Chapter 3
Structural Transformations in Higher Engineering Education in Europe

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Abstract This chapter aims to analyze the driving forces at work which have resulted in structural transformations that have taken place in higher engineering education throughout Europe over the last four decades. After a brief discussion of the theoretical concept of academic drift, a comparative study of two higher engineering institutions in Europe is presented: the IUTs in France, nested in the French universities, and the Fachhochschulen in Germany, which were non university institutions. The study dwells on the initial missions and status of these institutions, and the academic drift processes they have been through in this globalizing time span, with regard to their autonomy, their curricula, their pedagogical methods, the recruitment of their students and staff, and their research opportunities Finally, the dynamics of these transformations will be analyzed in the light of national and international standards and requirements.

Keywords Higher engineering education • Structural transformations • Academic drift • Vocational drift • Research • Driving forces

Introduction

The evolution of higher education in Europe over the last 40 years has been marked by a double and opposite trend: on the one hand, practice-oriented institutions have turned to more science-oriented curricula; on the other hand, universities whose traditional mission is to deliver research-based knowledge have developed profession-oriented curricula. In some European countries, like Denmark, Germany,

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the Netherlands or Belgium, this has led to a number of institutional mergers either within the framework of universities or by the creation of larger non-university entities. This phenomenon is part of "an international trend that the difference between the university and the college sector has become blurred" according to Jens-Christian Smeby (2006, p. 6). Smeby also points out that in the field of professional education the "curriculum has moved from a craft model towards an academic model" (Smeby 2006, p. 4). Similarly, Raymond Bourdoncle (2007, p. 135) first observes "the multiplication of professional university degrees, from the creation of IUTs in 1968 to the professional Masters in 2004" in France. He then sets out to show the complexity of the links between professional activities and academic ones by putting forward a distinction between *professionalization*, which derives from the creation of professional degrees by the university itself, and *universitarization* which he defines as a process of "absorption" of professional institutions, knowledge and teaching staff by the university.

This chapter is the outcome of personal reflections on the structural transformations that have taken place over the last four decades in our respective higher engineering institutions, an IUT in France and a Fachhochschule in Germany, while we have been working there as academics in the humanities. We first explore the way the concept of academic drift is delimited in the relevant literature with regard to general patterns of structural transformations in higher engineering education.

Then we present a comparative study of these two profession-oriented institutions in Europe, the French *Instituts Universitaires de Technologie* (IUTs) and the German *Fachhochschulen* (FHs), as regards their historical evolution in terms of degree of autonomy, creation or adaptation of curricula, pedagogical methods, student standing, personnel status and research opportunities. The choice of these two institutions seems to us relevant in that they have a number of traits in common: a strong focus on teaching rather than research, fixed curricula oriented toward practice including internships, close links with companies, academic staff recruitment, a particular stand with regard to universities, insistence on graduate operational skills, etc. Finally, this chapter deals with the driving forces – economic, political, social, professional, societal, technological – behind the academic drift processes, i.e. the harsh competition between the world's economies, the "knowledge-intensive" society, the internationalization of higher education as illustrated in the Bologna statement, the massification of secondary and post-secondary education, student expectations for higher qualifications and credentials to get better and more secure jobs, the demand of the teaching staff to obtain better academic recognition via research, the tremendous development of ICTs, etc.

The Conceptual Framework of Academic Drift

To delimit the concept of academic drift for our purpose, we will hereafter refer to the theoretical framework put forward by a number of authors such as Tyrrell Burgess (1972), Michael Gibbons et al. (2006), Jens-Christian Smeby (2006),

Raymond Bourdoncle (2007), Svein Kyvik (2009) and Steen Hyldgaard Christensen (2012). *Academic drift* as originally defined by Burgess refers to the dynamics of change in higher education since the massive expansion of student enrolments in the 1960s (1972); this working definition is supported by Gibbons et al. in that it closely relates transformations in higher education to the notion of massification (2006, pp. 70–76) and by Bourdoncle's concept of *universitarization,* defined as the process of integrating scientific knowledge, academic knowledge production and university teaching staff into higher professional education (2007, p. 138). In Christensen's classification (2012, pp. 147–148), academic drift encompasses four main dimensions, i.e. structural, institutional, cognitive and organizational (e.g. status and funding).

Concerning the *structural dimension*, Christensen notes that "academic drift operates across the entire non-university higher education sector to transform educational systems… from university-dominated systems, over dual and binary systems to unified systems of higher education, with stratified systems like the French as an exception" (Christensen 2012, p. 148). Like Bourdoncle, he identifies three general patterns of transformations: (1) *Expansion* designates the transformation of an institution into a higher level institution or a university, e.g. training schools in the USA turned into colleges in the nineteenth century, then into state universities of their own (Bourdoncle 2007, p. 138). But Christensen (2012, p. 149) introduces a slightly different perspective with the term "fragmented expansion" in that he refers explicitly to the initial phases of the process aiming at differentiation and diversification of institutions and curricula. (2) *Vertical integration* is characterized by the above-mentioned "absorption" of existing, rather autonomous institutions or faculties, both vocational and academic, by universities and the subsequent alignment of their policies and procedures with those of the university. Although IUTs have been parts of universities from the start, the concept of absorption, or vertical integration, can be applied to a number of local off-campus IUTs which were later integrated into new universities. (3) *Horizontal integration* generally applies to the integration of non-university institutions into polytechnic types of institutions that form coherent multi-sectoral entities beside universities, thus engendering a binary system of higher education. Numerous examples of such mergers in Europe can be given, e.g. in Germany (with the Fachhochschulen), Denmark, the Netherlands (with the Hogescholen) or Belgium (with the Hautes Écoles or the Hogeschools). These mergers are "characterized as a gradual transition to a binary model… beside the university sector" since they constitute "comprehensive vocational multi-professional colleges" (Kyvik 2009). Strictly speaking, pattern 3 does not relate to academic drift or universitarization, unlike patterns 1 and 2 which eventually lead to the extension or reinforcement of the university system. Yet insofar as in pattern 3 "the term implies that there is a macro-structure of higher education and that individual institutions are not self-sustaining entities" (ibid.), the notion of academic drift can be applied to these structural changes with some relevance.

The *institutional dimension* of academic drift refers to a tension between narrow vocational training and broad professional or research-oriented academic education (Burgess 1978). It highlights the tendency of non-university higher engineering

education institutions, student body and faculty staff to access to a higher university-like status in terms of curricula, research and academic recognition. The distinction between "noble" and "less noble" institutions has become blurred, as alternative institutions, e.g. the former Polytechnics in the UK or the Fachhochschulen in Germany once regarded as second-tier, have come to rival the universities, while universities have become more profession-oriented, a convergence which is highlighted in the concept of "extended university" (Gibbons et al. 2006, p. 72).

The *cognitive dimension* of academic drift relates to the tension between theory-oriented and practice-oriented curricula that all vocational education institutions experience, i.e. the tension between scientific rigor required by the production and validation of new knowledge and competences acquired through problem-solving practices (Bourdoncle 2007, p. 144). From this perspective, practice is not only a way to develop professional skills but it also aims to improve students' theoretical understanding (Smeby 2006, p. 16). Thus an increased emphasis on theory in vocational programs has developed in the college sector as theoretical knowledge has become the "axial principle" of development in post-industrial societies (ibid. p. 8). As underlined by Christensen, it does not mean that in practice-oriented curricula "no use is made of theories, laws, concepts, etc. from the basic sciences… Instead they are regarded as just one resource among many for the solution of practical problems" (2012, p. 147). Research-based knowledge obviously plays an important role in this dimension.

The fourth dimension of academic drift that we designate here as *organizational drift* refers to the status and funding of higher engineering education institutions which constitute key issues in their current management. Autonomy is evidently a decisive status for these institutions so that they can conduct their own policy of curricular development, course design, academic staff recruitment, student selection, research, etc. This autonomy is of course highly dependent on the degree of regular funding the institutions can obtain from a variety of sustainable sources ranging from state and regional grants to industrial financing via incomes derived from continuing education and/or technological transfer contracts. Thus the status of autonomy and the degree of funding of these institutions are clearly interdependent.

In the following, we will give a short presentation of two European higher engineering education institutions, the IUTs in France and the Fachhochschulen in Germany, which were created nearly at the same time in the late 1960s or early 1970s, in a period of transition from elite to mass higher education, in order to cope with massive numbers of students, a more socially diversified student body with different aspirations, fast-growing technological progress and industry's subsequent needs for high-level graduates (ADIUT 2007, p. 3). Then we will focus on five dimensions of academic drift: structural drift, institutional drift, cognitive drift, student and staff drifts, and research drift.

The Case of French Instituts Universitaires de Technologie (IUTs)

Historical Overview of the Rationale and Missions of IUTs

French IUTs were created in 1966 in an attempt by the French Ministry of Education to respond to a number of crucial challenges[1] the country was then confronted with: (1) The fast economic and social development closely linked to technological innovation in most industrial fields, with the resulting need for higher quality and competitivity, (2) The subsequent indispensable replacement of in-house technicians, engineers and executives whose skills no longer matched technological progress and the new requirements of industry, (3) The massive increase in the number of students accessing to the university, as a result of both the post-World War II demographic growth and the raise of the compulsory school-leaving age from 14 to 16 years old, and 4. The high dropout rate among Faculty students in the 1960s, e.g. 65 % of science students left the university without a degree.

The aim of the French government, as explicitly mentioned in the founding decree of IUTs in January 1966, was threefold: (1) To train skilled middle-level graduates "capable of putting into practice the engineer's designs or the results of theoretical research, of circulating and interpreting the general instructions given by administrative, financial and commercial superiors" (ADIUT 2007, p. 5), (2) To enable students from low-income families, who traditionally terminated their studies at the end of the technical secondary school, to join a shorter and more practice-oriented degree course, thus enhancing social promotion,[2] (3) To fill in a gap in the public technological education stream between the *lycée*, which already provided 2-year post-*baccalauréat* study programs in the STS (*sections de techniciens supérieurs)* and the university, whose few ENSI (*écoles nationales supérieures d'ingénieurs*) offered students a 3-year engineering course after completion of the 2-year first cycle.[3]

The IUTs were clearly established by the Ministry of Education as integral parts of universities, which created serious tensions in the early stages with the traditional science-oriented faculties who opposed these vocational practice-oriented, hence "less noble", institutions. Although embedded in the university, these institutes were assigned a general operating framework that showed a clear demarcation line with the other faculties. They provided, and still do today, 2-year course programs that were equivalent to the first cycle of the French university system (2 + 1 + 1 + 1), leading to the *Diplôme Universitaire de Technologie* (the DUT) originally meant to

[1] See *Le Livre Blanc sur le système IUT après 40 ans d'existence: Histoire, Bilan et Perspectives*. Available at: http://www.iut-fr.net/publications/livre-blanc.html.

[2] It is to be noted that, at the same period, the same social goal was assigned to the emerging centers of continuing education in a number of French universities.

[3] Actually, most engineering high schools at that time were either parts of private Catholic universities or non-university institutions like the *Grandes Écoles*.

be a terminal degree. Most programs, namely those of the industrial departments, were organized on the basis of an average 30-week tuition per academic year, with a further 6–10 weeks' internship, compared to the university norm of 26 weeks. IUT students' workload amounted to at least 32 contact hours per week, as opposed to the 12–16-h format at the university. In order to implement this intensive school-like teaching, the IUTs introduced innovative pedagogical methods based on lab practice and constantly reviewed in order to cope with technological evolutions. All courses were compulsory, attendance was monitored and students could be dismissed for absenteeism. Students were evaluated each year by means of a continuous assessment system taking into equal consideration theoretical and practical subjects.

The IUTs benefited from the determination of the Ministry of Education to give them a special status within the universities via a policy of autonomy in terms of financial, administrative, scientific and pedagogical matters, a policy strongly resented by universities as a loss of their power. The institutes were governed by their own administration boards, composed of delegates from the different personnel categories, students, and representatives from industry (employers and trade unionists). These boards had a real power of decision concerning IUT budgets which were mostly co-funded by specific IUT-signposted grants from the Ministry and, to a lesser extent, by industry's mandatory contributions under a special tax scheme. They also had their say in the introduction of new courses or local course adjustments, in the creation of student groups, etc. Concerning pedagogical issues, their autonomy was guaranteed under the umbrella of their national bodies, the CPNs (*Commissions Pédagogiques Nationales*). As for the teaching staff recruitment, they had their own selection committees who examined the applications according to profiles they had themselves established, before submitting their choices to the Ministry for approval.

Specificities of the Student Body

One of the initial missions of IUTs was to offer new opportunities of access to higher education to students from the technical and vocational lycées who traditionally went straight to the labour market after passing the *baccalauréat*. The short study length of the DUT course, its practice-oriented contents, the adapted pedagogical methods and the relatively small size of student groups, compared to the university, were meant to attract the best students from low-income, less educated families; a survey from the French Ministry of Education in 2000 showed that "the likelihood of working-class children going on to higher education increased by a factor of 3.5 compared to an overall 2.2" over that period (Hanchan and Verdier 2005). Thus the IUTs have contributed to the reduction of social inequalities, e.g. 33 % of the students they recruited in 2004 were from worker/employee background, and the percentage of students being awarded a state grant has always been higher (32 %) than at the university (16.5 %).

Student recruitment was also characterized by two seemingly opposite mechanisms: *selectivity* and *diversification*. As IUTs were allowed to admit students up to a limited capacity allocated by the Ministry of Education, admission procedures were highly selective and provision for a minimum ratio of students with a technical or vocational baccalauréat was mandatory. However, in the 1980s and 1990s, due to the high number of applications every year, IUT admission officers tended to be more selective and use more academic criteria, so that in a number of departments the proportion of students from general lycées increased dramatically to the detriment of those from the vocational and technical streams. This soon became a source of tension with universities who blamed the IUTs for depriving them of top-level students while they were themselves confronted with *massification*.[4] Besides, the diversification of student cohorts was encouraged as "there were three other possibilities for admission aiming at attracting high-calibre students: (1) Acquisition of equivalent training in industry, (2) Completion of a diploma that would grant access to university studies, and (3) Obtaining validation of professional experience or previous learning." (Christensen 2012, p. 154).

The IUTs had clearly been invested from the start with a dual mission: to train middle-level graduates who would be "more narrowly specialized than an engineer but with a broader background than a technician" (Saumade 1998), and to prepare them for higher studies. Although the DUT was meant to be a terminal degree which was to respond to industry's needs of an adaptable highly skilled staff, there has always been the possibility for the "top 10 students" to continue their studies either at the university or in a *Grande École*. However, as a result of the tight selection procedures, together with rising unemployment rates, as well as students' and their parents' aspirations for higher degrees and qualifications supposedly ensuring better jobs, this possibility has gradually become an almost regular route for a majority of DUT holders since the 1990s, "a clear mission drift of IUTs and a policy drift of the Ministry of Education" (Christensen 2012, p. 155). Besides, the strategy of a growing number of students from the general stream deliberately opting for the IUT route in the first place so as to be in a better position to access to higher levels of education at a later stage is also a significant marker of this mission drift.

Tensions and Aspirations of the Teaching Staff

The success of IUTs in terms of professionalization has been largely due to the involvement of the teaching teams, originally composed of three categories: university personnel, teachers from secondary education and engineers or executives from industry. This tripartite system did not apply to the staff composition proper, but to the quota of teaching hours delivered by each category, i.e. a third of the total

[4] Unlike most of their European counterparts, French universities are, by law, bound to enrol *baccalauréat*-holders without restrictions, since the *baccalauréat* has a dual function: it is both the terminal secondary education exam and the initial diploma giving access to the university.

contact hours was to be taught by university personnel, another third by teachers from the lycées and the last third by professionals. This national policy aimed at ensuring that all the domains of professionalization – technical, theoretical and transdisciplinary – were catered for through these pluridisciplinary backgrounds. However if it actually worked in a number of departments, and still does here and there, it is to be noticed that it generated real tensions. The first tension concerned the professionals: they were often recruited on the basis of personal/professional relations and/or designation by their company, but after two decades of active participation it gradually became difficult to get them involved, partly due to lack of time and motivation, partly to the low remuneration they were entitled to. As a result, their teaching quota in many departments has been, at least partly, taken over by the other categories of staff, thus entailing another dimension of policy drift.

Another tension concerned the academic category. As opposed to most European higher engineering teaching staff, the IUT personnel had the same academic status as their university colleagues, hence carrying out research in a university laboratory, but their lecturing or tutoring workload at the IUT was much more constraining in terms of energy and time devoted to pedagogical commitments and administrative tasks. As their promotions depended mostly, if not solely, on their research productivity, they realized that they were at a serious disadvantage compared with their university colleagues. Attempts have been made by the Ministry of Education and a few universities to equally recognize as promotion criteria the three types of tasks – research, administration and teaching – the academic personnel was assigned to, but up to now research has remained paramount as a general rule.

A third source of tension appeared between the secondary education staff and the university personnel: the former's major mission was dedicated to teaching activities as they were not required to do any research, and the latter expressed a staunch opposition to their recruitment on the grounds that they did not have the proper credentials and therefore contributed to the devalorization of university degrees. Yet, within IUT departments, the relationships with their academic colleagues were generally based on mutual trust, as they actively participated in the pluridisciplinary pedagogical teams and often took their share of administrative tasks. They also shared with them the drawback of being disadvantaged in their promotions, since they were still statutorily linked to secondary school procedures and criteria which took mainly into account the staff working in the lycées. Last but not least, this category offers a good example of professional drift: even though a relatively small proportion of this personnel was concerned, there was a growing claim on their part to be given the possibility of conducting research activities, which they later obtained in the 1990s.

What Structural Transformations in the IUTs?

After this overall study of the French IUT system, let us examine what structural transformations have taken place over the 40-year span since the IUTs were created. We have chosen to focus on the following five significant issues: autonomy policy, new curricula, pedagogical innovations, diversified student body, habilitation for research. First, as a result of the university reform called "Plan Université 2000" starting in the early 2000s, the IUTs have experienced a slow but regular reduction of their financial and human resources. More recently, their autonomy has been further jeopardized as the allocation of funding from the Ministry of Education has been transferred to the universities, irrespective of the IUTs' specific needs for technology and professionalization. Similarly, the creation of new teaching jobs does not respond any longer to the actual needs of these institutes. These limitations of their autonomy tend to turn IUTs into "classic" faculties since the decision-making body is now the university council, thus displaying a typical example of structural drift.

The IUTs have a long story of (re)designing curricula in order to cope with new social needs and technological requirements. They have been pioneers in developing continuing education in higher education, opening opportunities for promotion to industry's employees and technicians, as well as offering new skills to young people without qualifications. Besides, continuing education has played a crucial role for the development of IUTs not only to counterbalance the reduced state funding with regional and industrial contracts, but also to enhance its operational network of industrial partners (Convert et al. 2011). A major outcome of this trend has been the adaptation of existing curricula to this specific public with the introduction of course modules and a cumulative credit system for the obtention of the DUT degree. Another example of curricular drift was the creation in the 1990s of *Instituts Universitaires Professionalisés* (IUPs), in which the IUTs played an active role as initiators and course organizers.[5] It was one of the attempts by IUT teaching staff to offer a further professional 2-year course to first-cycle graduates, including DUT holders, thus leading to a *maîtrise,* a more prestigious university degree. This can be regarded as part of a long-term tendency of faculty and student body "to strive for an upward movement in the direction of an institutional setting or curriculum that resembles the university as the epitome of prestige" (Christensen 2012, p. 147).

The most significant example of this curricular drift was the creation of the *licence professionnelle* (DUT + 1) in 2000, when the French university system implemented the common European scheme of curricular cycles (3 + 2 + 3) under the Bologna process launched by the European Commission. The French university had to align with the new Anglo-American-type system, and thus faced a crucial problem with the 2-year-cycle DUT as there was no possible equivalence with the 3-year-cycle *licence* (bachelor's degree). Most IUTs seized the opportunity of this

[5] These institutes have had to align with the new university system derived from the Bologna process in the mid-2000s and have adopted the new master's degree.

change in degree structure to promote the *licence professionnelle* for the benefit of their institutes, their students and their teaching staff, so that 60 % of these new *licences* were IUT-supported in 2006. Even though the degree is conferred by the university, its curriculum and course organization are generally based on an IUT-type model, its student body is mostly composed of DUT graduates and a high percentage of its teaching staff comes from IUTs. The main issue concerning the *licence professionnelle* lies in the difficulty to identify its different specializations and in the relevance of some degrees which are too specialized.

As regards recent pedagogical transformations in the IUTs, academic drift in its cognitive dimension is reflected in a set of novelties that are closer to the university model. As a result of the university reform, DUT courses are now modularized and organized on a semestrial basis, as in the university, with the validation of modules at the end of each semester. On top of the core modules, each department now provides for complementary modules that students can choose. The number of student contact hours in terms of classic face-to-face teaching has been reduced in most departments while project works have considerably developed: on the one hand, tutored projects enable small teams of students to work on transdisciplinary subjects with a problem-solving approach; on the other hand, personal and professional projects (PPP) which aim at reinforcing the link between the student's aspiration and the professional world have been generalized.

These transformations are also linked to a number of changes in the IUT student body. Student drift refers to the diversification of students' backgrounds as well as their diversified expectations. As pointed out by Gibbons et al. (2006, p. 77), students "are drawn from a much broader social base; the balance between the sexes is more equal; and most graduates now go, not to positions of leadership, but to join the vast middle-range salariat of the public services and private corporations". These observations apply of course to the IUT student body, but two additional considerations are to be highlighted: first, due to the importance of continuing education within IUTs, together with the validation of professional experience and the possibility for first-cycle university students to enter directly the second year of the DUT course, the proportion of mature students in IUTs has increased; secondly, due to selectivity as well as new backgrounds, together with the regular use of ICTs which encourages self-learning, a majority of students already have a good command in subject areas like natural sciences, communication or computing when entering the IUT. All these features, together with their aspiration to get on to higher degree courses, result in the student body's higher requirements in terms of course contents and degree value.

Academic drift is also to be found in the evolution of research for the IUT teaching personnel. As mentioned earlier, the IUT staff with a university status conducted their research in university labs, a state of things which still prevails. However, today a greater number of academics carry out their research in the 160 IUT-based laboratories. This research focuses mostly on pluridisciplinary, academic and applied subjects. Even though this has not had much impact on their professional promotion, it has at least facilitated their working conditions. As for secondary education personnel, their access to research being recognized, they now enjoy the

same status as their academic colleagues in terms of reduced teaching workload. Their recruitment tends to be based on their previous or current research work. As the trend seems to be in the direction of a convergence between these two staff categories, the question remains as to the risks of degraded balance and complementarity between them, all the more so as the original tripartite composition of the personnel has already been reduced by the dramatic drop in the contribution of professionals from industry. In this respect, Bourdoncle points out to a difficulty inherent to research drift, when out of the three facets necessary to professional education, i.e. teaching, research and practice, he notes: "The transformation of the practitioner into a researcher ends up in the disappearance of his practical activity to the benefit of the other two" (2007, p. 146).

The Case of German Fachhochschulen (FH)

Historical Background and Missions of Fachhochschulen

Germany has a long tradition of non-university education of experts in certain fields. For a long time engineering was the major subject area in these institutions. Following France, which has an even longer history of highly regarded engineering schools, Germany saw the development of numerous technical educational institutions from the beginning of the nineteenth century onwards (Bode et al. 1997, pp. 8–21, 144–147; Becker et al. 2003, pp. 17–30). Engineering in Germany enjoyed high social and economic respect, nationally and internationally. Polytechnics, engineering schools and similar short-cycle establishments providing an engineering qualification, benefited from this positive attitude. Already in the nineteenth century some of them developed into technical universities. They sprang from the same roots as the Fachhochschulen, but lucky coincidences and state support helped them to cross the threshold early. Many other higher engineering education institutions continued to provide shorter study programs, usually with a strong link to industry and commerce (Christensen and Erno-Kjolhede 2011, pp. 285–299). In most cases, they were even financed by these and received little or no state support. Only supervision and quality control were regularly provided by the state, guaranteeing standards and keeping education in the hands of the state, whereas in many other countries professional bodies fulfilled this role.

In 1971 the German states in the Federal Republic, which still enjoy a high degree of autonomy in educational matters, transformed many of these pre-existing institutions into Fachhochschulen; some new ones were also founded at that time (Bundesministerium 2003). As was the case for British polytechnics, this process of horizontal integration has contributed to generate a binary system of higher education in Germany. The demand for higher qualified engineering staff in industry played a vital role in this development (Joschke 1981, pp. 4–11), together with the massive increase in student numbers which, as in France and the UK, required a

number of structural changes to serve the new types of students and the needs of the labor market in a more cost-efficient way (Teichler 1996). In Eastern Germany numerous similar and even more highly esteemed technical Hochschulen existed. They usually could award PhDs like universities. After German reunification, most of them were transformed into Fachhochschulen, often despite fierce opposition from within the institutions concerned. Many experienced the reorganisation as a devaluation and loss of status.

The original idea was to focus the Fachhochschulen on teaching rather fixed curricula with a practical orientation, and on benefiting from their efficiency in order to provide a highly qualified workforce (Vorstand der Fachhochschulrektorenkonferenz 1990). The aim was to preserve their close connection to industry and commerce, namely regional SMEs, and to use it to optimize their curricula and teaching, to train many graduates in a short period of time providing them with a reliable knowledge base and a high affinity toward practical job demands. Similarities to schools in curricula, teaching methods including internships, control by the state and in staff salaries were a significant factor for creating the Fachhochschulen. Financial considerations had a major influence on the concept: reducing the cost of higher engineering education compared to universities was a key issue.

From the very beginning, university legislation also applied to Fachhochschulen, but at the same time they were clearly kept apart from universities proper. Actually they were meant to complement each other in the domain of engineering education and in the professional qualification of their graduates: Fachhochschulen were supposed to be equal in status to the universities but were different in nature (Christensen 2012, p. 157). Christensen notes that the new structure "marked a transition from a dual system of higher education to a binary system via the horizontal integration of former engineering schools (Ingenieurhochschulen) and higher vocational schools (höhere Fachschulen)". This important structural change led to a number of tensions in German Fachhochschulen due to their *de facto* unequal contexts in terms of student aspirations, degree awards, staff status and research opportunities.

Student Body's Aspirations

Student admission procedures in Fachhochschulen were and still are more constraining than in French IUTs: on top of passing the *Abitur* at the end of the Gymnasium, students were required to go through half a year of practical training in industry. An alternative route for admission, as in the French continuing education system, was via a 3-year apprenticeship in a craft. The majority of these students applying for admission in Fachhochschulen not only looked for a vocational training which would enable them to enter the labour market rapidly but also sought "social, political or ecological meaning in their studies" (Rau 1993, p. 40). At the end of their studies, FH graduates had very good career prospects, as the limited number of university graduates, especially in engineering, usually guaranteed that there was no real conflict in the fight for jobs with the universities (Bundesministerium für Bildung und Forschung 2003). Their business graduates also had excellent job

prospects and career possibilities, and their alumni made their way to high positions in companies. Similarly, as Fachhochschulen were practically the unique providers of academically qualified staff for the social care professions, their graduates in this field had no problem to enter the labour market (Ministerium für Innovation, Wissenschaft und Forschung 2011).

However from the start a number of tensions arose in terms of degree structure and access to higher diplomas, and also as regards the salary differences with university graduates. Originally the study length for the German Dipl. Ing. awarded by Fachhochschulen was 3 years, but from the 1980s it increased to between 4½ and 5½ years (Grose 2000). As a result, the degree structure was no more in keeping with the "bachelor-master-doctorate" degree system implemented by the European Union since the advent of the Bologna process and more or less adopted worldwide. Besides, to differentiate between a university degree and one earned at the Fachhochschulen, the latter had to add the postfix (FH) to the degrees and titles they conferred, a distinction which was clearly meant to safeguard the higher status and value of university degrees but which ended up in developing into a quality brand highly appreciated by industry and commerce. Another degree-related tension was that, due to the terminal nature of their courses, FH graduates were not entitled to apply directly for a master or a doctoral degree, they had first to complete a university degree *in toto* (Teichler 1996, p. 126).

Another set of tensions related to the student body was the pay differences between university graduates and Fachhochschulen ones when entering industry, but it soon became marginal. Only public service salaries remained significantly lower for FH graduates. This led to dissatisfaction and lack of interest in state jobs in times of economic prosperity. At the same time the preference for less costly staff in the public sector led to an especially high demand for cheaper FH graduates and to a high proportion of them employed in many administrative levels.

Teaching Staff: Tensions and Aspirations

The fact that all teaching staff at the Fachhochschulen have been trained in universities is of vital importance. Swiftly doctorates practically became a prerequisite for the newly employed Fachhochschule professors. The staff of the precursor secondary sector institutions had rarely held doctorates. The lack of research staff, support personnel and the lower wages were soon blamed for the lack of qualified applicants for teaching positions and the rather limited research success. Especially young professors, having recently graduated from universities, were and are often trying to move the Fachhochschulen closer to universities. They spent their formative years in the same system as university professors and, whereas university professors in Germany usually have to complete a large scale research project (called Habilitation) following their PhDs, applicants for FH professorships are required to have at least 3–5 years of experience in industry after their doctoral degree, thus entailing close company ties. This further requirement reinforced the vocational orientation of Fachhochschulen.

As regards FH faculty members and professors, tensions soon appeared in terms of teaching workload and research opportunities, just as in the French IUTs, but with regard to salaries as well. Although they often had access to research previously, a professorship at a Fachhochschule often resulted in the end of research activities, due to the high teaching workload (18 h per week), lack of support staff and restricted laboratory equipment. The salary differences between university professors and FH teaching staff also generated important tensions: the former's remuneration was about 20 % higher than the latter's. Finally, the fact that, unlike their university colleagues, FH professors were not entitled to train their own graduates for master or doctoral degrees, and so could not participate in the training of their future faculty members, was another source of tensions (HRK 2009).

Structural Transformations in the FHs

All the tensions within German Fachhochschulen described earlier were bound to lead to a number of in-depth transformations as was the case for IUTs in France, Polytechnics in the UK or Hogescholen in the Netherlands, to name but a few European higher engineering education institutions, in the same 40-year period. In order to facilitate the comparison between the transformations in the respective German and French institutions, we have chosen to focus on the same five significant issues we discussed for the IUTs: autonomy policy, study programs, pedagogical innovations, students' prospects and research.

With regard to autonomy policy, two kinds of changes can be pointed out concerning the funding and the functioning of FHs. To begin with, their financial resources have increasingly diversified through their close links to industry, which have led to a wave of new developments and growth. Short-term contracts of staff financed by project partners, new payment levels that are going beyond traditional standards, a growing differentiation between research-active and less highly regarded teaching professors are some of the consequences these changes may bring about within Fachhochschulen. Besides, a few companies have started to establish Fachhochschulen of their own, taking staff development and research organisation in their own hands. Bigger companies may continue to cooperate more readily with universities, but they may also invest in FH research or in Fachhochschulen of their own. Private higher education institutions (HEIs) may increasingly gain a stronger role in the German university landscape, a policy drift which might in the long run prove detrimental to the state FHs. A second facet of this policy drift is to be found in the attempts by Fachhochschulen to reach equality with universities, for example to get more support staff like master and Ph.D. students. Reduction of the teaching workload so as to devote more time to research is another claim. Slowly these claims are acknowledged by ministries of higher education, thus reinforcing the binary model of higher education in Germany. Other measures including money and regulations to facilitate employing project staff, reduction of teaching workload as a reward for acquiring research money or research

professorships, are gradually made available to Fachhochschulen. These changes are to be assessed in the light of the privileges technical universities have long since enjoyed.

Concerning FH study programs, new curricula have sprung to life. Accreditation boards have taken over many of the former state competencies, enforcing institutional quality assurance and new administrative tasks. Joint projects with other educational institutions or companies are encouraged or are in place already. Worldwide competition for qualified students and staff will be a challenge in the near future. Elements from university degree programs cherished by the university graduates who took up positions as Fachhochschule professors are consistently being integrated in FH courses. Conversely, in many of their new course models, universities copy the better course organization and internship elements from the Fachhochschulen. By doing so, improving employability for university bachelor graduates comes within reach. Both institutions thus experience a specific curricular drift: FHs go through an academic drift as opposed to the vocational drift of the universities.

The emphasis of FHs on teaching and their strong role in the professional self-understanding of Fachhochschule professors have gradually been lost and the university philosophy of active participation in research as the basis and source of quality for teaching takes over. University teaching methods, traditions, organisational patterns and the university concept of academic freedom shape courses and institutions to an ever greater degree. Although universities copied many positive elements from the Fachhochschulen when the Bologna process made changes necessary, this led the FHs to discard the selfsame assets. Being a university or a FH does not any more dictate the choices. For example in Bavaria a bachelor degree program at a university now usually lasts six semesters, as opposed to seven in a Fachhochschule. Thus, the initial aim to provide a faster track toward engineering education through the Fachhochschulen was discarded, a clear mission drift of FHs. Only the lack of emphasis put on elements fostering employability in university bachelor programs still safeguards advantages for FH graduates in the competition for jobs.

As far as FH students' prospects are concerned, the Bologna process proved to be an important stepping stone not only for European student mobility but also in terms of degree awards. In a few German Länder the initially distinctive and vital internship parts of the degree courses were abolished, or reduced in others. As in France, the unification of degree structures (3 + 2 + 3) took place in Germany, but in both systems the prime concern of the reforms was to harmonize the first cycles. In Germany, however, this process went further than in any other European country, so much so that the gap between the two types of institutions in the binary system eroded from 1999 to 2004. This has resulted in the new right for Fachhochschulen to offer both academic research-oriented programs and professionally- or practice-oriented programs, like universities (Christensen 2012, p. 158). With this institutional drift, in that both bachelor and master degrees could be awarded by the two institutions, Germany came very close to a transition toward a unified system of engineering education (Witte et al. 2008, p. 222; Vogel 2009). However the fact that

Fachhochschulen still today have no right to award doctoral degrees renders contribution to research much less attractive.

Research is clearly a crucial issue which has concentrated tensions between universities and Fachhochschulen. The competition between the two institutions started in the 1980s and intensified considerably after the turn of the century. Recent years saw a substantial increase in research projects undertaken at FHs. This went hand in hand with an increase in research funds and state provision for first-class laboratory equipment, and companies are often partners in the financing of staff and/or equipment. Students' final projects contribute to research activities and give the opportunity to bring together company supervisors and their professors. Research has become a new internal and external indicator of status and a new source of income to professors and institutions (HRK 2005; Aspridis et al. 2001). Formerly, research activities of Fachhochschule staff were considered as an extra without any compensation in their salaries or in the reduction of their teaching workload. In recent years, this research drift has intensified as research has developed into an important asset for this kind of higher engineering institutions, insofar as it now offers FH academic staff greater freedom regarding their teaching workload and the funding of their equipment, especially when largely financed by industry. State salaries of graduates, previously a crucial differentiation between university and Fachhochschule leavers, are more and more aligned. The German governments' desire to generate more research and funding from private or company sources coincides with the options the Fachhochschulen offer. It is still not quite clear to what extent this research drift will impact the future of Fachhochschulen. It may work as an element of disruption within the institutions, it may lead to a stronger dependency on FH partners and it may bring new pressure from outside. Conversely, the outcome may be a strengthened Fachhochschule with research, Ph.D. courses, good company ties and graduates sought after by industry, administration and commerce.

The five different facets of academic drift we have discussed above illustrate the tendency of FHs and universities to integrate elements which used to be characteristic of the other type of higher engineering institutions. The current name "Hochschule", adopted by nearly all former Fachhochschulen by now, in its original meaning defined by German law, encompasses both universities and Fachhochschulen. The first step towards a merger of these two German institutions may have been taken without the intention to do so.

What Dynamics Are at Work in These Transformations?

We have shown in the previous sections of this chapter that, despite the actual differences between French IUTs and German Fachhochschulen – i.e. different status compared to the university, student credentialing perspective, academic staff status, a particular stand to research etc. – these two higher education institutions (HEIs) have always had a number of characteristics in common: socio-economic objectives, curricular orientation toward practice, strong focus on teaching rather than research,

close links with companies, not to mention their creations which took place, from scratch, at the same period. Since then, they have both been subject to a number of significant changes, which we discussed above, with regard to their institutional character and their relationship to the society at large, including economy. To put it in a nutshell, Michael Tomlinson notes:

> Over time, there has been a general convergence of the education-work relationship, which, in part, has been mediated by national governments' continued emphasis on education as both a source of national prosperity and a catalyst of social and economic opportunity. Changes in the political economy of nations have led to increasing concerns over the need for strong, fit-for-purpose and efficient forms of educational provision to meet the challenges of a globally 'knowledge economy' (Tomlinson 2013, p. 1).

According to Tomlinson, there seems to be a consensus in the literature on higher engineering education that both the academic drift of HEIs and the professional drift of universities have been generated by two major significant forces: the *globalization* of the economy and the value of *knowledge* in our society; the former encompasses economic, political and social dynamics while the latter include professional, societal and technological ones – all of which have been at work in the structural transformations these two higher engineering institutions, like many others in Europe, have been through.

In our globalized society, higher education is now assigned a dual mission: to contribute to the economic success of the nation and to run its institutions in a more cost-efficient way. In the first issue, providing a competitive edge on world markets as well as on national ones is the driving force; in the second, fund-raising is a crucial factor for the autonomy and accountability of individual institutions (Bell et al. 2009, p. 5). To keep their competitive advantage, global companies require engineering graduates with top-level technical skills in order to foster innovations and guarantee quality, but also with competencies in the humanities and communication skills so as to conquer new markets or merely sustain existing ones. As a result, the pressure of the economic world has led HEIs and universities alike to introduce new curricula, e.g. the *licence professionnelle* in France, as well as new subject areas covering a broader scope of knowledge, a trend referred to as academic drift in the case of HEIs and professional drift for universities. Likewise there have been strong pressures – economic, political and social – to provide a higher number of engineering graduates to cope with increasing market demands and "to pursue research and teaching activities that will potentially be of wider economic value" (Tomlinson 2013, p. 176).

Another facet of economy as a driving force relates to the self-governance of these institutions not only in terms of competing nationally and internationally for financial resources that will sustain their autonomy, but also of implementing more cost-efficient practices to comply with more strict regulations and monitoring, such as performance indicators and benchmarking (Tomlinson 2013, p. 185). German Fachhochschulen have a long-time experience in the competition for fund-raising, due to the close ties they have maintained with companies and industry; to a lesser extent, French IUTs get similar resources from companies, even though their main funding still comes from the state. In this respect, the institutions that are more

likely to capture international funds are those conducting world-leading research and those rendering the best service as regards curricular range, top-ranking credentials and teaching methods and facilities. As for their governance, universities and HEIs have become "publicly accountable institutions that need to rationalize and justify their share of public expenditure" (Henkel and Little 1999), via auditing of their practices and outputs.

A number of critiques have been expressed over this instrumentalization of higher education toward economic ends. Tomlinson argues: "Education has been reconfigured as a commodity good that should be used towards the utilitarian ends of enhancing national competitiveness. It has been economized" (2013, p. 11). Actually, if this "commoditization" of higher education mainly refers to the new managerial trend within universities throughout the world, it does not strictly apply to HEIs whose original missions already involved economic targets. However these institutions have also been impacted by the economic dynamics in that, as we have shown, the structural transformations of IUTs and FHs include curricular changes, new routes to a higher educational level, accommodating increasing student numbers and, above all, a new focus on research.

The dynamics of globalization in its political dimension is best illustrated in the implementation of the Bologna Process through the educational policies of the different national governments. In Germany, although there was no indication in the Bologna Process aiming to put an end to the binary system, the German state reform introducing changes in the degree structure, student credentialing perspective and market-oriented self-governance status came close to narrowing the gap between universities and Fachhochschulen (Witte et al. 2008). In France, the dynamics of the Bologna Process has led to a mixture of positive and negative outcomes for the IUTs. On the positive side, the degree structure was attuned to the bachelor level, via the *licence professionnelle,* and research was made available to all the teaching staff; on the negative side, there has been an operational drift away from their autonomy status, in that their financial and human resources have been largely transferred to the universities. As argued by Gombrich concerning higher education in the UK:

> …. Higher education is now subject to two complementary forces: mercantilism and dirigisme. The former is based on the belief that free markets and economic priorities should determine policy, while the latter involves the continued increase in state intervention in the structure and funding of higher education institutions (Gombrich 2000).

Although it refers a little provocatively to the British situation, this statement can also apply to the French and German institutions. Besides Bell et al. (2009) points to potential contradictions in state policies: they posit that economic success depends on substantial investment in higher education, but at the same time national governments have to reduce the budgets allocated to HEIs and universities due to global economic constraints.

The third globalization-related dynamics lies in the social dimension. The shift from elite to mass higher education may be viewed as a response to new global economic demands but it also evidences changes in the new demands for higher education. The issue of social justice is highlighted by Tomlinson: "The expansion

of education and its associated theme of lifelong learning are seen to represent an inclusive model of social justice that engenders social mobility" (2013, p. 12). As early as 1963, the Robbins Report in the UK already insisted that "all young persons qualified by ability and attainment to pursue a full-time course in higher education should have the opportunity to do so" (quoted by Bell et al. 2009, p. 4). Already from the start, French IUTs and German FHs had provided for a better access of students from lower social backgrounds to higher engineering education, thus contributing to the reduction of inequalities. This dynamics of social justice has led to the creation of diversified educational routes for a diversified student body, such as continuing education, distance learning, apprenticeship, validation of professional experience, etc. In this respect, vocational institutions like IUTs and FHs are recognized as having fulfilled their economic and democratic goals, by responding to student aspirations for streamlined curricula, top quality teaching, higher credentials so as to enter the labor market in a more rewarding position (Tomlinson 2013, p. 12). However researchers in vocational education point out that social disparities still subsist and that individuals from lower socio-economic backgrounds are still underrepresented in higher education; the academic drift of HEIs might deter a number of them from pursuing their studies.

The second major driving force that we have identified earlier in this section is the value of *knowledge* in our society, which encompasses three other dynamics, i.e. professional, societal and technological. Our global society is characterized by a strong focus on knowledge as the "axial principle" of development insofar as the sources of innovation derive directly from research and development (Smeby 2006, p. 8). According to Smeby, in our post-industrial society, knowledge is a source of value, not labor, thus leading to a new professional dynamics in higher education: the production of new knowledge through research, which has always been a core mission for universities, has entailed new aspirations among the teaching staff in HEIs (Horn et al. 1992). The research drift described in both IUTs and Fachhochschulen has been engendered by this quest for new professional status and institutional prestige (Buck-Bechler et al. 1995). In turn, such a move toward research has placed new demands on professors and students alike to enhance their work-related knowledge and competences (Tomlinson 2013, p. 42). It has resulted in added value not only for curricula, hence for professors' and students' careers, but also for the economy at large. As Tomlinson puts it: "The more human capital that people can acquire, the more their productivity and value to the labour market" (2013, p. 11).

The second knowledge-related driving force refers to societal dynamics which can be identified in higher education national policies on gender equality and lifelong learning issues. The diversification of the student body in higher engineering institutions together with the feminization of work have led to a significant increase in the number of female students in higher education. Such a move has brought "an increased value to the kinds of skills and work that they undertake" as women are regarded as "highly adept at the types of 'soft skills' – communication-based, information and interpersonal skills – that the new economy requires" (Tomlinson 2013, p. 43). The feminization of the student body has not been a conflicting issue

in most HEIs, even though engineering has traditionally been a male-dominated and orientated field of education. However it is to be noticed that this dynamics has actually enabled a number of engineering areas, e.g. biology, ecology, chemistry, informatics, etc. to develop significantly in IUTs and FHs. Lifelong learning, which has been strongly supported by the E.U., can also be considered as a dynamics affecting our society: it involves a totally new approach to the construction of skills and knowledge in individuals. It has an impact not only on their lifestyles, due to the inherent constraints of continuing education, for instance, but also on the public perception of higher education and what knowledge is.

Technological advances are both the outcomes and the sources or instruments of new knowledge. In this respect, they constitute the third knowledge-related dynamics. Technological innovations and developments that are created by research engender new teaching methods and support, new information resources, new knowledge. ICTs are widely used in HEIs today, and IUTs as well as FHs have largely contributed to their development both as a curriculum of its own and as an aid to other subject areas. The attractiveness of digital technology has a dynamic effect on the recruitment of students and the motivation and practices of the teaching staff; it can also be a source of income from technological transfer contracts with industry, a trait we have already discussed in previous sections.

Conclusion

In this chapter, we have discussed the structural transformations that French IUTs and German Fachhochschulen have experienced in the light of academic drift processes that have affected similar higher engineering institutions around the world since the 1960s. This trend developed against a more general post-WorldWar II background of quantitative expansion and massification of higher education (Christensen 2012, p. 163). These structural transformations were caused by a number of tensions within the HEIs themselves and between them and the universities: these tensions are related to institutional status, funding, degree-awarding system, salary differences and research. Besides the more recent globalization expansion and the advent of the knowledge society have amplified the trend:

> The traditional insular operations of nation states and their educational and welfare systems have given rise to an increasingly globalized convergence and coordination of policy, provision and practice. Increasingly, national governments have looked to align their educational systems with fast developments in a new, globally competitive knowledge-driven economy (Rizvi and Lingard 2010, quoted by Tomlinson 2013, p. 18).

According to Jónasson (2006), structural transformations of higher education systems take place in the following three steps: (1) Students' pressure to get higher credentials leads to educational expansion, as illustrated by French IUTs' curricular drift. (2) Faculty members' push for equal status and salary drive the internal structures of institutions along academic lines, as exemplified by German FHs.

(3) The constant pressure created in points 1 and 2 is modulated by national policies and labor market considerations.

As we have shown, these transformations that have affected higher engineering education in Germany and France, as well as other countries, have been convergent in their drive to implement an overall state policy of widening access to a greater number and more diversified student body and complying with the economic imperatives of efficiency and institutional accountability. Concerning credentials, there has been a significant advance in both IUTs and Fachhochschulen: in order to respond to the increasing expectations of a larger student body as well as institutional pressure, and in an attempt to attune their degree structure with international standards, FHs have been entitled to extend their degrees to the master level while IUT students can now have easier access to the bachelor level via the *licence professionnelle.* Similarly, the two institutions have registered a number of curricular changes as more theory-orientated or humanities-based subjects are integrated into their courses. Another commonality they share relates to research drift: even though research has long been a current activity in both institutions, since parts of the staff are university academics, the habilitation to conduct a research policy of their own and to accommodate research teams in their locus constitutes a crucial change, thus facilitating staff's working conditions.

Structural transformations are also to be examined in the light of the original status and mission of these two institutions, thus displaying major differences. University-embedded IUTs, which enjoyed a specific high degree of autonomy as regards funding, course design and staff recruitment, have recently lost parts of these prerogatives, thus bringing them closer to other faculties; on the contrary, non-university FHs have maintained their autonomy in their missions due to their long-time close relationships with companies. As for their respective teaching staff, while the pressure of IUT secondary education personnel has ended up in extending their access to research, the push by FH faculty members to reduce their teaching workload to the benefit of research and to reach salary equality has had little effect so far (Bassarak and Steppuhn 2002).

In the wider context of economic globalization and knowledge-driven society, we have identified a number of socio-economic driving forces that contribute to the structural transformations of higher engineering education in France and Germany, as in most developed countries: market demand for top-level engineering workforce with a broader knowledge base to ensure innovation and competitiveness – student pressure for better credentials and for social justice which also involve societal dynamics, e.g. feminization and lifelong learning – public and institutional drive for sources of funding and accountability – staff aspirations for higher status and access to research – and, to a lesser extent, technological advances. Jónasson argues that the core driving forces are actually the student body and the academic faculty, in that the former drive educational expansion while the latter contribute to revamp institutional structures along academic lines. According to him, the other "dynamics, i.e. market demand and institutional drive – to which technological advance should be added – are just external modulating or facilitating factors" (2006).

Academic drift should be regarded as a natural and irreversible process: "natural" because it interacts with the inevitable evolutions of society in its economic, political, social, cultural and technological dimensions, and "irreversible" as it constitutes a never-ending trajectory (Bell et al. 2009). Tomlinson notes: "The shifting dynamics in the interrelationship between education and work reflect broader social and economic transformations, all of which have a substantial bearing on individuals' formal (and informal) educational and labour market experiences" (2013, p. 3). Higher engineering education, indeed education in general, is not just considered important for the economy but is itself a driving force in shaping the so-called human capital of the future.

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References

ADIUT – Association des Directeurs d'IUT. (2007). *Livre Blanc sur le système IUT après 40 ans d'existence: Histoire, Bilan et Perspectives.* Available at: http://www.iut-fr.net/publications/livre-blanc.html

Aspridis, S., Block, H.-J., Griesbach, H., & Teichgräber, M. (2001). *Evaluation des BMBF-Programms „Anwendungsorientierte Forschung und Entwicklung an den Fachhochschulen (aFuE)"* (Hochschulplanung 152). Hannover: HIS.

Bassarak, H., & Steppuhn, U. D. (Eds.). (2002). *Angewandte Forschung und Entwicklung an Fachhochschulen in Bayern*. Düsseldorf: Hans-Böckler-Stiftung.

Becker, O., Hoffmann, H. M., & Iselborn, K.-W. (Eds.). (2003). *Fachhochschulen in Deutschland und Europa. Eine Bestandsaufnahme. Festschrift anlässlich des 60. Geburtstags von Prof. Dr. hc. Dietmar von Hoyningen-Huene*. Mannheim: Pylon Verlag.

Bell, L., Stevenson, H., & Neary, M. (Eds.). (2009). *The future of higher education: Policy, pedagogy and the student experience*. London/New York: Continuum International Publishing Group.

Bode, C., Becker, W., Habbich, C., & Klofat, R. (Eds.). (1997). *Fachhochschulen in Deutschland*. München: Prestel.

Bourdoncle, R. (2007). Universitarisation. *Recherche et Formation, 54*, 135–149.

Buck-Bechler, G., Jahn, H., Klockner, C., & Tietz, H.-D. (Eds.). (1995). *Angewandte Forschung an den Fachhochschulen der Bundesrepublik Deutschland*. Weinheim: Deutscher Studien Verlag.

Bundesministerium für Bildung und Forschung. (2003). *Die Fachhochschulen in Deutschland* (4th ed.). Bonn: Bundesministerium für Bildung und Forschung.

Burgess, T. (1972). *The shape of higher education*. London: Cornmarket Press.

Burgess, T. (1978). The officials' revolution: The British polytechnics: Ten years after. *Paedagogica Europaea, 13*(2), 45–58. European Universities: Ten years after 1968. Blackwell Publishing. http://www.jstor.org/stable/1502531. Accessed May 2011.

Christensen, S. H. (2012). Academic drift in European professional engineering education – The end of alternatives to the university? In S. H. Christensen, C. Mitcham, Li Bocong, & Yanming An (Eds.), *Engineering, development and philosophy: American, Chinese, and European perspectives*. Dordrecht: Springer Science + Business Media B.V.

Christensen, S. H., & Erno-Kjolhede, E. (2011). Academic drift in Danish professional engineering education. Myth or reality? Opportunity or threat? *European Journal of Engineering Education, 36*(3), 285–299.

Convert, B., Gugenheim, F., & Jakubowski, S. (2011). La loi Faure et son utilisation par les contestataires de 1968. La professionnalisation dans une université scientifique. In *L'Enseignement Supérieur et la Recherche en Réformes – Actes du Colloque International RESUP*, 1, 175–192.

Gibbons, M., Limoges, C., Nowotny, H., Schwarzman, S., Scott, P., & Trow, M. (2006). *The new production of knowledge – The dynamics of science and research in contemporary societies*. London: Sage.

Gombrich, R. (2000, January 7). *British higher education in the last twenty years: The murder of a profession*. Lecture given to the Graduate Institute of Policy Studies, Tokyo.

Grose, T. K. (2000, March). Re-engineering in Germany. In *Prism*. Available at http://www.prism-magazine.org/march00

Hanchane, S., & Verdier, E. (2005). Educational routes and family aspirations in France, a panel data. *The European Journal of Vocational Training, 35*, 53–64.

Henkel, M., & Little, B. (Eds.). (1999). *Changing relationship between higher education and the state*. London: Jessica Kingsley.

Horn, B., Klinkmann, N., & Salustowicz, P. (1992). *Forschung an Fachhochschulen – der Weg in eine neue Identität*. Weinheim: Deutscher Studien Verlag.

HRK (Ed.). (2005). *Forschung, Entwicklung und Technologietransfer an Fachhochschulen. Dokumentation der 34. Jahrestagung des Bad Wiesseer Kreises vom 20. Mai −23. Mai 2004* (Beiträge zur Hochschulpolitik 5/2005). Bonn: Hochschulrektorenkonferenz.

HRK (Ed.). (2009). *Quo Vadis Fachhochschule? Dokumentation der 38. Jahrestagung des Bad Wiesseer Kreises vom 01.- Mai – 04. Mai 2008* (Beiträge zur Hochschulpolitik 3/2009). Bonn: Hochschulrektorenkonferenz.

Jónasson, J. T. (2006). *Can credentialism help to predict the convergence of institutions and systems of higher education*. CHER 19th Annual Conference. Systems Convergence and Institutional Diversity, 7–9 Sept 2006. Germany: University of Kassel.

Joschke, H. (1981). *10 Jahre VHB. Denkschrift des Verbandes der Hochschullehrer an Fachhochschulen in Bayern e. V. anlässlich seines 10-jährigen Bestehens*. München: VHB.

Kyvik, S. (2009). *The dynamics of change in higher education: Expansion and contraction in an organisational field*. London: Springer.

Ministerium für Innovation, Wissenschaft und Forschung des Landes Nordrhein-Westfalen. (2011). *Eine Erfolgsgeschichte. 40 Jahre Fachhochschulen in NRW*. Berlin: Dr. Josef Raabe Verlag.

Rau, E. (1993). Inertia and resistance to change of the Humboldtian university. In C. Gellert (Ed.), *Higher education in Europe*. London: Jessica Kingsley Publishers.

Rizvi, F., & Lingard, B. (2010). *Globalizing education policy*. London: Routledge.

Saumade, G. (1998). *Les Instituts Universitaires de Technologies.* CNDP: Rapport au Premier Ministre, 50 p.

Smeby, J.-C. (2006). Professionalism in a knowledge society: The academic drift of professional education in the 'new' professions. In *4th Interim Meeting, European Sociological Association's Research Network "Sociology of Professions": "Professions, Globalization and the European Project: Shifting Spheres of Opportunity"*, 30 Mar–1 Apr 2006, University of Bremen. Available at: http://www.academia.edu/565379/Professionalism_in_a_knowledge_society_The_academic_drift_of_professional_education_in_the_new-professions

Teichler, U. (1996). Diversity in higher education in Germany. The two-type structure. In L. V. Meek, L. Goedegebuure, O. Kivinen, & R. Rinne (Eds.), *The mockers and the mocked: Comparative perspectives on differentiation, convergence and diversity in higher education*. Oxford: IAU Press/Pergamon.

Tomlinson, M. (2013). *Education, work and identity: Themes and perspectives*. London/New York: Bloomsbury Academic.

Vogel, M. P. (2009). The professionalism of professors at German Fachhochschulen. *Studies in Higher Education, 34*(8), 873–888.

Vorstand der Fachhochschulrektorenkonferenz (Ed.). (1990). *Die Fachhochschulen zu Beginn der 90er Jahre – Eine Positionsbestimmung*. Bremen/Wiesbaden: FRK.

Witte, J., van der Wende, M., & Huisman, J. (2008). Blurring boundaries: How the Bologna process changes the relationship between university and non-university higher education in Germany, the Netherlands and France. *Studies in Higher education, 33*(3), 217–231.

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