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Developments in the Organization and Finance of Public Agricultural Research in Switzerland 1988-1999

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Contents

1 Introduction

In the following, we describe the reform process of public agricultural research and try to identify the most important determinants and mechanisms of change.

1.1 Objectives

At the beginning of the paper stand the following questions:

- Which institutions belong to the Swiss NARS? What is there relative importance (staff, finances)?
- Who decides about research strategies and objectives?
- Who decides about financing?
- How did the research institutions change in the last years?
- Why did they change?
- Who is affected by these changes and how?
- Are the changes sustainable?

1.2 Outline

In appendix 1, the Swiss NARS and its environment is described. In appendix 2, some background information to the Swiss NARS, its origins and development are given. In section 2, the key developments that affected the agricultural research system are identified. In section 3, institutional changes within the agricultural research systems are described. In section 4, we draw conclusions about the crucial determinants, mechanisms and results of the changes until now. It is recommended to read appendix 1 and possibly appendix 2 before section 2 to 4.

2 Key developments that have affected the agricultural research system

2.1 Changing demand for public agricultural research

Increasing agricultural productivity:

Agricultural (physical) productivity isn't anymore a research objective that stands alone. This change dates back to the mid-eighties. Productivity remains of indirect importance, as far as it serves to improve economic performance of production (cost reduction).

Improving Natural Resource Management:

Has become the overall research priority with the commencement of the agricultural policy reform in 1992 and the passing of the revised regulation on agricultural research in 1995. This change of research priority was prepared since the seventies, and was promoted through environmental problems caused by agriculture (water pollution, heavy metals in soils, loss of biodiversity etc.).

Strengthening Agro-industrial (food processing) performance:

Has with the exception of milk (especially cheese production) never been a public research priority. Food processing is mostly private.

Strengthening Legislation, Policy Making and Consumer Protection:

Consumers, or more general non farmers, have since the eighties increasingly become a serious factor in designing agriculture-related environmental legislation (e.g. regulation about water and soil protection, or for prevention of cruelty to animals).

The consumer protection legislation with respect to genetic engineering, for instance, is in comparison with the EU more consumer friendly. Since 1. July 1999, negative declaration with the label "produced without genetic engineering" is feasible. Moreover, suppliers of products with such a label have to prove, that the products were fabricated without any influence of genetic engineering. In this revised food legislation the sceptical attitude of consumers towards biotechnology and genetic engineering is expressed.

On the other hand, 1998 Swiss voters rejected an initiative which wanted to regulate genetic engineering research very restrictively ("Genschutzinitiative"). This is at first glance an interesting contradiction, which can be resolved taking into account the outstanding economic significance of Swiss industries, that are engaged in genetic engineering research (Novartis).

These changes are hardly measurable in relative fundings. Firstly, because of lacking data, secondly because these reorientation mostly happened in the existing research institutions with existing funds. One exception is the only private agricultural research institute, the Research Institute for Organic Agriculture. Since the eighties, this institute gets financial assistance from the Federal Office for Agriculture. In the nineties, these funds were increased, but the percentage of total expenditures for applied research amounts to only 2%.

To the main explanations for these changes see section 4 and appendix 2.

2.2 Changing organization of science and research

A distinction has to be made between applied research in the 6 Federal Research Stations for Agriculture (FRS) and basic research at the Department of Agriculture and Food Science (D-AFS) at the Swiss Federal Institute of Technology Zurich (SFI-TZ).

Applied research/FRS:

Applied research is mostly influenced by agricultural policy. The political influence has strongly increased in the last years. In the nineties, agricultural research has become an integrated part of agricultural policy. Repeatedly, it is emphasized that the demands of agricultural policy for scientific decision support and policy evaluation are high.

In the FRS environmental related research activities increased. This not with more, but with less fundings. The strategy was not to assign this new research priority to just one FRS, but on the contrary, to reorient all of them into the direction of developing sustainable production systems. That FRS, which was previously charged with environmental research, was closed in 1993 (resp. transformed to an institute and integrated into one of the remaining FRS).

Basic research/D-AFS:

Basic research was mostly influenced by the rise of biotechnology/genetic engineering. Other research (and teaching) priorities – as Agroecology and International Agriculture – were set by the Department. This new priorities had to be realized without additional regular public fundings. The regular funding have been frozen since 1990. This situation led to more interdepartemental competition and to enhanced efforts to acquire additional fundings. Most of this additional fundings also come from public sources, but they are of temporary nature (e.g. contract research, participation in National Research Programmes).

The relative share of collaborative work (interdepartemental or with other departements inside the SFI-TZ or with other research institutions outside of the SFI-TZ) has grown in tendence. The scarcer resources enhance the incentive for searching partners.

Applied or rather directly production oriented research at the D-AFS decreased in the last 10 to 20 years. There is stronger orientation towards basic research and the international research community, especially in the plant sciences. The link to Swiss agriculture became weaker, in tendence.

2.3 Changing responsibilities of public vis-à-vis private sector research

In Switzerland private agricultural research is clearly oriented to global markets (Novartis, Nestlé). The expenditures for research & development of these industries amount to a multiple of the expenditure of the Swiss NARS (see appendix 1). They don't have a significance for national agriculture, but for national economy.

Agricultural research – both applied (FRS) and basic (D-AFS) – is at present reorganized according to principles of New Public Management.

2.4 Other major changes that have affected the development of agricultural research systems

Since the beginning of the nineties, applied and basic research are influenced more directly by politics. The FRS rather by agricultural policy, the D-AFS by general research policy. One of our main thesis is, that recent changes in the NARS are to a greater extent secondary reactions on policy changes than primary reactions on direct change in research demand, scientific organization or public-private responsibilities. The key developments which significantly influenced the reorientation and restructuring of the NARS are outside of the sphere of agricultural research (see section 4 and appendix 2).

3 Institutional changes within the agricultural research systems

From the mentioned thesis follows, that recent changes in the NARS are not so much a direct result of changed demand for research, but, quite the contrary, that the changes in the NARS are a result of institutional changes, that were initiated by policy reforms outside the NARS.

3.1 Institutional innovations in the field of governance and oversight

Decentralization of the research system, by region or commodity:

The process rather goes into the reverse direction. Traditionally, the FRS-system was rather decentralized. Mostly as an economy measure, the FRS are transformed into competence centres, each of which is responsible for the whole country. One FRS is responsible for animal related research (nutrition, meat quality etc.), another for milk related research (quality, technology of processing etc.) etc.

Shift in patronage from the Ministry of Agriculture to the Ministry of Science and Technology:

The NARS is located in two Federal Offices (=Ministries): The D-AFS (basic research) in the Federal Office for Education and Science, and the FRS (applied research) in the Federal Office for Agriculture. This has remained unchanged. Nevertheless there is some shift in patronage through the reorganisation of the field of „Education, Research and Technology" in 1998. New is, that the strategic planning of performances and resources is jointly managed by the two departments for the whole field, applied agricultural research in the FRS included. A common budget („Querschnittsbudget") facilitates shifts between partial fields (see appendix 2).

Increased integration of farmers and other stakeholders in oversight mechanisms:

(No integration of farmers). In 1996, a new oversight mechanism was established, the Research Council (see annex 1). This Council is composed of official representatives from the Federal Office for Agriculture and from the Swiss Federal Institutes, further, of experts, who are active in agricultural research, and finally, of representatives from organizations that deal with questions of research or environmental policy.

The Council functions as a consultant for the Federal Council. Further, the Council gives recommendations to the Federal Office for Agriculture about the long-term strategy of agricultural research.

Increased autonomy of research institutes:

Again, a distinction has to be made between applied and basic research.

Applied research: The autonomy decreased through the closer integration of the FRS into agricultural policy, and through extending the competence of the Federal Office for Agriculture (FOA). The FOA decides about the responsibilities of the FRS. The FRS have to deliver four years research programs, which have to be approved by the FOA etc. For the future it is intended, that the FRS function as a decision support system for agricultural policy (development, accompaniment and evaluation of policy measures). On the other hand, with the implementation of principles of New Public Management in 2000, the financial autonomy increases (see appendix 2).

Basis research: Basically, research and financial autonomy of the D-AFS increase (see appendix 2). On the other hand, with the stabilization of regular funding the necessitiy to acquire additional resources grows. Contract research, participation in National or International Research Programmes may reduce autonomy.

Privatization of research institutes:

No.

Establishment of more formal evaluation procedures:

For applied research in the FRS, yes. For basic research in the D-AFS, no.

3.2 Institutional innovations in the field of financing

To the financing see appendix 1. The greatest part of the cost are covered by regular public funds (from 2000 by global budgets in the FRS, resp. on own account by the D-AFS). As a reaction on frozen regular funds, the D-AFS increased the percentage of additional „other funds“ in the last years.

Enhanced emphasis on competitive grant mechanisms:

No.

Establishment of matching grant schemes for funding research:

Since 1975, there are periodical problem oriented National Research Programmes, which are formulated by the Federal Council. They are the most important establishment of matching grant schemes in Switzerland.

Establishment of levy systems to charge beneficiaries:

No.

Enhanced emphasis on contract research:

No.

Establishment of endowments to fund public research:

No.

Removal of funding decisions from implementation units:

?

3.3 Institutional innovations in the field of research implementation

Increased importance of international research networks:

Yes, especially in the field of basic research. E.g. CGIAR, Rockfeller, participation in EU-Research Programmes, INTERREG-Programmes. The importance of international research networks will further increase.

Public-private R&D joint-ventures:

No.

Private execution of publicly funded R&D:

No.

Increased importance of multi-institutional research programs:

No.

Increased roles of (existing) universities within the national research system:

No.

Other innovations:

The establishment of Universities of Applied Research diversifies applied research institutions (see appendix 1).

4 Conclusions

The present NARS developped in a continuous growth process after World War II. This development was not hindered by any meaningful obstacles. There was a general consent about the necessitiy of agricultural research serving needs of national agriculture. This explains also, why in 1999, the NARS is still almost completely publicly financed by the Confederation and to a smaller extent by the cantons. The objectives of research were previously to improve productivity of the farming sector. The strategic research orientiation and the specific research projects were only a matter of involved experts.

First indications of changing environment for agricultural research can be found in the seventies (see appendix 2). It took another 20 years, until these ongoing external changes became effective in institutional changes. Several problems had become so urgent that time was ripe for a profound reorientation and restructuring of agricultural research. Today, public agricultural research in Switzerland is in the midst of a reform process. Since 1992, expenditures have been stabilized or reduced, research priorities were changed, and research organisation as well.

In the following, we formulate six thesis about the basic determinants and mechanisms of changes in the Swiss NARS:

1. The institutional changes of agricultural research were initiated in two different political decision systems. The first decision system is that of agricultural policy, the second that of the research policy of the Federation. Changes in applied agricultural research (Federal Research Stations) were initiated through agricultural policy, those in basic research (Department of Agricultural and Food Sciences) through general research policy.

2. In both systems the same development were the driving forces of change. We disthinguish three external key developments:

   - The most important driving factor were the drastic household deficits of the Confederation since 1990. They reached an extent as it had never happened before. Expenditures increased much faster than revenues.

   - Secondly, the economic situation became more difficult. The real national product stagnated since 1990. The unemployment rate grew. The political and economical pressure for liberalization of markets in an increasingly globalized world with intensified competition became stronger (WTO, EU).

   - Thirdly, there is an advanced awareness of environmental problems and health risks attached to food in politics and society.

   Considering these developments, political reactions became inevitable: First of all, economy measures were to be taken. In the second place, a more active research policy of the Confederation to maintain and improve competitiveness of Swiss economy and to promote employment was asked. Finally, economic development should be ecologically sustainable.

3. These developments led to simultaneous restructuring of three policies, that are relevant for agricultural research (see appendix 2 for more information):

   - Agricultural policy: Agricultural policy reform started in 1992.
   - General research policy: Restructuring of general research policy started also at the beginning of the nineties.
   - Federal administration: The reform of governing and administration started in 1994.

   This means, that changes in the NARS were rather an indirect result of other policy changes. Primarily, it was not direct critic on the NARS that initiated changes, but critics on policy fields that influence the NARS. These developments indirectly resulted in new pressures on agricultural research.

4. The "translation" mechanisms of the basic driving factors worked in the two decision systems – via the mentioned three policies – in a different way:

   - Applied agricultural research (Federal Research Stations, FRS): Applied Research in the FRS was in a first step directly affected by the economy measures. Expenditures for research were frozen, while costs of agricultural policy as a whole increased a lot. In contrast to previous development, the FRS couldn't profit from this general increase of agricultural funds. Obviously, there is no effective agricultural research lobby. In the second step, the FRS have to partly reorient their research priorities, because they are integrated more closely into agricultural policy. By law, the FRS have to support agricultural policy in its task to fulfill the objectives of the Law on Agriculture and they have to supply the basis for future policy reorientations.
   - Basic research (Department of Agricultural and Food Sciences, D-AFS): In comparison with the FRS, basic research at the D-AFS is much less afflicted by the agricultural policy change. The D-AFS is mostly affected by the general research policy. Through the reorganisation of education and research policy, the interdepartemental and interdisciplinary competition for funds increased. The legitimation problem for public agricultural research at the Swiss Federal Institute of Technology Zurich is rather overproportionate in comparison with other departments. Also the disciplinary competition has rather increased. Non agricultural faculties increasingly engage in agriculture related research because, last but not least, many faculties deal with more legitimation problem than the D-AFS. On the other hand, the increase in competition promotes interdisciplinary research projects and leads to more efforts to look for international research collaboration. A further important difference to the FRS is, that in the D-AFS research in modern biotechnology and genetic engineering plays an important role. The competition for public and also private funds rather promotes research in modern technologies.

5. The common features of the "translation" mechanisms are the emphasis on economic efficiency of public finances and on environmental and health aspects (concerning research priorities), and the legitimation problem.

   - Economic efficiency: Firstly, applied and basic research expenditures were stabilized. Secondly, both fields are reorganized according to principles of New Public Management.

- Environmental and health aspects: In applied and basic research, priorities have been directed more towards ecological research subjects.
- Legitimation problem: Today, agricultural research is in a defense position. Research, means and objectives, have to be justified. This furnishs another explanation for the increased significance of environmental and health related research.

6. Environmental and health aspects are not the factors, that finally brought about a change, but they are rather "designing" factors concerning the result of change. They influenced the reorientation of research priorities towards environment and health aspects.

Are these changes sustainable? Our impression is that they basically go into the right direction. In the changed research priorities, expectations of politicians and society towards agriculture are expressed. The changes are in general implemented with diligence. The afflicted institutions got time to prepare themselves for the new situation. The question is rather, if the reform goes on. Public agricultural research remains in a defense position in tendence.

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Appendix 1: Swiss NARS and its environment (1999)

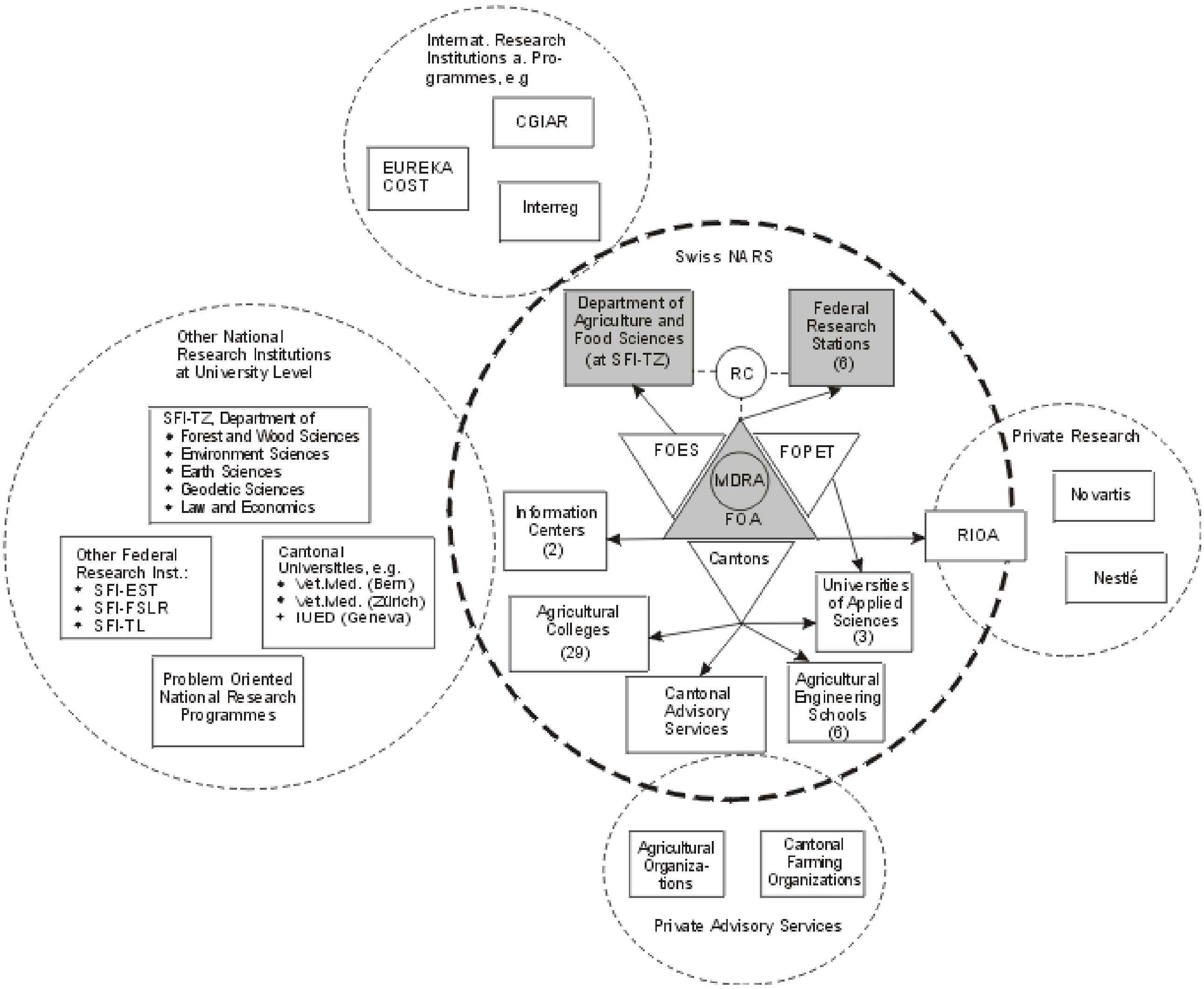

Figure 1 **Swiss NARS and its environment**

<u>Legend</u>

⟶	main source of funding
	central institutions of the NARS
FOA	Federal Office for Agriculture (Bundesamt für Landwirtschaft, BLW)
FOES	Federal Office for Education and Science (Bundesamt für Bildung und Wissenschaft)
FOEPT	Federal Office for Professional Education and Technology (Bundesamt für Berufsbildung und Technologie)
FRS	Federal Research Stations
MDBA	Main Division Research and Advice (Hauptabt. Forschung, Bildung und Beratung)
RC	Research Council (Forschungs-Rat)
RIOA	Research Institute of Organic Agriculture (Forschungsinstitut für Biolog. Landbau, "FIBL")
SFI-EST	Swiss Federal Institute for Environmental Science and Technology (Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, "EAWAG")
SFI-FSLR	Swiss Federal Institute for Forest, Snow and Landscape Research (Eidgenössische Forschungsanstalt für Wald, Schnee und Lawinenforschung, "WSL")
SFI-TZ/L	Swiss Federal Institute for Technology Zurich/Lausanne (Eidgenössische Technische Hochschule Zürich, "ETHZ"/"EPFL")

Description of the Swiss NARS, its environment and the Cooperation within the NARS (1999)

Swiss NARS

The principal research institutions of the Swiss NARS are the six Federal Research stations and the Department of Agriculture and Food Sciences at the Swiss Federal Institute of Technology Zurich.

Federal Research stations (FRS):

The six FRS are engaged in applied research in order to improve economic performance and ecological sustainability of national agriculture, and recently, to give decision support for agricultural policy. The FRS are assigned to the Federal Office for Agriculture. In 1998, they employed approximately 700 people and the expenditures amounted to approximately 100 Million Swiss Francs, of that about 60% for research and development.

Federal Office for Agriculture (FOA):

The FOA belongs to the Federal Department of Economic Affairs. With the administrative reform of the Confederation in 1993, the Main Division Research and Advice (MDRA) has been established as one of four Divisions (the other Main Divisions being: Plant Production, Animals, and Direct Income Payments). The purpose of this reorganization is to integrate the FRS more than before into the political tasks of the FOA (IDA-WI 1994, p.17). The enhanced competences to influence agricultural research are laid down in the revised regulation about agricultural research („Verordnung über die landwirtschaftliche Forschung"), which passed in 1995. The FOA determines the strategic orientation and the objectives of research, and the middle and long-term planning. Such, the FRS have become important instruments of the agricultural policy (development, accompaniment, and evaluation of political measures).

Department for Agriculture and Food Sciences (D-AFS):

The D-AFS is responsible for basic research. In the past, it was like the FRS rather nationally oriented. In the last years, it has increasingly become a part of the international research community. The funds of the D-AFS stem from the Federal Office for Education and Science (FOES), which is located in the Federal Department of Home Affairs.

The D-AFS comprises at present 18 Professors in four Institutes (fig. 2) with about 360 scientific co-workers. Three chairs of the Institute of Plant Science are placed in the Department of Biology (Biochemistry and Physiology, Plant Genetics, Developmental Biology). Further, three experimental stations are assigned to the D-AFS. In 1998, the expenditures amounted to around 40 Million Swiss Francs, of that about less than half for research. Measured against total funds the importance of agricultural research at the D-AFS is less than half of that of the FRS.

The Swiss Centre for International Agriculture was founded in 1993 by members of the D-AFS. It is open to public and private research institutions. More than 50% of the resources stem from the Swiss Agency for Development and Cooperation.

At present, to the D-AFS belong 3 experimental stations (2 were closed down in 1996).

In 1999, a new temporary professorship ("Assistenzprofessur") for Food and Development Economics was established at the Institute of Agricultural Economics .

Plant Science	Animal Science	Agric. Economics	Food Science
Plant nutrition and Fertililization	*Animal Breeding*	*Farm and Agrobusiness Management*	*Food Chemistry*
Fodder Crop Production and Crop Physiology	*Breeding Biology*	*Agriculture Market and Policy*	*Food Technology*
Agronomy and Plant Breeding	*Animal Nutrition*	*Food and Development Economics*	*Food Microbiology*
Applied Entomology	*Nutrition and Biology*		*Food Engineering*
Phytopathology	*Physiology and Animal Husbandry*		*Dairy Science*
Biochemistry and Physiology			*Human Nutrition*
Plant Genetics			
Developmental Biology			
Experimental Stations (3)			
Swiss Centre for International Agriculture			

Figure 2 Department of Agriculture and Food Sciences

The FRS and the D-AFS are at the core of the Swiss NARS. But there are more institutions envolved in agricultural research, extension and education:

Research Institute of Organic Agriculture ("FIBL"):

The Research Institute of Organic Agriculture is a private research foundation, that was founded in 1973. Today, it is mainly financed by the Confederation (1997 about 2.2 Millions Swiss Francs per year). The Institute of Organic Agriculture has seen a period of strong expansion, which is related to the new orientation of agricultural policy in 1992.

"Universities of Applied Sciences" ("Fachhochschulen"):

In 1997, with the enactment of the new Law on Universities of Applied Sciences ("Fachhochschulgesetz"), three of the former Agricultural Engineering Schools (see the following paragraph) were transformed into "Universities of Applied Sciences". They are maintained by intercantonal concordates, and get support from the Confederation (33%). The "Universities of Applied Sciences" are under supervision of the Federal Office for Professional Education and Technology (FOPET), which is located in the Federal appartment of Economic Affairs like the FOA. This development is part of the Swiss strategy to improve international competitivity and mobility of Swiss professionals, especially within the EU. The new "Universities of Applied Sciences" are kept to extend their activities in applied research and development.

Agricultural Education, Public Advisory and Extension Services:

Education, advisory and extension services form the nearest link between research and national agriculture. In general, own research activities are not important.

Agricultural colleges: At present, Switzerland has a total of 29 agricultural colleges. They are a matter of the cantons, but receive financial assistance from the Confederea-tion.

Engineering Schools: There are six Engineering Schools which offer agricultural or agriculture-related courses. They are cantonal or intercantonal institutions, but get financial support by the Confederation.

Cantonal Advisory Services: They are a matter of the cantons, but get financial support from the Confederation. There are great intercantonal differences in the financing system. In 1994, there were about 700 full- or part-time advisors all over Switzerland (IDA-WI 1994, p. 17). Many of them are teachers at agricultural colleges.

Interregional Information Centers: Ther are two Information Centers, which are managed by the Swiss Association for Advice to Agriculture ("SVBL"). They employ around 80 people. The annual support from the Federation amounts to about 8 million Swiss Francs.

In 1998, they aggregate Federal expenditures for supporting education, and advisory and extension services in the cantons amounted to arount 70 million Swiss Francs. The financial assistance is differentiated according to the financial potential of the canton (22-38%; advisory services in the mountain areas 40-65%).

Environment

To the environment of the Swiss NARS belong other National Research Institutions at University Level, International Research Institutions and Programmes, Private Advisory Services and Private Research:

Other National Research Institutions at University Level:

To the traditional research partners at the university level belong the Faculties of Veterinary Medecine (Bern, Zurich), the Departments for Geodesy (at the SFI-TZ and the SFI-TL), for Forest and Wood Sciences (at the SFI-TZ) or the Swiss Federal Institute for Environmental Science and Technology (SFI-EST). In the last years there was a growing interest in agriculture related research in other research institutions. This interest is closely related to environmental effects of agricultural production. To such new partners or rivals in research belong the Department of Environmental Sciences (at the SFI-TZ) or the Swiss Federal Institute for Forest, Snow and Landscape Research (SFI-FSLR).

Finally, since 1975 the Swiss National Foundation[1] carries out National Research Programmes ("NFP"), that focus on important contemporary problems and that are interdisciplinary oriented. The subjects are formulated by the Federal Council. Until now, many of these Programmes were relevant for agriculture. This explains the regular participation of agricultural research institutions in National Research Programmes.

[1] The Swiss National Foundation is a research institution under private law, that is almost completely fincanced by the Confederation.

International Research Institutions and Programmes:

Participation in international research programmes and international research cooperation are increasing. This is not only the case for research at university level (D-AFS), but also for nationally oriented applied research in the FRS. E.g. are COST-Projects or participation in EUREKA-Programme (IDA-WI 1994, p. 32). Participation in EU-Research Programmes will further increase with the expected realization of the bilateral agreement on scientific and technological cooperation between the EU and Switzerland, that was paraphed in Switzerland in February 1999. Finally, with the establishment of the Swiss Centre for International Agriculture, the participation in the CGIAR-System is increasing in tendence.

Private Advisory Services:

Switzerland has a large number of agricultural and farming organizations. They are involved in consultative bodies for applied research (Swiss Federal Office for Agriculture 1999, p. 9). Farming organizations get also financial support by the Confederation. In 1990, this support amounted to approximately 2 million Swiss Francs. With the partial liberalization of agricultural markets, their role might increase.

Private Research:

Private research activities for national agriculture are almost negligible. The only private research institute which meanwhile is almost completely financed by the Confederation is the Research Institute of Organic Agriculture.

The big private industries like Novartis or Nestlé are clearly oriented to global markets. Their global investment in research & development are a multiple of the research expenditures of approximately 100 million Swiss Francs by the Swiss NARS. In 1998 the investment amounted to 729 million Swiss Francs for Novartis (Agribusiness) and to 807 million Swiss Francs for Nestlé. Private agricultural research by big multinational industries is of little importance for national agriculture, but of importance for national economy.

Cooperation within the NARS

The central institution for coordination has been established with the Main Division Research and Advice (MDRA) in the Federal Office for Agriculture in 1993. The FOA/MDRA are charged to coordinate agricultural research within the Swiss NARS.

To help the FOA in coordinating agricultural research between the FRS and the D-AFS, an agricultural Research Council (RC) was established in 1995 (revised Regulation about Agricultural Research). The Council consists of maximum 11 members, among them minimum one representative of the Swiss Federal Institute of Technology Zurich and the FOA. The Council functions as an advisor to the FOA/MDRA and the Council of the Swiss Federal Institutes of Technology (Kurath 1994, p. 6).[2]

The Counseling Commission for the FRS ("Beratende Kommission für die landwirtschaftlichen Forschungsanstalten") is responsible for the operative coordination within the FRS.

The FRS and the "Universities of Applied Sciences" are coordinated by a framework contract (1997).

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[2] The Council of the Swiss Federal Institutes of Technology ("ETH-RAT") is responsible for advicing the Swiss Federal Council in the management of the two Swiss Federal Institutes of Technology (Zurich and Lausanne).

Apart from that, there are a number of permanent and temporary working groups and academic fora, which have coordinating functions, e.g. Consulting Commission of the Institute for Animal Science (SFI-TZ), Consulting Commission of the Institute for Plant Science (SFI-TZ), Swiss Society for Plant Sciences, Swiss Society for Animal Breeding, Swiss Society for Agricultural Economics and Agricultural Sociology, Swiss Society for Phytopathology.

Summarized, cooperation within the NARS was previously rather informal than institutionalized and depended from personal relationships (IDA-WI 1994, p. 21f.). This may be an indirect result of the smallness of the Swiss NARS, which facilitates communication and information exchange. The relevant actors know each other, even beyond disciplinary limits. Therefore, it is expected that the importance of informal cooperation and personal contacts won’t become less in the future although with the restructuring formal cooperation became more important.

Appendix 2: Some Background information to the Swiss NARS – Origins and development

In the beginning, Swiss agricultural policy was dominantly research policy. The objective of the first law on agriculture (1892) was the promotion of agricultural research in Switzerland (Rieder 1991, p. 178). Although there was a strong growth of expenditures for public agricultural research and advice services after World War II, the relative importance of research as a part of agricultural policy has changed significantly.

At present, the Swiss NARS is undergoing a phase of reduction and restructuring. This is firstly demonstrated for the aggregate expenditures for public agricultural research and advice services of the Federal Office for Agriculture (a) and secondly for the Federal Research Stations (FRS) (b). A similar development can be observed in agricultural research at the university level (c). Finally, a chronology of the development and of the institutional changes is given (d).

a) Federal expenditures for agricultural research, and education and advisory services

The investment in research went hand in hand with the extension of education and advisory services (fig. 3). We can distinguish four Phase in the development of expenditures: 1960-1975 they grew steadily, 1975-1985 growth slowed down, 1985-1992 they grew again with very high rates. Since then the expenditures for agricultural research have been frozen, and those for education/advice have been reduced.

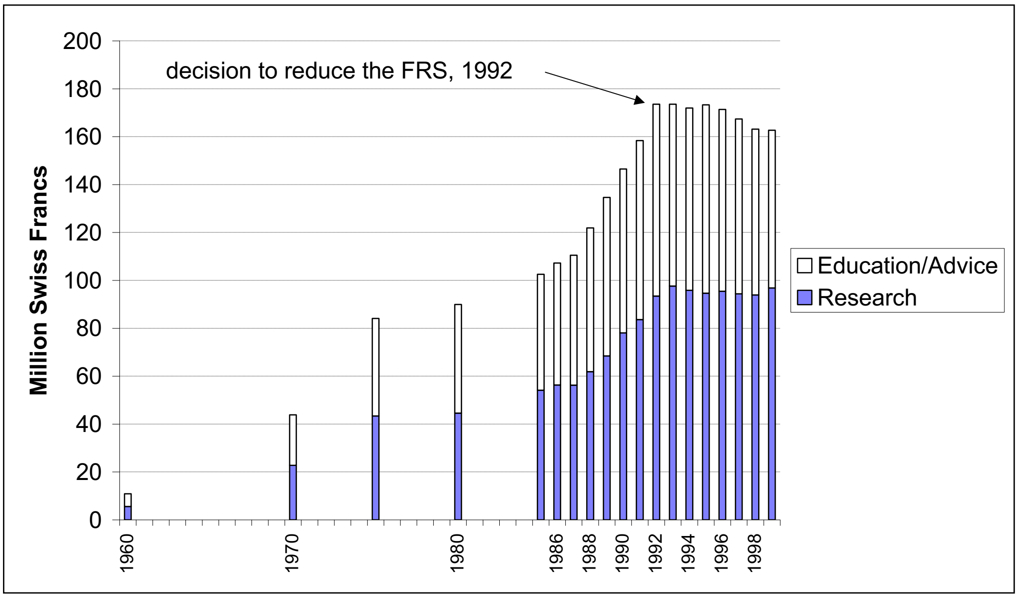

Figure 3 *Development of Federal expenditures for agricultural research (FRS), and education and advisory services 1960-1998 (1999, budget) (only operating costs, without investments)*

In total the expenditures have been stabilized on the level previous to reform in 1991. This is the effect of the decision of the Federal Council in 1992/1993 to reduce the costs of the FRS by 13,5% in the following years (IDA-WI 1994, p. 17). In total agricultural research funded by the Federal Office for Agriculture is to be reduced by 25% in the year 2001 compared with 1993 (Federal Office for Agriculture 1999, p. 2). The main reason for this turning point was the growing household deficit (Kurath 1994, p. 4). The reduction is seen as the beginning of a long-term renewal process of agricultural research (IDA-Wi 1994, p. 20). Between 1990 and 1998 the staff of the FRS was reduced from 813 to 721.

Measured against the total of expenditures for agriculture, the percentage for research is almost negligible. Since 1960, this percentage remained below 3%. In this context it is noteworthy that the budget for agricultural research and extension is excluded from the Federal decision about the means for agriculture in the years 2000-2003.[3]

b) Federal Research Stations for Agriculture (FRS)

In 1890 the first FRS, the „Federal Research Station for Fruit-Growing, Viticulture, and Horticulture", was founded. But only after the experiences of two World Wars, investment in agricultural research significantly augmented. 1963-1975 the parliament allocated 268 billions Swiss Francs for enlargement and transfer of the FRS. The growing direct engagement of the Swiss Confederation in agricultural research has to be seen as a central part of the national defense policy. Apparently, there was a general consent about the necessitiy of stimulating national agricultural research. In the periodic reports about agriculture to the parliament,[4] a calling in question of the investment policy is firstly mentioned in 1976. The critic related to the question, if the expansion programm stood in a reasonable proportion to the economic importance of the agricultural sector (Schweizerischer Bundesrat 1976, p. 73).

In 1969 the last of totally seven FRS, the „Swiss Federal Research Station for Agricultural Economics and Engineering", was inaugurated. This marked the beginning of a new Phase in agricultural research. For the first time, economic questions were addressed by the public agricultural research. The remaining six FRS had all worked on increasing agricultural productivity. The results, measured in productivity growth, are impressive. On the aggregate level, physical agricultural production has nearly doubled between 1939 and 1990, while the agricultural surface simultaneously had been reduced. On the level of single products, Switzerland belongs to the countries with the highest yields per hectar and per animal.

In 1996 one of the seven FRS („FRS for Agricultural Chemistry and Environmental Hygiene") was closed resp. transformed in the „Institute of Environmental Protection and Agriculture" and integrated into the former „FRS for Plant Production" that was reorganized and renamed to „FRS for Agroecology and Agriculture". This reorganization had been preceded by political confrontation. The conflict had emerged from the fact, that since 1973 the former „FRS for Agricultural Chemistry and Environmental Hygiene" had been charged with environmental research by the Confederation (Fifth Report on Swiss Agriculture 1976). The reorganization demonstrates the change of the research strategy and priorities of the FRS. All of the FRS are appointed to promote research for ecologically sustainable production systems by the completely revised regulation about agricultural research 1995 („Verordnung über die landwirtschaftliche Forschung vom 8. Nov. 1995"). Environmental research shouldn't be the task of one specialized FRS but of all FRS. At the same time, each FRS is assigned in its special field a competence centre for all Switzerland.

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[3] In the new law on agriculture (1998), it is demanded to secure the means for agriculture for four years at the time. The means for 2000-2003 were passed through the parliament in spring 1999.

[4] Until now there are seven reports from the following years: 1956, 1959, 1965, 1969, 1976, 1984, 1992.

At the beginning of the year 2000, the institutional organization of the FRS will be basically changed according to principles of New Public Management. The FRS work result-oriented („ergebnisorientiert“). They get an obligation to perform („Leistungsauftrag“) on the one hand, and a global budget on the other hand.[5] They have to present four years working programs which are evaluated by the Research Council and approved by the Federal Office for Agriculture.

c) Agricultural research at the university level

While research at the FRS is applied research in order to enhance productivity and to improve economic performance and – recently ecological sustainability – research at the university level is basic research.

Agricultural research at the university level started in 1871 at the Swiss Federal Institute of Technology in Zurich. The foundation of the Department for Agriculture happened in the time of the European agricultural crisis (cheap import from overseas) on the one hand, and the large-scale melioration and draining of Swiss marshs, that could not be cultivated before, on the other hand (Rieder 1991, p. 187). Until today the Department of Agriculture and Food Sciences has remained the only agricultural research establishment at university level.

Between 1960 and 1985 the faculty expanded, which is visible in the number of students in fig. 4.

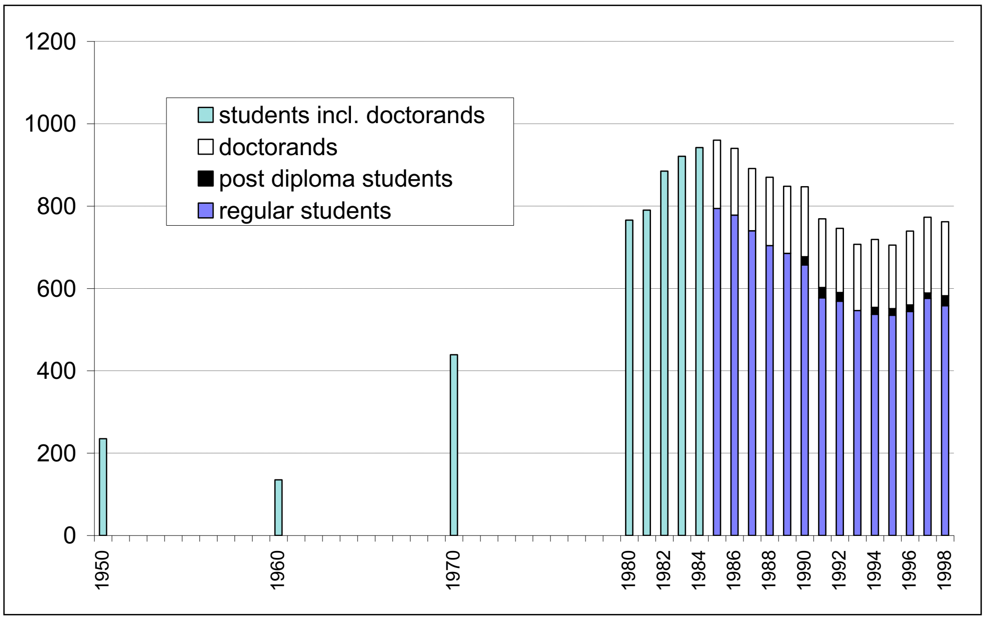

Figure 4 *Development of number of students at the Department of Agricultural and Food Science 1950-1998 (1950-1984 total, 1985-1998 disaggregated)*

In that period, the relative significance of the agricultural faculty, measured against the percentage of students, increased from 3.2% (1960) to a maximum of 11.1% (1982). Since then, the percentage of agricultural students has decreased to 6.4% (1998). The development of the number of students can on the one hand be viewed as an indicator for the decreasing demand for agricultural research staff in public and private research and extension institutions. On the other hand they also express the general interest of

[5] In the Swiss administrative reform it is called „Führen mit Leistungsauftrag und Globalbudget“ („FLAG“).

society in agriculture. The peak in the number of agricultural students in the eighties is also known as the „green wave“.

While previously the majority of students came from farm families, their percentage diminished continuously with the time. On the one hand, the decrease resulted from the „migration“ of potential agricultural students to the newly founded Department of Environmental Sciences. On the other hand, part of the “wave” must be explained with demographic development: Between 1965 and 1975, in Switzerland a drastic reduction of the birth rate took place.

Measured against the funds, the significance of the agricultural department is subproportionate. In 1990, the department immatriculated 7.6% of all students and used 5.1% of all funds of the Swiss Federal Institute of Technology. Until 1998, this percentage fell from 5.1% to 4.1%.

In the last years, there is a growing interest in environmental research questions. An analysis of the research projects in the Department of Agriculture and Food Sciences and the Department of Forestry showed, that about 40% of the projects explicitly dealed with environmental aspects (Reports of Institutes and Laboratories 1995).

There are also efforts to strengthen interdisciplinary research with other departments. An outstanding example is the „Polyproject PRIMALP – Sustainable Primary Production in the Alpine Region“, which started in 1997 and which lasts over five years.[6] Polyprojects are interdisciplinary research projects funded by the Swiss Federal Institute of Technology in which various institutes from engineering, natural and social sciences of the Federal Institute participate.

The reorientation of research priorities of the Department of Agriculture and Food Sciences is indicated in the “Vision and Goals” that have been published in the context of the “Planning Phase of the SFI-TZ 1996-99” in 1994. In the publication, two uniting research goals for all four Institutes are designated: They are “Sustainable Agriculture” and “World Nutrition”. The Swiss Centre for International Agriculture, which was founded in 1993 and which is open to individual and institutional members inside and outside the Swiss Federal Institute of Technology, is a result of this strategy. On the other hand, research priorities are put on gene-technology and molecular-biology. The enlargement of research subjects was accompanied by the creation of two new courses of studies, Agro-Ecology and Agro-Biotechnology. They are offered in addition to the traditional specializations for Plant Science, Animal Science, and Agricultural Economics. These enlargements were realized without additional resources. At the same time, a reduction and reorganisation of the experimental farms of the D-AFS was decided. Already in the preceding “Planning Phase of the SFI-TZ 1992-95”, the number of professorships had been reduced by two (1 agricultural economics, 1 statistics).

In 1994, the Council of the Swiss Federal Institutes of Technology (“ETH-RAT”) criticized, that the future strategy of the D-AFS, the way it was described in the “Planning Phase of the SFI-TZ 1996-99”, wasn’t yet compatible with the prescription “Reduction or Transfer”. The Council charged the president of the Swiss Federal Institute of Technology Zurich to revise the planning in agronomic research and education. Special emphasis should be given to the coordination with the FRS and the future Universities of Applied Sciences. The savings through synergies and rationalization should amount to 10%.

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[6] For more information look http://www.primalp.ethz.ch.

As a consequence, in 1995, the D-AFS was evaluated by an external committee. The result was that research and teaching at the D-AFS are on a high level and that the existence of agricultural and food sciences at the Federal Institute of Technology Zurich is justified. Possibilities of improvement were identified concerning interdisciplinary research and a stronger focus on basis and conceptual research (Lehmann 1996, p. 12).

The financial effects of these developments are shown in fig. 5. The regular Federal funds for the D-AFS have been frozen. The slight increase of total funds is caused by the „other funds“[7]. In 1998, the Department of Food and Agriculture had an overproportionate percentage of "other funds" (21.6% compared with 14.5% for the Swiss Federal Institute of Technology in total). In the development of funds the decreasing importance of agricultural research within the Swiss Federal Institute of Technology is expressed.

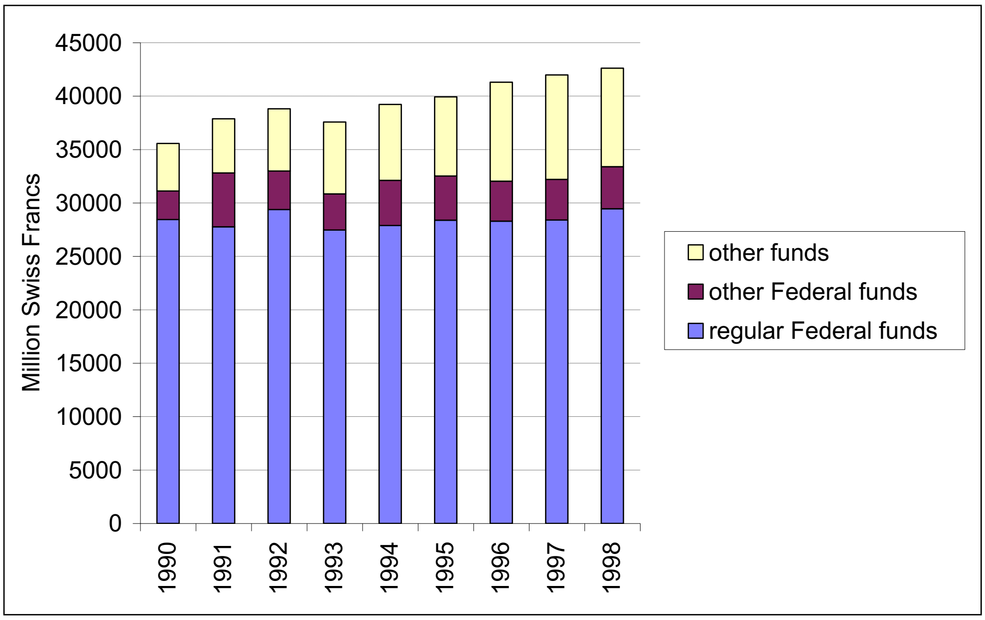

Figure 5 Development of funds of the Department of Agricultural and Food Science 1990-1998

The changes in the Department of Agriculture and Food Science is to be understood in the context of the ongoing reform process of the Federal Research Policy on the one hand, and the reorganization of the Federal administration ("Governmental Reform 93") to improve the performance of the public sector on the other hand (Bundesamt für Bildung und Wissenschaft 1997, p. 17):

- In Switzerland, the percentage of public research & development expenditures as a whole is with about 25% subproportionate as opposed to comparable OECD countries. Considering enhanced research needs, the Confederation wants to increase the influence in research activities. Firstly, the Confederation regularly formulates research objectives of the Confederation (Bundesamt für Bildung und Wissenschaft 1985, 1990, 1997). Secondly, interdisciplinary research and research cooperation especially with industry shall be promoted. Thirdly, the public research expenditures

[7] To the „other funds“ belong a great variety of mostly also public financing sources, such as: Swiss National Fund (independent foundation under private law, that is almost completely founded by the Federation), Commission for Technology and Innovation (funding instrument of the Federal Department of Economic Affairs that finances only projects with 50% private participation), other Federal Offices, cantons and municipalities, foundations, industrie/private economy etc. For the Swiss Federal Institute of Technology in total, the percentage of industry amounted to 30.7% of the „other funds“, resp. of only 4.5% of all funds.

shall be increased in a differentiated manner. Agricultural Research belongs to those research subjects which are to be stabilized or even decreased. Fourthly, research results shall be better evaluated.

- In 1997, the Federal Council decided to give the Federal Research Institutes more autonomy (as mentioned under letter a) for the FRS). From 2000, the Swiss Federal Institute of Technology Zurich (and the annex Institutes) will be managed for own account and with an obligation to perform („Leistungsauftrag“).

d) Chronology of development and of institutional changes

In 1955, the regulation about vocational training and agricultural research („Verordnung über die Berufsbildung und landwirtschaftliche Forschung“) was enacted. The principal objective of the new regulation was to promote know how and technical progress, especially through financial support of the agricultural colleges and extension services in the cantons. Concerning the tasks of the FRS, it is only mentioned that they have to promote production and use of products (Art. 52).

In 1958 the Agricultural Research Commission (“Landwirtschaftliche Forschungskommission”) was established by the Federal Council and got the mandate to coordinate agricultural research, and especially, to promote cooperation between the FRS and the department of agriculture at the Swiss Federal Institute of Technology.

In the same year 1958, the „Swiss Association for Advice to Agriculture“ („Schweizerische Vereinigung zur Förderung der Betriebsberatung“) was founded. The members of the association are the Cantons and the farming associations, while it is funded by the Confederation to a great extent. The association established two information centers.

Only in 1975, the first regulation that concerns exclusively agricultural research, was enacted („Verordnung über die landwirtschaftliche Forschung“). In contrast to the regulation from 1955, more precise tasks of the FRS are mentioned (Art. 4): The FRS have to support agriculture to accomplish her functions in the economy, to promote productivity effectively (“nachhaltig”) through qualitative and quantitative improvement of production and use of products on the one hand, and through reduction of the costs on the other hand. New is also the mentioning of environment, not as an objective, but as a restriction: Ecological aspects should be respected adequately (“angemessen”).

One year later, in 1976, the Fifth Report on Agriculture was published (1976). It seems that for the first time the costs of agricultural research were called into question (p. 73). It was also the first Report, that dealt with environmental pollution (p. 72). Environment became a new research priority, which was then appointed to the former „FRS for Agricultural Chemistry and Environmental Hygiene“ (p. 74). In the Report was emphasized that research priorities were to be placed differently. Explicitly specified were product quality, economical production, Integrated Pest Management, Biological Production, and environmental protection.

In the same year, the first report about State and Objectives of Agricultural Research was published (Landw. Forschungskommission, Forst. Forschungsrat 1976). It had been written by the Agricultural Research Commission and was initiated by the Swiss Science Council, who was investigating the results and demands of national research in general.[8] In the recommendations for the future development of agricultural research a change of perspective is indicated (p. 77ff.): Agricultural production shouldn't be maximal but optimal, continuosly adapting to ecological, economical and social factors in a changing environment. Agricultural research should not only serve farm interests but take into consideration common interests of society. Moreover, the always faster changing world demands an increasing flexibility of the agricultural research system. Therefore, a periodical reorientation of research priorities is essential.

In the following years, this process continued. Perception of Swiss agriculture started changing in society and politics. This is documentated e.g. in the Sixth Report on Agriculture (1984). The effects of the change in perspective became visible in the second report of the Agricultural Research Commission, that was published in 1988. This second report goes farther in its conclusions and can be interpreted as the first official reaction on a changed environment for agricultural research (Rieder 1991, p. 182). The crucial normative statement in the report was that agricultural research shouldn't be a tool in the interest of only one profession, i.e. farmers, but that it has to serve the needs and demands of the whole society (p. 3). Especially emphasized or new are the necessity, firstly, of international research cooperation for the benefit of developing countries (p. 71ff.), secondly, of a better coordination within the NARS and of interdisciplinary cooperation with annex research institutions (p. 75ff.), thirdly, of a better communication of research results (p. 78ff.).

Effective changes were inititated few years later. At the beginning of the nineties, several problems had become so urgent that time was ripe for a profound reorientation and restructuring not only of agricultural policy, but at the same time of general Swiss research poliy and of public administration:

<u>Reform of agricultural policy</u>:

Commencement of reforms in 1992 signified a turning point in the Swiss agricultural policy environment. The primary focus of the reforms has been to partially decouple price and income policies and thereby reduce trade-offs between economical, ecological and socio-cultural objectives. To this end, prices were initially frozen or cut, and in 1999 guarantees for prices and sales were removed. In 1993, direct income payments were introduced. These are designed as factor subsidies (for land or animals) and are subject to farmers' compliance with certain environmental regulations.

<u>Reform of Swiss research policy</u>:

In the beginning of the nineties a new institution of research policy was established: the "Group for Science and Technology". This Group is responsible for the Federal Office for Education and Science and all the Federal Institutes of Technology and their annex Institutes. The basic idea is to strengthen top down elements in setting research priorities and to enhance efficiency (Keller 1991).

In that context, the concept of "Universities of Applied Science" was born. On the basis of the law from 1997 ("Fachhochschulgesetz"), there is a large reorganization of research and teaching in Switzerland. The objective of this "Tertiarization of the education system" is, to improve international competitiveness and mobility of Swiss professionals.

[8] In 1973 only, the Science Council hat published the first research report, which gave an overview about research in Switzerland.

Since 1998, the field of „Education, Research and Technology", that is located in two different Departments (of Home affairs, respectively of Economic Affairs) is reorganized. New is, that the strategic planning of performances and resources is jointly managed by the two departments for the whole field, applied agricultural research in the FRS included. A common budget („Querschnittsbudget") facilitates shifts between partial fields.

Reform of governing and administration:

The reform started in 1994 with the project "Government Reform 93". In 1997, the new law on organisation of government and administration (Regierungs- und Verwaltungsorganisationsgesetz, „RVOG") was enacted. It gives the Federal Council the competence to restructure the administration of the Confederation and to manage the administration according to principles of New Public Management.

These three reforms influenced the NARS and its environment drastically. The following enumeration is incomplete:

In 1992, the Federal Council decided to reduce the FRS.

In 1993, the Federal Office for Agriculture was reorganized and the Main Division „Research and Advice" was established. The objectif of the newly created division is to coordinate the FRS and to better integrate research with agricultural policy (Kurath 1994, p. 6).

Since 1993, the private Research Institute of Organic Agriculture is financed by the Federal Office for Agriculture on a contractual basis.

In 1993, an ad-hoc working group of the Federal Office for Agriculture published a first report about agricultural research, situation and problems. In 1994, the Interdepartemental Committee for Science and Research ("IDA-WI"), headed by the state secretary of the "Group for Science and Technology", set up a new working group and gave the mandate to revise and complete the report. The new and broadly composed working group was headed by R. Kurath, vicedirector of the Federal Office for Agriculture. The final report "Public Research and Teaching in Swiss Agriculture – Basis, Models and Measures" ("Öffentliche Forschung und Lehre in der schweizerischen Landwirtschaft – Grundlagen, Strukturmodelle, Massnahmen") was published in the same year. It is the basis for the reorientation and restructuring of the Swiss NARS.

Since 1994, the Information Centers are financed on a contractual basis (4 year contracts) according to principles of New Public Management.

In 1995, on the basis of the IDA-WI report passed the revised regulation about agricultural research („Verordnung über die landwirtschaftliche Forschung"). The revised regulation marks a turning point for research in different aspects. An outstanding innovation are the general objectives: Firstly, „agricultural research shall help to fulfill the objectives of the law for agriculture". Secondly, „it shall promote sustainable and competitive agriculture, that takes care of the natural resources soil, water and air and contributes to the conservation and enhancement of biodiversity". Further, the general competences of the Federal Office for Agriculture in setting research priorities and influencing research in the FRS have been enhanced.

As a consequence, in 1996, one of the seven FRS was closed. A Research Council was established. The FRS published for the first time a joint Inventory of Research Projects 1996-1999.

At the beginning of the year 2000, the institutional organization of the FRS and the D-AFS will be basically changed according to principles of New Public Management.