elements in the academic health of institutions' and institutions were expected to continue its development to support CNAA courses (Pratt 1997, p. 312).

Another observation can be made about the British experience. The fact that polytechnics have drifted away from their original goal of being vocationally-oriented is less of a feature that is limited to polytechnics than a failure inherent in the British style of policy-making. As Donaldson put it, the policy mechanism that called it into being failed …'to develop sufficiently stringent controls which would, by their very nature, be resisted by interest groups both within the system and in the wider context of society' (Donaldson, 1975, p. 164). In other words, the drift within the higher education system simply reflects the pluralism and drift of the wider political, economic and social system. In his later study on the polytechnic experiment, Pratt comes to a similar conclusion when he refers to a combination of events. 'Britain did not exactly transform its higher education system by accident, but it could hardly be called planned' (Pratt, 1997, p. 306). In his view, the problems of governance and the failure to establish adequate governing arrangements led to the abolition of the binary policy. A limited steering capacity at government level may well lead to the erosion of the mission of the two sectors.

History repeats itself, as can be seen in recent developments in California. This much celebrated diversified higher education system which served as a model for other states and countries offers universal access to quality higher education opportunities at every level –certificates, associate degrees, baccalaureate degrees, and beyond – through an integrated system of public and private institutions. Several comprehensive reviews of this system, however, revealed concern about the primary missions of the different institutions and described 'a system dominated by segmental rivalries and poor planning and coordination' (Taylor, 2010). According to the Legislative Analyst's Office, the differentiation of the higher education system as a whole has deteriorated. Because of limited steering and weak coordinating mechanisms, institutions were able to act unilaterally and set their own priorities. In other cases, they secured approval from the government, even though their actions seemed to breach the core of the original Master Plan principle. The effect was a 'mission creep' in the range of programmes offered. The report argues for strengthening coordination mechanisms, capacity for policy leadership and active government steering in the harmonisation of institutional priorities and programmes to policy aims (Taylor, 2010; compare also Committee Veerman on this issue, 2010, p. 23).

It is worth taking note of these lessons from Britain and California. Below, we will discuss the directions in which such steering arrangements may be sought for research activities in UAS. First, we shall examine the driving forces for research and the distinctive research profile.

7.4 DRIVING FORCES FOR THE RESEARCH FUNCTION IN UAS

Although the UAS sector is, by its very definitions, primarily concerned with teaching and education, a number of forces have fuelled its research function across Europe.

7.4.1 Meeting the Needs of the Knowledge-Based Economy

Most countries place the research mission in the context of the 'Lisbon' agenda to make the European Union the most dynamic and competitive knowledge-based economy in the world by 2010, with more and better jobs and greater social inclusion. Increasing international competition is creating pressure for improvements in quality and productivity and a growing need for innovation. A national system of innovation policy has become a major strand of government policy in several countries.

Part of the development of a knowledge economy is the increase of public investment in R&D and the creation of mechanisms to ensure that this investment is turned into commercial value as far as possible. According to policy makers, the university sector shows important shortcomings when it comes to the application of research results. The term often coined in this context is the 'European paradox', referring to the failure to commercialise public science and translate research results into knowledge utilisation and valorisation (OECD, 2008). By taking part in the innovation agenda, UAS will have an important role in unlocking untapped potential. By its mission and nature, the UAS sector works closely with industry and can conduct R&D geared to the needs of business and industry. Because of these ties, it can contribute to transform scientific knowledge into new products and services. This potential has been recognised with increased research capacity.

7.4.2 Boosting Regional Innovation

Traditionally, innovation policy has concentrated on high tech manufacturing and national priority areas, but awareness is growing that innovation strategies must build on each region's distinctiveness. Most countries are witnessing a policy shift from giving state aid to disadvantaged regions to supporting indigenous development through skills and promoting entrepreneurship and innovation, for example through the involvement and commitment of higher education institutions. The location of

UAS in the country, their connection with local business and communities and their openness to working with the private and public sectors provide a basis on which progress can be built. New partnerships will drive innovation by bringing together public, private and third sector organisations to find innovative solutions to local or regional challenges. They include providing courses and student internships and meeting the training needs of the local workforce through special programmes, and supporting regional entrepreneurs.

The development of the research function of UAS fits into this regional strategy. The political request was to strengthen the regional environment. Regional engagement is often explicitly mentioned in legislation and governments see a future target to further strengthen and enhance the R&D co-operation of local companies with regionally-oriented UAS. The UAS must focus their research activities on the needs of regional small and medium sized enterprises (SMEs) and many of them have regional representatives in their governing boards. Most small businesses are unlikely to have the resources to engage in in-house research. The research mission of UAS will bring a specific small business orientation to innovation.

7.4.3 Changing Competencies for Professional Practice

The new professionalism concerns the orientation towards permanent innovation in professional practice. This is not merely restricted to the updating of skilled knowledge workers, but involves a curiosity-driven attitude focused on acquiring new knowledge and a critical-reflective attitude regarding one's method of working (Leijnse et al., 2007). Research is seen as a way of bringing together the preparation of future professionals and the improvement and renewal of professional practice. The overused phrase 'reflective practitioners' by Donald Schön (1983) is applicable in this context, as it refers to the process of continuous reflection about individual actions, approaches and methods and solutions. Professionals who have developed such an 'enquiring capacity' tend to take prevailing methods and approaches less for granted. Research informed by and linked to such a reflective attitude will play an important role in developing such an attitude, thereby continually improving and renewing professional work.

It follows that professional higher education cannot be limited to preparing students to work according to fixed protocols and standards. The reflective learning of professionals encompasses both the application of knowledge and the development of new knowledge. In a knowledge economy, graduates must have a firm understanding of research methods that are appropriate for their professional practice. More than in the past, professional practice expects graduates to acquire competencies that can be termed 'research skills': problem definition and diagnosis, curiosity, methods, and correctly inferring conclusions and interpretations. This develops and sharpens analytical capabilities which are important for all professionals (Borgdorff et al., 2007). They are not only important in research environments as such, but also in industry and society at large. As an international committee on the Dutch degree structure of UAS put it: 'Practical and professional experience of students, by preference from the start of their study and in combination with applied research, will allow these competences to develop' (Committee Review degrees, 2005; see also Stawicki, 2007 who makes a similar point in the German context). Empirical evidence for such a view comes from Cousin who shows that students involved in research-based inquiries acquire more sophisticated levels of intellectual development (cited in Healy, 2005).

7.5 TOWARDS A DISTINCTIVE RESEARCH PROFILE

These drivers have generated much support to extend the research function of UAS in Europe and have provoked a discussion on whether research in UAS is and should be distinctive from university research. The conceptualisation of the UAS research profile is far from easy. The most common term is applied research which includes a variety of activities in the sphere of research and development. According to the OECD manual for R&D statistics (Frascati manual), applied research involves 'original investigation undertaken in order to acquire new knowledge. It is, however, directed towards a specific practical aim or objective, or the objective is to search for practical applications of knowledge' (OECD, 2002). Although OECD makes a distinction between applied and basic research undertaken by universities, it also acknowledges conceptual problems with this distinction because it seems to imply a sequence from basic to applied research. Such a linear relationship is no longer seen as an accurate reflection of the complex reality.

Several models have been suggested to typify UAS research and separate it from university research. A much cited distinction is between Mode 1 and Mode 2 type of knowledge production (Gibbons et al., 1994). Contrary to Mode 1which refers to disciplinary research that emphasises the preservation and extension of academic knowledge 'for its own sake', the Mode 2 type focuses on transdisciplinarity and knowledge production in the context of application. The UAS sector embraces the Mode 2 type as the particular niche because of the emphasis on the applied character of its research.

Lundvall (1992) offers another typology. He distinguishes two forms of innovation: knowledge-driven (STI: science, technology, innovation) and practice-driven innovation (DUI: doing, using, interacting). Where STI deals with 'know what and why', DUI starts with practical knowledge (skills, competencies) and know how (internal and external networks and the skills to make use of them). This is often tacit knowledge and most often has a specific and local character. UAS research activities correspond more closely to the second type of innovation.

Donald Stokes' classification of types of research is probably the most advanced model. He argues that the conventional labelling of research as either fundamental or basic or applied research is inaccurate and pernicious. They are not the opposite ends of a continuum which moves in a linear way from theory to its application, but can appear simultaneously. Research can be undertaken both as a quest for basic understanding (rigour) and with considerations of use (relevance). In his view, research can be evaluated according to two dimensions: (1) the degree to which a quest for basic understanding motivates it and (2) the extent to which it is an attempt to solve a practical problem or is practice-oriented. Superimposing these yields four types of researchers known as 'Pasteur's quadrant' (Figure 1).

		Considerations of use?	
		No	Yes
Quest for fundamental understanding?	Yes	Pure basic research (Bohr)	Use-inspired basic research (Pasteur)
	No	—	(Edison)

Figure 1. Quadrant model of scientific research (Stokes, 1997, p. 73).

The work of the theoretical physicist Niels Bohr typifies the upper-left hand quadrant: pure, basic research carried out with no practical aim, even though there are many potential applications. On the lower right hand side is the quadrant of pure applied research, carried out to develop applied uses. This is exemplified by the work of Thomas Edison who, as Stokes observes, restrained his employees from investigating the deeper scientific implications of their findings in their pursuit of commercially profitable products. Stokes cites the impressive work of Louis Pasteur in the field of microbiology as a perfect synthesis of the aims of 'understanding' and 'use'[1].

The Dutch Advisory Council on Science and Technology used this quadrant in an attempt to classify research at UAS (AWT 2005) as distinct from university research and placed UAS research in Edison's quadrant. This research is not focused on fundamental understanding but on application and ensures a clear profiling in the Dutch research system. As Leijnse et al. (2007) argue, this labelling seems to be motivated by the political desire to make UAS research not competitive with university research. It may also be argued that this would be too narrow a view of UAS research and that it would be more appropriate to place this research in Pasteur's quadrant, involving a combination of fundamental understanding and application. Rigour and relevance are not by definition mutually exclusive. Discussing the mission of professional schools, Tushman and O'Reilly argue that placing them in Edison's quadrant would be inaccurate. Professional schools that either desire to pursue knowledge without consideration of use (Bohr) or pursue use without knowledge generation (Edison) would probably not deserve that name. Professional schools are about both and therefore operate in Pasteur's quadrant. This would distinguish these schools from disciplinary departments (Bohr) and from consulting firms which they place in Edison's quadrant (Tushman & O'Reilly 2007).

It is obvious that these classifications do not represent the full range of research activities and have met with much scepticism from various scholars because of the lack of an empirical base. Just as UAS research is difficult to put in a particular box, much university research cannot be cramped in a particular box. Pestre, for example, is quite critical about the Mode 1 and 2 types of knowledge production and argues that Mode 1 cannot be accepted as an accurate characterisation for university research in the knowledge economy. Knowledge has always mattered for states and to economic elites (Pestre, 2003). Similarly, Arie Rip, a scholar of science studies, argues that the difference between fundamental and applied or relevant research is 'not a principled contrast (...), it has more to do with the institutional division of labour than with the nature of research' (Rip, 2004). In this context, he coined the term post-modern universities, referring to a transformation process consisting of the emergence of conglomerates of research where the boundaries between institutions are more porous.

7.6 EXAMPLES OF NATIONAL RESEARCH PROFILES

Let us now turn to the question of how the research function has been specified by the UAS sector. Particular attention will be given to those countries where this research has acquired a certain substance in terms of funding, volume and research capacity.

7.6.1 Ireland: Integrated Research Continuum

After much discussion, the Institutes of Technology in Ireland (IoTI) designed the preferred research framework to encourage individual IoTs to pursue their priorities within its parameters. The framework attempts to accommodate an industry research focus with the practical realities of the current IoTs, key government policies, and the funding available. It allows for the diversity of research competencies and experiences in the IOTs. The scope of research for most IoTs is an integrated research continuum which embraces both basic and applied research. This framework as illustrated in Figure 2 aspires to enable a continuum of research from basic through to industrially-oriented and applied research.

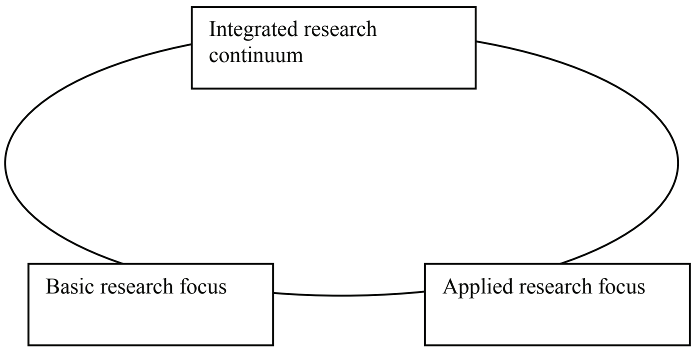

Figure 2. Research framework rationale for Institutes of Technology in Ireland (Institutes of Technology Ireland, 2008).

To achieve the appropriate research profile in the IOT sector by 2013, the current annual research programme should be broken down as follows:

- 15% of research should be industry related, i.e. funded by industry and industry schemes (e.g. Enterprise Ireland);
- 55% of research should be cutting edge applied and strategic industry-related research; and
- 30% of research should be basic research. This provides the understanding for future cutting edge applied and strategic research.

It should be added that, although most IOT priority research areas are in science and technology, they are also relevant for other areas of socio-economic activity and needs, including health, tourism, various aspects of business and social support, and design and the creative arts.

7.6.2 Germany: Applied-Oriented Research

Germany mostly uses the term application-oriented research and development. The German Rector's Conference states that application-oriented research and transfer of knowledge and technology are central tasks of the UAS. A core profile element is the transfer of results of basic research to innovative solutions of practical problems up to product development (HRK 1997). The Fachhochschulen themselves—being members of the HRK—endorse the strategy to connect fundamental and applied research and product research as a way of fostering innovations and impulses for new developing markets. The core competences of this innovation chain have been clearly assigned. Universities, UAS and enterprises all concentrate on parts of this chain. The core competence of UAS is in applied-oriented research, described as follows (HRK-Mitgliedergruppe, 2007):

- it is oriented towards utilisation and transformation of knowledge into operation;
- it is situated close to the market, is application-oriented and not in the last place focuses on a speedy transformation of research results into innovations; and
- it is theory-oriented in the sense of construction of theories, but as a rule with a view to practical soluble problems in economy and society. This means responding to concrete requests from enterprises and other societal organisations with 'product and customer-oriented' research for the short and medium term.

Applied-oriented research needs to be strengthened in the innovation chain. This emphasis is explicit in the 7th Framework of the European Commission. The German case can be illustrative to connect fundamental research and applied-oriented research by creating joint research endeavours across institutional borders. Various network structures between UAS and traditional universities have been built for this purpose.

7.6.3 Switzerland: Extension to More Basic Research

Since its creation in the mid-1990s, the UAS sector has been assigned a research role that should be applied and oriented to the needs of the regional economy and particularly the SMEs. UASs are considered to be downstream of the production of basic knowledge by universities. At the confederation level, an active promotion policy through the Swiss Innovation Agency aims to support UAS in this direction. Although the distinction between universities and UAS has always been stressed in the Swiss model and there is no sign of a weakening of this distinction, it is acknowledged that the divide between basic and applied research should not be taken as absolute. The UAS sector 'foresees some development of basic knowledge where needed for practical applications, while it is excluded that UAS engage in basic research for itself' (Lepori, 2008).

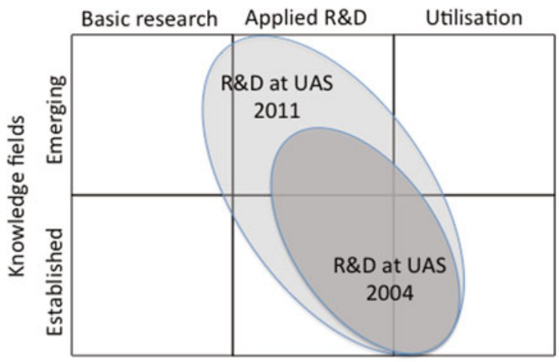

Figure 3. Development of research in Swiss Universities of applied sciences (Rektorenkonferenz, 2008).

In Switzerland, applied research and development subsumes all activities whose main purpose is to generate new knowledge and combine existing knowledge in new ways. This presupposes knowledge in its scientific and artistic contexts. The research problem formulations are based on problems that are connected with practice. The newly acquired knowledge flows back to education and practice which, in turn, will directly or indirectly benefit a circle of users and society (Rektorenkonferenz 2008).

In this view, as expressed by the Swiss Rectors' Conference of FH (KFH), there is continuous interaction between basic and applied research and no fundamental demarcation. Research in UAS is not limited to the established sciences, but increasingly seeks and discloses emerging fields. They undertake basic research insofar as this is necessary to attain applied-oriented research objectives. In Figure 3, the KFH illustrates the direction in which R&D at UAS should move in 2011.

7.6.4 Finland: Regional Strategies and Associations

The Finnish polytechnics (AMKs) have mandate to undertake applied research and development that serve professional education and the regional economic structures and employability. Research and development encompass activities to develop new knowledge and its use to explore new applications, respectively creating or improving new products, services, production processes or methods.

In the Finnish view, there is no difference between fundamental research on the one hand and research and development on the other. It is more important to know what is to be expected from institutions. The basis is laid down in joint regional strategies and development plans where the role of UAS is to contribute to the commercialisation of research results and carry out projects that foster regional innovations. The emphasis is on collaboration between UAS, universities and other actors in the R&D system. An example is the recently founded Aalto University, an association of UAS that enhances innovation by establishing 'design factories' to explore new products.

7.6.5 The Netherlands: Practice-Oriented Research

Unlike basic research in traditional universities, research in UAS should maintain and develop professional practice in society. As this practice is increasingly evidence-based and thus knowledge-intensive, innovative research and knowledge transfer play an ever-growing part in this. Several policy documents of advisory councils consider that 'design and development', and more particularly 'practice-oriented research', is an appropriate term (AWT, 2005). The latter term is preferred, as it does more justice to the professionally-oriented character of research and encompasses a diversity of practices. Research is not merely meant to carry out research for industry, but is placed in the context of knowledge development and circulation. Research has a bridging function to translate new insights from practice to education and to use knowledge to increase the innovative capacity of that practice. This is no linear process, but a continuous interplay between the development of new knowledge and insights, as well as products by professional practitioners. This mutual relationship has been formulated in the regulation of the 'lectorate'. It involves a relatively new position at professorial level to foster the research function by generating and leading research-oriented groups of staff within the institutions, as well as strengthening the links with the respective professional fields.

Although the UAS sector does not make a sharp distinction between basic and applied research, the term 'practice-oriented research' is most commonly used. Its central features can be summarised as follows (De Weert & Leijnse 2010):

– initiatives for research emanate from practice and new knowledge will be beneficial to that practice;
– research should be practice-driven to solve practical problems and intensify collaboration with external constituencies; and
– research should be relevant for the quality and innovation of education and the professionalisation of the teaching faculty.

Thus, primacy has been given to practical issues and to improving that practice, but at the same time to develop new knowledge that can be generalised and transferred to other practices. These two components—the scientific and societal realities—are fairly intertwined. Andriessen & Van Weert (2007) advocate an analytical distinction between the 'practice stream' and the 'knowledge stream'. The practice stream deals with particularistic issues in concrete situations. The knowledge stream is generic in the sense that it considers the knowledge and experiences distilled from individual situations that can be generated and transferred to other contexts. This implies that research starts from the 'specific' and moves to 'generic', rather than the other way round, as is most common in university research. Many UAS have been inspired by this approach.

7.6.6 Commonalities and Differences

This international exploration reveals a common understanding of what UAS research encompasses. It embraces a continuum of activities that are not clearly delineated. Hence, there are overlapping areas. Much applied research will be based on basic research findings and methods and will increasingly cover emerging aspects of science.

Nevertheless, a distinctive UAS research profile becomes apparent which consists of the following directives for action:

- meeting the needs of the knowledge economy through applied research and knowledge transfer;
- narrowing the gap between the development of knowledge and its application;
- advancing innovation towards regional SMEs;
- dictating research questions by practice (‘real life’ –situations) and focusing on the improvement of professional practice; and
- adequately preparing students for professional practice.

In the national profiles, research is seen as constituting a vital link between various knowledge domains and professional practice. It adopts a multi-disciplinary knowledge base by linking different areas of knowledge or combining existing knowledge. In most countries, research depends on external financial resources, which can be supplemented by government financial incentive programmes on the basis of collaboration with and knowledge use by clients. The knowledge transfer is not linear, as expressed in terms like ‘market pull’ or ‘technology push’, but is based on the interaction between higher education and external organisations. Thus, it is not a transaction from research in exchange for something else (financial). The interaction also yields new knowledge, new skills and competencies, and access to (new) networks. As Donald Schön put it, ‘knowledge is constructed when one is engaged in the activities of professional service or practice’ (Schön, 1983). In other words, collaboration with industry and other organisations must constitute an integral part of the mission of the institution and has to be treated strategically.

Countries vary in the extent to which the link with professional practice has been shaped. In countries where the technical sector prevails, as in Switzerland and to a lesser degree Germany, Austria, Ireland, there is a strong orientation towards the needs of the (regional) economic sector. Some UAS or departments can respond directly to external demands, especially SMEs, whilst others focus on particular application areas. This enables UAS to develop their research activities in different directions.

7.7 TRANSFORMING THE ORGANISATIONAL FIELD

The commonalities between the European countries regarding practice-led research and its distinctiveness from university research contribute to a further profiling of the sector as a whole. The view that research does not merely focus on the application of existing knowledge, but also generates new knowledge does not violate its particular profile in comparison with university research. This research is complementary and may result in a stronger differentiation between UAS and universities. In some countries, the binary divide is clearly marked and the UAS sector identifies its niche based on its expertise in the knowledge chain (Kornhäuser, 2009). The sheer magnitude of this transformation process can be ensured through appropriate steering arrangements in the allocation of financial resources for research, as well as quality assurance and accountability mechanisms. These are tuned to the following three components that make up the core identities of the UAS sector.

7.7.1 Strengthening Ties with Companies and the Professional Field

Our study of the UAS in Europe shows that much research is demand-led. The UAS must respond to a variety of demands (De Weert & Soo). Institutions are often confronted with poorly articulated and short-term problems. This demand-led research is not the most appropriate way to achieve innovation. Several institutions combine a demand-led approach with a more proactive approach. SMEs tend to avoid projects that comprise a high risk in terms of financial costs or short-term benefits. These situations offer a challenge to explore questions that lie beyond the daily worries of entrepreneurs. In this sense, innovation refers to a process of generating demand through research prior to meeting the demand. To play such a proactive outreaching role, UAS need a solid and sustainable research infrastructure.

In this context, networks in which several institutions and companies collaborate are important instruments. They are emerging in regions where many SMEs are active. For example, in Bavaria, innovation centres have been established to foster knowledge exchange between the UAS and the SME sectors. Research priorities are further defined and staff's professional competencies are enhanced through these networks. The Dutch RAAK programme (Regional Attention and Action for Knowledge Circulation) has a similar purpose. It establishes consortia for institutions and companies to carry out joint research projects (SIA, 2009). Hence, practice-led research strengthens the ties with industry and vitalises the mission of the UAS towards the professional field. Financial resources from business and industry are crucial, but the UAS cannot fully rely on these. Different funding sources are important, particularly government schemes, as is currently the case in various European countries.

7.7.2 Research and Teaching: Where the Twain do Meet

Since UAS research is motivated by the impact on professional education and training, the link between research, teaching and learning is a major issue. Students are not everywhere involved in research activities to the same degree. This occurs mostly on a voluntary basis, in the later phases of the programme when they do an internship or practical assignment, work-based learning or professional master programmes. That research should improve the quality of education has generally been accepted, but its impact on education and the professionalisation of the academic staff needs to be proven. Because of a possible decoupling, some UAS changed their policy and organised their research activities in separate units and sought a direct connection with educational sections (Koivula, et al., 2009). This research can be used as a vehicle to keep the curriculum up-to-date by translating the outcomes into new knowledge, new teaching contents and innovative curricula, thereby achieving synergy between research and learning. Quality assurance should include the impacts of research on the improvement of teaching and learning and assess to what extent aspects of research have been translated into study programmes both at bachelor and master levels.

As indicated before, the UAS sector in some countries is rather selective, with small student numbers (Austria, Switzerland), whereas in others, such as The Netherlands, it is very large with a heterogeneous student population with different entrance qualifications. These differences may invoke different approaches to the education–teaching nexus. Sometimes it is possible to involve all students in research activities (research-based) where the curriculum emphasises inquiry-based learning. In other programmes, research-oriented learning prevails, with an emphasis on content or processes and problems. Although there is a basic level of qualification, UAS research provides an opportunity for further differentiation in programmes between UAS, as well as within institutions. Students who feel challenged can be involved in more complex research projects, for example in the context of honours programmes. Such differentiation contributes to a further diversification of the higher education system as a whole.

7.7.3 Practice-Led Research

The transformation of UAS into knowledge institutions with practice-led research is complex, difficult and potentially lengthy, 'equivalent to a generational change among the academic staff ... which could take twenty years' (Hazelkorn 2008, p. 166). It implies that teachers must change from routine to innovative professionals and that the link with professional practice must be reinforced.

The profiling of research in UAS is directly connected with the profile of a UAS researcher. In some countries, professional experience in industry is required before being appointed as a researcher. As Lepori (2008) points out, non-technical fields tend to attach less value to practical experience of their staff and mostly recruit university graduates. This makes it more difficult to identify a specific profile for UAS in these sectors. Also, in other countries, UAS tend to regard their staff as needing higher academic qualifications so as to be compared with university staff. As Pratt (1997, p. 327) points out, in Britain, there was a steady increase in the percentage of polytechnic staff with a PhD while professional expertise was at least as important as academic qualifications. This puts a case for employing staff members in UAS who have acquired relevant professional experience.

This all depends on the quality criteria applied in the assessment of practice-led research. Standard criteria used in university research such as success in (international) peer-reviewed publication would not contribute to the profiling of UAS research. Criteria and indicators derived from perceptions of clients about the quality of research, the collaboration and the utilisation of results and expert improvements to professional practice should prevail. The transformation away from traditional research assessments towards market like instruments in multiple and heterogeneous stakeholder environments does more justice to the UAS research profile. The relevance for and impact on professional practice are of overriding importance, however without neglecting a quest for understanding (rigour). This represents a challenge for UAS research staff to elaborate methodological approaches that are specifically attuned to practice-led research. Initiatives have been taken to use a broader set of evaluation schemes that take into account research that is focused on its practical use. An initiative such as the evaluation in context project (Spaapen et al., 2007) is promising in this respect. Also worth mentioning is the view expressed by Andriessen & Van Weert (2008) that practice-led research comprises two qualities: (1) the level of individual or specific cases and (2) the search for knowledge derived from these cases that can be transferred to other situations. The validity of knowledge acquires a generic character which makes it applicable to other situations with similar problems. Such a conception of the research process will contribute to more in-depth knowledge production.

7.8 CONCLUSION

There are good reasons to assume that the binary system is not waning, since the UAS sector is able to develop a sustainable research profile. The strengthening of the ties with companies and with the professional field, the blending of teaching and research into the professional role, and the emphasis on practice-led research are core components of this profile. One of the main challenges of the UAS sector is to incorporate its research activities and transform the traditional teaching culture into an educational environment where the development of knowledge is part of its core competences.

The national views presented here suggest that UAS research is anchored in practical issues and oriented towards the improvement of professional practice. This requires collaborative interactions with the environment and the ability to forge engaged relations with practitioners in the field. One of the major challenges is to develop a creative connection between relevance and practical use (relevance). There is a risk that rigour may prevail and that the UAS would overreach themselves if research were devoid of practical implications or use. On the other hand, too close an interaction with practice could limit the objectivity and raise particular issues that are difficult to transfer to other contexts. More thorough analyses and reflection are necessary to arrive at more high-quality applicable knowledge. It is a major challenge to develop communities that jointly value the quest for fundamental understanding and considerations of use, as illustrated in Pasteur's quadrant. Instruments in the sphere of funding, accreditation and a quality assurance system for UAS research will be necessary to set and sustain standards.

A binary system may well co-exist with the current boom in university ranking lists, hierarchies or classification schemes. In the words of Ulrich Teichler, 'there is not an alternate debate between a 'binary system' on the one hand and a 'stratified system' on the other hand' (Teichler, 2007, p. 136). The opposite seems to be the case. Some UAS may develop greater capacities in their research than others, some may focus on particular domains or adopt a particular vision of practice-led research. A fair number of institutions will probably be unable to define and attain proper standards for their research infrastructure and activities, whereas others are more ahead. The more advanced institutions will be able to develop centres of expertise in which they can define their research priorities and can accentuate their specific strengths in key areas. As a consequence differentiation in the UAS sector may increase. Too narrow a definition of research and ideological hair-splitting could force UAS into a straitjacket that would not serve the development of practice-led research. They may aim to serve clienteles in different ways and this will probably contribute to a diversified higher education system. These differences should be encouraged to flourish.

NOTES

[1] The fourth quadrant is not empty, but contains research that explores particular phenomena without having either general explanatory objectives or any applied use against which to assess the results. Stokes refers to Peterson's *Guide to the Birds of North America*, which systematically describes the features and distribution of bird species.

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