The Concept of Risk Prevention: A new Approach to the Implementation of Applied Ethics in Engineering Curricula

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Summary

How can Applied Ethics be integrated in the curriculum of universities of applied sciences? The concept of risk prevention outlined here offers a new interdisciplinary approach. This approach presupposes that ethical questions belong inherently to every innovation process. Therefore questions in the field of security and safety, risk analysis, risk assessment and engineering risk management form the basis of this concept. Applied Ethics is a competence of reflection which initiates interdisciplinary thinking.

1. Introduction

Zurich University of Applied Sciences Winterthur (ZHW) is the largest and oldest university of all Swiss universities of applied sciences (Fachhochschulen). In addition to the 2300 graduate students, a large number of postgraduate students study there. ZHW is structured in four departments:

- Department of Architecture, Design and Civil Engineering
- Department of Technology, Computer Science and Natural Science
- Department of Business and Management
- Department of Applied Linguistics and Cultural Studies

In these departments various institutes and centers of competence are active. The following outline is a contribution from the Center of Competence for Security and Risk Prevention, which is part of the Department of Technology, Computer Science and Natural Science.

2. Legal Basis

The Swiss Federal Law on the Universities of Applied Sciences (Fachhochschulgesetz, FHSG) is the most important law for all degree programs. In article 4 of this law it is demanded that students should be qualified to:

- take on executive duties and social responsibility
- take on the responsibility for the preservation of the environment and the basic resources of human life (FHSG, Article 4, lit. c,d).

The conditions for the international recognition and accreditation of degree programs call for similar qualifications. The Accreditation Board for Engineering and Technology, for instance, demands:

'Engineering programs must demonstrate that their graduates have an understanding of professional and ethical responsibility' (ABET, Criteria 2000, lit. 3f).

These national and international requirements show very clearly that the focus 'professional and social responsibility of the engineer' should be a vital part of the curriculum. Although in this context the term 'responsibility' refers very clearly to the field of Applied Ethics, it is not that clear how Applied Ethics could be integrated in the curriculum.

3. Implementation of the legal requirements

In 1999 the Vice President of ZHW responsible for Development and Knowledge Transfer founded a task group This group had to develop a concept how these requirements could be implemented both in teaching and research. An interdisciplinary team, consisting of six engineers and two philosophers specialized in ethics, developed a concept. Below this Risk-Centered Ethics Concept shall be outlined.

3.1 The Risk-Centered Ethics Concept

'Modern technological acting can be summarized in contrast to acting within pre-modern technology as *acting under risk*.' (Gethmann/Sander (1999), 143)

The Risk-Centered Ethics Concept (Kuhn (2000)) is based on an analysis of the legal, social and economic conditions relevant to the curricula at Swiss universities of applied sciences. In order to consider these conditions as well as possible, a systemic theoretical approach of reflection is required. It is a fact, that all complex problems lead to conflicts of interests, goals or values. Well-known conflict potentials are problems such as stakeholder vs shareholder, economy vs ecology, security vs innovation

dynamics, etc. In order to recognize, to analyse and, if possible, to solve such conflict potentials, various methodical approaches of engineering, economic and social sciences are asked for. One of these methodical approaches is the discipline of Applied Ethics. In order to apply methods and contents of Applied Ethics as effectively as possible, an ethical-normative approach for the ethical reflection is required as a basis for making decisions.

In the task group different concepts for such a basis were discussed intensely. In this process various sustainability concepts were examined too. The group, however, realized that none of the existing sustainability concepts were based on a profound ethical-normative basis (CASS (1996)). In the ongoing discussion of sustainability this is still a central question, although today some approaches towards a normative argumentation exist. (Daschkeit (2002)).

In a second step various ethical positions were discussed and evaluated. The ethical-normative approach of Negative Utilitarianism, represented by scholars such as Günter Ropohl (* 1939), convinced most. (Ropohl (1996)). Negative Utilitarianism postulates that something can be called 'good' if it fulfils the criterion of 'the least suffering for the smallest number'. This definition is in analogy to the classical position of utilitarianism as it can also be found in Jeremy Bentham (1748-1832). Bentham defines the 'good' as 'the greatest happiness of the greatest number.'

Within the frame of technological innovation processes this ethical-normative basis implies that a technical innovation can be called 'good' if *the technology-induced risks are reduced to a minimum both in quantity and in quality*. This ethical approach is based on the condition that the reduction of risks in technical products and services is of central ethical relevance. The professional and social responsibility of the engineer (cf. ABET, Criteria 2000) manifests itself in his/her way of dealing with technology-induced risks.

The Risk-Centered Ethics Concept outlined here shows decisive advantages. On a philosophical level it has to be noted that the approach of Negative Utilitarianism is based on a profound ethical theory and coherent in itself. Further advantages of this concept can be found on the following levels:

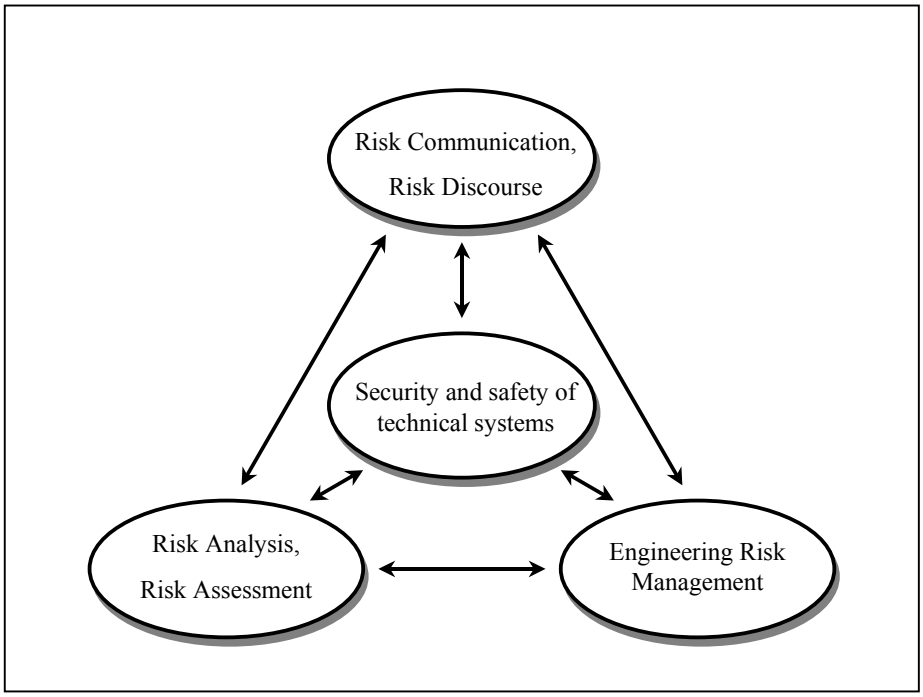
- Social level: In society it is generally agreed that new technical products and services should be as secure as possible and risks should be minimized.

- Technical-economic level: It is a fact that the quality of products ought to be as good as possible. One important criterion of quality is the security and safety of products.

- Legal level: For companies it is of vital interest to sell products and services which do not lead to liability insurance cases (e.g. product liability).

The focussing on technology-induced risks, however, implies that also the specific ethical reflection has to be focused on these questions both in content and methods. In recent years various contributions dealt with this specific problem and have shown new constructive approaches (Birnbacher (1996), Renn (1999), Nida-Rümelin (1999), WBGU (1999), 229-281, 306-315; Gethmann (2001)).

3.2 Risk Prevention: An Ethical Approach Based on Practical Experience



The Risk-Centered Ethics Concept forms the basis for the concept of risk prevention. This approach is the starting point for all activities of the Center of Competence for Security and Risk Prevention . The concept of risk prevention includes four fields of activities which are all based on the Risk-Centered Ethics Concept. Thus, these fields of activities are integrated in a comprehensive ethics concept, which makes it possible to take up implicit ethical questions within risk prevention in all four fields. Obviously, for the focus 'Risk Discourse' Applied Ethics is not an implicit but an *explicit question*.

4. Goals of the Center of Competence

The interdisciplinary approach of risk prevention forms the basis for all activities of the Center of Competence. The center focuses its main activities on education and R&D projects. In the context of this paper the goals for teaching and further education are presented and discussed.

4.1 Goals in Teaching and Further Education

The Center of Competence is a platform of ZHW, where lecturers, scientific assistants and external experts cooperate in interdisciplinary projects. An important goal is to initiate and carry out activities in teaching and further education. The students should be taught the following competences:

- to be able to analyse, assess and improve the security and safety of technical systems.
- in technologies with high risk potential (e.g. VT, bio safety, IT-security, etc.) to be able to assess risks (risk assessment).
- to be able to apply the basics of Engineering Risk Management.
- to know the principles of successful risk communication and to be able to apply them in practice.
- to understand the problems of ethical value conflicts and to know methods how these ethical problems could be solved.

These five goals show clearly that the teaching focus 'professional and social responsibility of the engineer' is a way of looking at specific questions which are inherent in engineering problems. Risk prevention is therefore primarily an *implicit approach to Applied Ethics*. The engineer comes to ethical questioning not by thinking in a different way but rather by thinking further! Applied Ethics can be understood as a specific discipline of reflection which has to be encouraged.

4.2 Goals in R&D projects

With regard to R&D projects the goals are analogous to 4.1, with the obvious difference that the people involved here are researchers rather than students. The interdisciplinary approach of risk prevention calls for an interdisciplinary combination of the research teams.

5. Conditions for the Implementation of the Concept

In analogy to R & D, the adequate implementation of this concept calls for lectures and courses given by interdisciplinary teams of lecturers. Only if the students are shown that lecturers cooperate in order to reach profound solutions, the students are ready to do the same. Only in this way 'ethical awareness' and so-called 'ethical proficiency' can be encouraged among the students.

At the moment 15 associated lecturers have committed themselves to the Center of Competence. This is a small number, seen in relation to the 2300 students. The Center of Competence officially started in May 2002 – and, naturally, keeps developing !– so, we have good cause for being optimistic.

Sometimes the cooperation between lecturers fails because, for instance, there is a lack of financial resources. If the lecturers are not guaranteed that there will be no financial loss because of their cooperation, the incentive is not very high. That is when idealism and personal commitment is asked for! Every university of applied sciences that has committed itself to ethical values, should be willing to provide the necessary frame conditions.

6. Experiences in Teaching and Further Education

During its period of development (1999-2001) the Center of Competence launched various pilot projects in teaching and further education. The most important results are listed here:

- 'Case studies in biotechnology': This lecture has already been given three times with great success.
- 'Information technology and ethics': Lecture with practical exercises – first time given in 2002.
- Postgraduate Course in 'Integrative Risk Management' (IRM): Part of the Postgraduate Degree Programme 'Integrated Quality Management' (IQM). This course has been run twice.

It is interesting to note that in the field of so-called key technologies (biotechnology, information technology, etc.) it is easier to initiate and successfully run such new courses. In the traditional fields of engineering sciences there seem to be fewer open questions! One encouraging and important result is that the students were highly interested in these courses.

At Zurich University of Applied Sciences Winterthur all courses will be modularised next year. The Center of Competence will launch new course modules that are based on the approach of risk prevention.

7. Critical Reflection

Compared to other ethics concepts the concept of risk prevention shows clear advantages. Concepts based on sustainability models have a top-down approach. The concept of risk prevention, however, represents a bottom-up approach. In many cases this approach is more pragmatic and also more effective: risk potentials are processed as far as necessary. Of course, it is not always easy to decide where the limits of the system are. Although the concept of sustainability and the concept of risk prevention

differ fundamentally, it is obvious that the two concepts complement one another. It has to be noted that the link between ethics and sustainability has often been realised. The conceptual link between risk prevention and ethics is less common. Thus the concept of risk prevention is a more innovative concept among Swiss universities.

It is highly interesting to ask how the present discourse on the Precautionary Principle, which is gaining importance, could be integrated in the risk concept outlined here. In this context the 'EU Commissionon on the precautionary principle' has published very interesting documents (EU (2000)).

It is gratifying to see that there is an increasing number of guidelines in European engineering associations which have an explicitly ethical foundation. A good example of this is the latest publication of VDI (VDI (2002)). Yet it is questionable whether such normative guidelines will be successful in the long term. Of course, comments of engineering associations showing an ethical commitment are to be welcomed. Yet in the future, not normative but rather process-oriented approaches with an iterative character might gain more acceptance, as Christian Hubig postulates. According to Hubig, top-down approaches such as purely normative concepts but also sustainability concepts will lead to a massive increase in the conflict potential between the competing values. This is the reason why it will be more difficult to find a solution. He therefore suggests replacing these concepts by discursive iteration methods 'until we can approve of the attitudes towards these values and their supposed consequences' (Hubig (1999)).

The concept of risk prevention has a good chance to follow this development because it is process-oriented and based on a specific bottom-up approach. It would have to be discussed whether the normative approach of Negative Utilitarianism would be endangered. Yet the prospects of keeping this approach are fairly good as long as there are engineers whose goal it is to produce secure products and services and as long as our society considers quality in technological innovations as crucial.

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