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Special measures: networking Swiss cantonal and federal universities

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Abstract

In the mid-1980s, the Swiss federal government launched special measures providing universities with funding for information technology and academic personnel to foster «education and further training as well as research in information technology for a period of five years». This article pursues the question of what made the special measures special across three fields of investigation. A first section shows that the federal government addressed the package to the socioeconomic challenges and dynamics of the era. A subsequent section discusses the special measures in line with mechanisms of cooperative federalism in science and university policy. The last section analyzes why a network for research and higher education (later called SWITCH) was well within the scope of federal science policy and discusses how it made a difference to university policy and Swiss federalism. The investigation is based on an analysis of resources from Swiss federal and university archives. It contributes to the history of federalism in the 20th century, to histories of computer science, and to the history of science and university policy.

Introduction

The Swiss network for research and education was planned in the mid-1980s as part of a package of «special measures» initiated by the federal government. These measures provided federal grants for investments in information technology (IT) for research and higher education for a period of five years. The term *special measures* points to the fact that they were exceptional. In the text that follows, I wish to examine the early history of the special measures and the network by asking what this «specialty» consisted of. The paper discusses why actors from the federal government and from academic institutions founded a scientific network. From 1986 until today the network is still known by the name SWITCH. Currently SWITCH is best known to users as an acronym and logo that can be found on login screens for academic email, library, and platform accounts. In the period investigated here the network was still without a name. Its planners had in mind to integrate aca-

demic services and to standardize access, but it would take time to realize these projects.[1]

From the very beginning, the network was intended to include and coordinate all of Switzerland's cantonal and federal universities. The institutions would be equipped with a great number of then brand-new computers called workstations to complement their already multifaceted fleet of digital machines. Sixty-two million Swiss francs was earmarked for the acquisition of the workstations. An additional 40 million francs would go for the purchase of a national supercomputer, and 15 million francs for the network. Most importantly, another huge part of the total of 207 million francs was reserved for temporary employment of personnel in computer science departments at universities and higher technical institutes. The official title of the document announcing the federal special measures – «Dispatch on special measures in favor of education and further training as well as research in information technology and engineering sciences» – clearly put the accent on education.[2]

As I began working on this paper, my investigative interest was twofold. First, I wished to explore the history of a computer network that was not yet operational during the period under study. It was still in the planning phase. A singular feature of the networking of Swiss universities is that it pioneered no new standards. It did not happen earlier than elsewhere (nor much later than in surrounding countries). No technology was invented, and there were no discussions or disputes about what standards or equipment should be used. Much was already in place, both in Switzerland and elsewhere. From a history of technology point of view, the fact that, indeed, very little happens in what follows is therefore due to the choice of the period under study. Nevertheless, I considered the early history of the network worth examining be-

1 This article is based on research led by a joint ETH Zurich–USI Lugano team on the early history of supercomputing in Manno and the SWITCH network (funded by the Swiss National Science Foundation, http://p3.snf.ch/Project-183007). It also benefits from insights from the «Trading Zones» research project and from a collaboration between the Chair for the History of Technology, ETH Zurich, and the Swiss Federal Archives. I would like to thank Henrike Hoffmann for acquiring further published and unpublished material, as well as for providing support for interviews at the University of Geneva.

2 Swiss Federal Gazette, 1986, 1: 321–383, on p. 374, table 6.

cause I wanted to know what prompted the special measures and how they differed from other measures to promote research and development at universities. That was my second research interest.

Maybe it's because I see the world through a particular lens – that of a historian of technology – but eventually I did stumble on a story of innovation. The planning and development of a network that would consist of components that both already existed but that had to be adapted and ordered abroad required technical, social, and organizational cooperation. That implied innovativeness. This initial finding squares with research results regarding the implementation of networks and development of digital standards in telecommunications in other countries.[3] More unconventional is my message about the planning methods. In history, planning is often synonymous with the postwar era, the associated years of prosperity, and unlimited belief in progress. Yet, in the last decades of the 20th century, planning methods continued to be refined and adapted to new missions.[4] What does that mean for

3 For a retrospective look at the development of packet switching, a fundamental technique for digital data transmission, during the period under review see Tony Rybczynski, Commercialization of Packet Switching (1975–1985): A Canadian Perspective, in: IEEE Communications Magazine, 2009, 12: 26–31. For pioneering Swiss research in packet switching, see the early work of Walter Neu and Albert Kündig, Project for a Digital Telephone Network, in: IEEE Transactions on Communication Technology, 1968, 16(5): 633–648. In the early 1980s, Swiss universities prepared local academic networks for research and teaching. For network planning at the University of Geneva within its setting of local multinational institutions, see University of Geneva, Archive (UniGE), rectorat, commission informatique. For a contemporary introduction to the concept of X.400 and the Swiss network's first standards and features, see Bernhard Plattner et al., X.400, elektronische Post und Datenkommunikation, Bonn 1993. On the politics of standardization of information networks, see the work of Andrew L. Russel, for example: Open Standards and the Digital Age: History, Ideology, and Networks, New York 2014. JoAnne Yates and Craig N. Murphy's «Engineering Rules» emphasizes that «computer networking usher[ed in] a new era in voluntary standard setting» – a field that was «well established and reasonably stable» in the 1980s but slow to react to new technologies. Joanne Yates, Craig N. Murphy, Engineering Rules: Global Standard Setting since 1880, Baltimore 2019, pp. 241–268.

4 On today's «thinking infrastructures» that configure entities, organize knowledge, and sort things out via rankings and ratings, see the case studies in the volume of the

the history of federalism after the 1970s? What does it mean for understanding the nature of a computer scientist's work? The concluding sections lay out a few hypotheses concerning developments in the field of science and university policy.

The aim of this article is to pursue the question of what made the Swiss special measures special across three fields of investigation. In a first section I will show that the first federal package of special measures was launched against a backdrop of structural change. The second section outlines the position of Swiss university policy and planning within the federal political system, especially in the context of a much-debated «cooperative federalism» in science policy. The final section analyzes events, debates, and studies that – within an institution dedicated to cooperative federalism – produced the first concept for a Swiss network for research and education.

The article is based on the research literature on Swiss science and university policy and on an analysis of source material from the Swiss Federal Archives in Bern, the ETH Archives in Zurich, and the Archive of the University of Zurich. An interview with Jürgen Harms of the University of Geneva gave me incredibly valuable advice on the background, scope, and goals of the Swiss network for research and education.[5]

Federal special measures in response to socioeconomic problems

Today the term *special measure* is synonymous with «a need for haste» in applying for potential funding, as a small window of opportunity is immediately going to close again.[6] The concept appeared prominently for the first

same name edited by Martin Kornberger et al., Thinking Infrastructures: Research in the Sociology of Organizations, Vol. 62, Bingley 2019.

5 The original language of sources is German and French. Quotes are translated for this publication.

6 An ad from 2011 gives the following instruction: «Knowledge and technology transfer is to receive additional funding of over 200 million Swiss francs. Applications can be submitted until mid-December. Nevertheless, there is a need for haste, as applications will

time in Swiss federal parliamentarism with the issuing of the government's dispatch. The implication was a one-time chance to get something funded and done quickly, but other special measures were launched later. The first *Informatikpaket* (or *paquet* in French) was followed by a second one (1986–1991), and by even more special measures passed by parliament up to the early 21st century. Subsequent measures were concerned with the twin issues of continuing education and IT. In other words, for more than a decade the federal government tried to steer development that was perceived to be triggered and characterized by the dynamics of «structural change». Along with «digitization» of society, this structural change stimulated investments in lifelong learning and continuing education.[7]

In the mid-1980s, structural change was perceived as an urgent but long-standing issue, especially in the light of other urgent problems. Many burning issues of the decade were easier to tackle. In 1985, the Federal Council, as the Swiss government, stated that «assessment of the content of the first half of the legislative term showed that significant deviations from the government program had become necessary, especially in three areas of responsibility». The first area was migration policy – the government was facing a «sharp increase in asylum applications».[8] Second, there was a «worry-

be dealt with on a first-come, first-served basis», www.startupticker.ch/en/news/september-2011/sondermassnahmen-des-bundes–jetzt-gesuche-einreic (12/2/2021).

7 A brief outline of federal measures to promote continuing education (*Weiterbildung*) in the field of technology since 1978 is given by Michael Geiss: «Microelectronics, in particular, served as the driver of an accelerated Swiss continuing education policy.» Michael Geiss, Sanfter Etatismus, Weiterbildungspolitik in der Schweiz, in: Lucien Criblez et al. (eds.), Staatlichkeit in der Schweiz. Regieren und Verwalten vor der neoliberalen Wende, Zurich 2016, pp. 219–246, on p. 234. Tobias Straumann deals with yet another contemporary federal package of measures that was supposed to combine regional and technology policy but was rejected by a referendum in 1985: Tobias Straumann, Rezession, Technologiepolitik und Risikokapital. Das Scheitern der Innovationsrisikogarantie 1985, in: Schweizerische Gesellschaft für Wirtschafts- und Sozialgeschichte / Société Suisse d'Histoire Economique et Sociale, 2001, 17, 403–419.

8 Report on the management of the Federal Council, the Federal Supreme Court, and the Federal Insurance Court in 1985. Federal Council Annual Reports, 1985, 120: 3. On

ing development of forest dieback».[9] The government made another entry to the files of the federal administration: «Finally, the rapid structural change in the economy, which we have already highlighted in the government program, has led us to propose a number of additional measures for funding.»[10] Directly following this passage, the Federal Council explicitly mentioned the special measures to promote IT and engineering.[11]

In launching the special measures, Swiss politicians were thus reacting to perceptions that were common in the Western world.[12] The special measures simultaneously reflected challenges confronting the Swiss economy in a period that, according to contemporary observers, heralded the decline of the industrial sector and the rise of the service sector.[13] However, economic historian Jakob Tanner has pointed out that this popular description of sectorial change overlooks something, namely,

planning efforts in federal migration policy, see Moritz Mähr's contribution in this special issue.

9 Rapidly initiated protective measures, such as the introduction of catalytic converters in cars, successfully halted the forest dieback predicted in the 1980s. Monika Gisler emphasizes that the federal government's measures were important for adapting the universities' research policies to environmental problems. Monika Gisler, Wie die Umwelt an die ETH kam. Eine Sozialgeschichte der Umweltnaturwissenschaften, Zurich 2020, p. 20.

10 Federal Council Annual Reports, 1985, 120: 3.

11 See Alban Frei's dissertation for an overview of the research literature on recent Swiss economic history and its resonances in science policy and management: Alban Frei, Sichtbare Netzwerke. Forschungspolitik und Life-Sciences zwischen 1990 und 2016 in der Schweiz. Eine Fallstudie zu SystemsX.ch, Zurich 2018.

12 Lutz Raphael, Jenseits von Kohle und Stahl. Eine Gesellschaftsgeschichte Westeuropas nach dem Boom. Berlin 2019. The Swiss PTT's (postal services, telegraphy, and telephony) archive gives an impressive insight into «postal change» during the liberalization and partial privatization of the former state-owned PTT enterprise: https://www.oralhistory-pttarchiv.ch/de/themes/liberalisierung-post (11/2/2021).

13 Sociologists Alain Touraine and Daniel Bell coined the term *post-industrial society.* Alain Touraine, La société post-industrielle. Naissance d'une société, Paris 1969. Daniel Bell, The Coming of Post-Industrial Society: A Venture of Social Forecasting, New York 1973.

> the fact of an interpenetration of industrial goods production and service provision that undermines the three-sector distinction introduced after World War II. Especially in the watch industry, which was able to stabilize at a considerable level after a crisis-like adjustment shock, this service intensity of goods production and, conversely, the dependence of most services on industrial goods (such as computers) became apparent.[14]

The interconnectedness of IT services and production described by Tanner suggests that structural change meant changes for companies and job markets, which were linked to each other through various dependencies. That, in turn, required the actors to be able to trust operational, communicative, and administrative structures. In the eyes of contemporaries, the announcement of comprehensive change made it obvious that the federal state – not individual cantons or even the private sector – had the say to act and to invest. In emphasizing advanced technology and education, the federal dispatch was asserting that parliament and the institutions of the federal state were in charge of managing change.

Apart from honing in on the era's socioeconomic challenges and dynamics, what was it that made the dispatch «special»? What ramifications did it have for science and university policy? And in what ways did introducing the measures help to transform the federal state? Answering these questions requires a look at the *courant normal* of Swiss science and university policy since the 1960s.

Ascent and crisis of cooperative federalism in university policy

Over the last half-century, Swiss science policy has become increasingly federal. In the words of Sebastian Brändli, during the 1960s there was finally movement in Swiss higher education policy thanks to the federal govern-

14 Jakob Tanner, Die Geschichte der Schweiz im 20. Jahrhundert, Munich 2015. On the crisis related to the reforms of the world monetary system and on the decline of the gross domestic product in the years from 1974 to 1976, see pp. 415–420. For the diminishing importance of the industrial-commercial sector in the 1970s and its qualitative knowledge-based reorganization in the 1980s, see pp. 483–485, here p. 485.

ment's use of «the constitutional provision of 1874 (!), according to which the federal state could subsidize the cantonal universities».[15] The role of the federal state as well as its relations with the cantons is thus an important topic in the research literature on Swiss science policy. In the 1960s, the protagonists and institutions of the federal state consequently recognized the importance of science and higher education policy.[16] The federal government commissioned several expert reports on higher education. In 1965, the Federal Council installed a body of experts – the Swiss Science Council – to advise it on university matters.[17] In 1969, the federal state took over the École Polytechnique de l'Université de Lausanne, which was henceforth called École Polytechnique Fédéral de Lausanne (EPFL). The polytechnic became a sister institute of the older federal institute of technology, ETH. ETH is based in German-speaking Zurich. Ever since its founding in 1855 it had been one of the federal state's most important investments in higher education.[18]

Over a hundred years after its first initiative in the field of higher education, the national legislature laid the groundwork for providing financial support to the Swiss cantonal universities. In June 1968, the Federal Assembly passed the Federal University Support Act (*Hochschulförderungsgesetz*; *L'aide aux universités*). The law regulated the distribution of financial resources to the cantonal universities. It envisaged the creation of a body that

15 Sebastian Brändli, Investition Bildung. Ausbaupläne und Reformpläne der Zürcher Universitätspolitik vor 1968, in: Erika Hebeisen et al., Reformen jenseits der Revolte. Zürich in den langen Sechzigern, Zurich 2018, pp. 11–25, on p. 12.

16 On Swiss science policy with an emphasis on its transitive and protean character in the middle of the 20th century, see Frédéric Joye-Cagnard, La construction de la politique de la science en Suisse. Enjeux scientifiques, stratégiques et politiques (1944–1974), Neuchâtel 2010. On federal science policy in a national and international «multilevel reality» (1960–1990), see Thomas Gees, Viel Diskurs – wenig Steuerung. Schweizer Wissenschaftspolitik in der Mehrebenenrealität, in: Criblez et al., Staatlichkeit in der Schweiz, p. 318: «That Switzerland needed a science policy was undisputed among the various players; the debate turned [...] mainly on the level at which it should be controlled.»

17 Schweizerischer Wissenschaftsrat / Conseil suisse de la science / Consiglio svizzero della scienza.

18 David Gugerli et al., Transforming the Future: ETH Zurich and the Construction of Modern Switzerland 1855–2005, Zurich 2010.

would promote, even require, the exchange of information between the cantonal universities and the federal state.[19]

The University Support Act and the soon to be founded Swiss University Conference are today considered the embodiment of «cooperative federalism», which represents a revival of relationships between the cantons and the federal state in the 1960s. Historian of education Marc Herren has pointed out that cooperative federalism implies cooperation of various kinds:

> The term «cooperative federalism» is used to describe different relationships and forms of cooperation between the member states and between the member states and the federal state. In particular, a distinction is made between horizontal and vertical cooperative federalism. In the first case, only the constituent states are involved; in the second case, both member states and the federal state are involved. There are also mixed forms, such as when the federal state is involved but does not have a voice.[20]

Universities were located in eight out of 25 cantons of Switzerland. Entire regions and the whole of Italian-speaking Switzerland had no university. Nevertheless, reading the University Support Act in its 1968 version, it is clear that it embodies the spirit of cooperative federalism. Consequently, cooperative federalism experienced a boost in the field of higher education pol-

19 Federal University Support Act [414.20], in: Swiss Federal Gazette, 1968, II: 10–21, https://www.amtsdruckschriften.bar.admin.ch/viewOrigDoc.do?id=10044039 (11/1/2021); Gees, Viel Diskurs, p. 321. Marc Herren, Die Nationale Hochschul- und Forschungspolitik in den 1960er und 1970er Jahren, in: Lucien Criblez (ed.): Bildungsraum Schweiz. Historische Entwicklung und aktuelle Herausforderung, Bern 2008, pp. 219–250, on pp. 222, 229.

20 Herren, Forschungspolitik, p. 221. Dietmar Braun prefers to call Switzerland's federalism a «decentralized» federalism: «At least on the revenue side, Switzerland is not yet concerned with ‹cooperation› [...]. It is only on the expenditure side that the interdependent network between the federal state and the cantons occurs in Switzerland as well, justifying the view that Switzerland is also a ‹cooperative federalism,› i.e., a closely intertwined system.» Dietmar Braun, Dezentraler und unitarischer Föderalismus. Die Schweiz und Deutschland im Vergleich, in: Swiss Political Science Review, 2003, 9: 57–89, on p. 63.

icy.[21] What kind of exchange between the Confederation and the cantons was envisaged? The federal government demanded information exchange within and between the universities. The tasks of the future Swiss University Commission therefore included «maintaining contact with the student body» and «issuing guidelines on admission requirements, curricula, and examination regulations for the various fields of study, as well as on the mutual recognition of examinations and degrees». Both the University Conference and the Science Council, however, drew up recommendations only; the federal state was not authorized to speak or implement laws. From a legislative and judicial standpoint, these were low-key interventions by the nation-state.[22]

In return for information exchange, the act allowed the cantons to receive financial support from the federal state – in the form of fixed budgets for operating costs (excluding funds for personnel) and funding for urgent structural investments, especially for buildings. The recipients of the funds were the cantonal universities. Another task of the University Conference was to «examine applications for grants for material investments». The universities had to report to the University Conference on the use of the funds.[23]

The establishment of EPFL took place in parallel with these measures. It emphasized a well-known division of labor that had existed between the federal state and the cantons since the founding of the federal state in the middle of the 19th century: the Confederation was responsible for polytechnic schools, and the cantons for universities.[24] However, the University Support

21 The same holds true for German federalism of the same era. Education policy is an important field of federalism. Dieter Langewiesche writes with a view to today's Germany: «No matter how one judges the role of the member states [...] they are deeply anchored in the political-social order. In school and education policy, they continue to be the main actors and have created their own instances of coordination.» Dieter Langewiesche, Vom vielstaatlichen Reich zum föderativen Bundesstaat. Eine andere deutsche Geschichte, Stuttgart 2020, p. 105f.

22 Federal University Support Act, p. 17. Since the canton of Jura was created in 1979, Switzerland consists of 26 cantons.

23 Ibid.

24 Around 1900 the Swiss national state was hardly interested in scientific research. «It was only in the three decades of the middle of the 20th century that mechanisms for a

Act, the expert commissions, and the Science Council reinforced a new kind of involvement of the nation-state. In the eyes of the cantons, it became involved in the field of university planning by demanding reporting and «coordination» among its constituent entities. For contemporaries, the demands of the federal state were double-edged. Thomas Gees has emphasized that during a period of strong educational expansion, the cantons were highly appreciative of the federal state as a funder, but at the same time were wary of national concepts. Marc Herren underscores how careful the federation had to be when evoking coordination and cooperation. An impression quickly formed that coordination was a matter of duty and synonymous with streamlining.[25] Summarizing the federal state's efforts in the field of science policy in the 1960s, Frédéric Joye-Cagnard has this to say: «[O]n the eve of the 1970s, the Confederation set up a set of founding bodies for its science policy, without, however, creating a federal department entirely dedicated to this activity.»[26]

Moreover, as far as the area of university funding is concerned, the federal state narrowly failed to establish a federal university. Just as striking as the multiformity of mechanisms and multiplicity of actors in contemporary Swiss research and higher education policy is the federal state's emphasis on material investments in universities and formal reporting on the need for funding. In other words, it did not build its own university, but rather provided the material to enlarge the existing cantonal universities and influenced the way the universities were managed. Looking back self-critically in 1983, the Federal Council noted that in 1968 it had clearly overestimated the importance of presumably one-off building investments compared to the

science policy began to be put in place.» Joye-Cagnard, La construction, p. 15. For ETH Zurich, the founding of EPFL had far-reaching consequences. Among other things, its supervisory authority, the «School Board» (*Schulrat*), was transferred to a new institution, the «ETH Board», which since then has supervised all federal institutions of higher education and research (the so-called ETH Domain). Gugerli et al., Transforming the Future.

25 Gees, Viel Diskurs, pp. 318, 320. Herren, Forschungspolitik, pp. 228–232.

26 Joye-Cagnard, La construction, p. 352.

universities' operating costs. The latter in particular had been rising continuously for 15 years.[27]

At the University of Zurich, the internal changes initiated in order to comply with the University Support Act date back to the early 1970s. Zurich serves as an example of a cantonal university that reacted quickly to the new law. The university's annual report for 1972 testifies to adjustments and even an attempt to anticipate further legislation: «The core of a planning organization was created [...] in the form of the Planning Commission and a Planning Committee, which will ultimately deal with all matters of medium-term university planning – not least in view of the requirements that will be imposed by today's or a future federal University Funding Act.»[28] The university also created a vice rectorate responsible for planning, led by business economist and longstanding head of the Planning Commission, Edwin Rühli. Rühli's approach to planning was well integrated into his daily work as an academic. For example, he taught lectures within the university curriculum on leadership tasks and university planning. The Planning Commission published 15 extensive studies in the period from 1973 to 1997.[29]

Archivist Inge Moser recently recorded the planners' inventory for the university's archive and described how closely planning and computing were connected:

> The institutionalization of planning and the increased surveying of the university since the 1970s did not just happen by chance simultaneously with the development of information systems and computer sciences. There was close collaboration with the Computer Center and computer scientists, and the planning staff often partici-

27 Dispatch on loans for the fifth funding period under the University Funding Act, in: Swiss Federal Gazette, 1983, 2: 221–270, on p. 224. In the 21st century, the aesthetics of concrete are characteristic even of data centers. See Monika Dommann et al. (eds.), Data Centers: Edges of a Wired Nation, Zurich 2020.

28 Annual Report University of Zurich 1973, p. 16. www.archiv.uzh.ch/de/editionen/jahresberichte.html (1/10/2019)

29 Inge Moser, Hochschulplanung an der Universität Zürich in den 1970er Jahren, www.archiv.uzh.ch/de/vitrine/aeltere_beitraege.html#29 (1/10/2019). A look into the files of the archives of the ETH Board shows that the management of IT for Lausanne and Zurich has preoccupied the council since the 1970s. IT in administration and research was an overarching issue.

> pated in projects to introduce documentation systems and databases, which in turn would serve as tools for planning.[30]

Up to 1981 the university had been busy building an entirely new and second campus at the Strickhof site just outside the city center.[31] In 1986 Rühli stated that in analyzing data, he had identified «three main conclusions from the planning: the divergence between the university's mission and its resources [was] steadily increasing; the explosive growth in computing require[d] special efforts; and a pronounced need for replacement [was] emerging in the area of apparatus.»[32] The university had diagnosed itself as having aging equipment that perhaps needed to be upgraded, or perhaps replaced with IT. Yet, through it all, one problem remained: even with the help of professional and computer-aided planning, the university had not come to grips with problems of growth and rising costs. This was a stinging indictment of the phenomenon known as structural change.

The frustration was palpable: planning efforts had failed to eliminate the financial problems that had arisen for the universities because of the steady and striking growth in student numbers. Additional, pressing equipment problems were added to the mix. And the same issues manifested elsewhere. By the mid-1980s, planners had a poor image among academic staff. The problem is well illustrated in a talk given by Urs Hochstrasser, director of the Federal Office for Education and Science and an outspoken friend of plann-

30 Moser, Hochschulplanung, www.archiv.uzh.ch/de/vitrine/aeltere_beitraege.html#29 (1/10/2019).

31 Sebastian Brändli points to the fact that «an important factor in rising student numbers was the steadily increasing proportion of female students». Brändli, Investition Bildung, p. 15.

32 «Prof. Rühli nennt drei Hauptschlüsse aus der Planung: Die Divergenz zwischen dem Auftrag der Universität und ihren Mitteln nimmt stetig zu; das explosive Wachstum im Bereich Informatik verlangt besondere Anstrengungen; bei den Apparaten zeichnet sich ein ausgeprägter Ersatzbedarf ab.» Archive of the University of Zurich (UAZ), F.3.110 Prorectorate Planning, Development Plan 1986–1991: General Files 1984–1986 (PSA 501 19 (1)), Current Planning.

ing,[33] to the Association of Swiss University Teachers titled «University planning from the federal government's perspective».[34] Hochstrasser was obviously at pains to explain to his audience what the workings and goals of federal higher education funding were and why it was important that the audience support planning. In speaking of the need for the Confederation to be frugal in all its expenditures, he addressed those present as citizens. He asked for understanding of the view of federal policymakers who did not wish to support universities with fixed budgets or to be fettered by long-term planning. «To maintain adaptability to unexpected new demands in research and teaching, it is necessary that donors not insist on stubborn adherence to plans but also be prepared to take special measures on short notice to cope with exceptional situations.» Hochstrasser spoke of an «emergency» that had arisen in the field of computer science and that threatened the «prosperous development of our industrial state».[35]

His statements showed how delicate his mission was: «A prerequisite for such extraordinary efforts is, of course, the optimal, full utilization of normal federal aid, which in turn is not possible without good planning.» Hochstrasser had to perform a balancing act in front of the university professors: planning wasn't everything, but it was very important. «Planning wasn't everything» meant that federal policymakers were allowed, beyond the agreed-upon, planning-based funding of the University Funding Act, to set substantive and extraordinary priorities to «push through important higher education policy goals». At the same time, planning remained important: «With all due respect for the reservations of university members about excessive planning, the federal authorities [...] nevertheless hope that the faculty of our universities will continue to support our common planning concerns in the future.»[36]

33 On Hochstrasser, see Andrea Weibel, «Hochstrasser, Urs», in: Historisches Lexikon der Schweiz (HLS), Version of 23/5/2005, https://hls-dhs-dss.ch/de/articles/024735/2005-05-23/ (5/3/2021).

34 Urs Hochstrasser, Hochschulplanung aus der Sicht des Bundes, in: Bulletin der Vereinigung Schweizerischer Hochschuldozenten, 1985, 1: 18–24.

35 Ibid., pp. 21, 23.

36 Ibid., p. 24.

Hochstrasser's oration provides another hint of what made the special measures special. First, the federal dispatch defined measures that were targeted to investments in IT and personnel, not building materials. Second, the measures were intended to be seen as a complement to the University Funding Act and its disputed administrative routines. This perspective was risky. The special measures might well trigger a crisis of cooperative federalism because they were grist to the mill for people fed up with federal monitoring and control. Moreover, in affecting the universities' «content control function» (*inhaltliche Steuerungsfunktion*), the measures reinforced well-known problems of cooperative federalism. In 1989, the cantonal Education Directorate of Zurich let its university know that it «ha[d] always been fundamentally opposed to ‹special funding›», while it did tolerate specific project-based funding by the Swiss National Science Foundation. The Directorate listed three reasons for its opposition to special measures:

> [F]irst, such funds [...] are taken away from regular funding and, second, the Confederation in effect takes over the content control function, which it is not constitutionally entitled to do. Finally, it is by no means desirable to have the federal state get its hands on areas that have become competitive through cantonal efforts (neuroinformatics in Zurich, for example).[37]

The Zurich Education Directorate was convinced that the measures did not stand to increase the bottom line. They represented illicit interference into the cantons' autonomy. On top of that, the confederation would reap the fruits that the cantons had sown. The directorate concluded that in the future, the federal state should use special measures only to fund continuing education, not university research and teaching. «The special federal funding that has now been decided should be limited to overarching areas, such as further education; the specific funding of individual areas is a matter for the Swiss National Science Foundation.»[38] In the same breath, the directorate

37 UAZ F.3.116, Rectorate, Development Plan of the University of Zurich 1990–1995, Preliminary Discussions with the [Cantonal] Higher Authorities Education Directorate, Finance Directorate, Health Directorate, Construction Directorate, 10–14 April 1989, p. 7.

38 Ibid.

linked special measures to «research projects». It expressed its hope and desire that the latter would involve «specific» funding and «individual» areas. Projects required grant applications, which in Switzerland meant primarily to the Swiss National Science Foundation. The directorate expected the foundation to handle its tasks responsibly.[39] With regard to the federal government's role, the magic words were «overarching areas»: the cantonal directorate committed the state to issues that affected all of Swiss society.

As a mechanism, the special measure was time limited, adapted to socioeconomic dynamics, and customized to dovetail with other mechanisms of funding universities and research. Yet despite the adaptability and customization, the special measure could not escape an already known problem, which is that federal measures are not neutral but have an effect on the autonomy of cantonal universities. Nor can such effects be contained by restricting federal mechanisms, for example, to construction or promotion of technology. From the perspective of the cantons, the federal government's short-term interference remained a sensitive issue, because funding for personnel and research infrastructure influenced specializations, roles, and teaching.

Taken together, these factors suggest that, like other tools of federal university policy, special measures presented universities with the challenge of meeting the demands of both the federal government and the cantons. They fell outside the normal budget process but apart from that their effect was similar to that of other tools of federalism. Special measures and projects showed that it is impossible to draw strict boundaries between research and teaching and between cantons and the federal state. They both rely on formalized planning. The federal government learned that for all the diversity of higher education policy mechanisms and the formality of planning tools, the

39 The Swiss National Science Foundation was founded in 1952. It funds basic research on behalf of the federal government. The Education Directorate addressed the most popular new mechanism of science policy within universities in the 1970s. In research, in teaching, and in administration, projects experimented with structures and collaborations that broke the bounds of conventional institutions, disciplines, and hierarchies. On the introduction of project-centered approaches in research, see Gugerli et al., Transforming the Future, pp. 250–256.

universities could not be managed uniformly because they pursued different directions in research and teaching.

In a third and final section I wish to show why a network for research and higher education was well within the scope of federal science policy. The idea of a network of university computers was first tested within the *courant normal* of cooperative federalism, but it was unknown to most users at the end of the 1970s. Yet the network developed into a productive thought experiment, and in 1985 the concept of a federal network quickly took shape – in advance of the special measures.

To switch or not to switch: «for most of them the idea of a network alone is new»

Much speaks for starting the story of the Swiss network for research and education in the 1970s with a task that was defined by the University Conference's Computing Commission (Commission pour l'informatique). The Computing Commission wanted to find out if it was possible to save money by having the universities' computing centers share their computers' calculating power. Automation and frugality were twin concepts in the federal administration.[40] The assignment was thus in line with the University Conference's mission to coordinate, to report, and to save money. The assignment furthermore accorded with the federal state's procedures for acquiring computing technology. By the end of the 1970s, a diverse landscape of computer use had emerged at Swiss universities. Technically, it was possible to geographically connect distant centers by remote data transmission. Was there also a need for remote data processing? Perhaps even more synergistic effects could be expected. That was the gist of the assignment.[41]

40 See Nick Schwery's contribution in this issue. See also Swiss Federal Archives BAR E7001C#1989/204#145*, Federal Central Office for Organizational Issues, Report on the Use of Electronic Data Processing in the Federal Administration, including an organizational chart with the current status.

41 Jürgen Harms, the first president of the future foundation that supported the network from 1986 onward, referred to this assignment in an interview with the author in March 2019. The final report dealing with the completed assignment can be found top-

It makes sense to start the network's history here, owing to continuities in personnel: some of the computer scientists involved later worked on the Swiss network for higher education and research. Moreover, the objects of desire were identical: the goal was to create a network for computers. Setbacks occurred during this time that had an impact on the network's development. Finally, and most importantly, locating the beginning of the network within the contemporary realities of university policy opens up perspectives on how actors negotiated concepts and practices of federalism in computer-based science and teaching.

In 1978 the Computing Commission created a «networks» working group that set out to conduct interviews with managers and users of university computer centers. The group also sketched out a network prototype. The members learned what the «typical mode of operation of the data centers» looked like. And they wanted to find out how a future network – a «Rechnerverbund-Netzwerk» – could be configured and operated.[42]

The authors of the final report laid out the results of their survey in August 1979. The report shows that the authors were particularly impressed by the diversity of the data centers studied. First, they found different types that mattered from a perspective of sharing computing power. The Federal Institutes in Zurich and Lausanne as well as the University of Zurich were «producers»: they had computing capacities that were accessible to third-party users. Then there were «consumers», computer centers that depended on others to provide calculating power for them. Finally, there was a «self-sufficient» center (Bern) and the «special case» (Basel), which bought computation time from a nonuniversity center.[43]

most in an archival box Albert Kündig handed over to the ETH Zurich University Archives: ETHZ Archives, Akz 2017–19, 7, Swiss University Conference, Final Report of the Working Group Networks, 15 August 1979.

42 ETHZ Archives, Final Report, p. 2. Authors of the report: Bonzon (University of Lausanne), Christen (University of Basel), Erard (University of Neuchâtel), Harms (University of Geneva), Mresse and Mumprecht (University of Zurich), Lutz (Swiss PTT, Bern), Guex (EPFL), Schicker (ETH Zurich), Wyss (Swiss University Conference), Bauknecht (University of Zurich).

43 Ibid., p. 3.

Almost all users – and this came as a big surprise to the authors – were happy with this pragmatic system of (non-)exchanges. At least, they did not wish to connect to another center via a network. According to the report:

> Experienced users of data centers were asked about their ideas on the topic of a computer network. The results showed that for most of them, the idea of a network alone is new. Spontaneously expressed concerns affected the technical and organizational difficulties of user support for computer use (operating system) and program packages in general.[44]

Computer centers were well-established institutions with proper cultures. They informed users about computer programs and documented and collected catalogues so that users could make their choice. A center's personnel consulted users in person.

The knowledge of how to use computing services, once acquired with great effort, leads to a pronounced ‹sedentariness› on the part of the user. This is understandable in view of the large architectural differences between systems of different manufacturers and types. Already the prevailing confusion of language in the manufacturer-specific term categories of electronic data processing favors the isolation of one data center community from others.[45]

The main conclusion the working group drew was that networks weren't suited to meet economic expectations.[46] It was common practice for universities to buy computing power from other academic, administrative, or private computing centers. The users' and managers' concerns pointed to essential features that demanded an immense programming effort if personal contact and consultation were to be substituted by telecommunication and

44 Ibid.

45 Ibid.

46 This conclusion thus reflected the assignment to sketch an economic solution: «Under the main aspect of economic efficiency, possibilities are to be discussed which allow each computer center user to be offered a comprehensive range of computing power and a well-rounded software range under optimal conditions. In addition to a qualitative and quantitative improvement of the IT service, an economically more favorable production of the same is also to be strived for, in that special components can be provided centrally.» ETHZ Archives, Final Report, p. 1.

automation in a multifaceted computer setup. The report predicted that the transformation of a local into a generalized «administration» would be one of the bottlenecks of computer networks: «The contentious issue of user identification, authorizations, and billing, which today is solved individually by each data center, must be replaced by a uniform system throughout Switzerland.»[47]

Peter Schicker, a mathematician who specialized in protocol design and network architecture, reported on behalf of the group to the University Conference's Electronic Data Processing (EDP) Commission.[48] «A general network cannot be considered economical at the moment, but this is not an ‹eternal› decision.» The minutes of the meeting show that Kurt Bauknecht, chairman of the EDP Commission, thanked Schicker and wished to proceed without further ado: «Thanks for the work. The final report will be prepared and transferred to the client by the overall commission.»[49]

The EDP Commission assembled delegates from Swiss universities on a regular basis to share ideas and to report on individual plans for organizing and acquiring technology for data processing. Members of the commission were computer scientists and computer center managers from the universities of Basel, Bern, Fribourg, Geneva, Lausanne, St. Gall, and Zurich as well as from the two federal institutes of technology in Lausanne and Zurich. Bauknecht himself was from the University of Zurich. Kurt Steiner and Urs Hochstrasser, representing the federal Administration, also sat on the committee. Hochstrasser was head of the Federal Office for Education and Science. Steiner represented the Federal Central Office for Organizational Issues and was both experienced in coordinating automation within the federal administration and was responsible for the efficient use of federal funds in any acquisition or operation of IT funded by the Confederation. Representatives

47 Ibid., p. 5.

48 For a contemporary publication by Schicker, see Peter Schicker, The Computer Based Mail Environment – An Overview, in: Computer Networks, 1981, 5: 435–443.

49 Swiss Federal Archives (BAR), BAR E6502-01#1993/126#392*, Minutes of the Meeting of the SHK-EDP Commission, 3 May, Bern 1979. The written version of the report was published in August 1979.

of the University Conference and the Swiss National Science Foundation sat on the board too.[50]

Hochstrasser immediately used the opportunity to learn more: «Is the statement that an entire network is not economical based on expensive transmission or on other factors?» Why was this so? Why did the costs not decrease when material and «computing time» were shared? This question addressed the cost of telecommunication in Switzerland, which was considered high. The question also addressed the area of responsibility of the Federal Central Office for Organizational Issues. It was the office's firm conviction that a correct – i. e., coordinated – use of IT resources would result in added value for all those involved. If the network working group came to a different conclusion with the help of expertise, Hochstrasser would have to listen closely.[51]

But the cost of transferring the data was not the decisive factor. Schicker strove for clarity. He concluded that the decisive factor was heterogeneity, in other words, «the universities' different hardware». The different hardware in turn was due to a plurality of computing technologies. For Schicker, the only way out of the dilemma was sophisticated programming. Alfred Schai, data center manager at ETH Zurich, reiterated that the cost «was due primarily to the complexity of the network», i. e., the mix of hardware and software. Costs that were linked to telecommunications would arise in every network. He suggested that «the final report of the group could serve as a first approach for a future decision».[52]

The report untied a knot. Because the usefulness of sharing hardware and software was fundamentally questioned, cost issues were a distraction. Now a highly productive thought experiment ensued. If costs could not be saved, it did not matter what the PTT charged for data transmission. If networks were ever to become relevant again, costs had to be treated as neither a

50 BAR, SHK-EDP Commission. The commission was an all-male collective of data center managers, professors with educational backgrounds in engineering, natural and economic sciences, and high-ranking administrative personnel.

51 On Steiner and the Federal Central Office for Organizational Issues, see Nick Schwery, Die Maschine regieren. Computer und eidgenössische Bundesverwaltung, 1958–1963, Preprints zur Kulturgeschichte der Technik, ETH Zurich 2018.

52 BAR, SHK-EDP Commission, p. 5.

limiting nor an enabling factor. Networks would have to be viewed as abstract entities for coordinating heterogeneous components. Thus, at least two state institutions were dismissed from the network planners' negotiating table: the Federal Central Office for Organizational Issues, with its savings regime, and the PTT, with its physical infrastructure and culture of standardization. At the same time, the experts interviewed from the computing centers were outvoted: local heterogeneity was not an obstacle, but in fact the goal. It is worth noting that the group had no issue with any specific software or transmission standard at this point, nor the cost of the PTT's so-called leased lines. For them there was a more general lesson to be learned. Networks could open up new possibilities. It was just that they were not made to expand computing functions and to reduce costs at the same time.

Only a few years later, members of Swiss universities had gained network experience, and it almost seemed as though a national network was superfluous. Local heterogeneity was now compatible with global standards. The European Academic Research Net (EARN) enabled Swiss scientists to link up with other networks, computers, and colleagues all over the world. The problem with EARN was that it was supported by IBM, which had pledged its backing only for an initial phase. Consequently, in 1984 a new «network» working group was established, led by Jürgen Harms, a professor at the University of Geneva who had been part of the 1979 group. Harms and his colleagues set about reworking a concept for a «réseau informatique suisse pour les universités et la recherche» – a «Swiss IT network for universities and research». The network was intended to replace EARN in Switzerland in 1988. This network represented coordination on a global, European, federal, and intercantonal level. In April 1985, Rolf Deppeler, secretary general of the Swiss University Conference, was pleased to announce to the Computing Commission that the University Conference had a «great interest in these network issues, and the cantons are willing to finance certain planning work; the federal government will also finance its share».[53]

The network had already found its future users, and the concept enjoyed support among the Computing Commission as well as cantonal and federal

53 BAR E6502-01#1993/126#400*, Minutes of the Joint Meeting of the Commissions for Computer Science and University Libraries, 14 March, Bern 1985, p. 14 f.

donors. The concept was well advanced when the federal government decided to fund a package of special measures. On the same day, Harms and his colleagues from the Computing Commission laid out principles that would apply for the future Swiss network for higher education and research. Harms told his colleagues to be «aware that the establishment of a future network requires a joint effort by the universities». Bauknecht emphasized that «as many building blocks as possible should be adopted» from the Deutsches Forschungsnetzwerk (DFN), the West German equivalent of the Swiss network. The DFN net wasn't yet finished, but the Swiss had a high opinion of the work being carried out by their neighbor. Schai hoped that the Swiss project would align with international standards. «The Confederation is interested in the Computing Commission taking on this role», declared Hochstrasser. «A longer-term concept needs to be worked out to ensure compatibility. When setting up a Swiss network, one must aim at realizing international standards.» Local heterogeneity remained intact; it was compatible with international standards and the federal intent to steer development in the field of computing. The first sketch of the concept was intelligent, and the members of the commission explicitly saw it that way. By the close of the meeting Jürgen Harms and his group were officially in charge of planning the network.[54]

At the same time, initial preparatory work was in process on the special measures. In August 1985, the Swiss University Conference commissioned the Computing Commission to submit proposals in the «immediate future». The conference made clear that there was no time to lose: «Because the concretization and quantification of the measures to be included in this ‹special package› is particularly urgent, CICUS has been commissioned to submit corresponding proposals in the short term.»[55] The commission had formed a

54 BAR E6502-01#1993/126#400*, Minutes of the Meeting of the Informatics Commission (CICUS), 14 March, Bern 1985, pp. 3–6.

55 BAR E6502-01#1993/126#395*, Financial Measures of the Confederation in Favor of the Cantonal Universities within the Framework of the «Special Package Computer Sciences». Proposals of the «Special Measures» Working Group of CICUS, 7/8/1985, p. 1. The paper names several institutions that were already involved in the process or were expected to join soon: the Swiss university conference's plenary assembly, its secretary, its

«special measures» working group that had already received an internal federal discussion paper that listed two «national» components of the package: a national supercomputer, and the same network for universities and research that was debated by the commission. The University Conference's working group «special measures» accepted both and wrote in the amount of 15 million Swiss francs to be paid by the federal government for the network, noting that it preferred joint sponsorship of cantons and federal government. The working group placed particular emphasis on the cantonal universities: «Care must be taken to ensure that the needs of the cantonal universities are taken into account with regard to the use of the national supercomputer.» It was important «that planning be done in close cooperation between the federal government and the ETH Board on the one hand and the [Swiss University Conference] and [its Computing Commission] on the other.»[56] In mid-1985, the working group proposed to allocate funds for temporary hiring of staff in computer science major and minor programs for both teaching and research. This measure could be clearly distinguished from other potential funding opportunities. Moreover, the amount to be allocated for it was «reasonable. [...] Staff positions and acquisitions for computing centers and computing services, as well as workstations and computer acquisitions for departments outside of computing» would thus clearly not be eligible. The University Conference wrote in 20 million Swiss francs for personnel at cantonal universities and another 12 million francs for the acquisition of workstations.[57]

Conclusion: cooperation in practice

Once the special measures were launched, the network was quickly assigned a special position within them: the promise of a future network of scientific computers transformed geographically, socially, and technically disparate projects into a consolidated «national» package. From a historical perspec-

Computing Commission and its «special measures» working group; the Federal Office for Education and Science; the Swiss National Science Foundation; ETH Board.

56 BAR, «Special Measures», p. 2.

57 BAR, «Special Measures», pp. 7 and 8.

tive, the special measures are an example of the possibilities of federal states to bundle together something that is already there and thereby achieve synergistic effects. The Swiss special measures make sense when seen in the historical context of Swiss investment in economic change since the 1970s. The measures have fully exploited the coordinative potential of a mechanism known as the «network». They offered a means of coordinating a «post-industrial» society that had not yet taken shape, especially at the supra-regional level. The network mechanism thus soon took on a dual nature: it was ideal and material at the same time.[58]

The special measures did not alter the state's role as funder. They reinforced the view that the federal government was in charge of «overarching» issues. By the same token, the individual measures in the package did promote geographical expansion of a digital federalism in *statu nascendi*. When the decision was finally taken in 1989 to establish a national center for supercomputing in the hitherto academically untapped canton of Ticino, it was a pixelated graphical representation of a nationwide digital network that made this step appear viable and visionary. Telecommunications networking even suggested that measures targeting the national level had the effect of stimulating international relations.

Yet the course of history that led to this sort of integration of the package of special measures was unpredictable. It was not clear at all to contemporary computer scientists in the late 1970s what a national computer network should look like. The successful match of computer science and federalism was possible only after the idea of an efficient federal-cantonal computer network had been discarded and replaced by the stable expectation of synergies in scientific communication. Recapitulating the development that led to the special measures reveals a few more surprises. It is important to appreciate these surprises, because they confirm that the concept of cooperative federalism was successfully rehabilitated and open to international exchange on many scales.

58 This finding of the imaginative power of networks corresponds to results of international research on national networks. See, for example, Eden Medina, Cybernetic Revolutionaries: Technology and Politics in Allende's Chile, Cambridge MA 2014. Paolo Bory, The Internet Myth: From the Internet Imaginary to Network Ideologies, London 2020.

Within the web of national relationships established by the cantons and the federal state, the actors and institutions involved moved smoothly to unexpected positions by mutual agreement. The planning of the network was initiated by the University Conference, an institution that represented both the federal state and the cantons. Nevertheless, the federal government put it on the list of «its» special measures, and was willing to pay a bigger share and to play a major role in developing the network. Furthermore, networking was not seen as a matter of physical connections between computers and the PTT.

The involvement of federal authority changed considerably while the network was taking shape: «Bern's» influence changed because the national and federal authority of the PTT and the Central Offices for Automation declined. At the same time, the future outcome of an investment in universities wasn't original but rather was intended to copy an international, perhaps German model. Another surprise was expressed by Jürgen Harms, the first president of the future SWITCH foundation that was to establish and maintain the network of the same name. He stressed how much effort was required to create this organization – a foundation that was carried by cantons and the federal government – «that could purposefully support and promote cooperation between universities». As far as the organization was concerned, «role models from the international arena were of little help. [...] Practically every country had its own boundary conditions [...] and came up with its own solutions».[59] Harms was later actively involved in enlarging the geographical, social, and political space of higher education by offering computer access to users at universities of applied sciences and by guaranteeing heterogeneity to operators of academic computing technology.

The future SWITCH computer network and its supporting organization, the SWITCH Foundation, were innovative, and hence constituted special measures relating to university policy that relied on institutions and helped to establish rules and boards for discussion and decision-making. Thinking and shaping cooperation is an important task for higher education and research institutions. This implies that planning and implementing a network was political and that it was, as Harms has put it, located on «this

59 Author's interview with Jürgen Harms in Geneva, 26/3/2019.

side» of the state and legal structures. With regard to the intended effects of the special measures – education, training, and managing structural change – the network most likely performed poorly or at least in a way that cannot be measured. Moreover, the emphasis of the special measures on temporary employment certainly did not alleviate the universities' personnel problem, especially when seen from the perspective of the employees. The positive societal impact is to be found somewhere else. The computer sciences today are still most effective when they invest time and resources in elucidating society, technology, and organizations. In this sense, computing is social precisely when it turns its gaze on itself. Computer science, like any science, has the potential to be unelitist and excellent at the same time.