SYSTEMS ANALYSIS
LECTURE 11
SOFT SYSTEMS

Zuzana Bělinová

Hard or soft system

- Hard system
  - system with distinguishable and explicitly presentable structure
  - Can be modelled using formal means for the
    - Record of system structure
    - Record of systems dynamics
    - Solving of system analysis tasks
    - System projecting

- Soft system
  - Is difficult to identify
  - With non-recognized or undistinguishable structure
  - The criteria for hardness or softness of the system are not based on its physical substance, but the degree how it can be objectively recognized and described using formal means of description
  - Softness comes from the uncontrolled or unmanageable system uncertainty
  - Typical examples of soft systems are systems recognized on **social** or **socio-economical** objects and systems of projects in the science area

Sources of system uncertainty

- Important influence of the remote system surroundings
- Insufficient dispensable information about system or its surroundings, mainly caused by
  - Complexity (combinatorial or algorithmical) – trans computability
  - Insufficient sources in the space, where system analyst is working (time, energy, money)
  - Limited ability of the system analyst
- Fragmentation of processes

  as a result of the situation, where changes in the surroundings are quicker than the time of run of strong processes in the system
- Quantum uncertainty – in the system analysis is not significant

Hard systems methodologies

- Basic tool for system engineering
- Vast and proved tool based on the tasks on the system, tasks of operational research, applied mathematics, informatics and system theory
- Main advantages
  - transferability
  - Relative objectivity
  - Proving of statements (sentences)
  - algorithmization
  - Automation of the solution
- Disadvantages
  - Danger of deforming the content of the task (semantic) Due to the fact that hard means are “aggressive“ , adjusting the picture of the model into the syntax of used formal tools
  - Cannot be used in the cases of high uncertainty and complexity

Soft systems methodologies

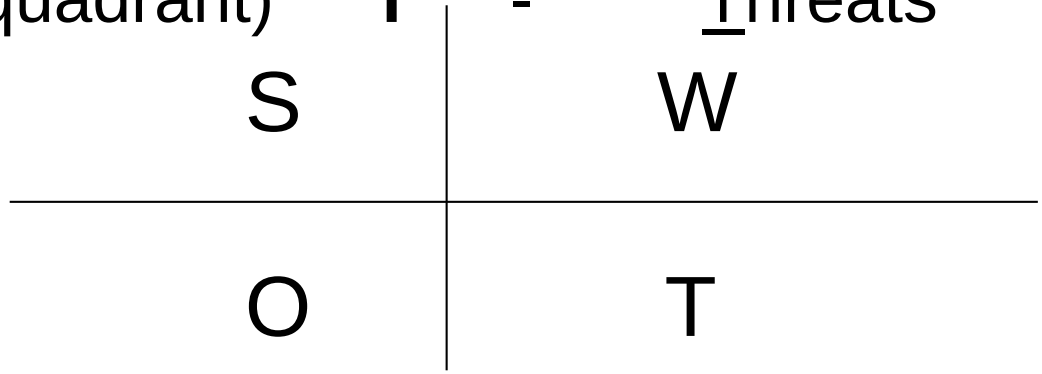
- Stressing necessity of complete understanding and describing of objects and their characters, even if not so formally accurate
- Transfer of the methods is possible only on the level of examples (that are used as patterns, not direct instructions)
- Rather pragmatic procedures, derived from experiences from solving particular problems, but also using some generalization of empiric procedures
- Soft algorithms – relative objective and rigorous usage of methods for managing uncertainty
- Emphasize the “rich picture“
- Disadvantages
  - methodical non-homogeneity, that does not allow to find our fulfilment of set criteria, enumeration of effects and controlling the solution by formal methods

Examples of soft system tools

- Methods
  - SWOT
  - Force field analysis
- Methodologies
  - Jenkins
  - Checkland

Soft methods - SWOT analysis

- Often used for planning of organization changes in the system
- Uses 4 quadrant structure
  - (IV. quadrant) **S** - Strenghts
  - (I. quadrant) **W** - Weaknesses
  - (III. quadrant) **O** - Opportunities
  - (II. quadrant) **T** - Threats

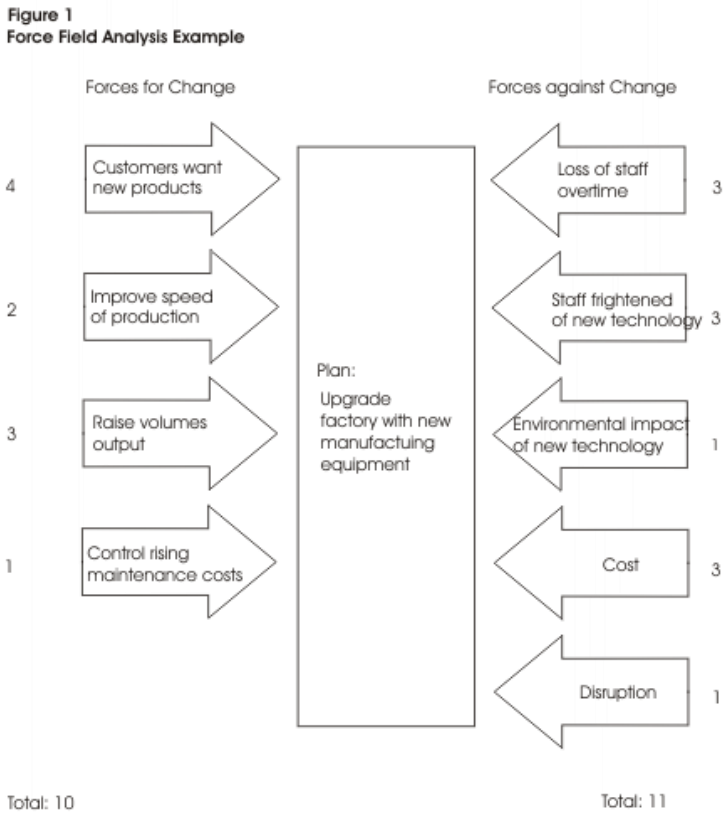


Soft methods - SWOT analysis

- Creates estimative picture of the situation in two time horizons
  - in present
  - in the near future (after doing the changes)
- Uses „brainstorming“
- Followed by proposals how to support the positive issues (S, O) and mitigate the negative once (W, T)

Soft methods – Force Field analysis

- Used for planning of changes in the system
- Analysing the pressures for and against change
- Steps
  - Describe your plan or proposal for change
  - List all forces for change in one column, and all forces against change in another column.
  - Assign a score to each force and displaying it in the graph as opposite forces



Source: http://www.mindtools.com/pages/article/newTED_06.htm

Soft methodologies - the system approach according Jenkins

- Often used during project analysis of extensive technical and socio-technical works
- Contains 4 main phases
  - System analysis
  - System project
  - Implementation
  - System operation

Soft methodologies - the system approach according Jenkins

1. System analysis
   - Finding and formulation of the problem
   - Organizing the work on the project – including good composition of the working team
   - Definition of systems and subsystems including flows and information relations
   - Definition of superordinate system – to specify the role of the system
   - Definition of the goals of the superordinate system – they have direct influence on our system
   - Definition of goals of our system – with respect to the goals of superordinate system
   - Setting of the whole economical criteria
   - Collection of data and information for future modelling of the system and prediction of future development

Soft methodologies - the system approach according Jenkins

- 2. System project (system design)
  - Key role is the definition of interfaces among particular participants in all relevant parameters including time
  - Following processes are applied:
    - *anticipation*
    - *Creating of model and simulation* – first a simple model is built that is being improved and more in details. Using simulation real results are find using real inputs and the best strategy to control the system is found.
    - *optimization*
    - *control* – should guarantee the ability to deal with unpredicted failures after the implementation into real world

Soft methodologies - the system approach according Jenkins

- 3. Implementation
  - Creation of documentation and its approval
  - Building of the system
- 4. System operation
  - *Initial operation* (preceded by the training of personnel and delivering the documentation to the user)
  - *Retrospective evaluation of the project* (enabling certain re-optimization of the system and bringing experiences for future projects)

Checkland soft systems methodology

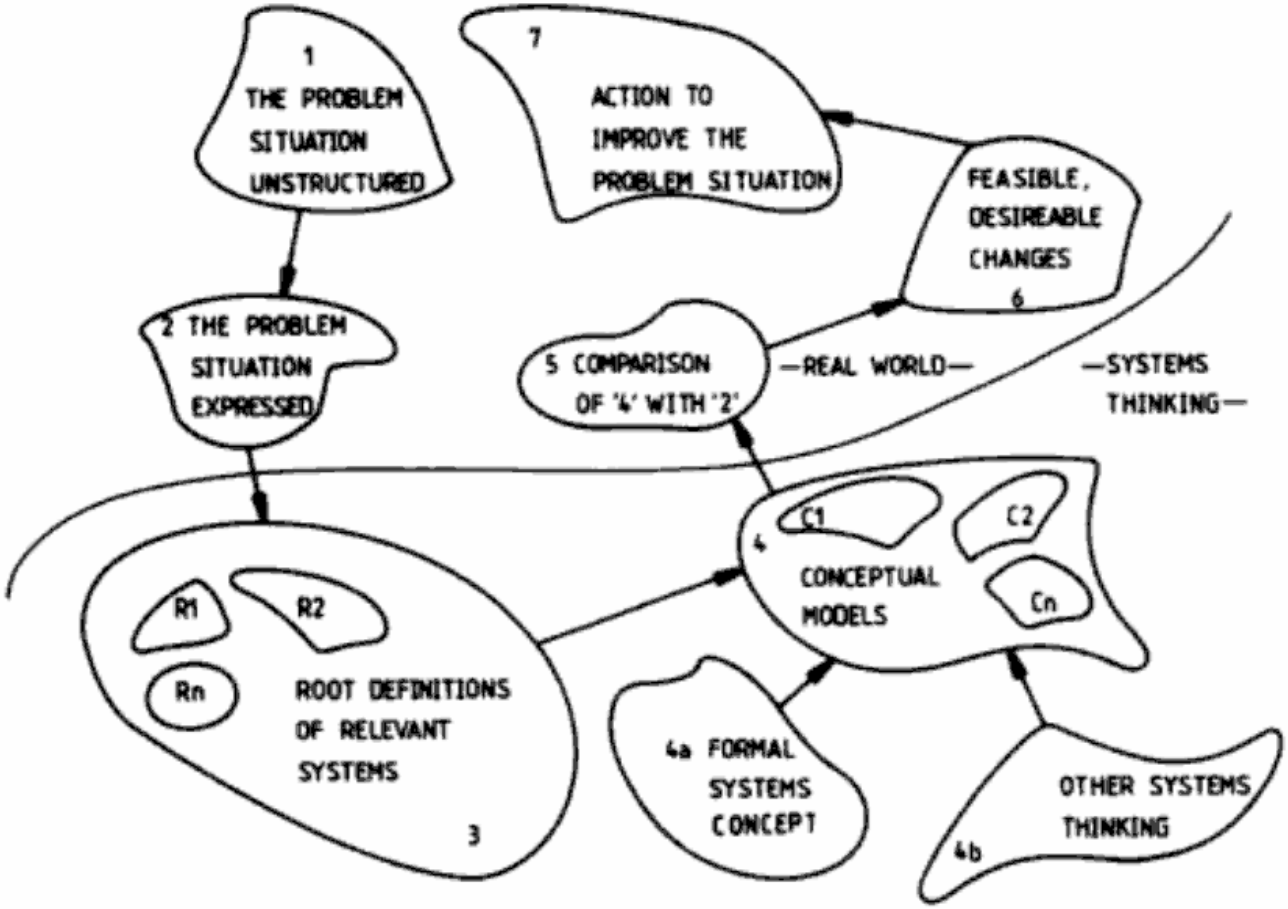


FIGURE 6.4. Soft systems methodology. (Checkland, 1981; reproduced by permission of Wiley.)

Checkland soft systems methodology

- Based on the fact, that during examination of problem situation there are several viewpoints, therefore it is difficult to find out borders and goals of such situation
- **Phase 1 and 2 – formulation of the problem (analysis)**

  goal is to achieve a representation of the problematic situation in as neutral a way as possible, from different views – so called “rich picture“
  - Helpful questions
    - What kind or resourceds are used in the activated processes?
    - How the processes are being planned?
    - What is the organizational structure?
    - What is the neighbourhood and what is the super-systém?
    - How the processes are managed and controlled?

Checkland soft systems methodology

- **Phase 3 – basic definition of relevant systems**

  Contain definition of positions and relations of relevant systems reflecting aspects **CATWOE**:
- **C** (customer) – who could be victims of beneficiaries of this system
- **A** (actor) – who would perform the activities
- **T** (transformation) what input is transformed into what output
- **W** (worldview) – what view of the world makes this system meaningful
- **O** (owner) – who could abolish this system
- **E** (environmental constraints) – what in its environment does this system take as given

Checkland soft systems methodology

- **Phase 4 – creation of construction models**

  Basic creative contribution to the problem solution. Defines concept models
- **Phase 5- comparing of concept models with results of problem analysis**

  contains results of comparison and agenda of possible changes
- **Phase 6 a 7 - project and implementation of changes**

  Involves achievable and desired changes of structure, processes, accesses and their realization

NIMSAD

- Normative Information Model-Based System Analysis and Design
- To help understanding system analysis and synthesis
- Meta-level model for evaluation of existing and emerging methodologies
- Tool showing the logical procedure during system analysis in an unknown environment
- Suitable also for non-soft systems

NIMSAD - phases

- Phase 1 – introduction into „real world“ – relations between the analyst, the problem and the client are formed
- Phase 2 – understanding of the situation

  - based on the previous knowledge, using system concepts, models and theories
- Phase 3 - diagnosis („where are we now“)

  Explicit formulation of findings from previous phase

  Result - 2 models:

  - 1. diagnostic model 1 **(DM1)** Describes logical ordering of roles, structures, flows, processes, functions, etc.
  - 2. diagnostic model 2 **(DM2)** *Shows situation in the terms of real entities, e.g. People, documents, products*

NIMSAD - phases

- Phase 4 – prognosis draft („where we would like to go and why“)

  Definition of client‘s expectations, construction of the prognosis model choosing differences between desired state and diagnosis
- Phase 5 – system analysis

  Analysis of the distance from actual to desired state, identification of critical elements hindering the transformation with current system sources
- Phase 6 - project of the system “logic“

  Identification of logical elements and relations, that are necessary for achieving desired state – creating logical prognosis model PM1 – is compared to DM1.
- Phase 7 – physical project

  Choosing of ways and means for physical implementation
- Phase 8 – implementation