Chapter 10

Engineering Academisation: The Transition of Lower Level Engineering Education from Upper Secondary School Level to Higher Education

Per Fagrell and Lars Geschwind

10.1 Introduction

By the end of the 1980s, engineering education in Sweden was being provided in two main forms: a relatively practice-oriented engineering degree at the upper secondary school level (Technical College Graduate, *gymnasieingenjör*) and a more theoretical engineering degree at the technical universities (master of science in engineering, *civilingenjör*). However, this was changed by a decision in the Swedish parliament (*Riksdagen*) in 1989 that upper secondary engineering would be transferred to the higher education level in the early 1990s and at the same time be extended. The reasons for the reform explained that Technical College Graduate education needed to be more internationally viable and comparable, and that the labour market and technology development demanded this extension. The decision in parliament had been preceded by around 15 years of investigations, lobbying and try-out periods.

Like the old Technical College Graduate programme (henceforth called T4), the new engineering education system would be spread geographically throughout Sweden and run at technical universities, comprehensive universities and university colleges. Traditionally, engineering education at the university level was concentrated in the existing technical universities, which ran educational programmes awarding the degree of master of science in engineering (hereafter ‘master’s programmes’). This was a timely and welcome decision for many university colleges in Sweden that had been created after the Swedish higher education reform of 1977. Most of these were small and usually had very limited activity in the field of technical education. The decision gave them an opportunity to broaden and expand their

P. Fagrell (✉) · L. Geschwind

Department of Learning in Engineering Sciences, KTH Royal Institute of Technology,
Stockholm, Sweden

e-mail: perfag@kth.se; larsges@kth.se

activities within this field. As for the technical universities, this decision created an opportunity to expand activities within a short period. Upon completion, the reform would mean an approximate doubling in the number of students enrolled in the field of technical/engineering education.

Many other countries had already implemented similar reforms to elevate their domestic, traditionally more practically oriented, engineering education, such as Germany and France in the 1960s (Delahousse and Bomke 2015), even if they organised engineering education within two different educational systems. In several European countries, similar systems were developed at the same time, that is, a dual education system for engineering programmes, with engineering master's programmes at the university level on the one hand, and more practically oriented engineering programmes on the other. The latter often had their own organisational forms – Teknika (Denmark), Regional Technical Colleges (Ireland) and Universities of Applied Science (The Netherlands) (see Christensen and Newberry 2015, for more about the Danish, Dutch and Irish examples) – and were separate from the university. Svein Kyvik (2009) calls this phase of the development of engineering education 'horizontal integration', characterised by a transition to a dual system consisting of research universities and professional colleges, sometimes referred to as polytechnics or universities of applied sciences.

In fact, in 1974, the Swedish Higher Education Authority (UKÄ) had already suggested to the Swedish government that a new type of shorter engineering programme should be established within the universities. One of the reasons for the proposal was that other countries had already implemented this type of reform. While the proposal was turned down by the government, it can still be considered the starting point for a period of investigations and discussions that lasted for 15 years. It was also the starting point for the historical study underlying this chapter, in which the main research question concerns the technical universities' response strategies to the proposals for reform of engineering education, a reform that could have a huge impact on the activities at the technical universities, potentially even changing their organisational identity.

10.2 The Settings

10.2.1 *Political and Social Developments*

The Swedish economy experienced rapid growth after World War II, boosted by the fact that the country, and especially the industry, were more or less unharmed by the war. However, growth slowed in the early 1970s when global events, particularly the 1973 oil crisis, triggered a recession throughout the western world that went on into the 1980s. In Sweden, the recession revealed several structural problems within society, not least in industry. Even before the recession, a global left-wing movement had depicted private industry as an 'enemy of society'. In combination with an

emerging environmental movement, this affected society's – and not least young people's – view of technology and industry in a negative direction. In concrete terms, the interest in science, engineering and technology studies decreased (Feldt 1991; IVA 1985).

A new Social Democratic government began its term in 1982 with a firm devaluation of the Swedish krona (16%), mainly to strengthen the competitiveness of Swedish industry. This, together with a generally improved business climate in key export countries, led to an increase in industry's demand for labour, including engineers. In order to determine whether this growth in demand was cyclical or more structural and consequently persistent, the government issued an investigation assignment to the Royal Swedish Academy of Engineering Sciences (IVA) in 1984 to map labour market needs and propose measures to ensure the availability of qualified technicians (IVA 1985, p. 67). In our study, it has been assumed that, as a stakeholder, IVA had a close relationship with the technical universities, thus making it relevant for this study. The IVA report presented in the autumn of 1985 is cited frequently in other studies and reports addressing changes in engineering education (T4) and is thus considered an important piece of the puzzle addressed in this study.

10.2.2 The Higher Education Institution Landscape

Compared with the Swedish higher education system of today, that of the 1960s and 1970s was more centrally controlled by parliament and government. The State (i.e. the parliament and government) made decisions at a detailed level about, for example, a university's internal organisation, professorships, salary levels, and premises and equipment (Askling 2012). However, the detailed regulations required less administration in the form of follow-up, reporting and reports, a consequence of today's New Public Management–influenced control system (ibid.). In 1977, a comprehensive higher education reform was implemented that aimed to connect higher education more closely to the labour market and its needs for skilled labour. The reform implied even greater central control, but at the same time, universities and university colleges received relatively greater local/regional freedom and responsibility to design and distribute their educational activities (Andrén 2013, pp. 85–86).

However, at least for the society outside the universities, the biggest change was the creation of more university colleges in Sweden. Ten cities received their own university college units instead of hosting branches of existing universities. Several undergraduate programmes were associated with these new university colleges and with existing universities, mainly in professionally-oriented education, which previously had no higher education status, such as preschool education, nursery education and art education. The new university colleges could initiate shorter technical education programmes but did not have the opportunity/permission to offer master's programmes. However, the 4-year Technical College Graduate engineering course, which formally consisted of a 3-year programme at the upper secondary school

level with one vocational year on top, was not included among the new higher education qualifications. In practice, this meant that the new university colleges had few opportunities to build activities in the field of technical education with any kind of volume.

10.2.3 Technical Education in Sweden

At the end of World War II, there were master's programmes in engineering in two cities in Sweden: at KTH in Stockholm and at Chalmers in Gothenburg. As in most other countries, the focus of the technical universities had up to that point been on engineering programmes that were aimed at a future for graduates as reasonably practically oriented engineers working outside the academy. The teachers, and thus the programmes, were supposed to be scientifically anchored but there were no resources allocated for research (Björck 2004; Lindqvist 1992).

After World War II, a rapid change took place in technical universities globally. Technological developments during World War II, not least the development of the nuclear bomb, had shown that efforts were needed in science and technology research to conquer new knowledge domains. Essentially, this was solved in two different ways; either the research was mainly placed at research institutes, more or less linked to the universities and their educational programmes, or the research was expanded at universities, thus closer to engineering education. In Sweden, the latter option prevailed, and KTH and Chalmers were developed in the 1950s, 1960s and 1970s into research-intensive technical universities with international ambitions (Lindqvist 1992).

By the mid-1970s, there were well-established master of science in engineering degree programmes in six cities in the country, with approximately 3500 students enrolled every year (Utbildningsdepartementet 1989; IVA 1985, p. 33). No other engineering degree programmes existed at Swedish universities or university colleges before 1977, with the exception of a very small number of operations & maintenance engineers and marine engineers (a total of about 150 new students per year) (Utbildningsdepartementet 1986, p.109). Of the six cities with master's programmes, two were the well-established technical universities KTH and Chalmers. Another two were strong and rather independent technical faculties within the comprehensive universities of Lund and Linköping. These were organised and acted in many ways as independent technical universities, and in the following we will treat them as that. The remaining two were a technical department joined to a large science faculty within the comprehensive university of Uppsala and lastly the master's programmes in engineering at the (then) university college in the city of Luleå.

As mentioned earlier, T4 was a 3-year technical programme at the upper secondary school level with a vocational year on top, resulting in a 4-year Technical College Graduate degree (hence T4). The initial engineering education at this level had a long history and had developed in parallel with the technical universities'

Table 10.1 Number of new students in T4 education, 1973–1984 (Utbildningsdepartementet 1986, p. 106)

Year	Total	% Female
1973	6260	5
1975	6448	8
1977	7671	12
1979	9798	13
1981	11,315	14
1983	12,649	21
1984	12,490	22

master's courses, although T4 was spread out over many cities and schools. The course saw an increased number of new students throughout the whole of the 1970s and a significant increase in the proportion of female students (see Table 10.1).

T4 was also considered to be well functioning in relation to the labour market (Utbildningsdepartementet 1986, p. 115); few graduates were left without a job after graduating from the programme. In short, it was popular with both students and employers. However, as we will see later, according to several stakeholders there was a need for modernisation and quality improvement, in particular a need for adaptation to international conditions and standards.

10.3 Theoretical Framework

With the proposed reform of transferring upper secondary school engineering education to the higher education level, technical universities (and of course, to some extent, the university colleges) faced external pressure to change. Our theoretical framework therefore has as its starting point the different ways in which organisations in general can act when they experience such external pressures to change. The two extremes – *perfect flexibility* and *perfect inertia* – are less useful (Gornitzka 1999), even for analytical purposes. Oliver (1991, pp. 151-159) identifies five different strategies that an organisation can choose:

- Acquiescence
- The strategy/response is to comply and to follow non-questioned norms and institutional models, as well as to adapt, imitate and obey to new rules, norms and standards. This can be the case when organisational models and standards are very popular and spread rapidly within one area or when the changes are in accordance with institutional norms.
- Compromise
- Organisations may choose to compromise with the external requirements by attempting to balance conflicting and/or inconsistent demands. This can be done by negotiating with different stakeholders, both internal and external.

- Avoidance
- Organisations can try to protect their current operation by seemingly accepting the new institutional rules and expectations while continuing to follow their own standards and values. Organisations can also make their own interpretations of new institutional plans and demands in order to conceal the absence of any intention to implement them. A third option is for the organisation to change its goals, activities or even areas of activity so that the new external rules or standards cannot be applied to it.
- Defiance
- Another strategy is not just to try avoiding new external demands but to simply ignore them altogether or, even more actively, to attack or challenge the content of the institutional processes and the actors behind them. If the expected impact of the new external requirements is very small, it may be worth taking the risk of adopting this strategy.
- Manipulation
- Finally, an organisation can use the strategy of participating and thereby having an influence on new values and norms, or controlling institutional processes. This strategy is proactive since the organisation attempts to influence the norms and values which it later will be judged upon. By being a part of the settings of new rules and norms, an organisation can also complicate the entry of new players.

In her seminal article, Oliver also discusses the “external” conditions: *why* pressure is being exerted, *who* is exerting pressure, *what* the pressure consists of, *how* and *by what means* pressure is exerted, and *where* it occurs. While this typology for response strategies might be suitable for organisations in general, adaptation may be required for higher education institutions (Gornitzka 1999; Reale and Seeber 2011). Geschwind (2010) has adapted these strategies into a somewhat easier-to-use analytical tool by categorising the strategies in two dimensions: type of behaviour and type of attitude. Four out of five aforementioned strategies (Oliver 1991) are found in the quadrants shown in Fig. 10.1, while the fifth, compromise, is positioned in the middle, that is, at the intersection of the axis.

Fig. 10.1 Higher Education Institutions’ responses to proposed policy changes (Geschwind 2010)

However, for an organisation to act and respond to external (or internal) pressure for change, it must have a goal or ambition that can be located in relation to the call for change. This goal or ambition may be explicit or unspoken but the response strategy the organisation chooses can be said to reflect the identity that the organisation has or wants to have. By studying an organisation's identity, we are better able to understand why a certain response strategy has been chosen. Modern theories and models of organisational identity have their origin in Albert and Whetten (1985), who, with their background in business administration research, saw how their own university (the University of Illinois) reacted and acted in response to financial cut-backs. Fairly modest budget cuts caused heated internal discussions about their consequences for the university's legitimacy and whether the university would be able to maintain its research profile. Theories about organisational identity have since developed at several levels (see Gioia et al. 2000; He and Brown 2013). Stensaker (2015) has developed a conceptual model of organisational identity related to changes in universities and colleges. This model is based on the challenge of explaining and understanding the relationship between continuity and change in higher education research, and Stensaker identifies four different ways in which organisational identity can play a role in relation to different types of change activity:

- Organisational Identity as Interpretation
- Organisational identity can be seen as an interpretative scheme to help members of the organisation make sense of internal or external changes.
- Organisational Identity as Image
- Even though there have been arguments that organisational identity and organisational image should be kept apart as different concepts (cf. Brown et al. 2006), Gioia et al. (2000) have shown that there are linkages between organisational identity and organisational image, that is, how organisations want to portray themselves externally.
- Organisational Identity as Innovation
- It may be suggested that organisational identity as a model mainly fosters organisational stability and consistency, and thus impedes creativity and innovation. However, Stensaker (2015) claims that studies 'suggest that the potential for using organisational identity for driving university innovation should not be underestimated...' (pp.109–110).
- Organisational Identity as Integration
- Internal discussions about organisational identity in relation to proposed changes can foster engagement and shared ideas of a distinct, collective identity.

We will use these theories in combination and thus take on the challenge made by Stensaker (2015) to further examine intangible aspects of higher education institutions in order to gain a better understanding of factors, such as the somewhat contradictory phenomena of simultaneous inertia and change in higher education institutions.

10.4 Method

This historical study is primarily set in the time before the governmental decision of 1989 to carry out an educational reform. The study applies an oral history approach combined with documentary studies. The primary documents are governmental reports, investigations and bills, together with different stakeholders' reactions to these documents and/or reports of their own. In addition, six interviews were conducted with persons who had key roles in the preparation work and transformation. The interviews were intended to add some 'flesh and blood' to the analysis of the documents, rather than to try to find 'correct' answers (see [Appendix 10.1](#) for a list of the primary documents used in the study). As for materials from technical universities, KTH stands out as the only one where we have found both comments in other reports (UHÄ 1986) and primary documents (KTH 1988, 1989). Thus, KTH is mentioned several times in the following sections, while other technical universities are relatively invisible.

The written sources that were identified and used must, in many ways, be evaluated from a methodological perspective; they cannot simply stand alone (McCulloch 2011). To give one example: the written materials in this study, without exception, reflect a top-down perspective because they were written and published by organisations, authorities and the like that were not directly involved in the education at hand. We have been unable to track down documents that might balance this top-down perspective, such as postings in discussions by teachers, students, or organisations representing them.

The use of oral sources in the form of interviews raises issues of both credibility and ethics. All interviewees had key positions in their respective organisations, such as the program manager at an upper secondary school who then moved to a technical university with the mission of organising and managing the new engineering course. Others were civil servants, political and non-political, who were involved in the investigations and reports that eventually led to the reform. However, we have promised the interviewees anonymity and therefore are unable to go deeper into their background or identity. We thereby potentially solved a number of ethical issues (Kvale and Brinkmann 2009), but at the same time the interviewees' versions have largely been left untouched; the chances of finding a plethora of suitable persons to interview were very limited given that it is approximately 30 years since the events occurred. However, to reiterate, the main purpose of the interviews was to supplement and to some extent help us to 'sort' the analysis of the written material.

Assessing the validity and reliability of the written sources, that is, the primary documents, was a delicate task, and some of the written sources must clearly have had more significance for the decision-making process than others. This led us to a discussion about how to classify the material (Dahlgren and Florén 1996, p. 185). To some extent, the process can be determined by the type of written material involved. For example, a government investigation has a different status than a report from a business organisation. Because the interviewees had various key positions during the process, we have asked them about the importance of the written

material for the process, thus asking them to contribute to our assessment of the written material. Overall, we must respect the fact that it has been about 30 years since the actual events. For example, we received some contradictory versions of events, but all in all, the interviewees' versions match. Besides, as stated above, the aim of the study was not to find the absolute 'truth'. Consequently, we are confident about the overall picture and the answers given in response to our research questions, even though both the assessments of the written material and some contradictions in the interviews can give a somewhat uncertain picture of some parts of the process. At the same time, we acknowledge the possibility that another approach could give other versions of the image we paint.

10.5 Results and Discussion

This story begins in 1974, when the governmental authority for higher education, UKÄ, proposed to the Swedish government that new shorter engineering programmes should be introduced at the universities. The proposal had emerged after an external analysis had concluded that this would be a good development for Sweden. The response from the government was negative, however. This was motivated by the argument that such a development would probably have a negative impact on technical upper secondary education (T4); consequently, government would not investigate further (Interview #3).

A few years later, when T4 was examined and discussed more actively in reports from, for example, the Swedish Employers' Association (SAF) in 1982 and the Association of Engineers (CF) in 1984, it was primarily not about a move from the upper secondary school level to higher education level, but rather about ways to extend T4 within upper secondary schools. Thus, the technical universities initially did not have a response strategy to the first proposals on changes to T4 because the proposed changes did not affect them other than minimally.

At the end of 1984, the Royal Swedish Academy of Engineering Sciences (IVA) was assigned by the Swedish government to investigate and address whether the growing demand for engineers and technicians was dependent on the economic situation and thus intermittent, or structural and thus persistent. The investigation also considered demands for technical skills for the period of 10–15 years ahead. IVA presented its report in autumn/winter 1985 (IVA 1985). As mentioned earlier, it has been assumed in our study that IVA, as a stakeholder, had a close relationship with the technical universities, thus making it relevant for this study, especially since there are no other primary documents from technical universities regarding T4 from the period before 1988. This assumption has also been confirmed in our interviews (Interview #1, Interview #3, Interview #4). It is not unusual for non-governmental organisations like IVA to receive such an assignment from the government. It had happened previously and has happened since; subsequent and similar assignments have been assigned to other countries' engineering academies by their governments (cf. The Royal Academy of Engineering 2010).

IVA started its investigation by interpreting and defining the assignment to analyse the demand for ‘qualified technicians’ to mean only master’s students and post-graduates, hence (initially) avoiding the question about T4. In the long run, however, it was impossible to avoid touching upon the demand for T4 and other technicians by the industry, not least because the demand for ‘qualified technicians’, regardless of definition, could not be covered only by the supply of master’s graduates. Therefore, T4 and other shorter technical programmes became a part of the report’s discussion, where it became even clearer than in the reports from SAF and CF that the quality of T4 was inadequate. Without referring to any survey or investigation, reference was made to the fact that the span between the ‘best’ and ‘worst’ students from T4 was very large, meaning that the subsequent job opportunities varied greatly and that only a few obtained qualified engineering positions. One (very concise) proposal in IVA’s report was therefore to establish engineering schools and that the length of education in these schools should be 5 years, that is, an extension of T4 by 1 year. However, it was not suggested that the technical universities should have a direct role in this development, and thus the technical universities could be regarded as non-stakeholders. Is it possible that the report by IVA was the first expression of a more active resistance from the technical universities to the external pressure for a change that pointed in their direction? It is impossible to answer this with certainty, but some factors point in that direction, such as the limitations of the original assignment, the somewhat reluctant widening of the assignment during the investigation and the fact that several new investigative assignments involving higher education institutions were initiated shortly after this report (and after other reports, we might add).

From the perspective of the model of different response strategies to an external pressure outlined by Geschwind (2010), we claim that the technical universities at first were passive and somewhat avoiding stakeholders, or even passive *non-stakeholders*. With the report from IVA in 1985, they shifted position and became more active and pronouncedly negative about the idea that T4 should be transformed to the university level. Hence, they shift quadrant in the model (see Fig. 10.2).

An indication that the years 1984–1986 were very intensive with regard to these issues is the fact that an expert group (created by the government) launched a report

Fig. 10.2 Technical universities’ change in response strategy 1985

about 'shorter technical education' during the autumn of 1985, that is, roughly at the same time as IVA presented its report (Utbildningsdepartementet 1985). Another major governmental educational investigation was also under way, responsible for reviewing the structure of the entire upper secondary school level system. This investigation presented its final report at the beginning of 1986 (Utbildningsdepartementet 1986) and, of course, also included education in the field of technology. In addition, reports from external stakeholders, such as CF (CF 1984, previously mentioned), TCO (TCO 1985) and an additional report from SAF (SAF 1985) can be added to the list. In short, a lot of investigations and external pressure was ongoing at the same time with regard to technical and engineering education in one way or another. (For an explanation of the abbreviations and a list of primary documents, see Appendix 10.1).

It is difficult to see a clear path for the future of T4 just by reading the many reports and investigations, but the criticism of the quality of T4 becomes increasingly pronounced. Eventually, a new governmental investigation was assigned with the mission of developing forms of cooperation between upper secondary schools and higher education within the field of technical education (UHÄ 1986). Within this mission, 11 different cities reported how they planned for this cooperation between upper secondary school and higher education. In particular, each city had to comment on the 'Engineering Schools', a work-in-progress name and trademark/organisation, and for the first time it was declared that the universities in one way or another should have a role in strengthening the quality of T4. For many of the 11 cities, which had young university colleges offering little or almost no technical/engineering education, this was a window of opportunity. It was not only attractive to the local university colleges, which, like all other higher education institutions in Sweden, were, and still are, governmental authorities, but also for the local/regional politicians who saw the emergence of university colleges as a way to strengthen the region (Interview #2, Interview #3, Interview #4). The university colleges and the local/regional politicians thus tried to influence the process, even though, compared to the technical universities, such as KTH and Chalmers, they had less power and legitimacy.

Even in the capital region of Stockholm, the issue had a local/regional political touch. There were political forces that wanted to spread technical education outside central Stockholm, where KTH was located. The southern part of the county of Stockholm was identified as being suitable for an engineering school, with KTH as one party and local T4 programmes as the other (UHÄ 1986, p. 41). SAF also suggested something similar in a 1985 report (SAF 1985). The proposal in the UHÄ report was that KTH should move its shorter technical education programmes to an engineering school, which in the texts still had no declared principal and was used as a collective term referring to places where technical education at the upper secondary school level, university level and adult educational level could be gathered under a united umbrella organisation.

While the entire report (UHÄ 1986) used the term 'engineering school' as a collective name referring to an umbrella organisation and something that may or may not eventually be a reality, KTH was already out of the blocks to separate all shorter

technical/engineering education from the master's programmes and to create an engineering school. The School of Engineering at KTH was established in July 1986, with its own administrative board, directly under the board of the technical university. All engineering and technical programmes at KTH were collected within the School of Engineering except for the master's programmes. The education activities within the School of Engineering were mainly run off the KTH central campus (KTH 1988).

If the technical universities' response strategies from the outset were to try to avoid the expansion of shorter engineering programmes, that is, a passive and negative approach under the Geschwind (2010) model described earlier, and the report by IVA in 1985 indicated a shift towards a more active but still negative approach, then KTH's initiative in 1986 to create an engineering school showed another approach that was significantly more active and positive (see Fig. 10.3). However, it is relevant to ask if this strategy was at the same time a way to protect the perceived core business and thus to preserve organisational identity.

In the spring of 1987, a new investigation was initiated by the Swedish government with the main aim of starting a try-out operation in some cities where T4 was to be transferred to the university level in order to pave the way for a permanent transition. The question was therefore no longer *if* the T4 would be transferred to the university (and extended) but *how* this would be done. In March 1988, this investigation presented its report (Utbildningsdepartementet 1988), but it was really subordinate to the actual and practical work conducted within the investigation to find organisational and financial ways to transfer T4 to the university level and extend the courses by 1 year (Interview #3, Interview #4). At the beginning of 1989, a Swedish government bill was presented with the goal of gradually increasing the try-out activities at the university level and, correspondingly, to reduce T4. It was planned that the whole reform would be completed and T4 dissolved entirely by 1993–94 (Utbildningsdepartementet 1989). The Swedish parliament voted accordingly on the bill in the spring of 1989. The description of the course of events covered by this study is thus complete and we can now examine how these developments challenged the technical universities' organisational identities and boundaries.

Fig. 10.3 Technical universities' changes in response strategy 1986

In the spring of 1988, a 'Policy for the Development of the School of Engineering at KTH' was presented (KTH 1988) and roughly a year later, a new development plan for KTH was presented (KTH 1989). The development plan was the first to include both research and education. Previous development plans (the most recent had been in 1985) had only addressed research and postgraduate education. Both of the new papers were primarily internal documents that pointed out a direction for the near future for KTH's own staff. Now, the previously somewhat blurry plans for the future for T4 were clearer and KTH saw a considerably larger future educational role for the 2-year engineering programmes, anticipating that they would have the same student numbers as the master's programmes in the long run. However, much of the text in the development plan was about preserving its self-image as a technical university, with research and master's education as its primary tasks, even when the mission was broadened by the introduction of other engineering programmes. One example:

The addition of the two-year engineering programmes makes it possible to have higher ambitions for master programmes and architectural programmes in terms of the scientific level and to give them a greater content of basic knowledge. (KTH 1989, p. 3)

There is also a clear statement:

KTH's main task in undergraduate education is Architecture and Master of Science in Engineering. (KTH 1989, p. 13)

This shows that KTH tried to use the challenge from the new engineering programmes as a way to strengthen and retain its image as a research-intensive technical university. Alternatively, as Stensaker's (2015) conceptual model suggests, with their internally and strategically designed decision to create the School of Engineering, they used the organisation's identity as a way of integrating the new engineering programmes, without the intention of altering either the original organisation model or its identity, we might add.

The new programmes' geographical location, at KTH and other existing technical universities, is another area where the relationship and tension between a shorter engineering education and their 'core business' (master's programmes) came to the fore. In Stockholm, the new engineering programmes were placed in a number of rather small educational centres (campuses) outside KTH's main campus in central Stockholm. There were short-term practical explanations for this; the main campus was already crowded and, initially, buildings and equipment were to be provided by the municipalities as part of the financing of the construction of the 2-year engineering programmes (Utbildningsdepartementet 1988; Interview #1, Interview #4, Interview #5). However, while other cities in Sweden integrated the new engineering programmes into their university college campuses relatively quickly after this initial period, KTH retained its multi-campus model of engineering education off the central campus (Interview #1, Interview #5). This organisational model endures at KTH to this day, except for one engineering programme available at KTH's central campus and the fact that the organisational entity and name School of Engineering disappeared at the start of the 2000s, at the same time as a major

organisational overhaul at KTH. Moreover, it was suggested in both the policy documents from 1988 and 1989 that the relocation, in fact a sort of outsourcing, was a good solution in that it would not 'disturb' the existing research and educational organisation at the 'main' KTH campus. This, of course, reinforces our view that KTH did not want the expansion of short engineering programmes to change the identity of the organisation, at least not the core of it.

Interestingly, three of the four leading technical universities at the time in Sweden arranged their new engineering courses in the same way. In Gothenburg, Chalmers University of Technology placed its new engineering programme some 10 km away from the main campus, on the other side of a river. Lund University, with a strong and fairly independent technical faculty located in Lund, located its new engineering programme even farther away, at a new campus in the city of Helsingborg, 55 km from the city of Lund. Lund University still practices this model, while the shorter engineering programmes in Gothenburg have moved back and forth over the river a couple of times (Interview #1, Interview #5).

When the shorter engineering courses in Sweden were evaluated nationally in 2002 (HSV 2003), that is, just over 10 years after the introduction of the new engineering programme, the evaluators reiterated the weak link between up-to-date research and education. This link was particularly weak at the large, 'old' universities with strong research traditions. Surprisingly, teaching–research links were stronger at the small/new university colleges, although the volume of the research was very small in comparison with that in the large universities. One exception is highlighted in the evaluation report, namely the fourth of the major technical faculties described earlier, at Linköping University, which made an attempt to integrate long and short engineering courses, both organisationally and geographically, from the beginning. This all gives us good reason to claim that at the traditional technical universities in Sweden, a dual engineering system was built within the framework of a seemingly uniform one. Thus, the core of the organisation's identity, the research and master's programmes, was retained despite the challenges of the new engineering programme.

As mentioned earlier, the cities with newer university colleges were quicker to integrate the new engineering programme into their other educational activities. In fact, local politicians, who had a direct role for financing vital parts of the reform, embraced this opportunity to increase the volume of technical education at 'their' university colleges. The reason for this behaviour was rational; a wider range of educational programmes would hopefully attract young people (and investors) to the region and thus enhance the development of the region. In these cases, the new engineering education system was an integrated part of the university colleges' emerging identities.

10.6 Conclusion

This study has addressed the question of how universities, and especially technical universities, act and respond to external pressures for change and how this stretches the limits of their operations and their organisational identity. Our case illustrates how a profound change challenges the self-image of a technical university. As in most historical studies, there is some uncertainty with regard to whether the sources available are telling the whole story, but even with these limitations we have shown similarities and differences between technical universities and other higher education institutions, as well as a development over time. While we have focused on the time before the actual implementation of the new engineering programme, further studies could examine how the implementation was handled and what effects it really had on the organisational identity of the technical universities. From another perspective, it would also be interesting to tell the upper secondary schools' side of the story. They were clearly on the losing side of this in terms of a lost technical education with a long and quite honourable history. On the other hand, and as we have seen in a plethora of reports, there were external stakeholders with, it would appear, great interest in the new development, namely, the industry. It remains to be seen if the industry was on the push or pull side of the development, or whether they, like the technical universities, changed position during the period of investigations and reports.

What does this historical case tell us about contemporary higher education? The climate of the Swedish higher education community of today can in several respects be characterized by New Public Management (Pollitt and Bouckaert 2011), autonomy (Nokkala and Bladh 2014), triple helix (Etzkowitz 2008), marketisation (Teixeira et al. 2004), managerialism (Deem et al. 2010), rankings (Hazelkorn 2015) and so on. Technical universities in particular may often be influenced by ideas about entrepreneurial universities (Clark 1998). If the issue that our study deals with were to be relevant today, these aspects would certainly be factors to take into account. In addition, media and students (and to some extent their parents) would surely be counted as stakeholders, with some kind of pronounced take on the matter. Almost paradoxically, the interest from students in T4 increased every year during the 1980s, even while these investigations were ongoing. The fact that there were investigations that increasingly pointed to a lack of quality in engineering programmes at upper secondary schools appears not to have been communicated beyond the political domain. In fact, we were advised by all interviewees not to search for articles in the press and media about this, for the simple reason that there is probably nothing to be found. Again, this shows how much things have changed. Similar investigations would most likely not be able to fly under the radar in the same way today.

As we mentioned earlier, the governance of universities and colleges was considerably more bureaucratic and less independent than it is now. What kind of wiggle room was there really for a university college or technical university to act on and/or react to the proposals? From the analysis of the primary documents, we have

assumed – and the interviews have confirmed – that the technical universities had a stronger position than the university colleges, but apparently this was not enough for the technical universities to preserve their initial passive/negative stance as a response strategy. While the pressure for change was externally triggered, KTH took initiatives for internal organisational change even before the external process, with its formal legal decisions, was brought to a close. Thus, this can be seen as an externally triggered, but internally designed, process with strategic characteristics in which the organisations' existing identity was used as a way of implementing the new engineering education system. In fact, in the cases of the leading technical universities, at KTH, Chalmers and Lund (but not Linköping), they used the change process as a way to preserve or even strengthen their existing identity, without adding or removing anything, as we have seen in the policy documents from KTH and from the reports of how they all organised their new engineering programmes geographically. However, the identities of these technical universities must have been altered eventually; by how much, when and why are subjects for another study. This is another example of the seemingly everlasting challenge to understand the relationship between continuity and change in higher education institutions better.

Appendix 10.1

Primary Documents

Reference (short)	Type of source	Short description/Title
Utbildningsdepartementet 1978	Government report	Inför 2000-talet: samhällets behov av naturvetare och tekniker
SAF 1982	Policy report	Den stora skolreformen
CF 1984	Policy report	Sveriges civilingenjörskörbunds syn på utbildningsfrågor
Utbildningsdepartementet 1985	Government report	Ds U 1985:11 Kortare teknisk utbildning: rapport från Expertgruppen för kortare teknisk utbildning
IVA 1985	Policy report	IVA-meddelande 249: Ingenjörer för framtiden
TCO 1985	Policy report	Tekniker: arbete och utbildning i framtiden
SAF 1985	Policy report	En svensk collegeskola
Utbildningsdepartementet 1986	Government report	SOU 1986:3 En treårig yrkesutbildning
UHÄ 1986	Official report	UHÄ-rapport 1986:18 Stockholm – Uppsala: 14 högskolor i samverkan
UHÄ och SÖ 1986	Official report	UHÄ-rapport 1986:16 Ingenjörskör- och teknikerutbildningar i samverkan

(continued)

Reference (short)	Type of source	Short description/Title
Utbildningsdepartementet 1987	Government report	Ds U 1987:12 Försök med samordnad ingenjörutbildning på mellannivå: delrapport från Arbetsgruppen för samordnad ingenjörutbildning på mellannivå (SIM-gruppen)
Utbildningsdepartementet 1988	Government report	Ds U 1988:20 Samordnad ingenjörutbildning på mellannivå
UHÄ 1988a	Official report	UHÄ-rapport 1988:4 Teknikerutbildning i högskolan
KTH 1988	Policy report	Policy för utbyggnad av Ingenjörsskolan vid KTH
UHÄ 1988b	Official report	UHÄ-rapport 1988:15 Ny ingenjörutbildning UHÄ:s yttrande över rapporten DS 1988:20 "Samordnad ingenjörutbildning på mellannivå"
UHÄ 1988c	Official report	UHÄ-rapport 1988:8 Från ingenjör till civilingenjör
KTH 1989	Policy report	Utvecklingsplan för 90-talet
UHÄ 1989a	Official report	UHÄ-rapport 1989:19 Ingenjörslinjerna i högskolan. Förslag till utbildningsstruktur
Utbildningsdepartementet 1989	Government bill	Proposition 1988/89:90 inkl Utbildningsutskottets betänkande och 3 motioner
UHÄ 1989b	Official report	UHÄ-rapport 1989:20 Första året med ny ingenjörutbildning
UHÄ 1991	Official report	UHÄ-rapport 1991:24 Utvärdering av försöksverksamheten med ingenjörutbildning
UHÄ 1992	Official report	UHÄ-rapport 1992:12 Utvärdering av försöksverksamheten med ingenjörutbildning
IVA 1992	Policy report	Ingenjörer för 2000-talet

Abbreviations

CF	Civilingenjörsförbundet (now Sveriges Ingenjörer)	Trade union
IVA	Kungl. Ingenjörsvetenskapsakademien	The Royal Swedish Academy of engineering sciences
HSV	Högskoleverket (ex UKÄ, ex UHÄ, now UKÄ)	Government agency
SAF	Svenska Arbetsgivareföreningen(now Svenskt Näringsliv)	Employers' organisation
SÖ	Skolöverstyrelsen (now Skolverket)	Government agency
TCO	Tjänstemännens Centralorganisation	Trade union
UHÄ	Universitets- och högskoleämbetet (now UKÄ)	Government agency
UKÄ	Universitetskanslersämbetet	Government agency

References

- Albert, S., & Whetten, D. A. (1985). Organizational identity. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior* (Vol. 14, pp. 263–295). Greenwich: JAI.
- Andrén, C.-G. (2013). *Visioner, vägval och verklighet – Svenska universitet i utveckling efter 1940*. Lund: Nordic Academic Press.
- Askling, B. (2012). *Expansion, självständighet, konkurrens – Vart är den högre utbildningen på väg?* Göteborg: Göteborgs universitet.
- Björck, H. (2004). *Staten, Chalmers och vetenskapen: forskningspolitisk formering och sociala ingenjörer under Sveriges politiska industrialisering 1890–1945*. Nora: Nya Doxa.
- Brown, T. J., Dacin, P. A., Pratt, M. G., & Whetten, D. A. (2006). Identity, intended image, construed image and reputation: An interdisciplinary framework and suggested terminology. *Journal of the Academy of Marketing Science*, 34(2), 99–106. <https://doi.org/10.1177/0092070305284969>.
- CF. (1984). *Sveriges civilingenjörsförbunds syn på utbildningsfrågor*. Stockholm: CF.
- Christensen, S. H., & Newberry, B. (2015). The role of research in academic drift processes in European and American professional engineering education. In S. H. Christensen, C. Didier, A. Jamison, M. Meganck, C. Mitcham, & B. Newberry (Eds.), *International perspectives on engineering education: Engineering education and practice in context* (Vol. 1, pp. 33–69). Dordrecht: Springer.
- Clark, B. R. (1998). *Creating entrepreneurial universities: Organizational pathways of transformation*. Oxford: Pergamon.
- Dahlgren, S., & Florén, A. (1996). *Fråga det förflutna*. Lund: Studentlitteratur.
- Deem, R., Hilliard, S., & Reed, M. (2010). *Knowledge, higher education, and the new managerialism*. Oxford: Oxford University Press.
- Delahousse, B., & Bomke, W. (2015). Structural transformations in higher engineering education in Europe. In S. H. Christensen, C. Didier, A. Jamison, M. Meganck, C. Mitcham, & B. Newberry (Eds.), *International perspectives on engineering education: Engineering education and practice in context* (Vol. 1). Dordrecht: Springer.
- Etzkowitz, H. (2008). *The triple helix: University-industry-government innovation in action*. London: Routledge.
- Feldt, K.-O. (1991). *Alla dessa dagar: i regeringen 1982–1990*. Stockholm: Norstedts.
- Geschwind, L. (2010). Getting pole position: Research strategies in the humanities at Swedish universities. *Tertiary Education and Management*, 16(2), 115–127. <https://doi.org/10.1080/13583881003756898>.
- Gioia, D. A., Schultz, M., & Corley, K. G. (2000). Organizational identity, image, and adaptive instability. *The Academy of Management Review*, 25(1), 63–81. <https://doi.org/10.2307/259263>.
- Gornitzka, Å. (1999). Governmental policies and organisational change in higher education. *Higher Education*, 38(1), 5–31.
- Hazelkorn, E. (2015). *Rankings and the reshaping of higher education: The Battle for world-class excellence* (2nd ed.). Basingstoke: Palgrave Macmillan.
- He, H., & Brown, A. D. (2013). Organizational identity and organizational identification: A review of the literature and suggestions for future research. *Group and Organization Management*, 38(1), 3–35. <https://doi.org/10.1177/1059601112473815>.
- HSV. (2003). *Utvärdering av högskoleingenjörsutbildning, ingenjörsutbildning samt brandingenjörsutbildning vid svenska universitet och högskolor*. Stockholm: HSV.
- IVA. (1985). *Ingenjörer för framtiden*. Stockholm: IVA.
- IVA. (1992). *Ingenjörer för 2000-talet*. Stockholm: IVA.
- KTH. (1988). *Policy för utbyggnad av Ingenjörsskolan vid KTH*. Stockholm: KTH.
- KTH. (1989). *Utvecklingsplan för 90-talet*. Stockholm: KTH.
- Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the craft of qualitative research interviewing*. Thousands Oaks: Sage.
- Kyvik, S. (2009). *The dynamics of change in higher education: Expansion and contradiction in an organisational field*. Dordrecht: Springer.

- Lindqvist, S. (1992). *En sliten och alldeles för trång bonjour*. Stockholm: KTH.
- McCulloch, G. (2011). Historical and documentary research in education. In L. Cohen, L. Manion, & K. Morrison (Eds.), *Research methods in education* (7th ed., pp. 248–255). London: Routledge.
- Nokkala, T., & Bladh, A. (2014). Institutional autonomy and academic freedom in the Nordic context – Similarities and differences. *Higher Education Policy*, 27(1), 1–21. <https://doi.org/10.1057/hep.2013.8>.
- Oliver, C. (1991). Strategic responses to institutional processes. *Academy of Management Review*, 16(1), 145–179.
- Pollitt, C., & Bouckaert, G. (2011). *Public management reform: A comparative analysis-new public management, governance, and the neo-Weberian state*. Oxford: Oxford University Press.
- Reale, E., & Seeber, M. (2011). Organisation response to institutional pressures in Higher Education: the important role of the disciplines. *Higher Education*, 61(1), 1–22. <https://doi.org/10.2307/41477782>.
- SAF. (1982). *Den stora skolreformen*. Stockholm: SAF.
- SAF. (1985). *En svensk collegeskola*. Stockholm: SAF.
- Stensaker, B. (2015). Organizational identity as a concept for understanding university dynamics. *Higher Education*, 69(1), 103–115. <https://doi.org/10.1007/s10734-014-9763-8>.
- TCO. (1985). *Tekniker: arbete och utbildning i framtiden*. Stockholm: TCO.
- Teixeira, P., Jongbloed, B., Dill, D., & Amaral, A. (Eds.). (2004). *Markets in higher education: Rhetoric or reality*. Dordrecht: Springer.
- The Royal Academy of Engineering. (2010). *Engineering graduated for industry*. London: The Royal Academy of Engineering.
- UHÄ. (1986). *Ingenjör- och teknikerutbildningar i samverkan*. Stockholm: UHÄ.
- UHÄ. (1988a). *Teknikerutbildning i högskolan*. Stockholm: UHÄ.
- UHÄ. (1988b). *Ny ingenjörutbildning*. Stockholm: UHÄ.
- UHÄ. (1988c). *Från ingenjör till civilingenjör*. Stockholm: UHÄ.
- UHÄ. (1989a). *Ingenjörslinjerna i högskolan. Förslag till utbildningsstruktur*. Stockholm: UHÄ.
- UHÄ. (1989b). *Första året med ny ingenjörutbildning*. Stockholm: UHÄ.
- UHÄ. (1991). *Utvärdering av försöksverksamheten med ingenjörutbildning. Årsrapport 1990/91*. Stockholm: UHÄ.
- UHÄ. (1992). *Utvärdering av försöksverksamheten med ingenjörutbildning. Årsrapport 1991/92*. Stockholm: UHÄ.
- Utbildningsdepartementet. (1978). *Inför 2000-talet: samhällets behov av naturvetare och tekniker*. Stockholm: Utbildningsdepartementet.
- Utbildningsdepartementet. (1985). *Kortare teknisk utbildning: rapport från Expertgruppen för kortare teknisk utbildning* (Ds U 1985:11). Stockholm: Utbildningsdepartementet.
- Utbildningsdepartementet. (1986). *En treårig yrkesutbildning: betänkande. D. 2, Beskrivningar och förslag för utbildningssektorena* (SOU 1986:3). Stockholm: Utbildningsdepartementet.
- Utbildningsdepartementet. (1987). *Försök med samordnad ingenjörutbildning på mellannivå: delrapport från Arbetsgruppen för samordnad ingenjörutbildning på mellannivå (SIM-gruppen)* (Ds U 1987:12). Stockholm: Utbildningsdepartementet.
- Utbildningsdepartementet. (1988). *Samordnad ingenjörutbildning på mellannivå* (Ds 1988:20). Stockholm: Utbildningsdepartementet.
- Utbildningsdepartementet. (1989). *Regeringens proposition 1988/89:90 om ingenjörutbildning* (Prop. 1988/89:90). Stockholm: Riksdagen.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.