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The Responsibility of the Engineer

The Engineer in between his Capability and the Expectations of the Various Pressure Groups

For centuries the mission of the bible: "Submit the earth to mankind!" has given credit to the belief of technical progress. In this mission mankind has seen the authorization to dominate the nature.

Until the beginning of the industrialization this attitude has led to a great number of inventions, and – with a few exceptions – these inventions were accepted by people. If men were afraid, it was out of economic reasons. They feared for their living conditions. This was for instance the case in the weavers' rebellion in Manchester in 1844. But since it had only concerned a smaller group, there was no broad effect.

However, with the increasing development of our industrialized society the belief in a steady progress of technical development got more and more questioned. This is despite the fact that in the world's industrialized nations it is undeniable that technical progress has freed us from the constraints of heavy, monotonous manual labour. It has improved the range and quality of medical treatment available and produced a concomitant increase in average life expectancy. More: it has increased the productivity of labour as such, generating a higher level of economic prosperity, which in turn generated enhanced social security, and thus a less discontented and more peaceful society.

30 years ago 75% of the German population believed in a steady progress of technical development. Today 50% are very critical. One of the many consequences is that the number of students in natural sciences and engineering is drastically decreasing. The Association of German Engineers has estimated that in the coming years the German industry will have a deficit of twenty thousand engineers per annum.

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On the whole, the loss of public acceptance nowadays is endangering our economic and societal development as such.

What is the background of this change of attitude in our society?

- The extensive use of technology is increasingly causing significant changes in the environment, social structures, institutions and behaviour patterns.
- The consequences of the diffusion of new technologies in everyday life and at the workplace by far exceed the technical/sociological development processes of earlier years in their speed, complexity and ramifications.
- In the past decision-makers in industry have experienced technical progress as a largely undifferentiated trial-and-error, take-it-or-leave-it process and have paid little attention to the social and ecological aspects. This, however, is rapidly changing. Increasing numbers of industrial companies are learning that they must widen their corporate objectives in order to secure their own long-term future. They must take society's demand seriously and must consider the social and ecological consequences of their products. This, in turn, requires new products, new manufacturing processes, new sales, channels, new business segments and new management philosophies.
- The business, scientific and engineering communities have found it difficult to explain understandingly to the public that technology involves not only risks, but also opportunities for higher-quality, environmentally compatible and socially acceptable products.
- Irrational, politically motivated movements have succeeded in mobilizing parts of our society against technology as such.

In former years, as a then member of the German Federal Parliament and Chairman of the Enquete Commission on Technology Assessment, I had frequently been involved in public discussions on the chances and the risks involved in both, new and old technologies. And I had repeatedly found that these discussions degenerated into a sterile confrontation, into an uncompromising conflict between "technophiles" and "technophobes". The missionary zeal of these polemics had generated a climate of uncertainty among many of our citizens who were no longer sure what information could be regarded as reliable or which concepts would ensure a healthy environment and a safe life for the future generations.

Out of my own experience in politics I can affirm that the majority of our citizens do not in fact welcome these simplistic disputations between "technophiles" and "technophobes". They would much prefer to see a dispassionate examination of the quality of technical progress, a meticulous scrutiny of the chances and risks involved in new technologies, and (if necessary) restrictions imposed by prescriptive and prohibitive legislation. What the majority of people want is a responsible technology, and technology can only be responsible, if it is properly managed.

Notwithstanding the dynamic forces of technological development, technical structures are in no sense metaphysical constraints sent by heaven to try us! Nor

are they a random result of ineffable conditions. On the contrary, technologies are created and used as a result of decisions taken by human beings.

However, the creation, the introduction and the utilization of new technologies are embedded in a system of social groups and institutions. I.e. the creation of new technologies is influenced by these groups and in turn triggers changes in these groups and institutions. The protagonists involved are the state (the executive as well as the legislative powers), the scientific community, the business community, and society as a whole. And among these protagonists conflicts of interest are frequent.

The overall task of the state is to guarantee the welfare. Experience, however, shows that those political parties being in power above all exercise the dominance of their office, while those being in opposition seek to obtain power.

The interest of the economical groups is the growth of capital. This is their predominant task and is the overall condition for the maintenance of our economical and societal system. The economical groups are well-organized and powerful. They influence politics via lobbyism.

The third major group, the scientific community, finds itself quite often in the dilemma of experts.

The societal groups, on the other side, have their own opportunistic interests and seek their own advantages.

The engineer with his capability to develop innovations stands inbetween these pressure groups. He has got a specific responsibility for his professional actions and tasks corresponding to his competence and qualifications while – at the same time – carrying both, the individual as well as the shared responsibilities.

The German Association of Engineers (VDI) has passed in March this year the "Fundamentals of Engineering Ethics":

- Engineers are aware of the embeddedness of technical systems into their societal, economic and ecological context, and their impact on the lives of future generations.
- Engineers avoid actions which may compel them to accept given constraints and thus lead to reducing their individual responsibility.
- Engineers base their actions on the same ethical principles as everybody else within society. They honour national laws and regulations concerning technology use, working conditions, and the natural environment.
- Engineers discuss controversial views and values across the borders of disciplines and cultures.
- Engineers contribute to defining and developing further relevant laws and regulations as well as political concepts in their countries.

The conflicts between the stakeholders – outlined above – are difficult to dissolve. A solution, however, is of absolute necessity for the sake of our future. Predominant, however, is that all groups involved realize:

The objective of every new development in technology is to preserve and enhance our quality of life. The path taken towards this objective must, like all

human actions, be an ethically legitimate one. The values underlying this objective have been defined in a VDI-(Association of German Engineers) guideline as follows: prosperity, cost-efficiency, practicability, safety, health and environmental quality. These value groupings are, of course, in some cases indirectly or even directly antithetical, and the task of the technology management is to resolve these antitheses as far as possible and to develop systems, products and processes which have to be sustainable. This means such products have to be cost-efficient, environmentally compatible and socially acceptable.

In order to achieve these objectives the limits of responsible feasibility must be specified. Chances and risks of technologies must be systematically and foresightedly identified and analysed. Once the limits of responsible feasibility have been specified, damage control can be initiated for old technologies by minimizing the risks involved, and damage prevention can be effected for new ones by developing environment-friendly and socially acceptable products and processes. Viewed from this angle, we have three elements in technology management: diagnosis, therapy, and prophylaxis.

The instrument for the diagnosis is the participative technology assessment:

– Technology assessment is to analyse the current state-of-the-art of a particular technology, and the possibilities of its further development.
– It is to estimate the indirect and direct technical, economic, health-related, ecological, human, social and other consequences of this technology, and is to delineate possible alternatives.
– These consequences have to be evaluated against defined objectives and values, and further desirable developments have to be promoted.
– Technology assessment has to derive and elaborate options for action and future management of the technology concerned, so that proper substantiated decisions can be taken.

The expectations are that technology assessment will:

– provide decision-makers in politics, science, industry and society with decision-making tools and data for technology management which are comprehensible to the general public;
– focus the awareness of our decision-makers (and of our society as a whole) on the interdependences of technology and society, technology and environment, and technology and civilization;
– bring about a social consensus on the evaluation of technologies and technical systems currently existing or awaiting introduction, against the criteria of justified purpose and long-term responsibility, and will thus contribute to an increased public acceptance of technology as such.

I do not regard technology assessment as a scientific task – pure and simple. Though it, of course, demands scientific competence, and though its results must be scientifically substantiated, we must also recognize the social component of the

task involved. Technology Assessment (TA) has to be performed on real-life examples against application-based criteria; its subjects are taken out of everyday life and the industrial practice. And its results must correspondingly be communicable to an industrial workforce and to the general public.

In this mode of perception, TA also demands that a scientific analysis be supplemented by forms of a social discourse. And the participation in such a discourse should come from all groups of our civilization directly or indirectly affected by new technologies – politics, industry and business, science, and the society as a whole.

Apart from a few rudimentary beginnings, in the EU the "participative TA" lacks the requisite permanent organizational form, and the continuous practical work in teaching and research that would support such an organization.

In this context the European Academy of Sciences and Arts has offered to the European Parliament the knowledge of its members and the experience they have gained in their responsible positions in the various scientific disciplines, in industry and in politics. To name two examples:

A team of representatives of the professional medical societies, industry, the European Parliament, the European Commission, WHO and OECD has worked out "Strategic Visions of European Health Care". The paper will be handed over on December 4 to the President of the European Parliament. Thereafter there will be a hearing by the parliament.

The EASA Institute of Advanced Studies on Sustainability has just submitted a research proposal to the European Commission: "Global Learning – Living Responsibly in my Community and the World". The target of this project is to enhance the attractiveness of the scientific subjects at schools, in order to promote and ultimately recruit more professionals in the scientific and engineering professions. To achieve this goal the project will work with the idea of sustainable development in order to take up the day-to-day issues relevant to the students and which can only be understood, if reflected in an interdisciplinary, scientific way. Germany, Austria, Hungary, Spain and Ireland will be the partners in this project.

Let me conclude: we all know that a basic requirement for the development of our economy and our society is that we keep up to date with the developments in natural sciences. These must be transformed into innovations which will be accepted by the public.

I hope I have succeeded in showing a way in which direction to proceed.