Ethics Quality Management

Yannick Julliard
University of Karlsruhe

This paper illustrates the possibilities of institutionalizing ethical decision-making in industrial enterprises. The concept of ethics quality management tries to open a path between theory and practice by defining the (ethical) responsibility of the parties involved in the development and application of new technologies. Analogies between total quality management strategies and ethical reflection are identified and methods from Total Quality Management are adapted to the ethical reflection procedure. The present concept tries to define the responsibilities of manufacturers and users of technology according to the degree of their involvement in the process of technology design and application/utilization. Given that the social dimension of technology holds a key role in ethics quality management, the social aspect of technology will be briefly discussed in order to reveal its impact on technical design, as well as the need to include the stakeholder's perspective in industrial design. In the author's view, social acceptance of new technologies can only be achieved if this perspective is included in the design process. Acceptance of a new technology in society is the base for its commercial success. The goal of achieving acceptance seems to be the pragmatic place where ethics and economic interests play a win-win-game.

Technology, Culture and Society

Any approach towards an ethics of technology depends on the concept of the technology behind it, i.e. which form of technology we are looking at and how it influences our everyday life. In order to give a basic understanding of the conclusions derived from the TQM approach, the underlying culturalistic concept will be presented briefly.

The objective of the culturalistic concept is the fact drawn from everyday life experience, that technology obviously is a societal need of humankind. In a societal perspective, technology may be considered as part of human interaction, enabling the coordination of human actions in a collective context.

The technologies found at specific historical stages and the manner in which they are employed depend on historical processes and cultural choices of the past. This means that technologies of the past and those of the present strongly influence the development of new technologies in the future (Julliard 2003).

In a culturalistic perspective, paramount importance is assigned to the interdependency of society and technology according to which technology is a central element of culture. Culture may be defined as the know-how required by humankind to cope with everyday life. For this purpose, humans use all kinds of technology. In this sense, we live in a world that has been transformed by man through the use of technologies, i.e. a culturalized world (Grunwald 2001; Hartmann & Janich 1996). Ethical questions arise, when technologies come into conflict with interest and action possibilities of different groups of society, and/or when new technologies need to be integrated into society, as this may involve the need for society to subject itself to a learning process. The basic concept presented here can be understood as a pragmatic approach against the background of discourse ethics developed by German philosopher Jürgen Habermas (1968).

Inculturalization of New Technologies and Ethical Relevance of Technology

New technologies are successively integrated into societal practice by means of an inculturalization process. Inculturalization has recently been modeled within sociology (Bijker & Law 1994). According to the social theory of technology, technology is integrated either through infiltration or a diffusion-like process (Grunwald 2000b), where a society is allowed some time to adapt to new technology; on the other hand, the development and integration of new technologies is caused by the needs and requirements of a society. For the field engineer, the question of whether a technology has been adopted by society through infiltration or whether this process is a revolutionary one is of secondary importance; the important question is where ethical reflection and sociological aspects should play a role in today's industrial decision making structures.

A look at the industrial practice shows that the modeling of the process of introducing a new technology to society has already partly been done e.g. in the field of industrial marketing strategies, where typical life-cycle analyses of products have been established over the years (Julliard 2003).

The objective of life-cycle-analysis is to define typical product cycles. The technical details of product types change rapidly (cf. different versions of one and the same product, updates, face-lifting in the car industry etc.), whereas the underlying principles (product generations) only change over long-term periods. New technologies typically arise over decades, e.g. every 30 to 40 years, depending on the technological development. This means that the diffusion of new technologies into society is more or less a step-by-step process. Through the diffusion of new technology into society, new action patterns are created and the new technology is combined with currently used technologies and the human action possibilities linked to these technologies. Linking technologies to action possibilities creates the technological texture of a society (Julliard 2003).

By looking briefly into the stories of successful and unsuccessful products, one may conclude that new technologies require two basic prerequisites: social acceptance of the product and the possibility to be integrated into the technological texture (Rammert 1993).

Ethical questions usually arise either when new technologies affect the normative framework of a society (cf. genetic engineering) or if technologies that are being used suddenly become problematic. The social aspect of technology has been largely overlooked by technology designers of the past, but it plays a key role with respect to ethics. The objective of ethics quality management is to ensure that ethical conflicts are considered as soon as they arise. A prerequisite for the achievement of this objective is the categorization of ethical conflicts based on the impact of technology on society.

The impact of a technology on society and the need for ethical reflection in the development and application of new technologies depends on who is, in fact, affected by this technology. I suggest two basic levels of ethical questions in the development and application of technology:

a) Bilateral level. This applies to all technologies where only producers and customers are involved in the use of a given technology and no third parties have to bear the potential risks. In this case, ethical questions may be solved between the manufacturer and the customer without the participation of society. Conflicts may be settled by and between manufacturer and user.

b) Societal level. Technologies which involve changes in the normative framework of society and which involve potential risks for third parties require ethical reflection with the participation of society. Such ethical conflicts can never be decided exclusively within a company.

Furthermore, a classification of the ethical responsibility of the parties involved in technological development is required in order to determine which questions may be solved within industry and which questions require the participation of society.

Total Quality Management and Ethics

Total Quality Management is a method focusing on the optimization of industrial processes under economic aspects. The Total Quality Management approach claims that customer satisfaction is a central value with absolute priority and assumes that achieving customer satisfaction automatically implies optimal economic results. In order to reach this objective, the entire company is submitted to a continuous optimization of all procedures within: the production, sales and after-sales process, with special emphasis on how they promote customer satisfaction. Measures have to be taken to improve the complete value-creation-chain step by step and to monitor the improvements.

In short, total quality management is structured according to the three levels Total, Quality and Management. The aspect ‘Total’ refers to the fact that all activities of a company are included in the optimization process, i.e. procedures, staff, management activity, suppliers and customers. The Total Management approach therefore implies a holistic view of the company and its relations as well as a procedural approach by continuously developing all activities further in such a way as to

increase customer satisfaction. For this purpose, the development of new technologies is a means of achieving customer satisfaction rather than an end in itself. The 'Quality' aspect refers to the objective of increasing the efficiency and effectivity of the company. In contrast to the classical interpretation of quality as 'product quality', the TQM approach considers 'quality' as a measuring device for the assessment of processes and management techniques with respect to customer satisfaction. The aim of the 'quality' part of TQM is to establish a structure in which all persons involved in the process do their job in the best possible way. The component management aims at bringing the entire company in line with customer expectations, i.e. to produce goods adapted to the customer's requirements instead of selling standardized products that do not entirely match customer needs. On a second level, management refers to the continuous restructuring of the company's procedures by checking whether there are redundancies, inefficient procedures etc. In a wider sense, the TQM strategy implies a broader view of how technology should be designed and moves from a product-oriented concept to a stakeholder perspective, which sees technology within the context of supplier, producer, customer and shareholders of the company.

In focusing on customer satisfaction as central value, a certain change in technology management paradigms takes place, as the customer regains importance as a human being, whereas technical skills are of secondary importance. Furthermore, the Total Quality Management philosophy also means that a company is regarded as a part of society with several interested parties, and therefore provides a starting point for the reflection of social implications of the company's activities.

The ethic quality management concept aims at enlarging the scope of TQM to involve the social implications of a company, i.e. more or less moving from a shareholder perspective to the larger stakeholder perspective. Total Quality Management and ethics have in common that an integral perspective is needed in order to achieve the intended goals. The process approach is mentioned in ISO 9001 chapter 0.2 as "necessary for an organization to function effectively, it has to identify and manage numerous linked activities" This is also true for engineering ethics, where it is useless if one focuses only on the ethical activity of individuals. To be effective, engineering ethics need to be integrated throughout the engineering process and involve the decision-making

parties. Similar to quality issues in total quality management, ethics tasks have to be fulfilled by all members of a company. Individuals may solve conflicts as long as their responsibility, effective action level and ethical competence are sufficient to solve a given problem. As soon as individuals are no longer able to solve the conflict, they need institutional support.

Ethics Quality Management (EQM)

I suggest Ethics Quality Management as a method aimed at companies and manufacturers to take social responsibility in the development and application of products and systems. It is based on an integral view of a company in a procedural approach, including the societal viewpoint, which sees a company as being embedded in a society to whose members it sells its products.

The general task of the ethics quality management approach is the identification and structured solution of ethical conflicts in the development and application of technical systems. Ethics can be regarded as a non-material social resource for companies. I refer to the resource paradigm under two aspects. Firstly, companies need a minimum acceptability for their products to be saleable. Socially unacceptable products usually bear economic disaster (Rammert 1993).

Secondly, companies need a fixed and stable normative ethical framework to which customers and manufacturers commit themselves. The importance of this ethical framework becomes apparent where it is not employed. Companies consider a lack of security for transactions or sales processes as a financial 'risk' leading, in turn, to higher prices and/or smaller revenues.

The task of ethics quality management is to focus on the acceptability of technology and products as a central value. To be successful, enterprises need acceptance of their technology, users to buy them, and a positive image. Companies can get into major trouble if certain products or methods of company's members suddenly become unacceptable. A case for this is the Shell Brent Spar Platform, where a technology suddenly became problematic with respect to society, while being perfectly 'legal'. The ensuing boycott of Shell fuel stations led to major economic losses.

Finally, by social pressure, Shell decided not to dump the platform into the sea, although it would have been 'legal' to do so. The case led to a learning process for the company.

In a company's view, acceptability of products and systems in the eyes of society is much more important than factual product success. Acceptance of products may be limited to the company's customers, but what really leads to social trouble is when methods, systems or products become unacceptable.

It seems that, at the moment, from a company perspective, ethical questions are reduced to the question whether the portfolio is acceptable to society. Lessons learned can be a basis for Ethics Quality Management. The main idea is to let companies select certain values to reflect their own corporate culture. Of course, those corporate values should be within the range of values accepted by society. By committing all members of the company to the set of values chosen to reflect the corporate culture, companies become transparent.

The Procedural Character of Ethics of Technology

The central position of this paper is that technology design in industrial processes is done via a decentralized structure involving individual decision-making within a collective context. So far, engineering ethics has focused mainly on the actions of individuals. Classical reflection patterns in engineering ethics focused on the individual engineers and decisions they have to take, as if they were the only group involved in the design process. In my opinion, the assessment of ethical claims of technology design must take into account the whole chain of technology development and use, as a procedure from design to after sales services. Basically, ethical reflection is needed at each step of the procedure, as conflicts may always arise.

On the other hand, technology design involves many steps backward and forward, with structured checks and retrials. In the ethical discussion of technology, it has been largely overlooked so far that establishing a technical system is done in a way that includes a lot of standards and test procedures. Furthermore, new technologies usually rely on older technologies that are still being used, and that are considered as non-

problematic by society. Technical systems are elaborated recursively; a solution to a technical task is achieved by trial-and-error methods and in step-by-step procedures. Ethical reflection needs to be carried out all along the procedure, while continually asking which person has which responsibility at which step of the process. Furthermore, an ethics of technology must include the user and the problem of misuse.

Repartition of Responsibilities along the Technology Design Process

When trying to integrate ethical reflection into industrial processes, one of the central questions involved is how to socially assign the ethical responsibilities to the involved parties. I try to follow a pragmatic approach by using the method how technical responsibility is assigned analogically for ethical responsibility. Whether this claim is suitable is, of course, subject to further investigation. The repartition of responsibilities follows the idea of assigned responsibility as a means of constructing responsibility by social ascription (Grunwald 2000a). Social ascription of responsibility may be done without considering personal fault. Following this concept, not every engineer has to continually think about all ethical tasks of the entire company, nor how he may take a global responsibility for the world upon himself, but he has in fact a limited responsibility, depending on his function and level of action.

It is the *responsibility of top management* to define the company's mission, its vision and the binding values for the enterprise. In doing so, it also defines the worldview to which the company subscribes. For big companies it may be advantageous to spread this definition on a global level, in order to define, both for the company as a whole and for a local area, which precise values are binding for specific situations of working groups and their respective working area. In multicultural holdings, it is even possible that global values are accompanied by a set of culture-dependent values, which are binding for national divisions only. Note that it is very important for global and local sets of values to be consistent. It is very important that global sets of values do not interfere with local ones. Furthermore, top management should consider a systems perspective that plays a role in the definition of goals and long-term strategies for the companies as well as long-term decisions. In those decisions, the social aspects are absolutely vital, due to the importance of acceptability. A company's top management has to establish a

framework that enables ethical decision-making by the staff and fosters ethical behavior of individuals. It has the ascribed integral responsibility for the company and its actions. Beyond the central responsibility of the top management, further areas have typical responsibilities. Generally spoken, the potential for alternative solutions decreases with ongoing technology design; therefore, ethical questions mainly play a role in the early project stages, where basic decisions about technological lines are made.

The *sales staff* works in an ethically sensitive area of technology development. They are responsible for a suitable choice of technology. As product specifications and the choice of a specific technology are closely related to values and strongly influence the actual technology development, ethical reflection is important. Corrections and changes in the product profile can be implemented much easier at an early stage of project management.

Typically, the potential for action and correction decreases with time. In the definition of constraints and performance of a technology, worldviews play a key role. For example, the design of a control system depends on whether this user is an expert or not. Depending on this, a product could be designed either in a failsafe version, if users are experts, or in a foolproof version. Moreover, perceptions of society of the future play a role in defining overall concepts (Bijker & Law 1994). Examples for this are the ecologically friendly society, paperless offices etc. It is extremely helpful if these views of society are explicitly defined within the company's code of conduct. More precisely, on a first level, the sales staff has the responsibility to ensure that the chosen product matches customer's expectations and is appropriate for the area of intended use. Therefore, customer requirements have to be identified and product constraints have to be defined. The societal perspective is that products must comply with the actual technology that is currently being used; further development may be necessary if problems with products in use arise. Furthermore, the sales staff may be considered as a warning and supervisory body. It may elicit a possible non-acceptance of technologies and, if necessary, take steps towards a further development of technology, or for entering into discussion with stakeholders who regard this technology as problematic.

The *basic and detail design working group*, which has to work out the technical system's basic and detail design, as well as the scope of works, is, perhaps surprisingly, not an area of special ethical sensitivity. It has to design the technical system according to the system specifications defined and agreed upon by the sales department and customers. Design engineers therefore are responsible for the material aspect of technical development (Moriarty 2000). If product constraints are clear, it is even possible that this group will not have to deal with ethical questions at all. Due to unforeseen and suddenly arising questions concerning the design, it may be possible that design engineers have to deal with ethical questions, when decisions are taken which refer to choices between alternatives. To a lesser extent, design engineers may be committed by society to design technology in such a way as to facilitate future improvement. Such a technology would be suitable for further development and can be seen as a starting point for sustainable development.

Test Laboratories in industry are a central area of ethical responsibility in societal perspective. Test labs have the responsibility for the engineering process ex-post. Technical systems are tested under ordinary and extraordinary conditions, as well as for the case of failure. After design and pre-qualification tests, systems are tested before they are shipped to the customer, and are tested again, at the commissioning stage, before being accepted and taken over by the customer. Frequently, the operation itself is preceded by several months of reliability run. Therefore, it is a myth that engineering ethics would be only a matter of concrete decisions of one individual. On the contrary, technology development takes place according to a recursive strategy.

Test procedures are part of that recursive strategy and systems undergoing the test procedures have to meet all kinds of requirements coming not only from inside, but also from outside a company. If a system does not meet the specifications defined in standards of customer, engineering associations and the manufacturer himself, new steps in design can be taken and the system may be improved by this procedure. In separating the design step from the system test step, and in assigning the different tasks to suitable staff, it is less likely that failures will not be discovered. Test labs have the ethical responsibility to check whether or not the test procedures defined in standards are adequate for the

technological product that is being tested. If the test procedure is inadequate, they have the duty to inform superiors and the respective authority defining this standard. For entirely new technologies, test labs must define the test routines themselves and may be obliged to assist engineering associations and national standard boards in their work (cf. the working groups and Task forces in organizations defining those standards) The duty of test labs may be enlarged with respect to a societal perspective, where test labs and marketing should be obliged to check whether or not new technologies may be integrated into societal practice.

Commissioning, under ethical aspects, is a matter of correct risk transfer and is usually an ethically non-sensitive area, if all other areas involved have functioned correctly so far. Methods of correct risk transfer have been used in the past e.g. procedures for putting technical systems into operation step by step. Engineers in this area have the duty to familiarize users with the said technology and to prevent foreseeable misuse.
The *users* are responsible for the use of technology and for all negative effects resulting from the use of technology beyond its area of application. Users must be able to control their chosen technology and employ suitably skilled and qualified staff to work with it. Furthermore, their tasks also include maintenance and correct dismantling of technologies. If the problem of a non-acceptance of technology by society arises, they have to initiate a discourse process involving society and manufacturers.

Structures and Institutions

In order to assign the responsibilities along the technology development process, several institutions are necessary. These institutions should foster ethical action of individuals and coordinate conflict-solving processes. The main idea is that conflict solving should only involve parties affected by this conflict, and that it should be done in a structured way. The following draft for institutions in ethics quality management has to be discussed in the future and it might well be that structures need to be modified again and are not suitable for every company. In the following I refer to a case study in a systems engineering company working with computer systems, but the EQM idea has also successfully been applied to other areas such as paper industry.

At an *individual level*, EQM requires ethically educated engineers and other staff members. The level of ethical education should correspond to the level of action of an employee. Engineers do not need to be ethical experts, but they need a minimum of ethical understanding in order to be able to identify conflicts. All members of a company should be committed to the common ethical standard of the company and/or to the standard of their professional organization. The main task of individuals is to identify and communicate existing or arising conflicts. They may also solve ethical conflicts, if those are of the business-as-usual type problems that can be solved by individuals. Whether this is the case, or whether a given problem can only be solved by a larger group has to be defined in the company's standard of ethics. As members of society, individual engineers should be able to provide technological counseling for society. Help-lines may be necessary for anonymous calls.

Ethics Task Forces are the next institutional level. Ethics Task Forces consist of a group of engineers working in the same area. This task force reflects a kind of miniature society. Task forces have to define and adapt the global values of the company into the concrete situation.

In doing so, they define a kind of groups ethics for working groups. Furthermore, they have to solve all conflicts that may not be solved by individuals. Members of the task force need enhanced ethical education. In the case of a conflict, the person reporting the dilemma joins the ethics task force. Conflict solving is either done by the task force itself using discourse methods and recording the conflict-solving process by means of the documentation database or by including further experts into the decision-making process. If the conflict vitally affects society and/or the company, the task force applies for help from the EQM public relations group and the Ethics Officer. Those conflicts should be treated isolated from the person reporting the conflict to prevent damage for the reporting person. Furthermore, ethics public relation may decide whether or not the conflict can be solved on a corporate level. Conflicts involving societal tasks and the inclusion of stakeholders have to be solved in a discursive manner with the aid of the public relations division.

The *Ethics Public Relations Group* acts as an interface between society and company; its task is to include the stakeholder perspective into the

engineering process. Firstly, this group defines the values, worldviews to which the employees of a company are committed. Secondly, it has to monitor the groups ethics defined by the task forces with respect to their compatibility to the general company standard. Moreover, it manages conflicts that cannot be solved by the task forces and may even decide to attract the conflict solving in cases where engineering ethics problems need participation of stakeholders. In this case, the duty of the public relations group is to invite discussions with the public. It is of great importance that the ethics public relations group is independent from the human resources department in order to prevent negative consequences for the employees reporting ethical conflicts. On a second level, the ethics public relations group informs the public about conflict solving within the company and is open for questions from customers and for those of public interest. In this way, transparency to society with respect to ethical decision-making within the company is created which enhances the acceptance of the company and its product. The group is the institution for holding "paramount the safety, health and welfare of the public"(IEEE Code of Ethics). The group is supported by the EQM monitoring system. The ethics public relations group also monitors and discusses the ethical framework of the company and reflects it regularly in order to develop it further on if necessary. Philosophically spoken, this group belongs to the reflection level in ethics.

EQM Monitoring and Documentation finally has to establish and manage a database where all ethical conflicts and the found solutions are recorded. The database should be structured in such a way as to facilitate research into and profiting from similar conflict situations. Ethical conflicts should be classified and archived with the solution found for each conflict. This can be understood as a learning process for the company where employees and task forces can learn from the knowledge and experience acquired by others in ethical conflicts. Furthermore, the database is a control tool for the management of ethical conflicts within the company and may be used for transparency to society. This database can be used in auditing the employees in regular cycles. Another task of the public relations is monitoring inculturalization processes for the company's products and taking part in the strategic consulting of society, if questions about whether or not a technology should be used arise.

The *ethics officer* has to coordinate and supervise ethical behavior and actions of the entire company. He takes part in decision making of the EQM public relations. On a further level, he is responsible for ethics management. He is a member of the top management and acts as an interface to professional societies. Furthermore, he is the contact person for the public.

Classification of Ethical Conflicts and levels of solvability

According to Armin Grunwald (2000b), ethical conflicts in engineering may be differentiated into *business-as-usual* conflicts and *Engineering-ethics* conflicts; they require different conflict solving strategies. Business-as-usual conflicts refer to types of situations where the normative framework is not affected and the choices of values are clear. In this case, there is no need for reflection about new ethical categories or strategies, but conflicts may be solved by classical prioritization of values and through a straightforward approach of ethical rules to the situation. Business-as-usual means that ethical decision-making based on rules and prioritization strategies for rivaling values is possible. Such conflicts can usually be solved by relying on codes of conducts or engineering ethics codes and the principles stipulated in these codes. I do by no means wish to imply that in these cases ethical reflection and behavior is not necessary at all, but I simply wish to point out that there are well-established conflict solution strategies for those cases. Business-as-usual conflicts may be solved by engineers or groups of engineers within their companies under certain circumstances. Generally speaking, they are more or less trade-offs between rivaling values.

Engineering ethics conflicts are conflicts that cannot be solved simply by the application of prioritization rules, but which need reflection of ethical values and strategies themselves. More generally, they imply a reflection of ethical theories. This is generally the case with all conflicts where the normative framework of society is affected, or third parties are involved into the conflict. In this case, there is a need for the participation of societal groups in the conflict solving process and the conflict is no longer solvable within a company alone. Building a solution for such conflicts implies both knowledge about technical tasks and knowledge about ethics. In these cases, the construction of an appropriate solution is a task of interdisciplinary reflection and decision-making. It may be

necessary to develop the normative framework of society further and /or develop technology further in order to obtain sound solutions. This may imply that engineers take part in a political decision-making process. Engineering ethics conflicts almost always imply societal participation.
Including the reflection about the levels of ethical questions in section 2 and the types of ethical conflicts in the section above, I suggest a total of four types of ethical questions within the process of technology development and inculturation:

aa) bilateral business-as-usual conflicts.

Minor conflicts without risks for third parties may be solved on an individual level if they are of the business-as-usual type. In this case, the design engineer may decide how to solve the conflict and manage the trade-off between the values by himself, by using prioritization rules and principles included in ethics codes. If he does not wish to solve the conflict himself or if he is not sure that he can deal with the conflict, the next level for the solution of this conflict should be the ethics task force. If risks for users are involved, a discursive process with the user should be launched. Any decision will be registered by the EQM Monitoring system.

ab) Society-relevant business-as-usual type conflict

Society-relevant business as usual conflicts need the participation of third parties exposed to the risks of technology and do often appear in the early inculturation stage. If technologies do not affect the normative framework of a society, users need to be involved to achieve a better acceptance of technologies. A differentiation between conflicts that can be solved by technical developments within the expected time schedule of a project and conflicts that are not solvable within this schedule may be necessary in order to assign responsibilities for conflict solving. Conflicts involving long-term reflection and which cannot be solved within the specified time may not be solved within companies; they are a task of society and need not be reflected upon within the industrial process. For instance, the 100% environmentally friendly production of electric energy is an ethically desirable goal, but is not achievable within a short-term schedule of 5 years, due to technical constraints and the large involvement of electrical power in societal practice. The normative

claim for environmentally friendly energy is useful in so far as it defines a long-term task for society, but it is not useful for decisions about short-term power production strategies. If this is done, it leads to utopian demands resulting in apathy. Such utopian requirements are not helpful for short-term decisions and therefore cannot play any role in practical engineering, because they do not lead to other design requirements, and therefore are useless.

ba) bilateral engineering ethics type conflicts.

Bilateral engineering ethics type conflicts usually arise if a technology is used by a limited number of people and system constraints are obscure and/or affect the normative framework of society. It should be explicitly mentioned that no third parties have to bear any risks. In this case, conflict solving should include the manufacturer and the customer; society should be informed by EQM public relations. An example for such a conflict is the use of cellular phones and the risks of exposure to electromagnetic radiation. Here, there is still unclarity about the dangers related to electromagnetic radiation and whether the levels of exposure specified by the standards are really below the damage threshold. On the other hand, cellular phones are becoming a well-incultured technology.

bb) society-relevant engineering ethics conflicts

If the conflict is of engineering-ethics-type, it may involve questions about the normative framework of society. In that case the conflict is no longer solvable within the company but needs the participation of stakeholder groups. Conflict solving therefore has to be done on the societal level and should almost always include discourses with the groups affected by the (new) technology. Companies may take part in this process, where they may advise policy-makers and society members about advantages and risks of new technologies. It is an ethical imperative that this should be done in an open and fair manner. At the moment, the designing engineer himself implicitly carries out social and ethical reflection in technology design to a large extent. The integration of a society perspective is restricted to the marketing activities of a company, where market potentials and acceptability of products are analyzed. In a societal view, this activity is largely limited to users of a technology and does not directly involve third parties that do not profit

from a technology, but have to bear its risks. This is an ethically sensitive case. It needs participation in discursive processes. An actual case is the use of cloning for reproduction purposes, where it is not yet clear whether society actually wants cloning and where other ethical questions arise, e.g. questions about the value of human life, whether it is desirable to eliminate gene damage before the implantation of a fertilized ovum into the uterus etc. These conflicts may never be solved by the technology-producing company alone, but require a societal perspective. On the other hand, companies can get into trouble when techniques in the phase of introduction suddenly get socially problematic (cf. GM-food in Germany and the Netherlands). Companies and society can play a win-win game if the socio-ethical dimension is discussed all along the design process and measures are taken for a smooth inculturation of new technologies.

Proposals for a Standardization

The society in its relevant institutions needs to develop a dialogue about which ethical duties it assigns to companies and the values and paradigms that are imposed on companies by society. Standards might be one way of introducing instruments for ethical reflection into the engineering process. This has already been done within the field of quality management with respect to the value of "quality and consumer satisfaction." In quality management, almost every company needs to be certified according to the ISO 9000 system. Hence, it seems possible to extend this ISO system to ethical standards and values. The standard is a matter of assigning social responsibility to companies. Companies may elect the values they commit themselves to. Preferably, values should be chosen according to existing standards like the VDI 3780 Technology Assessment. Institutions and monitoring processes should be prescribed, as presented above. Auditing and control procedures should be executed by central authorities on a regular basis. The standard may include participation of stakeholders where necessary. The advantage of this course of action is that QM Systems are accepted in industries to a large extent, and the institutions already existing may be used for this purpose. Companies do not wish to lose their QM standard certificate.

Conclusion

This contribution is a first reflection on the question of 'how to enhance ethical decision-making in the industrial context' by including a stakeholder perspective into technology development. This is only possible if the development and application of a technology is seen as part of a social process. This approach implies that one has to abandon the principle of discussing engineering ethics only through an individual perspective with respect to ethics codes. The objective of the ethics quality management approach is to investigate project management and the responsibility distribution within this process in order to determine possibilities of enhancing and fostering ethical decision-making. A division of labor between society and industry seams necessary where long-term planning on the macro-level is done by society, whereas industry is largely involved in short-term planning and the micro-level of reflection. At the corporate level, different institutions are required in order to promote individual actions in collective decision-making. In Quality Management, institutions have already been established which have developed suitable strategies for supporting ethical reflection. Furthermore, the structural analogies between quality management and ethical reflection processes are used to introduce the social perspective into the design and use of technology. Whether this approach is effective or not largely depends, like all TQM strategies and company cultures, on its support by the top management. EQM is only effective if it is taken seriously and if it creates transparency for society. Therefore, standardization may only help to foster the process, but it does not mean that all problems can be solved simply by means of standardization. A large amount of investigation, especially with regard to ethical decision-making and technology development, still needs to be carried out. Questions like rules for responsibility-distribution and assignment to the different actors in the process of technology development and use need further research. Furthermore, the role of companies as the developers of technologies and - through technology- as the developers of culture requires closer attention with respect to the resulting ethical obligations.

Acknowledgements

The author would like to thank Armin Grunwald for fruitful discussions.

References

Bijker, W. & Law, H. "Shaping Technology—Building Society" Boston: MIT Press, 1994

Grunwald, A. "Against Overestimating the Role of Ethics in Technology." *Development Science and Engineering Ethics* 6 (2000a): 181-196.

_____. "Between Theory and Practice: Scopes and Interfaces of Engineering Ethics as Subject for Further Research." Proceedings of the IEEE ISTAS 2000, Rome. 2000b, 183-186.

_____. "Philosophy and the Concept of Technology." in Grunwald, A. (ed.), *On Human Nature.* Berlin: Springer, 2001.

Habermas, J. *Theorie und Praxis.* Frankfurt: Suhrkamp, 1968a.

_____. *Theorie kommunikativen Handelns.* Frankfurt: Suhrkamp, 1968b.

ISO 9000 standard Quality Management Systems

Janich P., Hartmann, D. *Methodischer Kulturalismus*. Frankfurt: Suhrkamp, 1996.

Julliard, Y. *Ethische Technikgestaltung.* Frankfurt: Peter Lang, 2003.

Moriarty, G. "The Place of Focal Engineering in University Education." Proceedings of the IEEE ISTAS 2000, Rome. 2000, 67-75.

Rammert, W. *Technik aus soziologischer*. Perspektive Westdeutscher Verlag, 1993.

VDI 3780 Guideline Values in Technology Assessment