Global J. of Engng. Educ., Vol. 2, No.2
Printed in Australia

From Crisis in Education and Innovation to Social Crisis

Vollrath Hopp
University of Rostock, Odenwaldring 31, Dreieich D-63303, Federal Republic of Germany

On a daily basis we make use of the advantages offered by science and technology, but every now and again we stumble over one or another unpleasant side effect and, all too often inappropriately, offer criticism. In order to understand the direction that the future is taking - if we are making the right decisions in the present for what we want to undertake in the future - a minimum technical, scientific and sociological knowledge is required in order to communicate at a general level. Neither high-quality products, good service nor qualified training can be had for free. Activating the innovative potential of every citizen who is willing to work and to learn is an urgent demand that must be made of societies worldwide.

INNOVATION

Innovation can be defined as the capacity for a nation to adapt to worldwide changes in nature, technology, and economics, but also as its capacity to influence these. From this perspective, population growth is a dominant factor. Pressure from population is what keeps us searching for new solutions toward a better chance of survival (Figure 1).

Innovative potential is determined by the following:

- The intellectual infrastructure of the population.
- The technical infrastructure of a nation, ie the capacity to transform theoretical scientific findings into technically feasible solutions.
- The historically developed tradition of skilled trades and technical know-how in large sections of the population that are employed in handicraft enterprises as well as in small, medium, and large industrial companies.

This tradition has provided German industry with its excellent international reputation. The present is the result of the past, but how will the present of the future look, which will then be based on our present?:

- A well co-ordinated education system and consensus between educational institutions, science, the economy, and society. The role of skilled workers, master tradesmen and technicians has virtually been forgotten in our technology-oriented society, or is at least underrated.

Scientific thinking and skilled know-how create a unit and are the basis for innovative technology (Figure 2). Innovative potential is furthermore determined by a people's basic mental attitude towards the developments of science and technology and through the political framework: success in innovations is based on the joy in inventing, the pioneering spirit, the desire to work, the curiosity, and the willingness of individuals to take risks.

These factors can either be restrained or set free by the framework of a state, a federal region, a city, or public opinion. It is not uniform human beings that are being sought, but rather individuals with their uniqueness, their individual talents, mentality, their likes and dislikes.

THE DRIVING FORCES IN NATURE, TECHNOLOGY AND THE ECONOMY

A vital economy and a creative society are distinguished by the smooth flow of materials, energy, information and financial resources. It acts in accordance with the laws of potential difference and equilibrium of flow taught to us by nature. Streams, ie flowing systems, can be brought to a standstill by two measures:

- More and more barriers are inserted into a widely branched out flowing system, eg an increasing numbers of laws that are introduced into the economy.

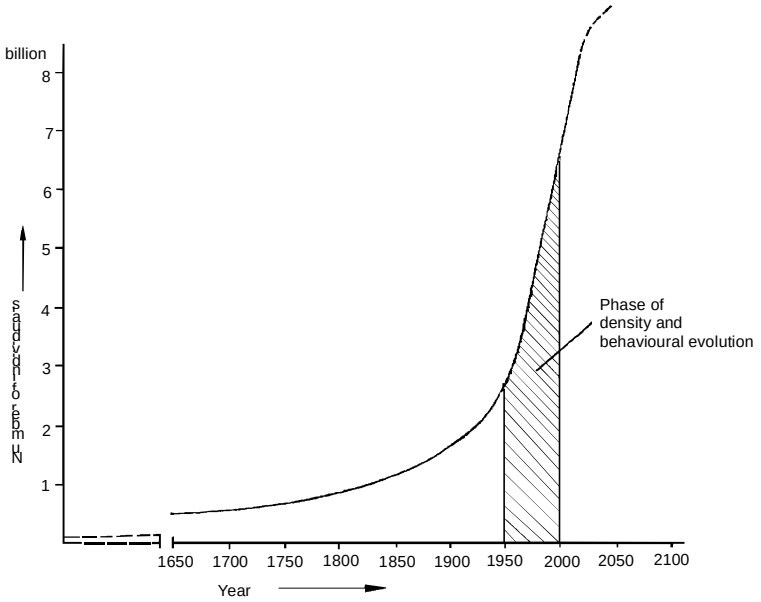

Figure 1: Growth curve of the Earth's population.

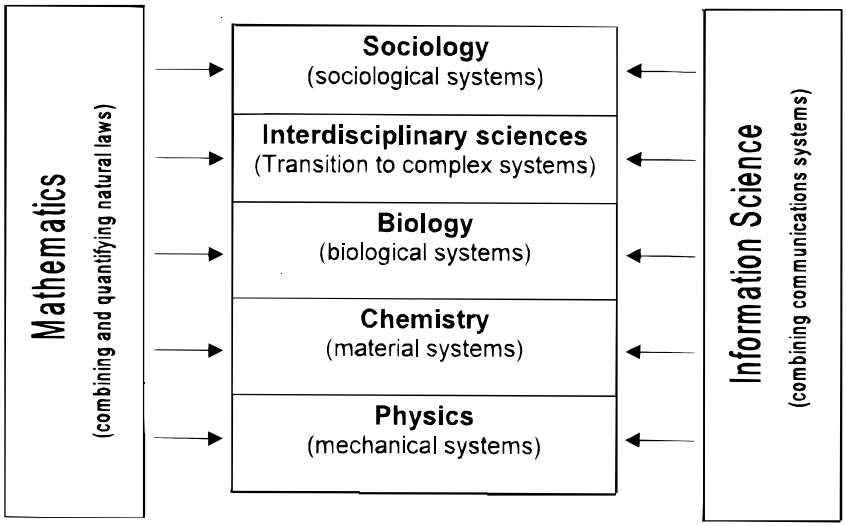

Figure 2: Different systems.

The system no longer flows. The stream comes to a standstill.

- The potential differences, ie differences in level, which serve as a driving force are flattened. A running stream becomes a stagnant pool that, in the worst case, begins to decay because water always flows from a higher level to a lower level. The same holds true for electrical current and also for heat, which dissipates from a high temperature level to a lower one (Figure 3).

These laws of nature also apply to the flow of materials, energy, information and financial resources. Curiosity is the driving force behind the flow of information; the uninformed person, as a rule, wishes to be informed.

The flow of money, too, is subject to the laws of streaming and of flow equilibrium. The equal distribution of money, ie of income, savings and ownership structures, would paralyse the innovative potential, the desire to work and the joy of designing a way of life in both our public and our private lives. A colourful social system that is characterised by individualists would turn into a grey, uniform society in which everyone would possess an equally small share.

Industrial location crisis

The current location crisis is not only a consequence of the high costs (labour costs, environmental stipulations, etc) but the result of an innovation crisis and an education crisis. Both crises very slowly developed in their first phase, being virtually unnoticed over several decades, and they are of a socio-political nature.

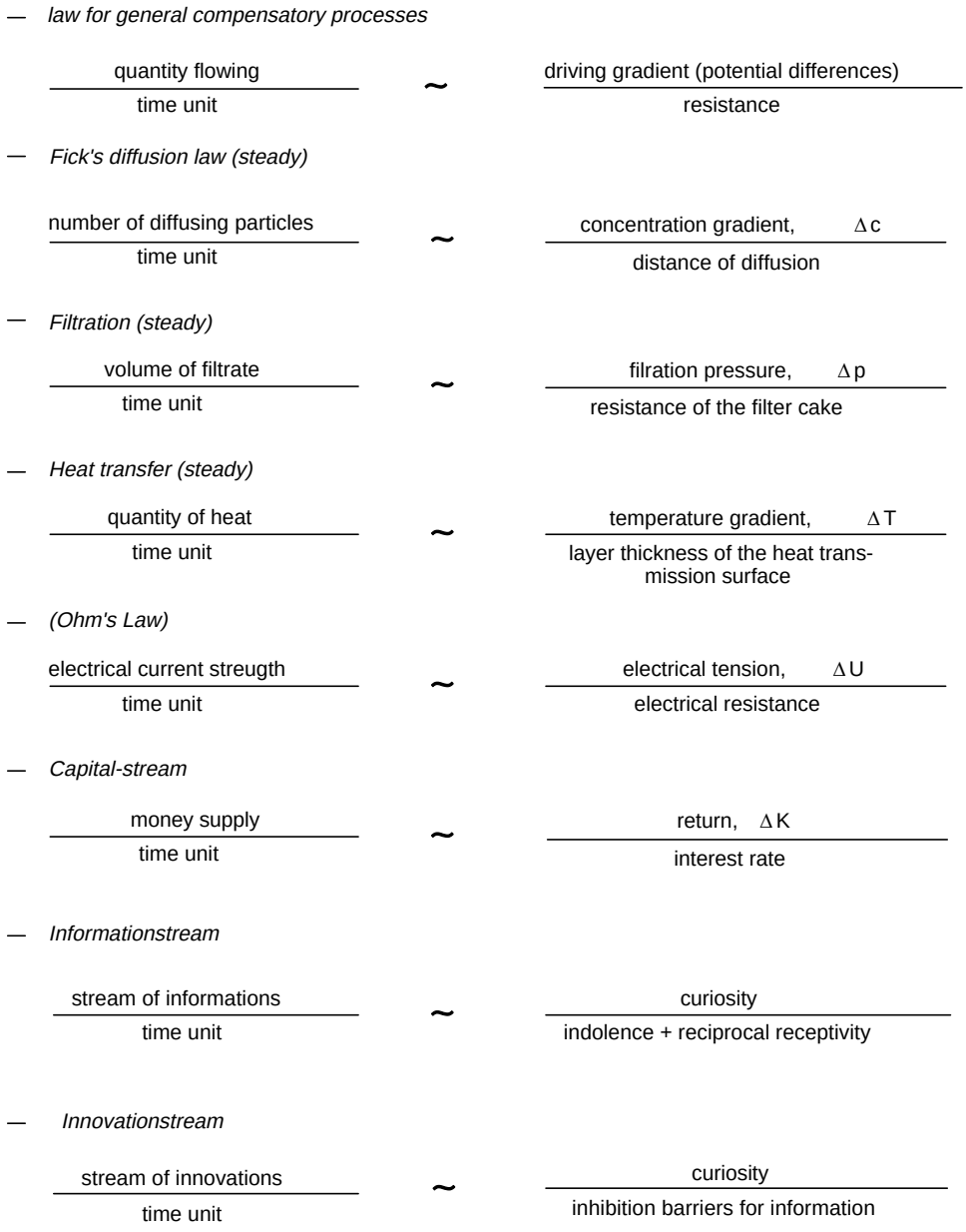

Figure 3: Examples of compensatory processes.

This is a long term process in a nation.

Willingness for innovation has something to do with individualism and elitism. Here, elitism is not meant in the conventional sense of *being better in terms of status and class thinking*, but rather as a model for the willingness to assume responsibility, risks and duties.

Mediocrity is not conducive to innovation and lowers the chances of survival. Seen from this point of view, it is a social aberration that well-educated and capable young persons cannot find a job despite the fact that there is enough work. This is a squandering of national resources. To deplore the lack of innovation in our society and, at the same time, not to provide the opportunity for talented people to make their contribution is a typical characteristic of the double standards in politics, society and the economy. Working has become too expensive as the result of an incorrect understanding of social responsibility.

RELATED CRISES

Education reform, education crisis, innovation crisis, industrial location crisis, unemployment and social crisis, these all are closely related to one another.

Education reforms were guided, among other things, by the misconception that self-realisation, a professional career, and a good income could no longer be attained by practical/manual occupations. By placing all the bets on science and university degrees, the importance of mankind's practical/manual talents was neglected and underrated, which in turn led to a tacit discrimination of skilled workers and craftsmen.

Today, there are more students at universities than apprentices in the handicrafts and industrial compa-

nies. A crisis in innovation has ensued from this situation. Innovation can only flourish in places where curiosity, imagination, know-how and pleasure go hand in hand with a profession or a vocation.

An industrial location can only assert itself in the arena of international competition of industrialised nations if all men and women are convinced of their capabilities and identify with their professional tasks. Imagination and impulses for product improvements and the development of new products, as well as better performance in the service sector, must come from the production and the service base and not from the top, from the think tanks and management echelons which are full of theories and ideas. At the production base and at the service level, however, skilled workers, craftsmen, trade masters, technicians, sales people, purchasing staff and other similarly qualified persons are employed, and in them many interesting and important talents lie dormant. Without them a highly developed industrial nation such as Germany cannot prosper. These talents must be activated.

Unemployment occurs when the quality and the price of products and a corresponding service standard can no longer be maintained. Germany is then no longer attractive as a purchasing market. For as long as rationalisation in the economy and the state is limited to discharging high numbers of skilled workers with a capacity for innovation, rather than developing cost-effective, high-quality products, ie quality results, unemployment will continue to rise. This leads to an individual psychological crisis which, in time, will consolidate into a mass psychosis and lead to a social crisis.

A *crisis in society* is an extended social crisis that can no longer be controlled politically and can invalidate all the smoothly functioning democratic rules of behaviour. Such a development could ultimately lead to the constitutional *right to work,* which results in the *right to work,* ie the transformation of job offerings into a *duty to work*. The consequence is that citizens are incapacitated, innovation of any kind dies out, and the industrial crisis is reinforced. The circle closes in the form of a planned economy which is controlled by the state and the reduction of public assistance to the strictest minimum.

Table 1: Twelve theses for lifelong learning.

- Vocational and continuing training mean mobilising and maintaining human skills and knowledge.
- Continuing education strengthens and increases professional efficiency.
- Education and knowledge enable one to speak, read, write and calculate, and thus to inform and communicate.
- Education and knowledge enable the making of discoveries, and arouse and satisfy curiosity (drive of curiosity).
- Education and knowledge make individual gifts and talents active, and trains them.
- Education and knowledge open up and extend chances of adventure and profession.
- Education and knowledge simplify and support making contact with other people and allows one to have an understanding of other cultures.
- Education and knowledge stimulate mental and psychological fantasies and support innovative power.
- Education and knowledge surmount fear of technological change in the workplace.
- Education and knowledge strengthen the consciousness of being an emancipated citizen.
- Education and knowledge make one independent and self-supporting and strengthen one's sense of responsibility.
- The association of education and communication is the prerequisite for peaceful globalisation and association of energy, material and finance.

CONSEQUENCES

In an economic location, education - general education, vocational training, and continued education - must be understood as a qualifications' factor both by citizens in their private lives and by persons working in politics and in the economy. Its influence on scientific development, ie on innovations as well as their economic realisation (application in skilled trades, industry, sales, and administration), is crucial. Lifelong learning (LLL) is the aim in future (Table 1).

BIOGRAPHY

Vollrath Hopp was born in Mecklenburg, Germany, in 1929. He studied chemistry and chemical technology at the Technical University of Berlin, and received a doctorate from the Faculty of General Engineering in 1961. From 1961-66 Dr Hopp worked in the chemical industry in West Germany as laboratory and plant chemist. In 1966 he joined Hoechst AG as head of vocational and advanced training in science and engineering.

Since 1977, Dr Hopp has lectured in chemical technology at the Technical University of Darmstadt. He was appointed Honorary Professor in 1980 by the Minister of Educational and Cultural Affairs of Hesse. He was offered a guest lectureship at the Tongji University, Shanghai, in 1986, subsequently becoming an Honorary Professor.

In 1992 Dr Hopp was appointed Professor at the University of Rostock in the areas of chemical technology and food technology. He is a full-member of the Committee on Education and Training of the World Federation of Engineering Organisations (WFEO), Chairman of the German Committee for Lifelong Learning, and a member of the Committee for the Basic and Advanced Training of Engineers. He is an international consultant in the field of training.

Dr Hopp has published extensively in journals on issues of chemical engineering and basic and vocational training. He is the author of four chemical engineering textbooks, which have been translated, in part, into French, English, Spanish, Indonesian and Chinese. He has received several prizes and decorations for contributions to co-operation between education and industry.

ALLTED - A Computer-Aided Engineering System for Electronic Circuit Design

by A.I. Petrenko, V.V.Ladogubets, V.V. Tchkalov and Z.J. Pudlowski

ALLTED is the fifth publication in the *Monash Engineering Education Series*. The series was established by the UICEE in 1995 in its on-going mission to undertake research and development, and to act as a clearinghouse on information on engineering education. The publication of this book is a joint effort of the UICEE and the CAD Department of the National Technical University (NTU) (Kiev Polytechnical Institute), Ukraine.

ALLTED (**All Te**chnology **D**esigner) is a Computer-Aided Engineering (CAE) system developed in the former Soviet Union at a time when computer hardware lagged behind that available in the West. The designers overcame this problem by developing the software around original algorithms with the result that ALLTED, the designers believe, surpasses the abilities of SPICE, the industry standard, and yet can operate on a system with as little as a 386 processor.

ALLTED is an educational tool which has been developed for the simulation, analysis and design of such diverse devices as drives, control systems and dynamic systems composed of electronic, hydraulic, pneumatic, mechanical, electrical, electromagnetic, and other physical phenomena elements. This can be done by considering each technology individually or in combination. Complex drives and systems of this type are widely used in modern aerospace, robotics, NC machine tools, test equipment, highway engineering, agricultural and other applications. This book deals with the design of electronic circuits using ALLTED.

Both the UICEE and the CAD Department of the NTU distribute the ALLTED code and will be able to deliver one or two-week long seminars for training in optimal design for electronics and mechatronics. Such seminars can be organised in Kiev, Ukraine, or Clayton, Australia, or at any university or company worldwide which can provide suitable conditions.

To obtain a copy of *ALLTED*, draw a cheque for $A70 in favour of Monash University - UICEE, adding $A10 for postage within Australia and $A20 for overseas postage, and send to: UICEE, Faculty of Engineering, Clayton, Victoria, 3168, Australia. Tel: + 61 3 9905 4977 Fax: +61 3 9905 1547