In this Issue

Zeleny's 'High technology management'

High technology presents a qualitatively different set of challenges to the manager than traditional 'technology'. While 'technology' can mostly 'take care of itself', *high* technology must be managed. Operational and fully practical definition of high technology is presented, its implications discussed and its applications and modeling possibilities demonstrated. All managers should benefit from achieving *managerial* insight into the nature of rapidly emerging and future-shaping high technologies of the modern era.

Professor Zeleny has tackled the phenomenon of 'high' technology in a so far lacking and much needed operational and practical fashion. Instead of the traditional (and traditionally useless) *listing* of what 'belongs to high technology', he proposes an operational definition from a clearly managerial (rather than traditional engineering) viewpoint.

Technology here is neither machine or equipment, nor hardware or software, nor any other 'stuff'. Technology is rather a form of *social relationship*: it is the user and his circumstance who ultimately determine the nature, purpose and performance of this or that 'technology'.

Each technology is embedded in a network of supportive flows and relationships which are requisite for its functioning. It is the *support net* of relationships which is the most important and clearly dominating dimension of technology. It is also one which is mostly neglected (if not entirely ignored). Yet, without it, any study of technology becomes a study of 'stuff' (hardware, software), management of technology cannot be even postulated, and the crucial role of human user vanishes altogether.

High technology is the technology that affects the existing support net in a qualitative rather than quantitative manner: it leads to net's restructuring and reorganization. Therefore, it must be managed with previously unavailable competence.

Professor Zeleny goes beyond the definitions. He demonstrates useful modeling approaches which capture the essentials of technology support nets, make them 'visible' and available for analysis, facilitate their purposeful redesign and restructuring, and allow computer simulations of the necessary 'what–if' scenarios. Examples from models of real-life consulting applications are also presented.

This seminal paper should spawn better awareness of the increasingly pressing need for *high technology management*. It is no longer sufficient, at the end of the twentieth century, to study technology in the narrow 'hardware–software' frame of the Industrial Revolution. Professor Zeleny shows that high technologies are not simply new extensions and modifications of the same thing, but rather a new thing altogether. Failing to understand this leads to unnecessary societal and corporate waste of capital, human and intellectual resources.

High technologies of today (1) restructure the very 'architecture' and organization of our traditional corporate and societal support nets, and (2) lead to re-integration (not further division and specialization) of labor and knowledge. These two effects not only require a most serious managerial attention, but in themselves signal the beginning of one of the most profound societal and corporate transformation in history.

We are moving – at least in the American practice of management – from doing things better, through doing things differently, to doing better things: from efficiency to effectiveness, from know-how to know-why, from economies of scale to economies of scope, from administration to management, from data and information to knowledge and wisdom ...

Caro and Sethi's 'Technology strategy'

When high technologies are introduced in organizations, the previous technology support network is changed and restructured: organization, skills, information flows, power structure and

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managerial culture – all are affected. Such qualitative changes are demanding and could be even considered 'stressful' to unprepared managers and workers. Technologically advanced societies are facing an unexpected dilemma: the very technology which makes these societies 'advanced' and was designed to make work easier and less stressful – this technology 'causes' technostress.

Professor Caro and Professor Sethi address the issue of strategic planning and technostress monitoring. The idea is that proper strategic planning will ease the pains of technostress through preventive, proactive manner. The authors quote a former Minister of Communications of Canada, who publicly stated that new technologies will 'quite obviously, exert *great stress* on the Canadian federation.'

The technostress is of course the highest in less educated, poorly trained and poorly motivated groups of managers and workers. Other groups experience just the opposite: sense of control, independence, high productivity and joy of accomplishment. In comparison to Canada there is virtually no technostress in Japan, South Korea or Taiwan.

Caro and Sethi, in their definition of technostress, emphasize its important dimension of individual uncertainty which is heightened by poorly understood and poorly designed organizational changes which accompany technology implementation. This organizational and contextual uncertainty then leads to temporary feelings of either challenge and demand, or distress – depending on the actual context and organization involved. It is especially the distress which could be harmful and has to be managed. A strategic plan for technology implementation is proposed.

The authors extend the notion of technological feasibility (traditional feasibility study) into four basic dimensions: operational, technical, economical and social feasibility. It is really the 'social' impact which potentially addresses the technology support net restructuring and redefinition and thus the source of potential stress. The other three categories are unlikely to be 'stressful'.

The social (or support net) effects are in need of most concentrated analytical attention. Support networks must be explicated, computerized, and extensive 'if–then' simulation analyses carried out. Without such technological support the strategic management of technology implementation could remain at a non-technological, verbal level.

The authors correctly recognize that coping with technostress does not involve only hardware and software dimensions, but, most importantly the motivations, skills and incentives – peopleware. (This dimension is often referred to as either *brainware* or *knoware* in high-technology literature.) Regardless of name, the emphasis and direction are unmistakable: beyond hardware, beyond software, towards management aspects of high technologies.

The research on the 'brainware' and management dimensions of technology is only now beginning. The level of technological thinking is still at the hardware/software foundation, research journalism is only rarely venturing into managerial/organizational implications. Paucity of research on technostress is proverbial even in technologically sophisticated societies. This is why the authors' article is important: research on the social aspects of managing technostress is the major and most important issue at the onset of information-oriented society.

It is quite useful that the concept of techno*di*-stress accompanies Caro and Sethi's discussion of technostress: it is the *technodistress* which is negative in its consequences and should be minimized. Technostress, in general, is a motivating factor and should be allowed to work for us as such.

Krauch's 'Maieutic systems design'

Professor Helmut Krauch from Kassel is submitting a spirited attempt to combine *maieutics* (search for knowledge through dialogue) with human systems management. It will be misunderstood, at first ...

Maieutics is needed. The advances in telecommunications, interactive knowledge bases, management support systems (MSS) and man–machine symbiotics call for a systems-holistic approach based on discourse, dialogue and even conversation (a far cry from the imposed, engineered design of operational sciences).

Professor Krauch is presenting a useful and properly focused work. Even the historical review of *systems philosophy* is refreshing: Claude Bernard, Giambattista Vico, J.H. Lambert, Bronislaw Trentowski, and other pioneers of systems thinking, autopoiesis and self-reference, are competently discussed.

The origins of maieutics ('Socratic Questioning') come from Socrates' efforts to make his students realize their own dormant wisdom through the *process of interrogation.* This approach has been largely abandoned as a teaching tool in the era of 'teaching' (replaced by fancy voice modulation, jokes, cartoons, pictures, 'funnies' and cases à la HBS). The era of 'learning' which is upon us will require *dialogue and interrogation* to be reinstated as the appropriate and modern tool of university 'teaching'. Removing the constraints, which prevent students to realize their own knowledge and insight, rather than 'ramming down' the greased atoms of information through all the constraints left intact – that is the proper distinction to make. Even at our schools of business.

Professor Krauch contrasts Instrumental Systems Analysis with Maieutic Systems Analysis.

The first one requires the 'client' to define the system, to 'give' it, to specify its goals, parameters, purposes, etc. The analyst then simply and mechanically 'fiddles' with its model, *accepting everything as given*, and thus doing nothing really useful for the 'client'

The second approach does not pre-formulate the problem situation. Latent criticism of the situation is activated through the skillful interrogation, bringing up the hidden knowledge, cognitive intelligence and competence of action. NOTHING is 'given', the understanding of the problem is progressively refined.

Maieutics is a devastating indictment of so-called 'operational sciences', including the 'systems approach', which in their own infatuation with the trivial mathematical formalism begin most of their communications with the magic words: 'Given ...'.

Professor Krauch presents a summary of *The Santa-Barbara-Procedure* which served as the background for the Teller-Pauling Debate over the risks of nuclear testing. A number of additional applications and cases from chemical and biological research, German Chancellor information support, instant democracy, Porsche project, and some future applications of maieutic systems design are presented.

The maieutic procedures enable human actors to be placed in the midst of their environments, facilitate the articulation of their Weltanschauungs, and demonstrate the interplay with the assertions and worldviews of others.

Maieutic Dialogue *is* the appropriate 'technology' for modern systems science, management support systems, and human systems management. It is appropriate to thank Professor Krauch for his perseverance.

Heller's 'Technological choices'

Dr. Frank A. Heller directs the Center for Decision-Making Studies at the well-known Tavistock Institute of Human Relations. He is concerned, as all workers and managers are, about the negative and inappropriate impacts as well as the positive and beneficial effects of *high technologies*. He is concerned about increasing workers' autonomy, freedom of choice, human faculties, flexibility, and work satisfaction. That can be done, but *appropriate* technological choices must be made.

Why is some new technology being perceived as having negative effects? Dr. Heller correctly points to the neglect of the socio-technical model and its choice implications as a major cause of reduced human satisfaction in their interaction with technology. The preoccupation with the hardware and software of high technology (perpetuated and emphasized even by information-disseminating institutions) is *the cause* of human misinformation about technology. We have to broaden our definitions of technology, work, employment, etc. – to include, explicitly and primarily, the human ('brainware') dimension and its social embedding.

'Technological imperialism' of the narrowest of specialists, supported be the narrowest disciplines and by almost 'molecular' splintering of scientific journalism, must and can be overcome – to the benefit of all. Dr. Heller sets out 'to question the validity of a generalization based on maximization of a single variable'.

It is true, that there are still some 'professionals' who do that: maximize single objective function, maximize single criterion, maximize 'overall utility'. Within the total system, to attempt to optimize only one factor without reference to the others (the programmatic goal of the 'sciences' of Operations Research, Management Science, Decision Science, and the like) is dismissed by the author rather simply: *It did not work.*

We at *Human Systems Management* can only add: Of course not.

The other emphasis of the paper is not only on the variability and flexibility of technology, but on the variability and flexibility of requisite social arrangements. For example: many 'social engineers' suddenly fight for the drudgery, alienation and dehumanization of the current 'specialized' workplace. They thunder against work at home, telecommuting, computers, and networking in general. Why? Because the medieval workplace serves as a 'place of socialization'! Imagine: the worst institution for socialization and human conduct ever designed by man – defended by the 'engineers of human souls'.

Dr. Heller mentions the case of 'Xanadu' (Xerox Association of Networkers and Distributed Utilities). They have started the 'neighborhood office scheme': you know, people sharing offices on the basis of their geographical proximity, i.e., neighbors, and not according to departments, functions, levels, and so on. Simple. And the only people who complained were the 'core managers' – they became irrelevant, underpaid and 'hurt'.

Workers should be able and allowed to determine their own division of necessary time between work, rest, hobbies, self-service and leisure. High technology, personal computers, telecommuting and networking are all enhancing these capabilities.

There is a university, somewhere in Europe, where a new professor has to sign an affidavit promising *not to work* after 5 p.m. on the university premises. Yes, you read correctly: *not* to work. Such experiences make one appreciate the call for employees' decision-making autonomy, expansion of choices, and self-reliant participation in a dignified workplace.

Schlesinger and Imany's 'Statistics and robot performance'

Robotics is becoming a way of life for millions of workers, managers and consumers in *all* areas of human endeavor. For example, the recent advances in *stereotactic surgery* destroy the myth that perhaps at least brain surgery could remain closed to computers and robots: in fact, classical (scalpel, blood and hands) neurosurgery is going to be the first 'to go to the robots'.

In such an exciting environment, our concerns about robot performance and compliance with their specifications are mounting. Rapid technological advances are leaving robot 'standards-makers' and 'measurers' confused by complexity.

Professor Schlesinger and Mohammad Imany from San Diego State University present a *statistical approach* to evaluating the potential impact of trade-offs of performance requirements (such as, for example, repeatability, velocity, degrees of freedom, and lifting capacity). Evaluation of robots and their performance is on its way: like human beings, they will be subjected to 'aptitude tests' and performance evaluations in an increasing degree. Except that, for robots, the more, the better. They do not mind it and they certainly need it.

Managers, at least the current generation, are certainly non-expert in terms of robotics. They will remain so for a very long time (until a crop of MBAs starts leaving our business schools equipped with essential material from courses which do not exist today – at most B-schools). Faced with decisions concerning robots they need reference points, guidelines and some 'rule of thumb' to guide them through the embarrassment.

The problem is that robots manufacturers are no decision makers: they list their specifications as maximum performances along individual dimensions and characteristics. Yet, rarely are *all* maximum performances required (or achievable) simultaneously: the user may be quite willing to reduce the requirements along one dimension in exchange for improving the performance along the other dimensions. This is called *trade-offs* and Multiple Criteria Decision Making (MCDM) is the name of the game. And *multiple* criteria they are: more than 30 parameters (dimensions) are routinely listed for better machines!

Not being aware, educated and skilled in dealing with the *multidimensionality* of the complex world of high technology is going to come to haunt the single-dimensional singletons of simplicism. Schlesinger and Imany are trying to help at the time when the already critical problem is going to be aggravated by a rapid transition from 'dumb' to 'smarter' robots: the number of criteria of performance cannot be even estimated at this time. (Where are the times when 'maximize the objective function' was all that was needed?)

These are the first steps in developing the methodologies for dealing with *complexity*. If we do not master high technologies (NOT in terms of hardware/software, but in terms of their manageri-

al/organizational impacts), multidimensionality and complexity of business/management world, and the requisite demands on human judgment and decision making, then we become incompatible and unfit for this world, we become barriers to progress, implementation and advancement. Just to think of that gives to many of us 'the creeps': so soon?

As long as published robot specifications permit *mutually exclusive maxima,*, our managers – not robot manufacturers – are going to remain bewildered. Perhaps even a more rapid advance is needed in this area?

Veryard's 'Visibility in systems'

Richard Veryard of Data Logic Education has prepared a discussion on an interesting thesis: it is important, in the age of systems, to make systems and their functioning visible to users.

The 'black-box' approach of 'experts' is not only arrogant, passive and unscientific, but, most importantly, inefficient, self-defeating and medieval in impacts. The more we talk about the end-user designs, user-friendly systems and user-support, the more glaring is the old tendency to *hide system's inner workings.* Richard Veryard is one of the first serious systems analysts who calls for making system structures and functions *visible,* not hidden, overwhelming, puzzling or witty.

We at *Human Systems Management* can only support and amplify this thesis: if the end-users are ever to be in control, the black-boxing of technology by 'experts' must be abandoned very rapidly. The do-it-yourself mode of modern societies will not tolerate the habitual efforts to conceal, hide and make incomprehensible. Modern technology must be turned 'inside out'.

Elegant design does not hide workings, form should follow function. Even in problem solving, one does not reduce the intricate processes to some aggregate artifact of 'utility function' (which hides everything) but tries to explicate the process itself, in terms of its full *description* and essential dynamics. There is no respectful prescription without adequate description. The same with technology.

Any expert system would become inexpert if it would *only prescribe* diagnosis and courses of action. For it to be expert at all, it has to explain its reasoning, make it *fully* visible and accessible to the user. This is why the so-called 'utility function approach' failed: it failed to make the reasoning, the processes, the inner workings, explicit.

Visibility goes hand in hand with *simplicity, transparency* and *openness* – all more than desirable traits of most systems of serious human interest. It is intriguing (and still remains to be explained) to contemplate the historical reasons for the period of *black-box design of systems.*

If people take efforts to understand computers, they will also make new and fresh demands for understanding the inner workings of political systems. We can only agree with Veryard that the computer awareness translates directly into political awareness: the quest for unveiling the hidden works of systems, as for undraping of human form, is insatiable.

Visibility improves users' control of the system, it puts people in charge, it makes them self-reliant, confident, effective and *demanding.* Computer-aware people are becoming more demanding – in *all* areas of human endeavor. The race for quality, for the highest possible quality, which in the end is the quality of the process, not quality of the product, is on.

People are less and less willing to put up with 'given' systems. Who gave them? How? Why are they given the way they are given? The point is not to use a given system efficiently, not even to improve it: the point is to design it optimally, *for the user and by the user.* 'Our user is our master' is the motto of technology companies with even the slightest chance for long-term success.

Consumer-aided design (CAD) is the new and only perception of the future with a ring of truth to it. We are sure that Richard Veryard would more than agree.

Making systems visible makes them efficient, effective and explicable. Anything less is self-defeating: centralized mainframes, expert controls, monopolized maintenance, other-person repairs, etc. All these concepts are on their way out, out of our system design bloodstream. No more typists who do not know what they are typing, managers who do not know how is 'their' product produced, typesetters who do not understand the text (only in 1986 were all typographical errors – 5,000 of them – in Joyce's *Ulysses* identified and corrected; the damage done to literary criticism is irreparable).

Richard Veryard has proposed an obvious and natural thesis: make *systems more visible.* That this call comes from Great Britain, the kingdom of centralized mainframes, is even more satisfying. Something significant is taking place: for the first time in history, people are learning to use systems to their own advantage.

Some may lament about the implied loss of 'mystery', the loss of *Deus ex machina.* Let us assure our readers that there is nothing more mysterious, more satisfying, more challenging and more awsome than even a partial understanding of the inner workings of systems. Scientific explanation creates more mystery than it dispels. Veryard's is a *hopeful,* optimistic proposition.

Negoiţă's 'Human management of systems'

Professor Negoiţă argues for *knowledge* – not for data or information. The transition from EDP (Electronic *Data* Processing) and MIS (Management *Information* Systems) has taken place some time ago. Even though some practitioners have not noticed it yet and are still investing in centralized MIS mainframes.

The transition to *knowledge-oriented* Management Support Systems (MSS) is taking place now and integrates Decision Support Systems, Expert Systems and Artificial Intelligence into a powerful, integrated methodology with all the chances and potential to make the next transitional step: towards *wisdom.*

'Wisdom-oriented' systems go beyond knowledge because knowledge, of course, is insufficient. knowledge can be misused, wasted, misapplied or simply destroyed – if used unwisely. The transitional chain: DATA–INFORMATION–KNOWLEDGE–WISDOM is now clearly visible and allows us to position our research and application properly.

Professor Negoiţă deals with the INFORMATION–KNOWLEDGE stage of the transition. He argues that going *beyond* hardware/software –towards human 'brainware' – is becoming a widely felt necessity in better informed circles. He is critical of *management science* which remains on the level of early fifties in its modelling abilities; it has also escaped any evolution.

So-called 'human emphasis' has not penetrated very deeply into mathematical modelling methodologies. To model 'imprecision precisely' has become the unfortunate heritage of the old thinking and a continuing dilemma of the 'new' thinking: in the age of knowledge and knowledge-based society, some existing methodologies still exclude 'human component' explicitly.

Negoiţă summarizes the comparison of two paradigms in simple and clear statements:

(1) Human users' rules of logic and conduct exploit the facts in data bases.
(2) Human users' facts trigger the rules of relations in knowledge bases.

While the first is typical for operations research, the second is characteristic of artificial intelligence.

The fact is, that some 40 years of OR/MS/DS has led to almost total collapse of American management, characterized by low productivity, low quality, high cost, and overblown bureaucracy. Any efforts, like Negoiţă's, to drive this message 'home' are to be applauded.

Zeleny's 'Human systems management'

Professor Zeleny uses the label of 'Human systems management' (coinciding interestingly with the name of this very journal) to characterize the entire array of profound changes in management practices, methods and conduct. All these changes, taken as a whole, amount to nothing less than a *paradigmatic change.*

The new paradigm does not grow from the old one, it is not an improvement of the old one, it is not an extension of the old one. We are seeing a profound *qualitative* change, sudden break with the past practices, beliefs, experiences and methods: none of them is working anymore. We are witnessing the emergence of a *new paradigm in management.*

Professor Zeleny shows, in a short and swiftly argued paper, what are the conditions which cause and underlie this rapid quantitative change. It is self-evident that the cause itself must be fundamental and qualitative. Most of us can see the manifestations of changes and accept readily their fashionable 'surface' descriptions as 'megatrends'. But only a few ask *why* is that? Why do these 'megatrends' occur? What is their cause? There, in

searching for answers and explanations, we have to move away from 'gurus' of management.

Prof. Zeleny suggests that it is the process of *division of labor*, an ancient movement in the direction of larger and larger atomization of task, and deeper and deeper specialization of knowledge.

This process, considered crudely uni-directional and forever 'progressive' by *all* traditional economists, is showing undisputable signs of *powerful and rapid Reversal.* Instead of further division, atomization and specialization, we are witnessing extremely powerful and unmistakeable signs of *re-integration, re-aggregation and re-construction of task, labor, and knowledge.*

Multifunctional worker, general purpose machinery, flexible organization, non-specialized 'renaissance' manager, together with rapidly *decreasing* numbers of job categories, vendors and suppliers, middlemen, management levels and unionized adversaries – all these present conditions of management *profoundly changed.*

Prof. Zeleny's message: study the change, understand it, grasp it, act accordingly – don't be left out.