malik

## Malik Sensitivity Model®Prof. Vester

# The Computerized System Tools for a New Management of Complex Problems

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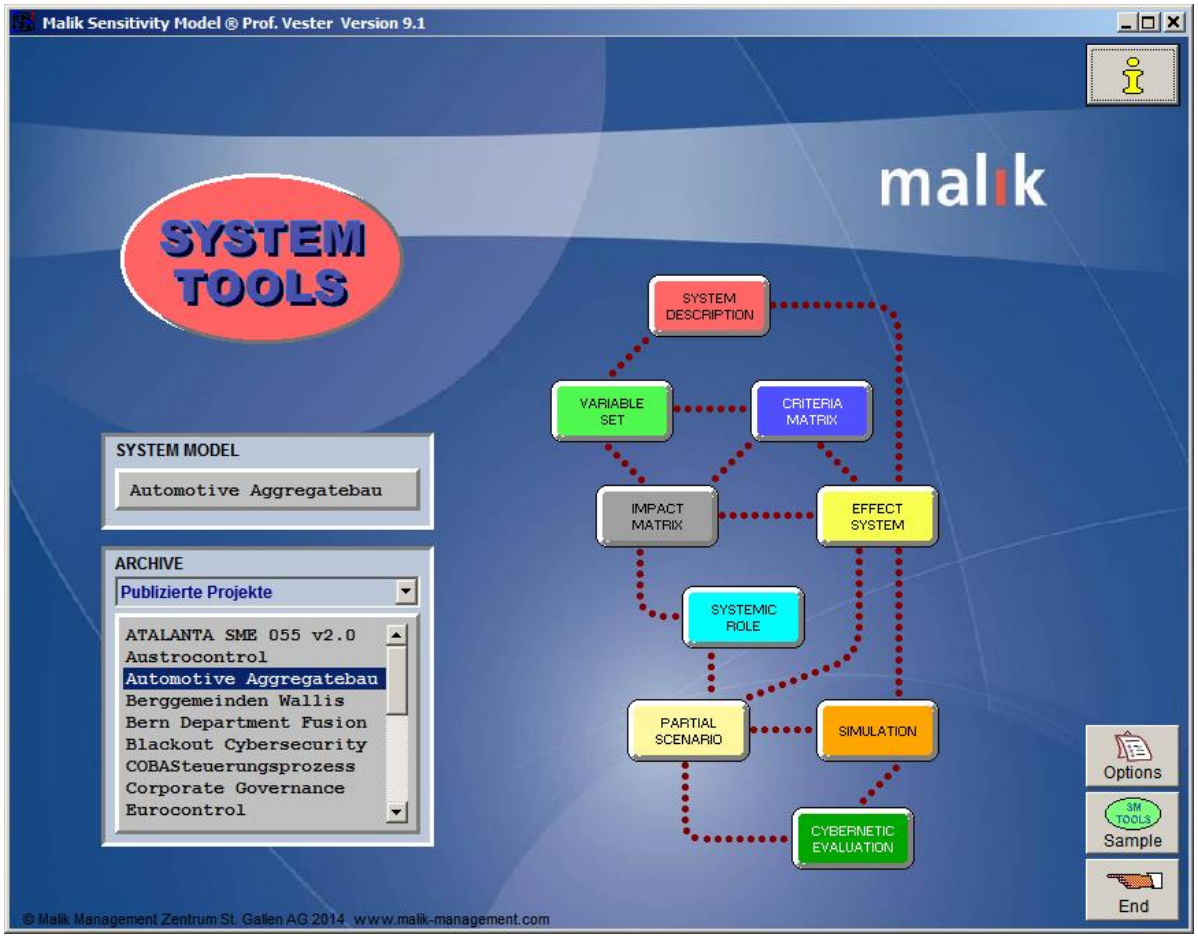
## Handling Complexity with the Tools of the Malik Sensitivity Model®Prof. Vester




The main menu of the sensitivity model shows the recursive structure of the 9 steps of the system tools that can be directly activated by clicking the respective buttons.

Through nine structured steps, the user is guided through the process of information gathering and data reduction to the few system relevant key parameters that will model the system. Through specially developed tools, the user is allowed to build up, visualize and analyse the cybernetic dynamics in a feedback diagram of the whole system. By focusing on particular issues, "subsystems" of especially interesting "clusters" of the overall effect system are developed. These partial scenarios are simulated to explain the dynamics and significance of the feedback cycles, which have been defined in the previous steps.

A relational database supports continuous modifications in the entire process. The final verification of the policy tests and the validation of the proposed measures are based on the application of a set of biocybernetic rules for the sustainable and long-term viability of the system under consideration. These nine steps recursively lead to a permanently interactive working tool which non-experts can easily understand by visualization and self-explanation.

## MEDIATION CAPACITY BY TRANSPARENT SIMULATION

One of the main features of the model is its mediation capacity. New ways of visualizing the cybernetic behaviour of the system and its parts help to put the different interests in the same model showing their role and mutual influence in the complex pattern. This ability of mediation is supported by the fact that each project participant is able to place their own requirements and beliefs in the system's pattern thus recognizing that these are inter-linked when sustainability is the aim. Based on this general concept, the visualization was also extended to the simulation tool, which is recommended for specific scenarios in order to gain some knowledge about the behaviour of one or the other system part or clusters. The complex behaviour could not be followed with the usual algorithms, not only with systems dynamics, but had also to be constructed with fuzzy logic, e.g. using broad areas of data instead of fixed points, using variables instead of constants. Therefore, the simulation tool was designed to help the user to visualize the realistic course of the effects between the variables and to describe these verbally.

As in reality, very few effects follow mathematical functions such as exponential, asymptotic or linear relations but obey to limit values, threshold values and broken courses. A simulation that will integrate all these inner systemic interdependencies and disturbances can only be constructed by table functions where one can put all these extra deviations of a non-linear relation. Another requirement was to make the simulation interactive, allowing the user to react during the runs upon critical developments - again, as in reality.

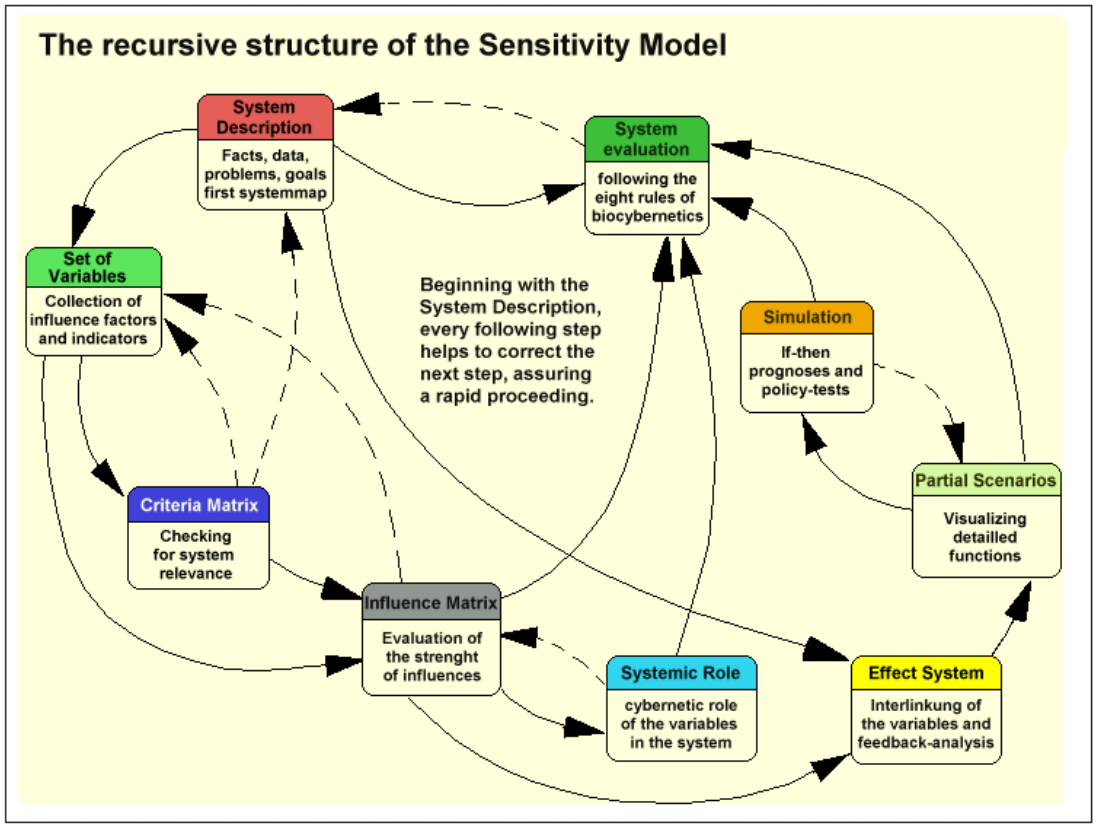
## THE AREA OF USE

Through the open structure of the instrument, the areas of use of the advisory package are practically unlimited and are useful everywhere where the complexity of the problem can no longer be tackled by customary methods:

- Corporate strategic planning
- Technology assessment
- Developmental aid projects
- Examination of economic sectors
- City, regional and environmental planning
- Traffic planning
- Insurance and risk management
- Financial services
- Research and training.

In addition to an environmental suitability test, the instrument can - on the basis of a biocybernetic assessment - also be used for the most diverse projects, in the sense of a system's suitability test.

**THE RECURSIVE STRUCTURE**



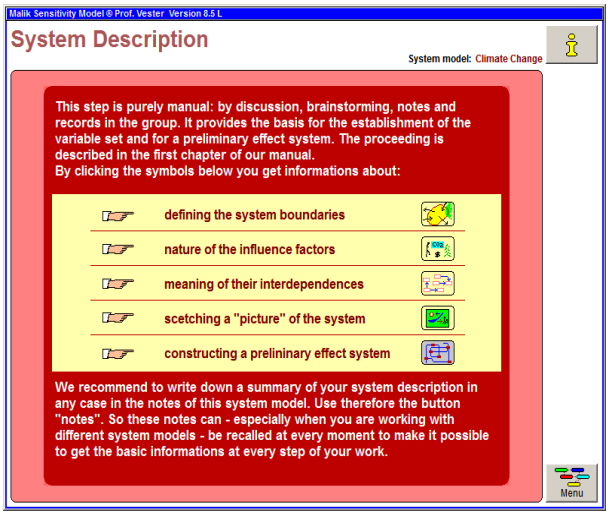

The recursive structure of the nine tools of our software is a replica of how evolutionary management works in nature.

It makes the sensitivity model a permanent working instrument where initial faults were successively corrected by the following steps.

Its neutral design - independent of the problem to solve - makes it applicable to any system striving for sustainability, be it regional planning, management, medical care or technology assessment.

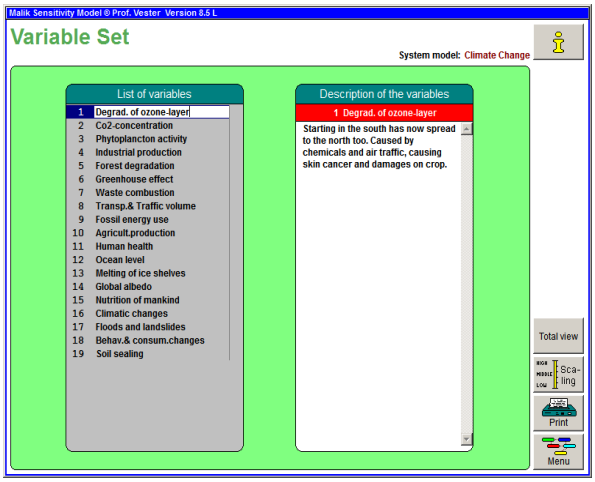
## SCREENSHOTS OF PARTS OF THE SOFTWARE OF THE SYSTEM TOOLS

### SYSTEM DESCRIPTION



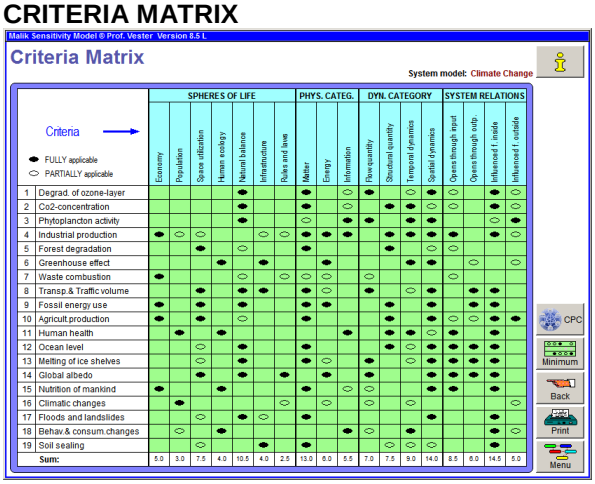

Every system analysis begins with the system description, which is constantly updated during the development of the model according to the current findings. From there, a collection of key variables with extensive descriptions is entered during a common workshop. Every system is always open touching others. Closed systems do not exist in reality. Every system is always part of a larger system and contains several smaller subsystems. Thus the variables used are bound to have the same level of aggregation adequate to the system in question.

### VARIABLE SET



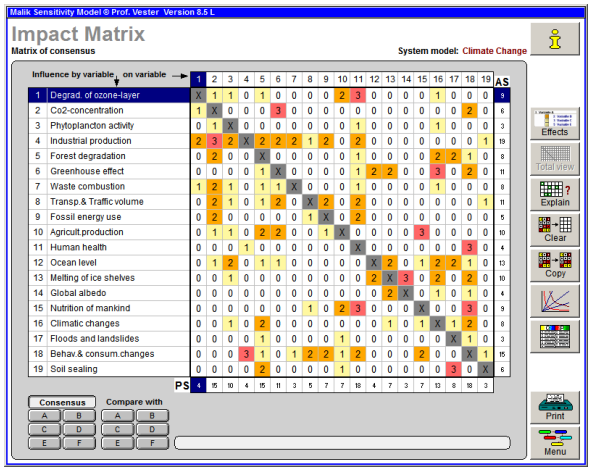

The resulting variable set is the 'gene-pool' of our system model and at the same time, its fingerprint. Its contents will be distributed automatically to all steps of the model by the special relational database of the Sensitivity Model. The variables can be improved or updated at any time, if this appears to be necessary.
Here we are using practical examples from an analysis of global climate change (details to this model see Frederic Vester: “The Art of Interconnected Thinking”).

### CRITERIA MATRIX



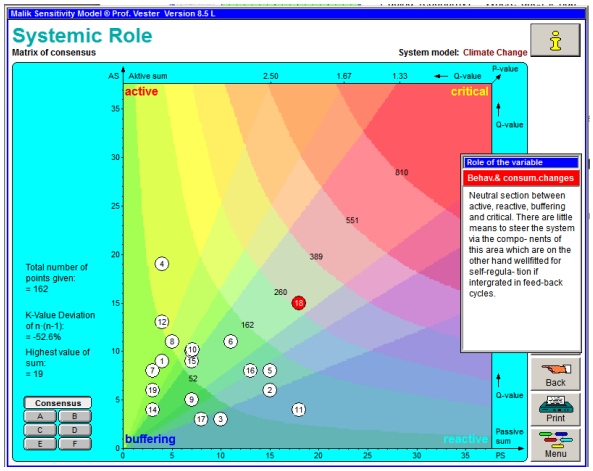

Checking the relevance of the variables. This next step is very important because here the set of variables is checked by screening through 18 essential criteria of any viable system. Example:
Beginning with the 7 spheres of life:
- Who is there (people) - What are they doing (economy) - Where does it happen (realm of space) - How do they feel (human ecology) - Exchange with environment (energy and waste)
- Ways of communication (infrastructure)
- What are the rules (laws and culture).

## IMPACT MATRIX




With this tool, the "impact matrix" we go from the level of components to the level of their interactions. For this purpose the set of variables appears in a cross-impact matrix where the effect of every variable upon any other will be asked for.
During this step, which will be carried out in three separate groups and is followed by a consent discussion, you will get to know your system from a new point of view and identify the relevant factors.

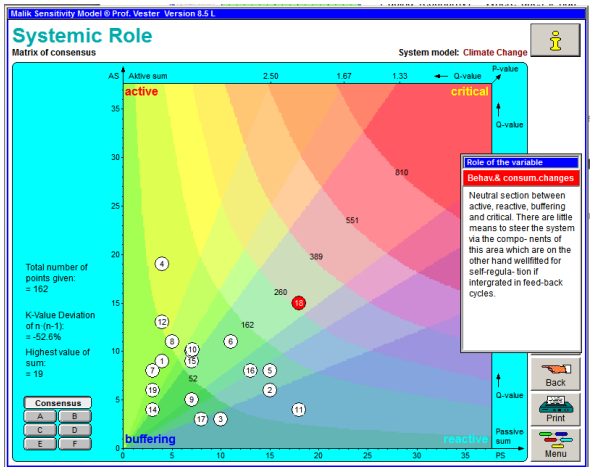
## SYSTEMIC ROLE




The resulting 'consensus-matrix' is the basis for the calculation of the INDEX OF INFLUENCE of each variable, that is: between 'active' and 'reactive' on one hand and between 'critical' and 'buffering' on the other.

These positions will enter the tool SYSTEMIC ROLE, where every variable is evaluated cybernetically due to its interdependencies. In this step it is the system as a whole which distributes the variables within a net of 50 fields of different meaning.

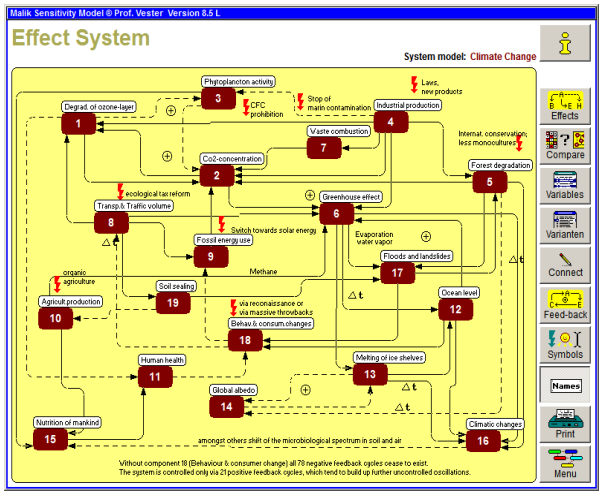
## SYSTEMIC ROLE: INTERPRETATION




According to its pattern of influence, each variable is sent towards the four corners of the 'compass' and thus reveals its cybernetic role. This may be as a lever (active), a risk factor (critical), a measuring sensor (reactive), an inert element (buffering) or any position in between.

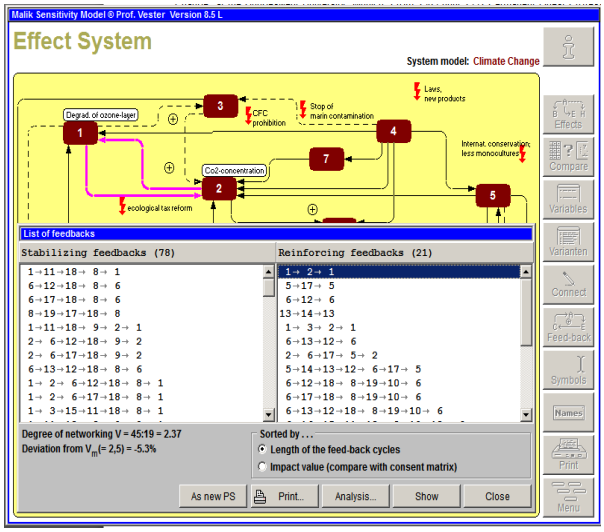
Thereby, the retrievable statements of this system tool will give you the first strategic hints. They are based upon more than 20 years of experience with the evaluation of concrete projects.

## EFFECT SYSTEM



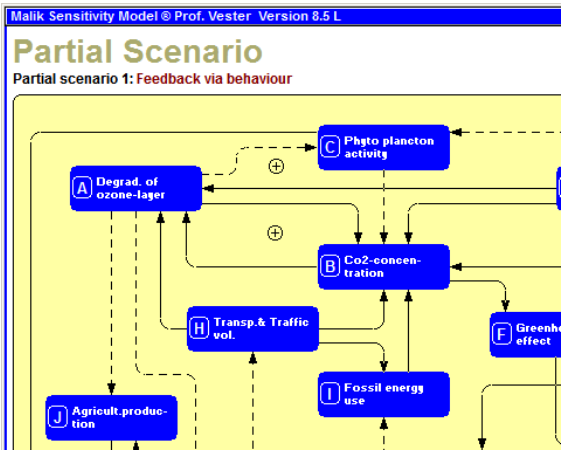

While the INFLUENCE MATRIX reflects the 'genetic reservoir' of a system, including its latent possibilities, the pattern of the EFFECT SYSTEM should show its actual interrelation. This network is to be built up on basis of the influence matrix With this, another way of visualizing the system's interrelation starts and thus the recognition of main focuses, structures, patterns. Differing from the classic methods of deterministic network planning (PERT, CPS etc.) which from the beginning are directed towards a particular aim, in a sensitivity analysis cycle interactions and time delays play a big role.

## FEEDBACK CYCLES




Thus, the plan to be followed to achieve sustainability or to dissolve the system does not come from outside, but is delivered by the system itself. The feedback analysis of the effect system allows recognition of the dominant cycles, the relation between self-control and mutual amplification. This way one recognizes how contradictory influences regulate or disturb each other, how they are connected to others and where one may run into a blind alley. One may also virtually delete variables to see their importance for the behaviour of the system. The systemic significance of each variable and its connections can be understood and presented visually in view of the sustainability of the system.

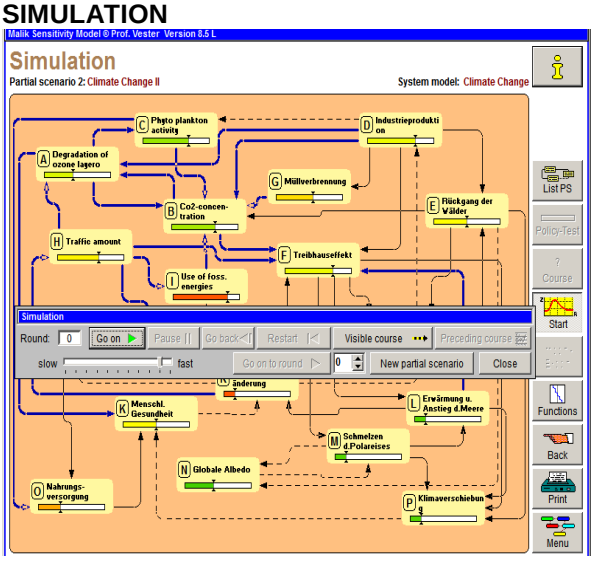
## PARTIAL SCENARIOS




In the next step, out of the EFFECT SYSTEM one can pull out as many partial scenarios as required. Such a 'cluster-analysis' facilitates the cybernetic examination of especially interesting areas of the system in a clearer way.

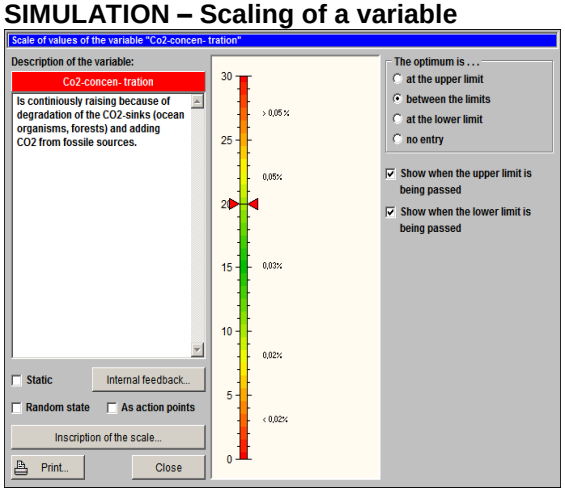
While the feedback cycles reveal certain risks and chances of the system's cybernetics, the following tool SIMULATION will give transparent insights into the dynamic development and the possibilities of controlling it.

## SIMULATION




The graphical basis of the SIMULATION is delivered by the PARTIAL SCENARIO and will automatically be taken over from it for this step by 'freezing' its pattern of interaction. Because of its unique transparency and the application of the fuzzy logic, the building up and interpretation of this tool is particularly suited to working in groups and can even be carried out by non-experts in mathematics.
The algorithm is based on table functions that allow non-linear relations. This way limit and threshold values as they occur in reality will be recognized as well as mechanisms of stabilization or time delays.

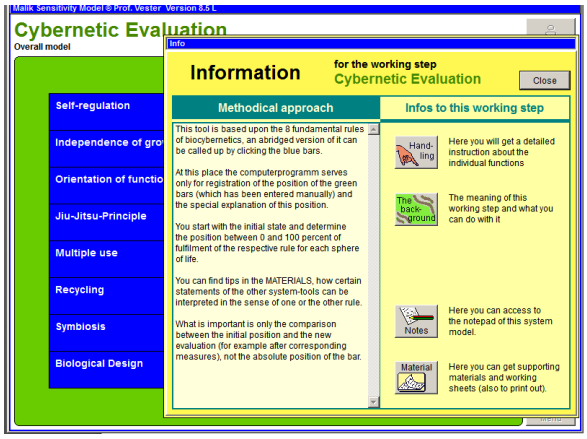
## SIMULATION – Scaling of a variable




Then as a policy-test one can follow how, for example, that a change of behaviour might indirectly influence the further increasing of the Co2 concentration. But if the political consensus is not high enough, this change will not come.

That changes already if the consensus is put some steps higher and helps to meet the difficulties. The SIMULATION however, does not at all serve as an instrument of prognosis but mainly for policy-tests and 'if then' analyses in order to test different strategies for a selected group of inter-linked variables.

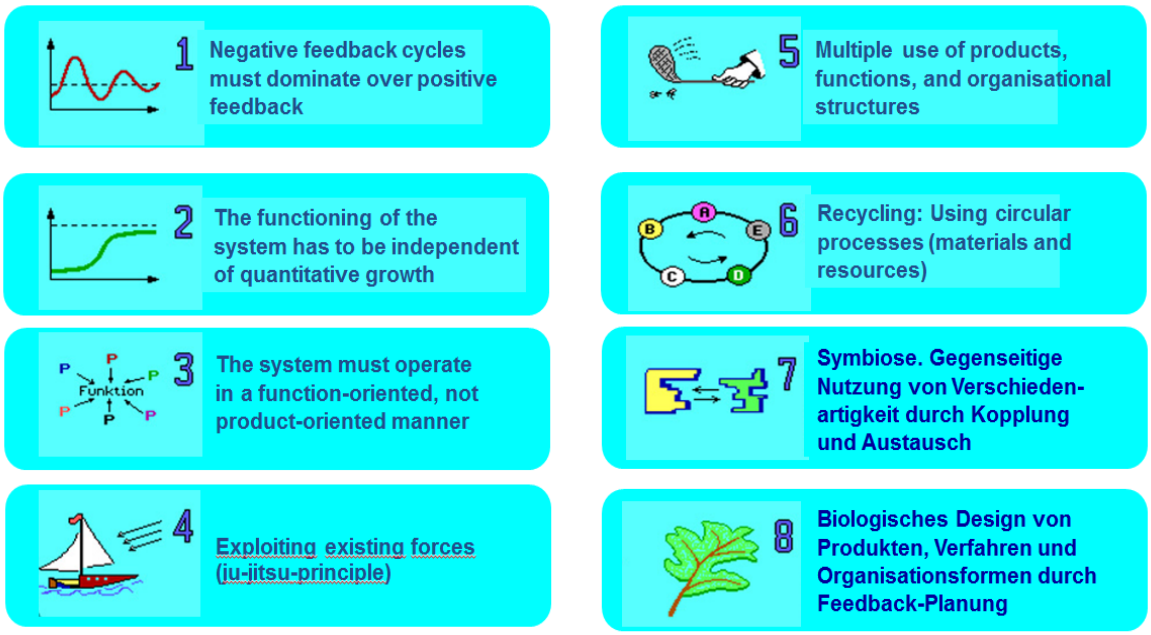
## SYSTEMIC EVALUATION




For the general evaluation of the viability and the behaviour of the system due to unforeseen events - that means its general robustness against changes - we recommend to use our checklist of eight fundamental rules of biocybernetics which are based upon the findings of modern 'organizational bionics'.

They reflect the cybernetic principles of the biosphere, which has managed to survive over 4 billion years without 'becoming extinct'.

## >> Eight Basic Rules of Sustainability (after Frederic Vester)




These rules are able to guarantee a successful 'evolutionary management' by showing possibilities for long-lasting survival and development of every living system - be it a human being, an ecological system, a company, a city or a country.

From the evidence taken out of these nine steps of the sensitivity model you can estimate the degree of the sustainability of a system and how this eventually can be increased. This is because you now have found out where the system is reacting, where its acting parts are, where it is critical, where it is flexible and where it is reluctant to change. You can also find out how dependent it is, how far it is self-regulating or endangered by positive feedback. The evaluation will also show you where one or the other of the cybernetic rules is violated and by which strategy or measure they can be better fulfilled.

### FREDERIC VESTER: THE NEW REPORT TO THE CLUB OF ROME

In his latest book “The Art of Interconnected Thinking”, which has been chosen as a new Report to the Club of Rome (where he was a member) Vester tried to summarize his biocybernetic approach to deal with complexity and the experience gained by applying the **Malik Sensitivity Model®Prof. Vester** in different fields.

## HOW DOES THE MODEL LEAD TO A COMPREHENSIVE CAPTURE?

The system tools of the Malik Sensitivity Model®Prof. Vester make the capture and assessment of complex systems accessible to the human brain by visualizing and using the linguistic approach of Fuzzy Logic. It puts the user in the position of capturing the examined system and its socio-economic-ecological environment in plain language, as a biocybernetic unity, without getting lost in an endless number of mathematical factors and variables. By visualizing simulation processes, additional qualities of the sensitivity approach appear as a new kind of dialogue instrument which leads interactively through a holistic illustration on the system level to a lasting consensus.

**Argument Aid**
With its new simulations, interpretation and assessment program, it provides the political and material decision aids for the future development of the system under consideration. At the same time, the model also provides the necessary reasonable arguments by multimedia presentation, a must for decision-makers.

**New Types of Solutions**
The behaviour of the system is always interpreted with regard to its sensitivity or robustness in the whole system and offers new types of solution possibilities and opportunities under the main criterion of increased survival capability.

**No Data Overload**
Instead of data overload, as is usually the case in the capturing of complexity, in the sensitivity model it occurs by means of a programmed screening of the variables, which are to be included with a clear number of representative influential dimensions with the fuzzy logic approach. At the same time, another problem was solved by the fact that not only quantitative inputs but also qualitative connections gain access and can be processed together in the instrument.

**Fuzzy logic as a Basis**
The type of representation, which is related to Petri-networks and the use of the mathematics of Fuzzy Logic makes it possible, already from little relevant data, to draw conclusions regarding the function of the examined system. The background consists of the concept of the survival capability by means of self-regulation and flexibility, which is ensured by the strictest possible adherence to the basic rules of biocybernetics.

**Interactive Way of Working**
Last but not least, the instrument is deliberately designed so that the user is in continuous open dialogue with the computerised and manual parts of the method. As the dialogue takes place at all stages of the processing and is included in the interactive course of simulations and priority tests, it allows the recursive type of working which is important for complex systems. Therefore, every stage of the process remains open until the end and can always be realized. This means that every system model, which has once been developed, later serves as a permanent-working instrument.

**No Nonsense Predictions**
The result of examinations does not consist of the usual type of predictions. It refrains from developing future scenarios by means of calculation of trends or the prediction of the occurrence of events, which is obsolete in complex systems anyway. It is far more helpful to recognize the characteristics and developmental possibilities of such a system. By using it, predictions regarding the behaviour of the system can be applied in such a way, which enables the system to be better able to cope with unexpected events.

**Thinking Aid, no Thinking Replacement**
Individual mental effort is necessary, as before. However, it is noticeably easier, as all mechanic, organizing and documenting activities are automated in such a way that the cybernetics of the system is revealed and the parallel procedures of dynamic occurrences, which are no longer impossible for the brain, can be followed up.

**Support for Integrated Thinking**
Furthermore, as a result of its instrumental guidance of projects of various types and levels of difficulty, the method gives the support of consequently providing integrated thinking. Hereby one can avoid slipping back into linear thinking, which is hardly avoidable without the help of appropriate instruments. Nonetheless by whom and wherever it is used, the use of the sensitivity model will undoubtedly offer new insights into otherwise obstructed connections.

## Malik Sensitivity Model®Prof. Vester – the software

This compact software for Windows 95, 98, NT, 2000, XP, Vista, Windows 7 was newly developed without purchasable tools with - in part - self-designed drivers, in order to be able to carry out all the processes on the screen. All that is necessary for the installation of the programme is Windows PC. The software is protected by a programmable hard lock protection. The user is supported by a user interface, whose development is also based on the discoveries of modern biology of learning. It is presented clearly and attractively. The proceedings on the screen are easy to understand and allow efficient work without any knowledge of programming. The operation itself is as simple and self-explanatory as possible, so that a manual for the technical software handling is dispensable.

**Permanent Orientation**
By means of the integrated relational data bank, the user always has access to an overview of the state of the entire process, e.g. which manual or computer supported work stage he is at, which work stages he has already completed and which work stages he should tackle next. Even incomplete stages are not in a coded form but are always represented by tableaus.

**Secured Parallel Processing**
As is already evident, the program has been designed in such a way to allow simultaneous processing of as many system models as you want. These are secured by each other through the relational data bank, so that they can be simultaneously processed from the same menu without the risk of confusion.

**Copy and Print Functions**
Again, directly from the user interface, entire system models which are being worked on as well as only parts of them can be copied onto other models, what greatly simplifies the processing of similar systems analyses. The same applies to the functions for the background print as well as the colour print of the respective screen (for pre-presentation purposes also on film) which is accessible from the user interface.

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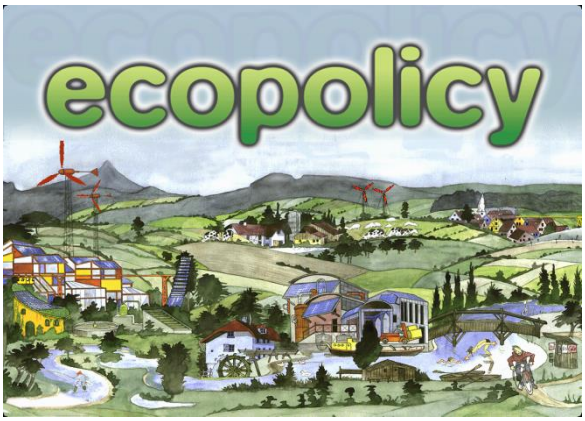
**Internet:** For further publications on projects that were carried out by users of the „Malik Sensitivity Model® Prof. Vester“ see: *www.frederic-vester.de* or *www.sensitivity-model.com*

## ecopolicy® - Frederic Vester's Simulation Game as an Introduction




A derivate of the professional Malik Sensitivity Model®Prof. Vester is a strategy game called ecopolicy® - using the same transparent interactive simulation part. This game (available as a German/English Version), awarded with the European Comenius Medal for its outstanding pedagogic value, serves as a first introduction in the art of network thinking (CD-ROM for Windows 98, NT, 2000, XP, Vista, Win7/8). **www.ecopolicy.net** Since 2008 until now the game is part of an international gaming contest of students, the **ecopolicyade®** **www.ecopolicyade.info**

Frederic Vester (1925-2003). Born in Saarbrücken, biochemist. Prof. Dr.rer.nat.habil. Dr.oec.h.c. Main area of work until 1970 was molecular biology in cancer research. 1970 establishment and until 2003 management of the private Study Group for Biology and Environment Frederic Vester GmbH (since 2003 named frederic vester GmbH under direction of his wife and coworker Anne Vester).
Frederic Vester was from 1981 until 1988 Professor of “Interdependence of Technical and Social Change" at the Armed Forces University, Munich. From 1989 until 1991 Permanent Guest Professor of Business Management at St.Gallen University. Since 1993 member of the Club of Rome. Author of bestsellers, e.g. “Thinking, Learning, Forgetting”, “Phenomenon Stress”, “Neuland des Denkens”, “Ausfahrt Zukunft”, “Crashtest Mobilität”. His latest book "Die Kunst, vernetzt zu denken" (The Art of Interconnected thinking) was chosen as Report to the Club of Rome in 2000. Extensive lecture and consulting activity. Big system studies and projects. Scientific television films and radio broadcasts. Several exhibitions, including “Our World - an Interlinked System”, “Man and Nature - Joint Future”. Numerous prizes and awards. His environmental simulation game "ecopolicy®" on CD-ROM was honored with the Comenius Medal 2000 as outstanding educational medium. The first application of the Sensitivity Model was awarded with the Philip Morris Research Prize. In 2006 Frederic Vesters life-work has been integrated with all the tools and rights into the Malik Management Zentrum St. Gallen in Switzerland after a long cooperation. Gabriele Harrer, Vesters long-term co-worker, is now head of the Malik Competence Centre Vester. Prof. Fredmund Malik and his 250 experienced consultants and trainers at Malik Management continuously apply and develop the approach and software tools in research and practical projects, introduced with the brand name **Malik Sensitivity Model®Prof.Vester**

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