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How effective are doctoral schools? Organisational characteristics and related objectives

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Introduction

Gumport (1993) explains the competitive force of top tier American universities by their Graduate Schools, among other things, which strongly relate graduate education and research. Concretely, American doctoral students pass through coursework and examination within a department based Graduate School and then do their doctoral research within the same department. When studying doctoral education in Germany, France and Britain and comparing it to American doctoral education, Clark noticed that European doctoral students become research students or 'junior academic staff cut free from organized instruction' (Clark, 1995, p. 157). Indeed, traditional European doctoral education was, and in some cases still is, based on the apprenticeship model consisting of the transmission of knowledge, skills and behaviour through the supervisor. In other words, one only person was in charge of doctoral students, instead of an organisation like an academic department.

American Graduate Schools had already existed for more than a century (Clark, 1995) when European universities and (sometimes) ministries in charge of higher education started thinking about doctoral education's reorganisation. The latter especially means increasing doctoral education's degree of structure, often through the creation of 'doctoral schools' (see also Amaral and Carvalho in this book). Indeed, the word 'structure' has become popular in the context of the Declaration of Bologna, among others. Given the minimalist degree of organisation of the European apprenticeship model, a lot could be invented from scratch (Teichler, 2006). However, no unique model has been recommended by the Bologna movement, nor has one been implemented (for a typology of doctoral schools in Europe see Amaral and Carvalho in this book). Although inspired by American Graduate Schools, a large variety of organisational forms have been invented and established. As evidenced by other chapters in this book, it is important to notice that one term covers different realities. For instance, the term 'doctoral School' does not yet mean one only organisational form. In reality, this term as well as others – for instance, 'Research School' – includes various organisational forms and activities. While certain doctoral schools remain within their disciplinary and institutional boundaries, others go beyond them. Thus, doctoral schools may be organised in a mono-institutional – *i.e.,* within one same higher education institution (HEI) - or an inter-institutional way – *i.e.,* in collaboration between several HEIs. Activities may cover for instance doctoral student recruitment, further education, supervision,

scientific exchange, tracking and career, or only some of these (Baschung, 2016). It is important to note that, at least in the cases addressed in the present chapter, doctoral schools are organisational structures which have been *added* to the existing apprenticeship model. In other words, each doctoral student is still enrolled as such within his or her faculty or – according to the used terminology, department, and has a formal supervisor. In addition, he or she may also be part of a doctoral school. Thus, doctoral schools do *not* necessarily *replace* but complement the apprenticeship model.

The beginning of European doctoral education's reform varies according to the country and even the HEI. However, at least in some cases, experience with doctoral schools already lasts more than a decade. Hence, the question of doctoral schools' effectiveness may be asked. The present chapter examines this question, especially regarding the doctoral schools' organisational structure. Therefore, the identification of the reform's underlying objectives and their relationship with the organisational structure of doctoral schools are put in the centre of this analysis. The latter is carried out on the basis of public management literature and data dealing with Swiss higher education. Indeed, a study of Swiss doctoral schools showed that various organisational forms emerged. Some doctoral schools are organised within one only HEI, whereas others follow an inter-institutional logic. Collected data stems from the national level and four case studies, covering varying organisational forms and scientific disciplines.

Swiss higher education is mainly publicly funded. Therefore, it makes sense to borrow concepts of public management when discussing organisational forms and their effectiveness. On the basis of this discussion, which is carried out in the next section, several hypotheses are made regarding the effectiveness of doctoral schools. These hypotheses are then examined in the following parts dedicated to the objectives, activities and organisational structures of Swiss doctoral schools. Final results are summarised in the conclusion.

Organisational forms and their effectiveness in the public sector and higher education

Effectiveness is a central element of the New Public Management (NPM) narrative. Explicit standards and measures of performance are defined, objectives are fixed and output is controlled (Hood, 1991). However, other concepts of public management, like 'Network Governance', emerged and put into question the effectiveness of NPM itself. It has been argued that collaborative organisational forms could be even more effective. Central elements of the Network Governance narrative consist of a greater range of interacting actors, lateral rather than vertical forms of management, shared coordinating power, self-organising and self-steering capacity as well as sharing of knowledge and 'best practices' within the network (Ferlie, Musselin & Andresani, 2009). According to Agranoff and McGuire (2001), knowledge development and learning occur best in networks. Since those two elements correspond exactly to the core mission of HEIs, it is not astonishing that the network

governance narrative also had been detected in higher education (Deem, Hillyard & Reed, 2007; Paradeise, Reale, Goastellec & Bleiklie, 2009). Lang (2002) indeed indicates that HEIs may have good reasons to cooperate with other HEIs. He distinguishes four kinds of reasons: first, in order to do things that they would not be able to do individually because of lacking financial resources; second, in order to gain a competitive advantage in the educational market; third, in order to guarantee institutional survival; fourth, because of common history, culture, language and geography.

If these reasons seem to be rather rational (except perhaps the fourth one), the question of effectiveness has to be asked. Is cooperation within networks necessarily improving the implementation of (higher education) policies? A first answer, which is given by Lundin (2007) in the context of the Swedish active labour market policy, is: it depends on the public policy's degree of complexity. The more complex a public policy is, the more it is probable that inter-organisational cooperation has an added value. On the contrary, if the problem underlying the public policy is rather simple, its implementation remains rather unaffected by cooperation. However, it causes high coordination costs. Schalk, Torenvlied and Allen (2009) furthermore demonstrated for Dutch colleges for the training of primary education teachers that being part of a network does not automatically have a positive impact on a HEI's performance. It is the quality ('embeddedness') of the network's internal and exchanged resources and relationships – *i.e.,* credible commitment and degree of trust – that makes a difference in performance.

Kenis and Provan (2009) explain that measuring performance or effectiveness of networks has to be done very carefully since what is understood by effectiveness necessarily has a normative component. Therefore, criteria for measurement have to be appropriate. In this context, they underline that 'The fact that a network scores low on a certain criterion may be related to the fact that that particular network, based on its structure, mission, and so on, cannot score highly on that criterion' (Kenis & Provan 2009: 444). The appropriateness may vary according to several factors, including three exogenous factors: first, the form of the network, varying between a shared governance network, a network led by one member organisation and a network managed by an administrative organisation; second, the type of inception, *i.e.*, mandated or voluntary bottom-up networks; third, the developmental stage, distinguishing between newly emerging and more mature networks. Kenis and Provan (2009) estimate that voluntary bottom-up initiated and rather mature networks are considered as having more chances to be effective than mandated and recently created networks. Concerning the three organisational forms, the quoted authors evaluate them in terms of involvement of all network participants, flexibility, sustainability, legitimacy and efficiency rather than in terms of effectiveness. However, it seems plausible to us to consider that larger networks are more difficult to steer than smaller ones. As a consequence, we make the hypothesis that mono-institutional institutions and small networks *a priori* are more effective than large networks. In addition, since administrative organisations ought to support the network members by taking charge of part of the organisational

work, we also make the hypothesis that networks managed by an administrative organisation are more effective than a shared governance network whose members coordinate their activities themselves. A network led by one member organisation may be effective, yet, not necessarily for all network members.

When coming back more specifically to effectiveness of HEIs, Cameron's study carried out in the 1970s (Cameron, 1978), which has been validated again by more recent studies (Kwan & Walker, 2003; Ashraf & Abd Kadir, 2012), identified three general types of criteria for organisational effectiveness: goal achievement, acquisition of resources in the environment and internal organisational processes. In addition, nine specific effectiveness dimensions for HEIs were identified, among which are four student centred ones: educational satisfaction, academic development, career development and personal development of students; – plus: faculty and administrator employment satisfaction, professional development and quality of the faculty, system openness and community interaction, ability to acquire resources and organisational health. His study showed that no HEI operates effectively on all dimensions and that different profiles of effectiveness can be detected. However, once a profile of effectiveness is identified, a detailed analysis of effectiveness can be made (Cameron, 1978).

Based on the arguments mentioned in the present section, the following hypotheses are made concerning the effectiveness of doctoral schools:

- Hypothesis 1 (effectiveness-profile): Doctoral schools' activities and degree of cooperation are directly related with their objectives.
- Hypothesis 2 (organisational-effectiveness): Doctoral schools' form (mono-institutional organisation or different types of networks), type of inception, and developmental stage have an impact on their effectiveness.
- Hypothesis 3 (effectiveness-profile): Doctoral schools are particularly effective regarding the objectives they have chosen.

Methodology and data

Two parallel approaches are necessary in order to examine the effectiveness of Swiss doctoral schools and, more particularly, the mentioned hypotheses. On the one hand, the development of the Swiss landscape of doctoral schools has to be analysed as a whole. On the other hand, the question of effectiveness has also to be dealt with in a more detailed way on the basis of case studies.

The first approach is carried out on the basis of four elements: first, the elaboration of a database of Swiss doctoral schools through desktop research; second, interviews with key actors at the national and regional levels (Swiss National Science Foundation, Rectors' Conference of the Swiss Universities, University Conference of Western Switzerland). Both elements were realised during the

years 2006 and 2007; third, document analysis in order to follow the evolution of the Swiss landscape of doctoral schools until 2018; fourth, analysis of relevant statistics provided by the Swiss Federal Statistical Office (Bundesamt für Statistik [BFS]).

Concerning the second approach, four case studies have been chosen in order to cover various organisational forms (one mono-institutional doctoral school, three inter-institutional network doctoral schools with different degrees of cooperation) and disciplinary fields. In accordance with Becher and Trowler's (2001) typology of academic fields, each of the four case studies covers (mainly) one type of field: life sciences representing the hard-pure field, engineering sciences the hard-applied type, an interdisciplinary doctoral school in humanities the soft-pure type, and finance the soft-applied type. Two forms of data have been used: interviews and annual reports. The former were carried out during the years 2007 and 2008 with 54 actors from various HEI levels concerned with doctoral education, from doctoral students and supervisors, to doctoral school administrative and academic leaders, to vice-rectors. Annual reports allow for observing the doctoral schools' evolution between 2007 and 2017.

The landscape of Swiss doctoral schools: development, objectives, activities and organisational structure

The Swiss landscape of doctoral schools is definitely not the result of any centrally planned public policy. On the contrary, it is the result of many different initiatives taken by the federal government, the Swiss National Science Foundation (SNF) which is funded by the federal government, the Rectors' Conference of the Swiss Universities (CRUS) and – first and foremost – the universities and the academic professions themselves. This kind of situation is rather typical for Swiss higher education and can be explained by the federal and therefore strongly decentralised character of the Swiss state, the increased institutional autonomy of Swiss HEIs, and also the incremental emergence of the idea of doctoral schools.

In 1997, several reports (Lévy, Roux & Gobet, 1997; Maurer & Zeltner, 1997) highlighted the insufficient supervision of doctoral students as well as their work overload due to important teaching duties. Among other things, these reports contained the recommendation to establish doctoral schools. Hence, the latter were seen as a mean to improve doctoral students' supervision. This issue was again raised in a report published in 2010, pointing to important differences in terms of supervision frequencies between doctoral students of 'hard sciences' and 'soft sciences', the latter clearly having fewer meetings with their supervisor than the former. This report also demonstrates a strong correlation between meeting frequency and student satisfaction (the more meetings, the higher the satisfaction) (Young, Curty, Wirth, & Bürgel, 2010).

The echo provoked by the 1997 report at the federal level was rather weak and consisted of the timely limited funding of eight individual doctoral schools, from 1998 on and in the framework of the

politically oriented programme 'Switzerland: Towards the Future', launched by the SNF, and aimed at strengthening the social sciences. Furthermore, timely limited funding has been provided since the beginning of 2000 for the establishment of 'National Centres of Competence in Research (NCCR)', which were meant to establish a kind of doctoral school (without precise requirements). In 2006, an SNF programme called 'Pro*Doc' specifically dedicated to the establishment of small doctoral schools began, first exclusively in the field of social sciences. In parallel and in the context of the Bologna reforms, CRUS put the reform of doctoral education on its agenda. Thanks to specific federal funding, CRUS had the ambition to create a complete offer of doctoral schools, covering all scientific fields, in order to give all doctoral students the opportunity to enter a doctoral school. However, this plan was abandoned and the obtained funding was added to the SNF Pro*Doc programme. CRUS stated that this programme should increase the quality and attractiveness of the PhD (Baschung, 2013). In 2011, Pro*Doc was stopped and in 2013 CRUS developed its own, yet again federally funded, programme. This time, CRUS (which became the 'Chamber of Universities' of 'Swissuniversities', the Rectors' Conference of all Swiss HEIs) wanted to offer doctoral schools for as many doctoral students as possible. These doctoral schools had to be established as networks contributing to the scientific socialisation of doctoral students through different activities (community building and courses). Formal requirements consisted of a minimum of twenty students coming from at least two HEIs, in order to assure critical mass (www.swissuniversities.ch; consulted in July 2018). The federal funding was always to be provided for a four-year period; therefore, a new solution had to be found for the 2017-2020 period. Indeed, another funding source was obtained and the related objectives were enlarged. In addition to the increase of the quality and attractiveness of the PhD, this programme was also meant to create good career conditions for doctoral students, to diversify the offerings according to the needs of the various scientific fields, and to continue the development of the doctoral level. These last two points especially concern the collaboration with the rather young universities of applied sciences (UAS) and universities of teacher education (UTE), who currently do not have the right to award PhDs themselves. If Swissuniversities is hoping that the needs of UAS and UTE will justify another specific federal funding for the period 2021-2024, it clearly plans digressive funding for traditional university-based doctoral schools during the period 2017-2020, with the objective that traditional universities will continuously integrate the funding of the hitherto federally funded doctoral schools into the ordinary universities' budget (Conférence suisse des hautes écoles [CSHE], 2016).

As mentioned, HEIs and the academic profession did not rely on the implementation of these politically initiated doctoral schools. In parallel to the above mentioned initiatives, several HEIs developed their own doctoral schools or assured the further existence of doctoral schools which were founded with timely limited federal funding; for instance, doctoral schools established within NCCRs.

The Swiss Federal Statistical Office's graduate survey offers the following snapshot regarding the number of doctoral students (among those who finished their PhD in 2014) who had the opportunity to pursue activities within a doctoral school, and those who used this opportunity.

Table 1: Offer of doctoral schools and degree of use

	Offer of doctoral school		Doctoral school followed	
	%	+/-	%	+/-
Total	52.6	1.8	87.8	1.6
Human and social sciences	55.3	3.6	79.6	4.0
Economic sciences	68.0	6.9	86.3	6.2
Law	23.1	6.7	**	**
Exact and natural sciences	58.7	2.6	92.1	1.9
Technical sciences	40.4	3.8	92.8	3.4

Source: Swiss Federal Statistical Office; provided on demand.

Thus, a small majority of doctoral students had the opportunity to enter a doctoral school, yet with important differences between the scientific fields. The variation of the fact whether doctoral students entered a doctoral school may also depend on formal obligation. As a matter of fact, large differences are seen in the analysis of formal obligations (Baschung, 2008).

The same graduate survey also details what kind of activities take place within doctoral schools. Four kind of activities have been identified: first, courses and seminars for doctoral students (in 84% of all doctoral schools); second, scientific writing, presentation and publication courses (62%); third, disciplinary (57.2%) and interdisciplinary (38.2%) research colloquia; fourth, research management (31.6%), media (24.6%) and other courses related to the profession and practice (29.1%). Interestingly, doctoral schools in human and social sciences suggest fewer courses and seminars for doctoral students than average (75.4%), but more disciplinary (68.3%) and interdisciplinary (31.6%) research colloquia. Thus, the need for scientific exchange seems to be stronger in human and social sciences than in other scientific fields.

Finally, no national data is available regarding the organisational structure of doctoral schools. However, given the formal requirement related to most of the politically initiated doctoral schools consisting of a network structure of at least two HEIs, many doctoral students may have attended a network doctoral school. In addition, the largest initiative of doctoral schools developed by universities themselves, *i.e.*, the today 33 CUSO (*Conférence universitaire de Suisse occidentale*)[i] doctoral schools, are all organised in an inter-institutional way.

Contextual data at the national level

Four main objectives have been mentioned in the national context with respect to doctoral schools, namely the increase of the PhD's attractiveness (1), the improvement of the supervision quality (2), the creation of good career perspectives (3) and the improvement of the PhD quality (4). However, since, on the one hand, no unique public policy has been developed at the national level, nor implemented on a systemic level and, on the other hand, created doctoral schools have different organisational forms and especially activities, it is difficult to examine on a national basis to what extent doctoral schools are effective regarding the mentioned objectives. Thus, case studies are needed to demonstrate the relation between doctoral schools' organisational form and activities on the one hand, and effectiveness on the other hand.

Nevertheless, available data at the national level is used in order to provide a general description of the case studies' context. First of all, regarding the PhD's attractiveness, it has to be noted that, as in many other countries, the number of doctoral students has sharply increased since about two decades.

Table 2: Number of doctoral students

Indicator/year	2000	2017
No. of doctoral students	13,494	25,209
Number and % of Swiss doctoral students	8,440/62.5%	11,243/44.6%

Source: Swiss Federal Statistical Office; www.bfs.admin.ch

This increase is partly due to the HEIs' massification as a whole. Indeed, all Swiss HEIs have been growing in terms of number of students, staff and research funding during the last two decades. Total funding of traditional universities doubled from about 4 billion CHF in 2000 to over 8 billion CHF in 2017 (Staatssekretariat für Bildung und Forschung [SBF], 2005; www.bfs.admin.ch). In this context, it is important to note that most doctoral students of Swiss HEIs have paid positions at a traditional university, usually as teaching or research assistants (BFS, 2010). From this point of view, the increase

in the number of doctoral students is not surprising. However, since the number of doctoral students has almost doubled, whereas the number of Bachelor and Master students, and the number of professors, has increased about by half during the same time period, one can suppose that the number of doctoral students' positions have deliberately received particular importance (Baschung, 2018). The second interesting observation concerns the number of foreign doctoral students. Today, they constitute the majority of the doctoral students, and the main reason for the increase of the total number of doctoral students. No fundamental policy change, like in the field of visa regulation, has happened since the beginning of the 2000s. The only noticeable change concerns the possibility for non-European graduates to stay six months after graduation in Switzerland in order to find a job. After this period, they generally have to depart. Before the introduction of this rule, they had to depart immediately after graduation. Nonetheless, it is uncertain if this new rule fundamentally changed the attractiveness of the Swiss PhD. Thus, explanation for the increase of foreign doctoral students has to be found in the case studies.

Regarding the second identified objective, the improvement of the supervision quality, available data does not allow any monitoring since no inquiry about doctoral students' satisfaction regarding their supervision has been realised since the study of Young et al. (2010). Consequently, any systematic impact due to doctoral schools' activities cannot be demonstrated either.

Available data is more abundant regarding the creation of good career prospects for doctoral graduates. Generally, the picture seems to be quite positive, at least if one is looking at data stemming from the graduates surveys, which are realised by the Swiss Federal Statistical Office. The percentage of unemployed doctoral graduates one year after graduation varies between 2.3% and 4.7% during the period of 2002 to 2016.[ii] Generally, this percentage is slightly lower than that of graduates at the master's and especially bachelor's level of traditional universities (universities of applied sciences and teacher education are not taken into account for this comparison). Five years after graduation only 0.5% to 3.0% of doctoral graduates are unemployed, depending on the year. Again, doctoral graduates seem to be less concerned by unemployment than graduates at lower levels (Horta also notes in this book that one of the types of motivation for doing a PhD may be better employment prospects). In other words, it seems to be worth doing a PhD when it comes to job security. Income of doctoral graduates generally is also 15% to 21% higher than master's graduates' salary. This might be explained to some extent by the age difference at graduation. Still depending on the year, between 88.6% and 96.5% of doctoral graduates are in jobs that require a HEI diploma, which is systematically higher compared to graduates at the master's level. Finally, around a third of all doctoral graduates are already in a leading position one year after graduation, compared to 12.5% to 14% of master's graduates.

Table 3: Objective 3 – Create good career perspectives[iii]

Indicator/year of graduation	2002	2004	2006	2008	2010	2012	2014	2016
% of graduates unemployment (1 year after graduation)	3.3%	3.1%	2.7%	3.3%	2.3%	4.2%	4.7%	4.6%
% of graduates unemployment (5 years after graduation)	1.9%	0.5%	1.3%	1.4%	3.0%	2.2%	-	-
% of adequacy between job and diploma (1 year after graduation)	96.5%	93.7%	88.6%	92.0%	89.7%	91.3%	89.9%	89.8%
Standardised median gross income in CHF of master vs. doctoral graduates	75/ 91K	73.5/ 89.2K	74.2/ 92.8K	77.5/ 91.1K	78.2/ 90.2K	79.5/ 92.1K	78.1/ 90.1K	76/ 90K
% of doctoral graduates in leading positions	-	-	36.9%	38.3%	30.1%	31.4%	33.1%	33.9%

Source: Swiss Federal Statistical Office; www.bfs.admin.ch.

In view of the sharp increase in the number of doctoral students, it is indeed remarkable that doctoral graduates still find positive conditions in the Swiss labour market. However, this might be relativized to the extent that a significant portion of graduates are foreigners and are professionally more mobile than Swiss graduates (Baschung, 2018). Thus, their working conditions are not really known. Finally, case studies are again necessary to see whether and to what extent doctoral schools contribute to the graduates' career perspectives.

Regarding the fourth mentioned objective, it is difficult to measure the absolute quality of doctoral education or its academic outcome as such. However, it is possible to measure to what extent doctoral graduates consider themselves competent regarding different dimensions. Table 4a shows that only two types of skills seem to be slightly more strongly developed by doctoral graduates who attended a doctoral school in comparison to the ones who did not, namely social skills and planning and organisational skills. Thus, the way out of isolation seems to have a positive impact. For instance,

doctoral students' gatherings seem to allow for learning how to interact in academic (and maybe other types of) environments and foster exchange of good practices in terms of planning and organisation.

Table 4a: Objective 4 – improve the quality of the PhD

Indicator	Doctoral school followed	No doctoral school followed
Specific skills	6.1	6.1
Social skills	4.1	3.8
Planning and organisational skills	5.3	5.1
Communication skills	5.2	5.1
Learning and problem solving skills	6.0	6.0
Personal skills	5.6	5.5
Interdisciplinary skills	3.9	3.9

Source: Swiss Federal Statistical Office; www.bfs.admin.ch; provided on demand. The scale goes from 1 to 7.

In the case of human and social sciences, skills improvement in terms of planning and organisation seems also to have an impact in terms of overall PhD duration, since doctoral graduates who attended a doctoral school needed five years to complete the doctoral degree, whereas their colleagues who did not needed more than half a year more (see table 4b). However, in absolute terms the PhD duration is rather a criterion of efficiency than effectiveness or PhD quality.

Table 4b: Objective 4 – improve the quality of the PhD

Indicator	Doctoral school followed	No doctoral school followed
PhD duration in years		
Human and social sciences	5.0[a]	5.6[a]
Economic sciences	4.5[a]	4.7[a]
Law	**	4.4[b]
Exact and natural sciences	4.5	4.4
Technical sciences	4.6	4.6
Total	4.6	4.8

Source: Swiss Federal Statistical Office; provided on demand. a: variation coefficient >2.5% and <5%; b: variation coefficient > 5% and <7.5%.

Objectives, activities and organisational structure of four case studies

As mentioned in the methodological section, four case studies have been chosen in order to cover diversity in terms of organisational structure and academic disciplines. This breadth should allow a more concrete examination of the fixed hypotheses. The present section suggests a synthetic presentation and evaluation of the case studies in terms of objectives, activities, degree of cooperation, form, type of inception and developmental stage.

Objectives related to doctoral education's reform through the establishment of doctoral schools vary between different actors of HEIs, from doctoral students, supervisors, doctoral school administrative and academic leaders to vice-rectors. Table 5 summarises the different mentioned objectives as well as the doctoral schools' activities as detected in the different case studies.

A first type of activity concerns the doctoral students' *recruitment* process. Concretely, instead of announcing PhD positions individually, they are advertised collectively in the name of a doctoral school. A recruitment committee, composed of several professors, analyses the applications resulting from the two or three application deadlines. A second activity consists in the offering of *courses*. Such courses may be specifically related to a mono- or interdisciplinary scientific field, or may consist of transferable skills courses. Some doctoral schools also provide *multiple supervision* through a thesis committee, composed of several members. Doctoral students regularly meet such a committee and discuss the scientific problems they face. A fourth activity is represented by *enlarged scientific exchange* among doctoral students themselves. In contrast to informal exchange among doctoral students, such opportunities are deliberately organised by doctoral schools in the framework of seminars, conferences and retreats. Some doctoral schools also *track* doctoral students' progress in a more administrative way. They oblige all involved actors – *i.e.*, doctoral students and their supervisor(s) – to regularly – for instance, every six months – give an account of the advancement of

the thesis project. In case of serious problems, thesis projects can be reoriented or abandoned. Finally, some doctoral schools also developed activities to actively promote doctoral graduates' *career*. Activities range from providing information about the non-academic job market, transferable skills courses and sending students to important scientific conferences where they present their 'job market paper'.

Table 5: Objectives mentioned by interviewees and activities carried out by doctoral school[ivv]

Doctoral school	Mentioned objectives	Recruitment	Curricular	Monitoring	Scientific exchange	Tracking	Career
Life Science Zurich Graduate School (Uni Zurich and ETHZ)	Create the next generation of leaders in life sciences (academia and industry)	x					x
	Educate independent researchers						
	Rationalise the recruitment process	x					
	Develop discipline-specific competences through courses		x				
	Foster social and scientific integration of doctoral students				x		
	Enlarge supervision			x			
	No related objective mentioned					x	
EPFL Doctoral school	Uniform recruitment procedures as quality assurance measure	x					
	Attract the best doctoral students	x					
	Increase the number of doctoral students						
	Improve the course offer for doctoral students		x				
	Improve the integration of doctoral students				x		
	Develop professional networks for doctoral students				x		
	Prepare for the non-/academic labour market						
	No related objective mentioned					x	

Pro*Doc Athetics (Uni Basel and Berne)	Shorten doctoral education's duration					x	
	Structure doctoral education						
	Improve scientific exchange and supervision through networks				x		
	Foster interdisciplinary research		x				
	Improve the preparation of the next generation for the Swiss academic labour market		x				
Swiss Finance Institute PhD programme (Uni Geneva, Lausanne, Zurich, Lugano and EPFL)	Place the graduates in prestigious universities thanks to the attraction of the best doctoral students and the provision of the best possible education	x	x		x		x
	Improve the reputation of the Swiss Finance Institute						x

With two exceptions, all activities can be related to a given objective. From this point of view, indicated activities are coherent with declared objectives. Thus, the first part of hypothesis 1 can be confirmed: doctoral schools' activities depend on their objectives.

Principally based on the exogenous factors of effectiveness developed by Kenis and Proven (2009) and own reflections developed in the theoretical chapter, the case studies' organisational characteristics first are described and second are evaluated regarding their predisposition for effectiveness. Each out of the four criteria is assessed and gets between 1 and 3 points.

Table 6: Organisational characteristics and their evaluation regarding potential effectiveness by doctoral school

	LSZGS		EPFL DS		Pro*Doc Athetics		SFI DS	
Degree of cooperation (number of involved HEI)	2 HEI	++	1 HEI	+++	2 HEI	++	5 HEI	+
Organisational form	Managed by admin. Units	++	Managed by 1 admin. Unit	+++	Shared governance network	+	Shared governance network	+
Type of inception	Bottom-up	+++	Top-down	+	Bottom-up (with constraints)	++	Bottom-up	+++
Developmental stage: first and last year of existence	2005-...	+++	2003-...	+++	2006-2009	+	(1997-...) 2006-...	+++
Total evaluation		10		10		6		8

Based on table 6, the LSZGS and EPFL doctoral school seem to have the best predisposition to be effective. The conditions for the Swiss Finance Institute (SFI) Doctoral programme are still rather good, while the Pro*Doc Aethetics only gets half of the potential points.

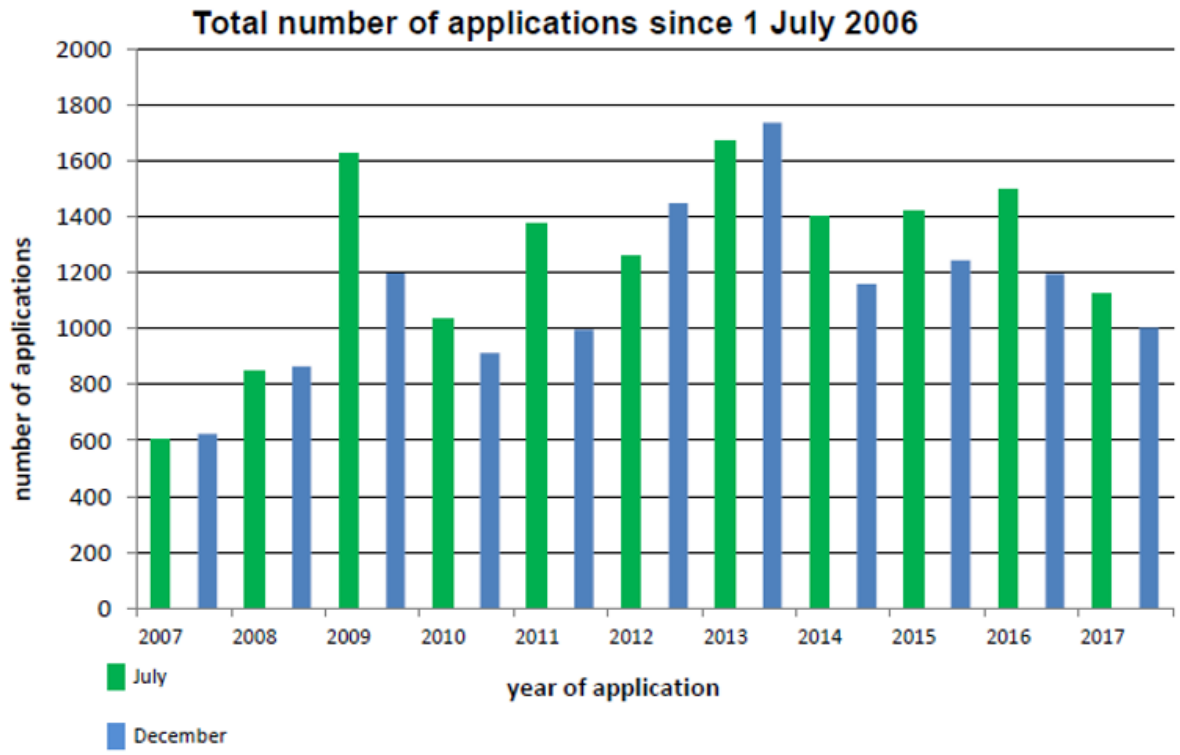
Effectiveness of doctoral schools: examining the attainment of specific objectives

When evaluating the effectiveness of HEIs, Cameron (1978) concluded that HEIs have specific effectiveness profiles. Thus, they chose their organisation in order to favour effectiveness regarding certain criteria rather than others. The previous section presented the description of the case studies' effectiveness profiles (table 5). In other words, we now should be able to examine to what extent the doctoral schools are effective with regard to their specific objectives. This is done on the basis of plausibility and available data.

If some LSZGS objectives are rather vague (e.g., create the next generation of leaders in life sciences, educate independent researchers) and therefore difficult to evaluate, others are simpler to examine. For instance, the objective 'Rationalise the recruitment process' can be measured by the type of

recruitment process which has been established, and its results. Since the creation of the LSZGS in 2005, doctoral students are officially recruited in the framework of two yearly application rounds (in July and December). Worldwide advertisement, for instance in the journal 'Nature', is done in the name of the doctoral school. Potential doctoral students apply for one of the currently 17 PhD programmes housed by the LSZGS. The preselected candidates are then invited to a three-day recruitment process in Zurich, with all expenses covered by the doctoral school. Though this recruitment process attracts a varying number of candidates over the years and application rounds, there seems to be a certain effect, since the initial number of about 600 candidates per application round in 2007 increased to more than 1700 candidates in 2013 and has always been over 1000 candidates during the last six years. Applicants come from 100 different countries.

Graph 1: number of applications to the LSZGS



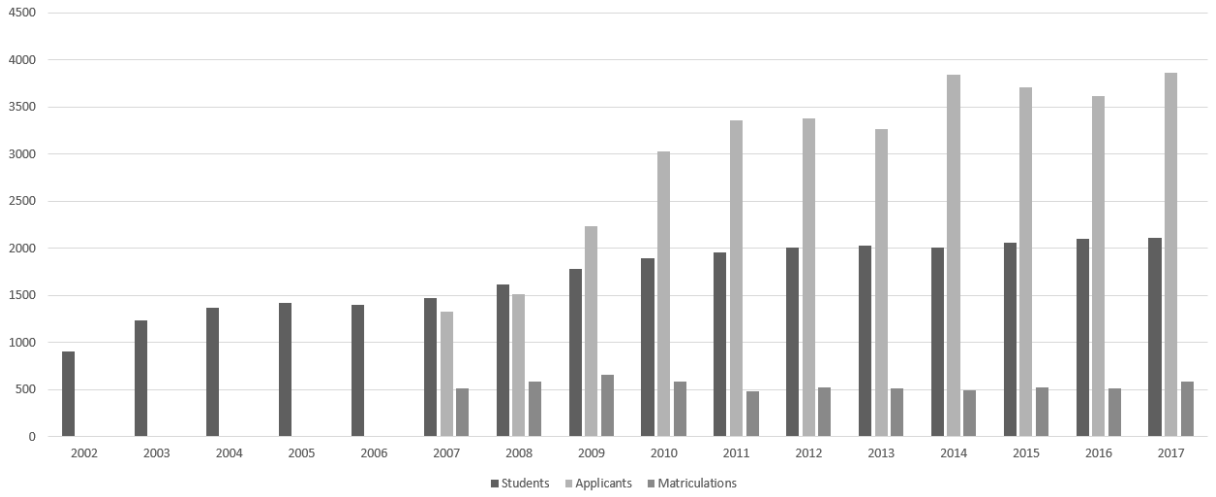
Source: Bachmann (2018).

Thanks to the application to a PhD programme instead of one only PhD position and a recruitment process run by committees composed of several PhD supervisors instead of one only supervisor, potential matches between PhD positions and candidates are more probable and are also likely more adequate than with a traditional one-to-one recruitment procedure. Indeed, according to interviewed LSZGS actors, the three-day recruitment procedure allows matches which otherwise would not have happened. In addition, multiple applications to several supervisors from the same PhD programme can also be reduced. From this point of view, the objective of a more rationalised recruitment procedure

certainly is achieved. However, the annual reports also indicate that by far not every doctoral student is recruited by the described procedure (called Track I). In 2017, 58% of all current doctoral students are still directly recruited by group leaders (called Track II). 'Because not all open positions can be filled during a given recruiting round and some outstanding applicants don't want to wait for 6 months, if they have just missed an application deadline, all programs also accept "track II" candidates' (Bachmann 2018: 13).

The EPFL Doctoral School has similar objectives as the LSZGS. Objectives like 'Uniform recruitment procedures as quality assurance measure', 'Attraction of the best doctoral students' and 'Increase the number of doctoral students' can be examined to a certain extent. This last objective has been clearly achieved since the number of doctoral students more than doubled since the creation of the EPFL doctoral school.

Graph 2: evolution of the number of applicants, matriculations and students at PhD level at EPFL



Sources: EPFL Annual reports 2010-2017 (for applicants and matriculations); Swiss Federal Statistical Office; www.bfs.admin.ch (for students)

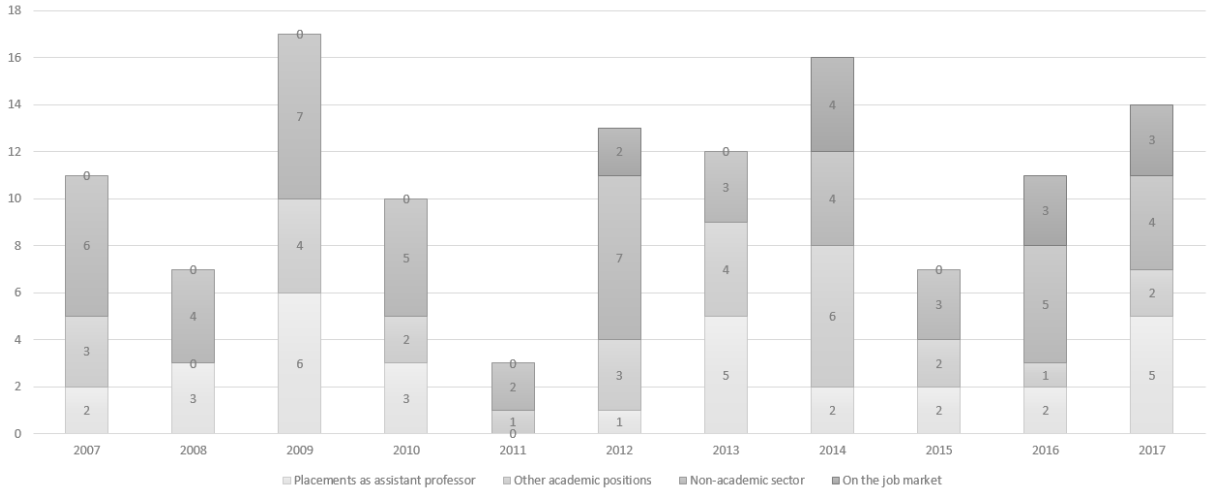
It is difficult to evaluate to what extent the EPFL doctoral school recruited 'the best students', however, the ratio between applicants and newly matriculated students shows that the choice of candidates strongly increased during the last ten years (ratio from 2.6 in 2007 to 6.6 in 2017). Finally, the recruitment procedure is uniform to the extent that every PhD applicant has to fill in an online application form, requiring letters of recommendation, among other things, and to choose one of the 20 PhD programmes. Each programme has its experts committee, which evaluates the applications, according to the programme, two to three times a year. In some cases, these application deadlines are followed by Skype interviews and/or hiring days. Baschung (2013) observed that HEIs with such recruitment practices indeed attract more foreign doctoral students than HEIs which recruit their

doctoral students in a more traditional way. Thus, the increasing number of foreign doctoral students and the total number of doctoral students can be largely explained by such new recruitment practices.

It is difficult to examine to what extent the Pro*Doc Aethetics programme attained its objectives, since it only existed for four years (from 2006 to 2009). However, interviews with involved actors, carried out during the programme's existence, showed the ambiguity regarding the objectives 'shorten doctoral education's duration' and 'more structure'. If there was a consensus on the necessity to pursue these objectives, it has also been underlined that a too-high amount of training activities may be counterproductive and too much structure should not be introduced either, in order to avoid a strong 'school like' character (*Verschulung*). Scientific exchange and supervision in the framework of networks are evaluated positively. It seems to represent a real benefit, to the extent that it allows doctoral students to get out of isolation and to enlarge their horizon. Concerning the 'development of interdisciplinary research', both doctoral students and supervisors underline how difficult it is to go beyond traditional disciplinary boundaries.

Finally, the SFI PhD programme's main objectives are, first, to place the graduates in prestigious universities thanks to the attraction of the best doctoral students and the provision of the best possible education and, second, to improve the reputation of the Swiss Finance Institute. This first part of the objectives is clearly oriented towards the final goal of placing graduates in prestigious universities. An analysis of the SFI annual reports between 2007 and 2017 allows tracking what kind of job the graduates have a few months after graduation.

Graph 3: SFI doctoral graduates' placement on the labour market



Sources: SFI Annual reports 2007-2017

Almost 50% of all 122 graduates quickly found a job in the academic job market, 25% even found a job as assistant professor. This is clearly above the Swiss average; 33% of Swiss doctoral graduates (28% in Economics and law) found a job in academia one year after graduation (BFS, 2018). Among the 42 HEIs where academic placements of SFI graduates took place, 33 HEIs figure in a specialised ranking in the field of finance, the Arizona State University ranking. The latter is based on the number of published articles in four academic journals, specialised in finance.[vi] Within this ranking, 21 HEIs out of the 42 are part of the top 100 HEIs and 11 HEIs are even in the top 50. Thus, the objective of placements in prestigious HEIs has been attained to quite some extent.

The improvement of the SFI's academic reputation represents the second final objective. Reputation can be measured by academic rankings based, among other things, on reputation. Yet, when consulting different rankings like 'QS' or 'THE', finance is only suggested combined with accounting. In addition, SFI member universities only figure as individual institutional units and not in aggregated forms as the 'Swiss Finance Institute'. One exception with regard to these two issues is the ranking suggested by the Arizona State University. If one compares SFI's ranking between 2006/2007 (38th rank) and 2016/2017 (6th rank)[vii], the improvement is considerable. This may contribute to SFI's reputation.

Rather than compare the absolute effectiveness between the four case studies, this section's goal was to examine hypotheses 2 and 3. Regarding hypothesis 2, the doctoral schools' form, type of inception and developmental stage seem to have an impact on their effectiveness. The tendencies in terms of potential effectiveness, calculated in table 6, have been confirmed, though they have to be refined. Concerning the hypothesis 3, according to which doctoral schools are particularly effective regarding the objectives they have chosen, the partial results seem to confirm this hypothesis, although available data did not allow for systematic examining the attainment of all objectives.

Discussion: the role of organisational structure regarding effectiveness

Regarding the first hypothesis – *i.e.*, doctoral schools' activities and degree of cooperation depend on their objectives – the four doctoral schools' activities are coherent regarding the identified objectives. Furthermore, cooperation takes place in order to achieve them. In the case of LSZGS, the PhD students' recruitment needed rationalisation and it made sense to do that on a scale with a critical mass, suggested by two neighbouring HEIs, active in the same academic field within the same city. EPFL's objectives were clearly centred on EPFL as an institution (increase the number of PhD students, uniform the recruitment procedure, recruit the best doctoral students) and, in addition, EPFL's geographical neighbours (Universities of Lausanne and Geneva) have quite a different academic profile (except common points in the field of life sciences). Last but not least, EPFL has itself a critical mass to organise one doctoral school. Thus, a collaboration was less 'natural' and not really necessary. The situation is different in the case of the humanities and finance. The given academic (sub-)fields are so small in Swiss higher education that a cooperation is necessary in order to improve the doctoral students' scientific exchange (Pro*Doc Aethetics), for instance, or to improve the reputation (SFI).

However, what role do the doctoral schools' organisational characteristics play regarding effectiveness? Kenis and Provan's (2006) exogenous factors indeed seem to have a certain impact on the doctoral schools' effectiveness. For instance, concerning the type of inception, completely bottom-up initiated networks seem to have quite a long lifespan. Consequently, their developmental stage becomes increasingly mature. Thus, there seems also to be some relation between those two factors. However, the factors evaluated in table 6 are not completely predetermining either. All examined doctoral schools with demonstrated high effectiveness have a different organisational form, varying between management by one or several units, to shared governance. If the organisational form of management by one unit theoretically is the most effective, other forms also seem to work in certain conditions. In addition, the number of network members is not necessarily predetermining either. In other words, it seems possible to compensate exogenous factors, which *a priori* are not the best preconditions for effectiveness. Indeed, Agranoff and McGuire (2001) point to a number of factors, which favour successful network management. In contrast to Kenis and Provan's (2009) exogenous factors, they are rather endogenous factors like trust, mutual dependency, resource availability, catalytic actors, managerial ability and common purposes. These factors could not be investigated systematically in the present chapter. Yet, on the basis of the identified objectives it is striking that the SFI's interviewed actors are the most unanimous regarding the objectives. Furthermore, in contrast to the Pro*Doc Aethetics whose funding stopped after four years, the three other doctoral schools have resources which allow their operation over a longer period of time.

Conclusion

How effective are doctoral schools? This question cannot be answered in a general way, not even for one single, yet federal, country like Switzerland. On the one hand, the related reform in the Swiss context is not (yet) systematic nor homogeneous in terms of activities and organisational characteristics. On the other hand, available data does not allow a general conclusion. HEIs or even single doctoral schools have their own objectives. Some of them place rational recruitment procedures on the top of their agenda, whereas others prioritise training and supervision activities and/or career development. The described case studies illustrate that doctoral schools may indeed make an important contribution to the achievement of effectiveness through particular measures.

What about the impact of the organisational aspects? On the basis of the case studies, it can be said that no organisational form is superior to another in absolute terms. Exogenous factors indeed have a certain impact on the doctoral schools' effectiveness. For instance, voluntary bottom-up initiated and rather mature networks definitely have better chances to be effective than network doctoral schools whose funding is finished after a four-year period. Mono-institutional doctoral schools' organisation is *a priori* less complex and more effective than inter-institutional networks. However, the case studies also showed that exogenous factors are not completely predetermining. Endogenous factors like the degree of convergence on objectives also play an important role. Thus, common objectives can even compensate weaknesses in terms of exogenous factors, like high coordination costs of large networks.

Hence, the organisational form and the type(s) of activities of doctoral schools should be and generally are chosen according to the objectives. Simply copying the American Graduate School or another model is not necessarily the right thing to do for every situation. On the contrary, it is worth spending some time thinking about the objective of a doctoral school within its disciplinary and institutional context and making sure this objective is shared by all involved actors. The organisational characteristics and activities can then be built around it, ideally without neglecting the remaining endogenous factors like trust and managerial ability.

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[i] CUSO includes all traditional universities of the French speaking part of Switzerland.
[ii] (www.bfs.admin.ch)
[iii] Adequacy was measured on the basis of the question 'Did your job require a HEI diploma?'.
[iv] ETHZ: Eidgenössisch Technische Hochschule Zürich (Federal Institute of Technology Zurich)
[v] EPFL : Ecole polytechnique fédérale Lausanne (Federal Institute of Technology Lausanne)
[vi] Journal of Finance, Journal of Financial Economics, Review of Financial Studies, Journal of Financial and Quantitative Analysis
[vii] Source: http://apps.wpcarey.asu.edu/fin-rankings/rankings/results.cfm, consulted end of July 2018.