

# Managing the interfaces between science, industry, and society

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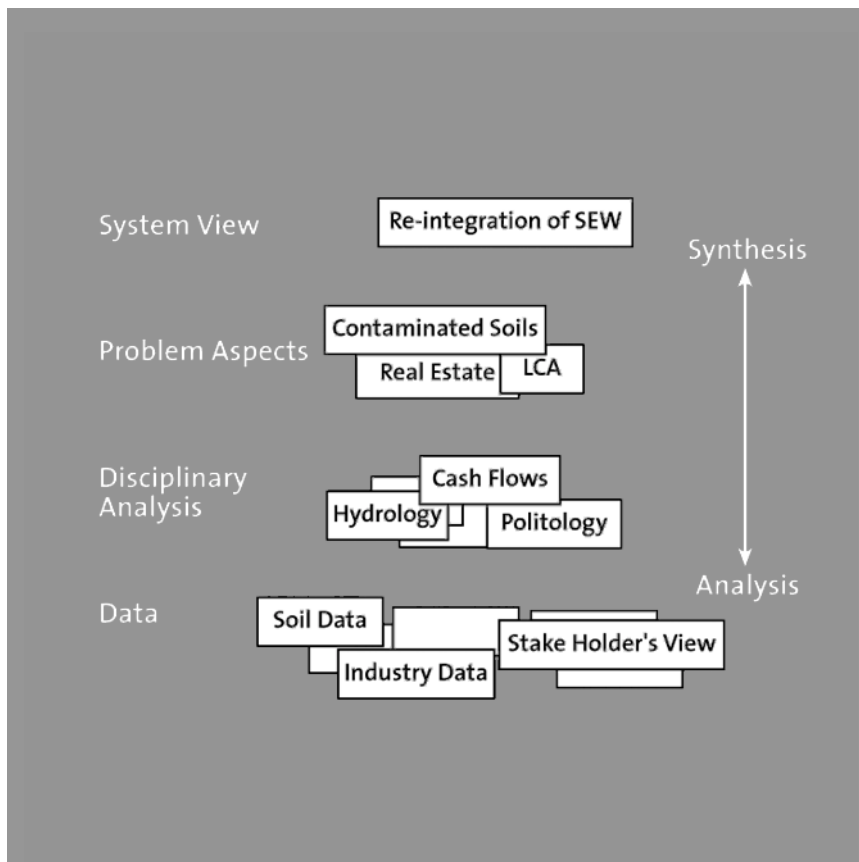
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## ■ Managing the Interfaces between Science, Industry, and Society

Harald A. Mieg

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# Managing the Interfaces between Science, Industry, and Society: Case Studies for Environment, Education, and Knowledge Integration at the Swiss Federal Institute of Technology<sup>1</sup>

Harald A. Mieg

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## Summary

There is a long tradition of combining engineering education with natural sciences at the Swiss Federal Institute of Technology in Zurich (ETH). In 1987, a new specialized course program was established: the Natural Environmental Sciences. By this way, a new type of Environmental Case Studies was developed in order to combine educational, environmental, and (area) developmental objectives.

This article exemplifies the 1995 case study on the Sulzer-Escher Wyss site in the City of Zurich. The study focuses on the problem of re-integrating urban industrial sites, involving problems of contaminated soil regimes as well as real estate investment policies. This case study brought along co-operations within sciences as well as between university, industry, and public authorities.

Case studies aim to start a problem solving process among the interest groups involved. It is shown that the case study project management requires an institutionalized interface based on three principles: 1. From project-planning to process-control, 2. Combining competencies through "modularized" co-operation 3. A new type of research.

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<sup>1</sup> Published as: Mieg, H.A. (1996). Managing the interfaces between science, industry, and society. In: UNESCO (Ed.), World Congress of Engineering Educators and Industry Leaders (Vol. I, pp. 529-533). Paris: UNESCO.

The Swiss Federal Institute of Technology (ETH) in Zurich was founded in 1854. It is still the main polytechnical institute in Switzerland, famous both for education and research. In 1987 a new department was created: the Department of Environmental Sciences. Its task was to face the new challenge of ecological problems which threaten our societies and industries [1].

Within the Department of Environmental Sciences, a special type of case study was developed involving a new kind of co-operation between university, industry, and other interested parties. The case study is conducted by the (independent) Chair of Environmental Sciences / Natural and Social Science Interface (UNS). We present the UNS-case study not only in order to give an example of co-operation, but also to show the functioning of an university-based institutionalized interface designed to integrate the aims of research, industry-relations, and environmental protection.

UNS-case studies are concerned with "ill-defined" problems with environmental aspects. They benefit from the human and knowledge resources of the ETH. They have three main aims:

**Education** . All students of Environmental Sciences have to work together on one project in their fourth year. The educational aim is to improve the cognitive competencies in mastering complexity and to enhance the "environmental problem solving ability" [2].

**Research**. Developing scientific methods for integrating knowledge from different disciplines and different types of sources (science, federal offices, industry, people involved...)

**Problem solving** . The case study should support the problem solving process and foster local sustainable development.

Previous and ongoing case studies:

- 1991 Renaturation of the river Birsig - Aquatic Ecology
- 1992 Waste and waste management - Case Study Winterthur
- 1993 Municipal environmental policies - Aarau/Arbon
- 1994 Sustainable agriculture - Perspective Grosses Moos
- 1995 Re-integration of industrial sites - Sulzer-Escher Wyss
- 1996 New environmental qualities in urban planning - Zurich North
- 1997/98 Sustainable regional development - Klettgau

The special strength of the case study lies in its integrative, encompassing view of the problem. As an example we present the 1995 case study: re-integration of an industrial site, the case of Sulzer-Escher Wyss in Zurich [3].

## The Case

Founded in 1805, the Escher Wyss plant produced steamer ships for the Swiss lakes. In 1969, Sulzer, an internationally operating manufacturing-holding, merged with Escher Wyss. Subsequently, the Sulzer-Escher Wyss underwent an almost typical development. The core problem now arising for Sulzer-Escher Wyss was threefold:

**The historical change of industry** . Industrial production became more efficient and more internationalized. The last steamer ship left Escher Wyss a long time ago. In 1987, the foundry on the Sulzer-Escher Wyss site came to an end. Heavy industry was no longer profitable in Zurich. The remaining turbine production was modernized. The space actually used for production shrunk. There was no need for new production space on the Sulzer-Escher Wyss site. Founded as a factory next to the old town of Zurich, the site now became part of the growing city.

**The decline of the market for office space in Switzerland**. In the Eighties, the Swiss construction industry faced a substantial crisis. The construction industry together with Swiss banks and real estate owners saw a chance for investments in office space. Huge amounts of office space were built. Nowadays, there are millions of square meters of unused office space in Switzerland. The profit calculations for the reuse of the Sulzer-Escher Wyss site have lost their basis. The estimated value of the site, 2 to 3 billion Swiss francs, cannot be realized in the present real estate market situation.

**Contaminated soil** . During the 100 years of production, the soil and buildings of the Sulzer-Escher Wyss site became contaminated. There are different ways of dealing with the problem. Total remediation of the contaminated soil is only one option. Technical solutions were sought.

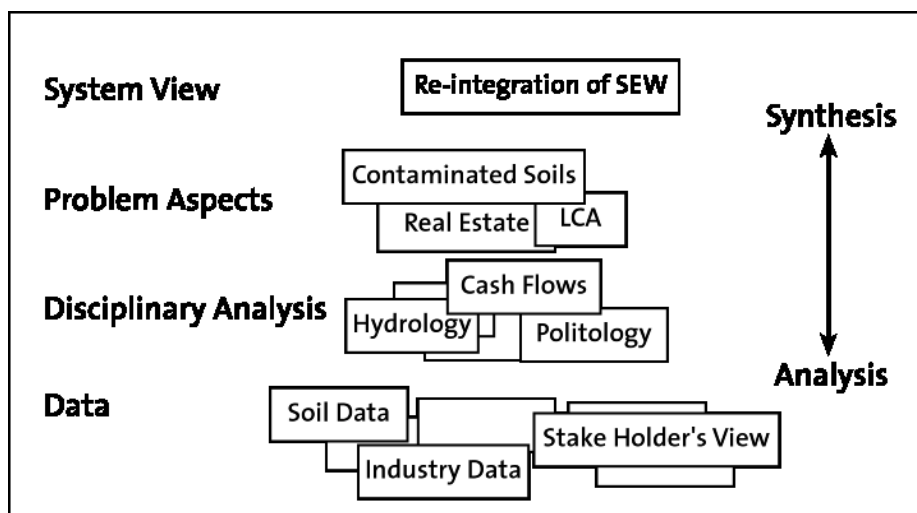


## The Study

The case study is **encompassing**. The study takes the system view of the case and the problem. It comprises all relevant aspects of the problem, e.g. the contaminated soils; the real estate interests; the public and environmental view. The study also comprises different data sources, e.g. from science, industry, and other parties involved.

The study is based on **scientific methods of knowledge integration**, integrating the data from various sources. The study has four levels: 1. The (holistic) system view of the problem "reintegrating SEW" 2. The various problem aspects, e.g. the contaminated soils and the life cycle assessment of re-integrating scenarios 3. The disciplinary analyses, e.g. hydrology and cash flow analysis 4. The data from the various sources. The main work to be done in the case study concerns the second and the third level: to synthesize an understanding of the problem out of the data analyses.

The case study is a *process of expanding co-operation*. The study starts with a phase of preparation lasting more than one year. In this phase, all the necessary projects partners are contacted. The hot phase of the project, where all the students (about 100), researchers (about 30-50), and project partners (about 30-50) work together, lasts one semester (April to July 1995). The students work in groups of 5 to 20, guided by a team of professionals and scientists. Then there is another year of post-work, the results are summarized and the problem solving process is reinforced. In November 1995, there was a workshop called "area development negotiation", held with the interest groups in the SEW case.



## Co-operation

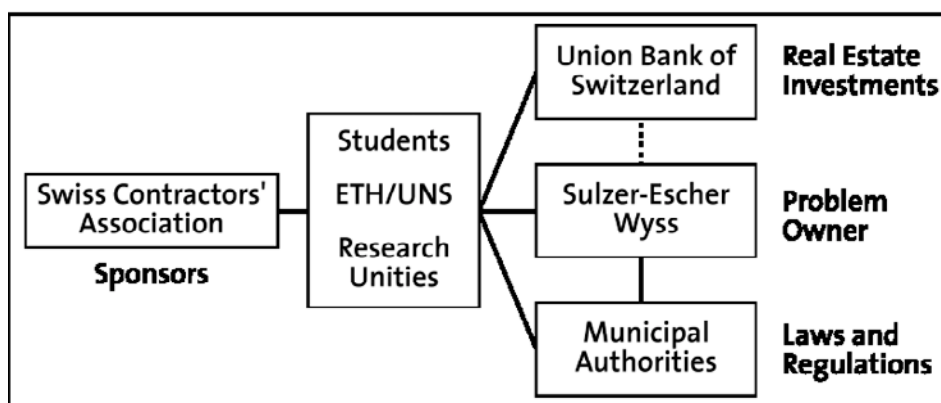
The case study is not simply a co-operation between university and industry, but between students, problem owners, scientists, and the public. The external partners of the '95 case study were:

- the problem owner: Sulzer-Escher Wyss;
- for the municipal authorities: the Zurich office for constructing;
- for the professional organizations: the Swiss Contractors' Association, and the Swiss Society of Engineers and Architects;
- for the investors: the Union Bank of Switzerland.

Within ETH, there was co-operation with the Department of Architecture and the Department of Civil Engineering.

There were three main bodies of coordination and co-operation for the '95 case study:

- The **Case Study Commission** (1 to 2 sessions weekly) manages and heads the case study. It consists of then to twenty students, as well as experts and the members of the Case Study Bureau.
- The **Case Study Bureau** (5 permanent members) provides professional project management.
- The **Steering Board** (1 session monthly) consists of representatives of all the project partners involved. They discuss project strategies and comment on the actual work done during the case study.



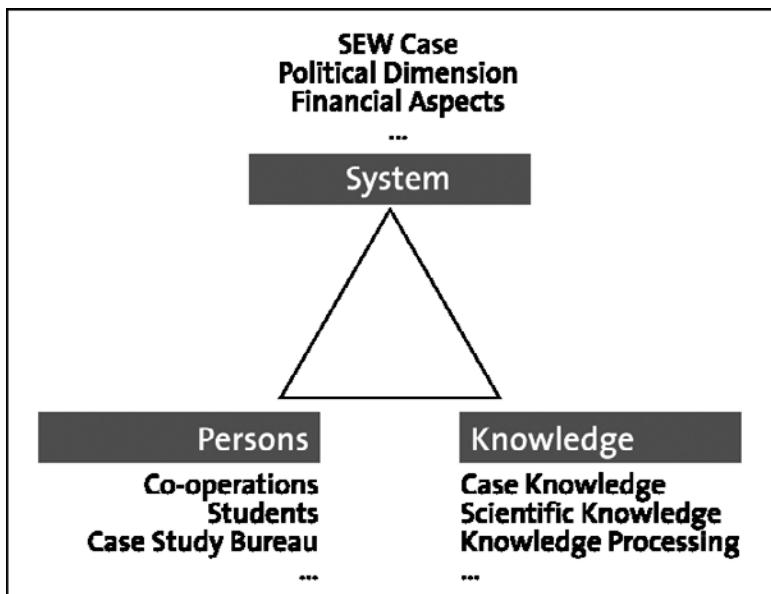
Products of the '95 case study were: a report describing the SEW problem and planning solutions [2]; a booklet with tables and working instructions for eco-controlling in construction; a video tape on sustainable architecture (addressed to students of architecture), to list only the most important products. Besides educational and research aspects, the results of the '95 case study must be seen from the view point of the different partners. As the Sulzer-Escher Wyss site is one of the biggest real estate investments in Switzerland, every co-operation partner had an interest in obtaining information on the case and the feasible options for re-integrating the site.



But the case study aims at more than information. We have a saying: "**Products of a case study are products and processes**". The "area development negotiations" and the study itself have reinforced negotiations on the Sulzer-Escher Wyss problem. The study provides a platform for compromises and new ideas.

## The University-Industry Interface

The Chair of Environmental Sciences / Natural and Social Science Interface (UNS) not only is an interface between natural and social sciences, but also between university and industry on the one hand and between university and society on the other hand. In the case study, the co-operation is focused and structured for a certain time. A special project management is required. A balance has to be found between (i) the problem solution ("the system view"), (ii) the coordination of persons and partners involved, and (iii) the types and sources of knowledge and know-how needed.



We can characterize the case study project management by three principles:

**From project-planning to process-control** . In UNS-Case Studies, time is really short and the problem is "ill-defined". Therefore, the project cannot be planned in advance in every detail and project management focuses on the process [4]. Moreover, the case study has to live with the risk of wrecking some subprojects (e.g. because of unavailable data); the project management has to ensure that this risk does not impair the whole study. This would be impossible without a shared case orientation among all subprojects and project partners. If - in the course of the projects - problems arise, they can be settled by emphasizing the shared interest in the overall problem (that means the need of re-integrating the Sulzer-Escher Wyss site).

**Combining competencies through "modularized" co-operation** . Though UNS is an institutionalized interface, it is obvious that most co-operations are limited to the ongoing study. Moreover, for every partner and every expert involved, a special form of integration within the

project has to be created. For instance, during the '95 case study, the Union Bank of Switzerland paid an investment expert to tutor a student group, the Sulzer-Escher Wyss assigned one employee as a guide for all on-site visits, the Swiss Contractors' Association delegated a member as a permanent consultant and so on. Top level managers of the co-operating partners were members in the Case Study Steering Board. The case study does not integrate their participants totally (even the students work only part time in these studies). Therefore, co-operation is modularized in a variety of groups that constitute the case study in their sum only [5].

**A new type of research.** To ensure high-quality work, UNS conducts own research in key topics, e.g. contaminated soil remediation and credit risks. UNS research is done by an interdisciplinary group partly integrated into the case study. One problem is time: basic research needs time to be planned and conducted. In order to integrate more research groups (within ETH and external), the 1997 and '98 case studies are linked. Thus planning time is expanded. Another problem consists in defining a new type of science which integrates co-operation with industry as well as environmental aspects. In this context, UNS is researching scientific methods of knowledge integration, e.g. scenario analysis [6]. This research is mainly conducted within the UNS-case study or through theses resulting from the case study.

To summarize: the UNS-case study is an university-based project on ecological problems supported by the Chair of Environmental Sciences / Natural and Social Science Interface (UNS), an institutionalized interface between university, industry, and society.

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