The Scenario Method Application

An Overview with Examples

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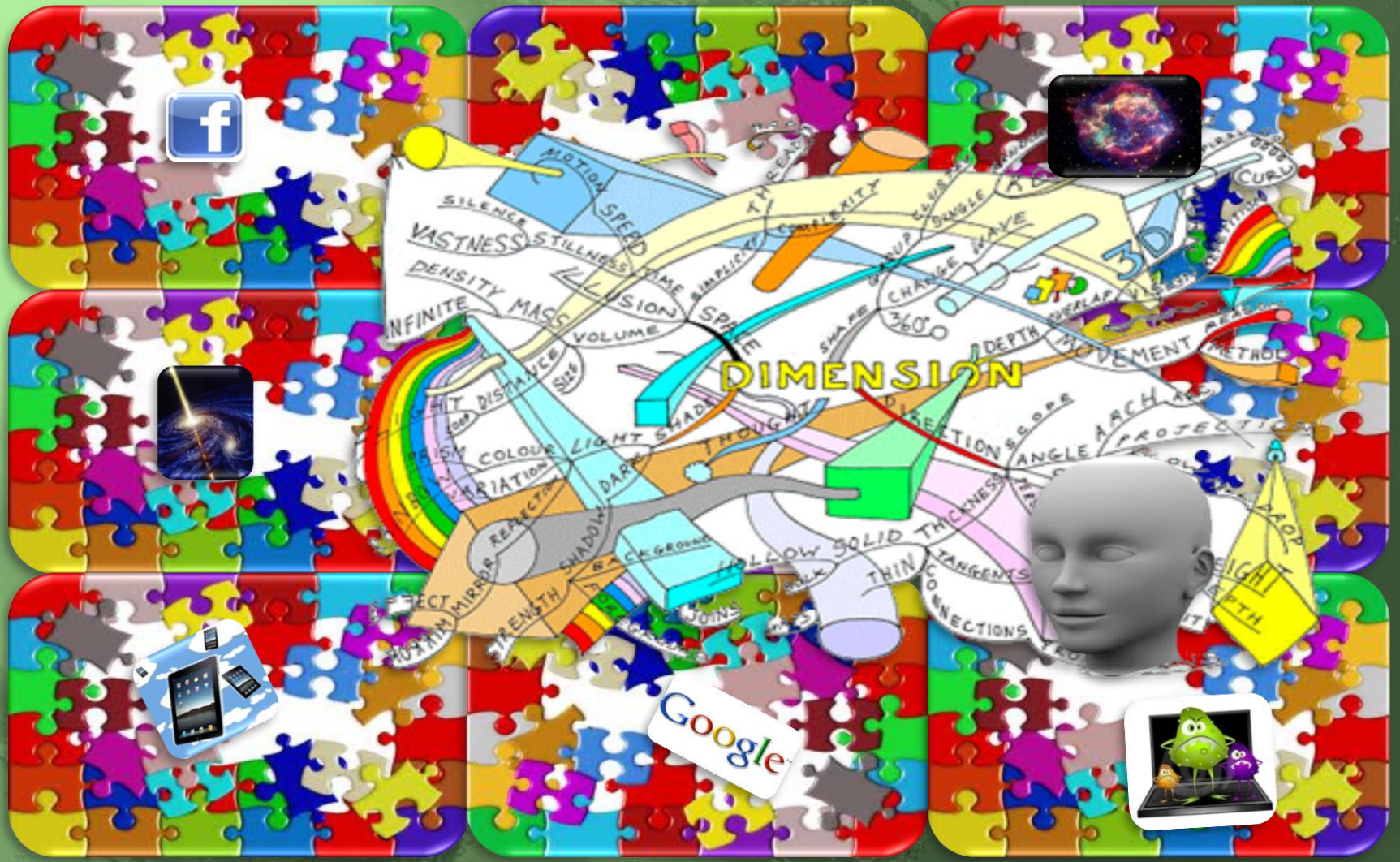
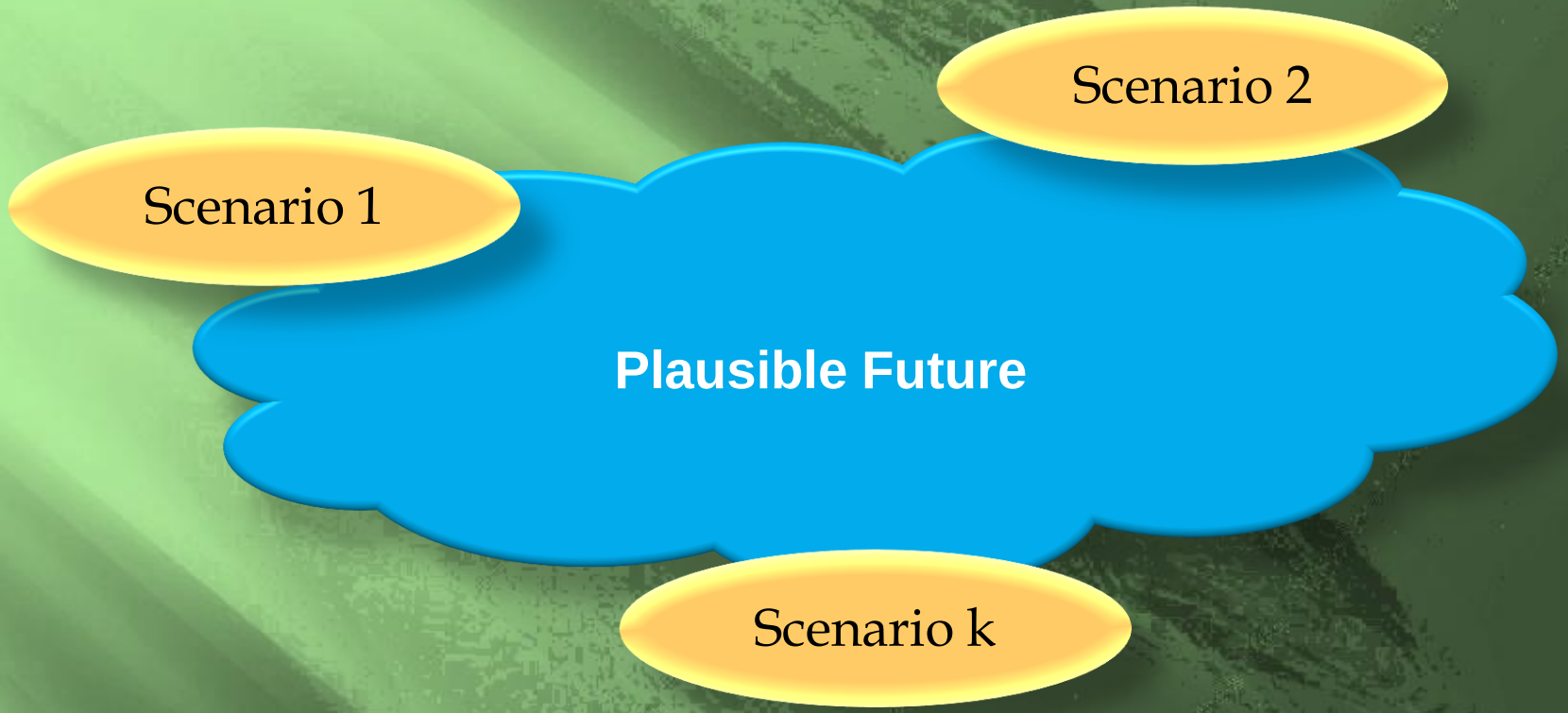
The Great Complexity of the World Around Us

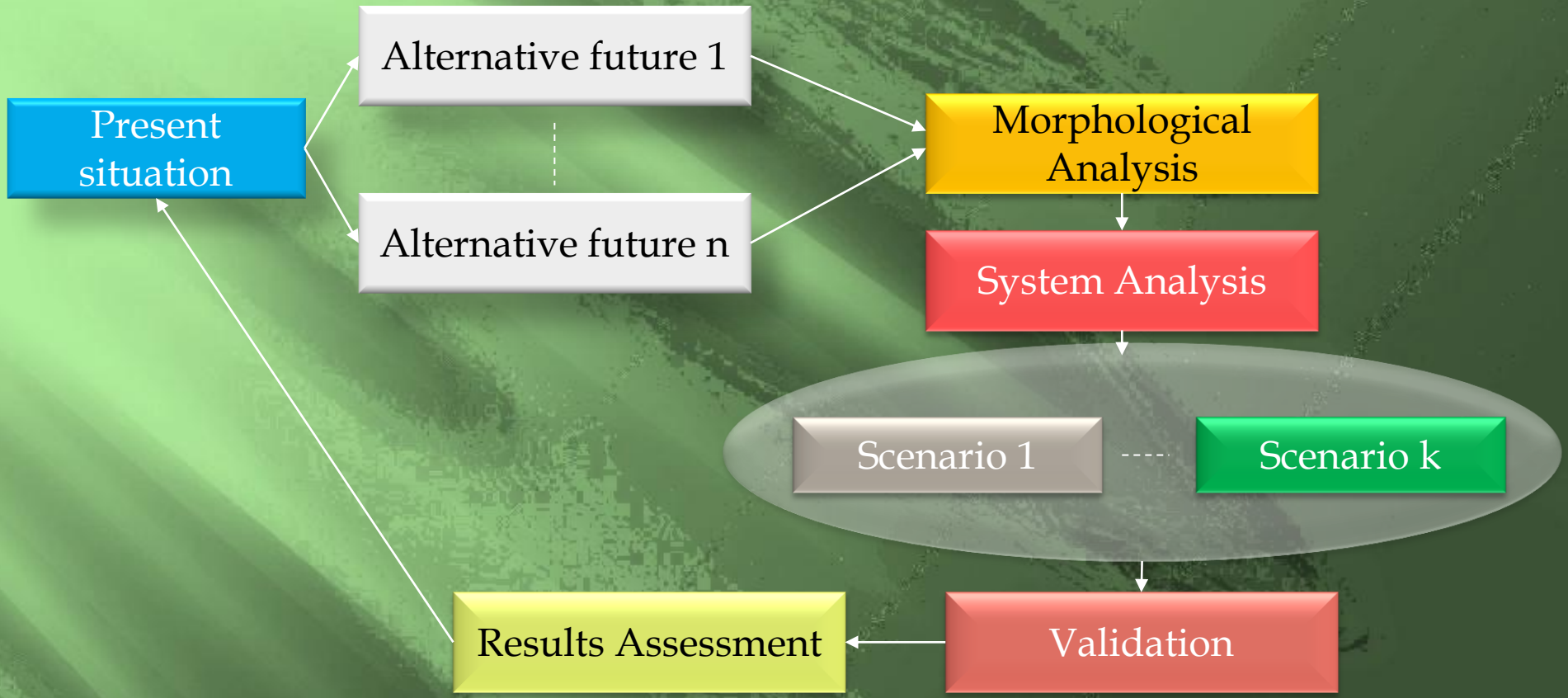


Building Context

The Scenario Method



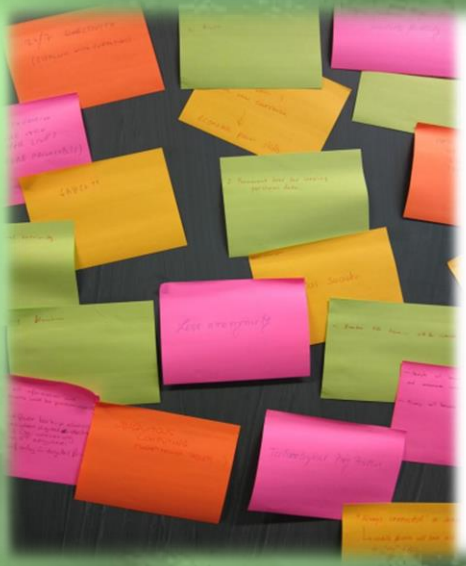
The Scenario Generation Process

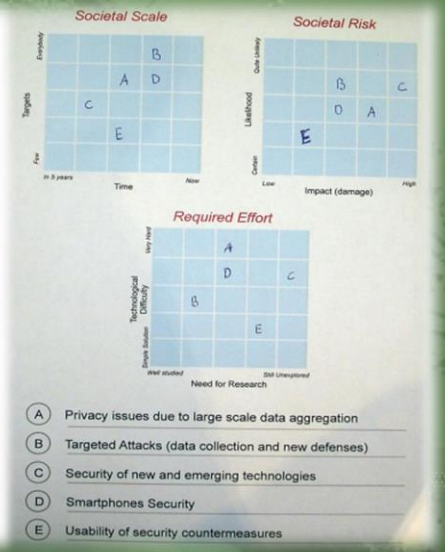


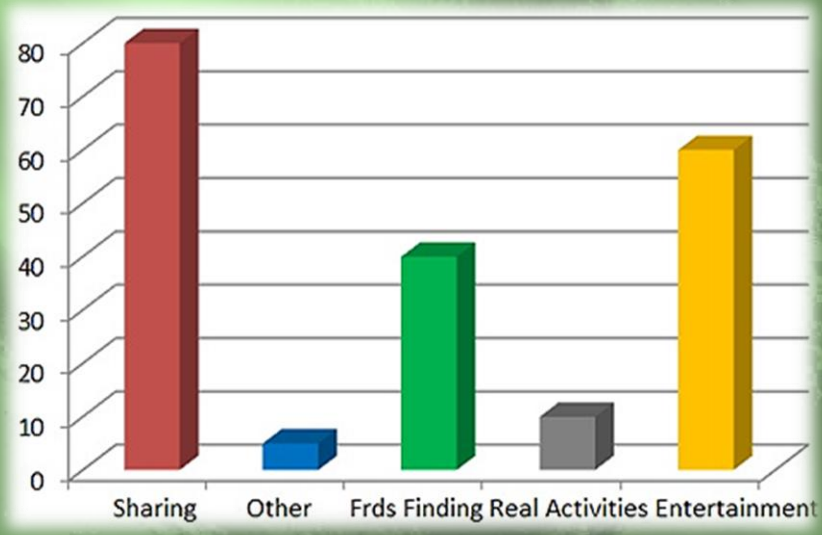
Experts' knowledge extraction

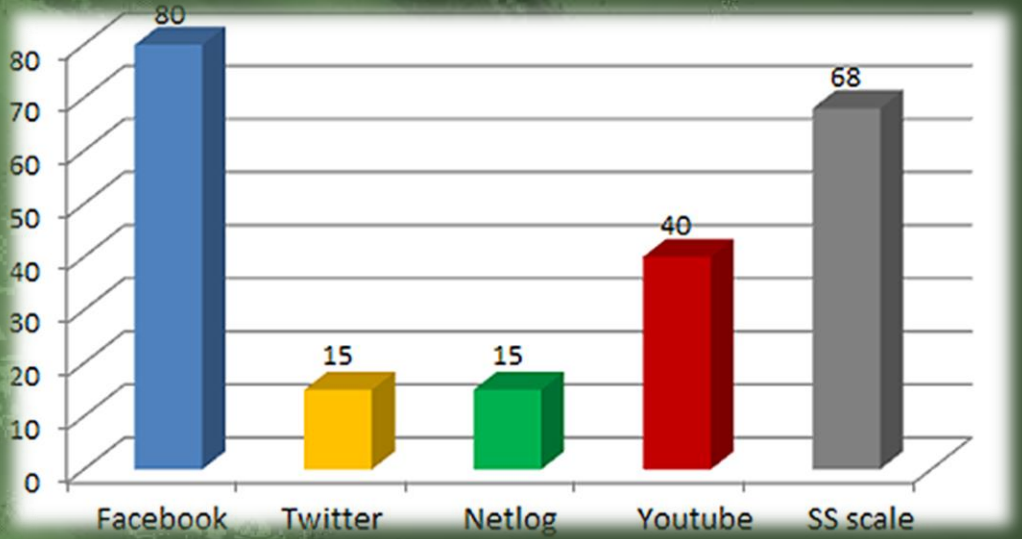
- Brainstorming
- Discussions
- Delphi method based on questionnaires

Some Data aggregation examples









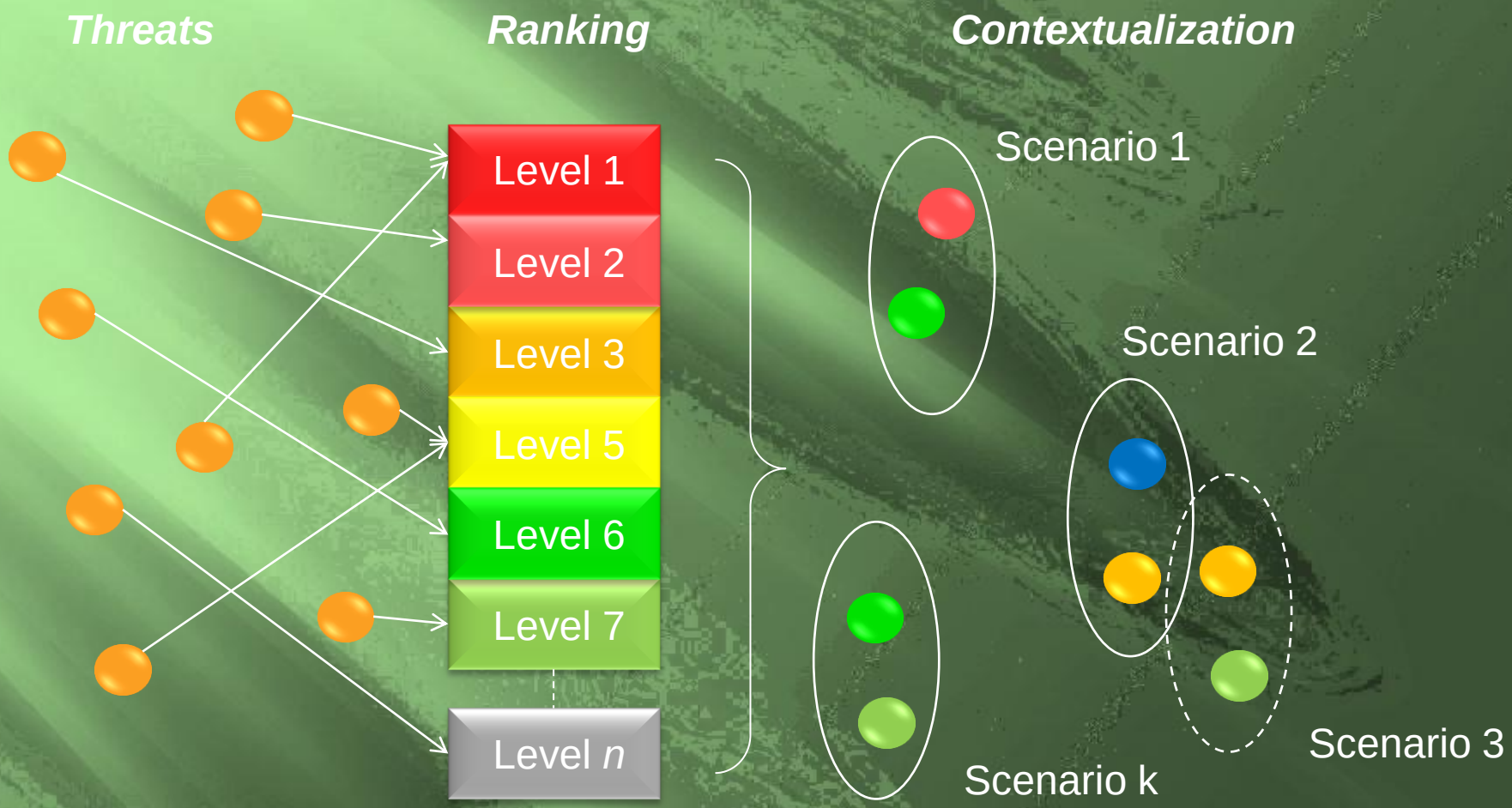
Key Problems

- Experts selection
- Proper understanding
- Noise reduction
- Human subjectiveness
- Software support necessity
- Validation Difficulties

Threats Identification & Contextualization

- Proper threats identification is context dependable
- Ranking is inevitable
- Overlapping is difficult to surmount

Ranking & Contextualization



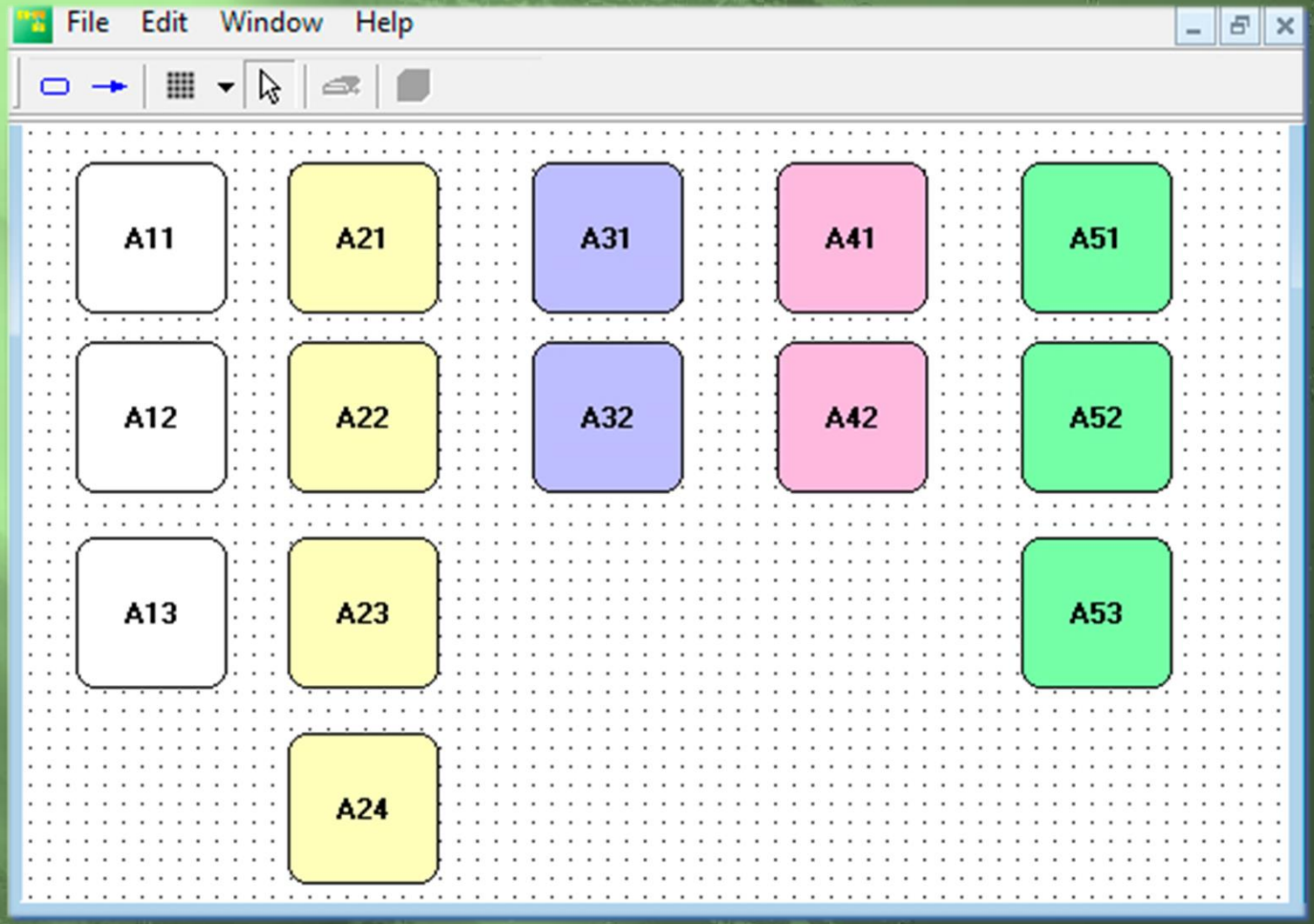
Extracted knowledge analysis

- Techniques:
  - Morphological analysis;
  - System analysis;
- Working environment:
  - MS Office/OpenOffice;
  - Intelligent Scenario Computer Interface Program (I-SCIP).

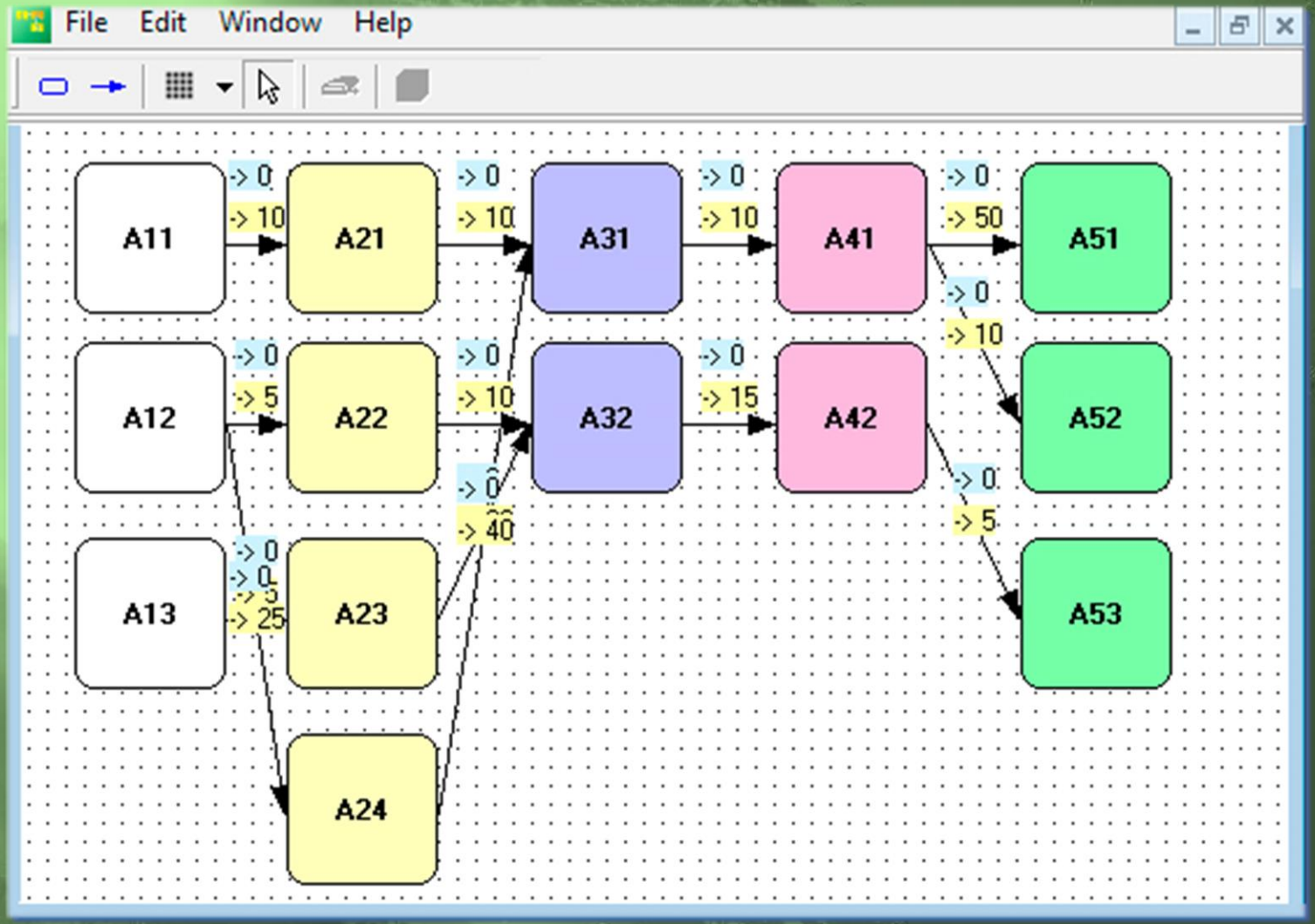
Morphological Analysis

- Complete task consideration;
- Wide used for classification tasks;
- Familiar to the security & social sciences.

Step 1 Dimensions & alternatives definition



Step 2 Alternatives binding

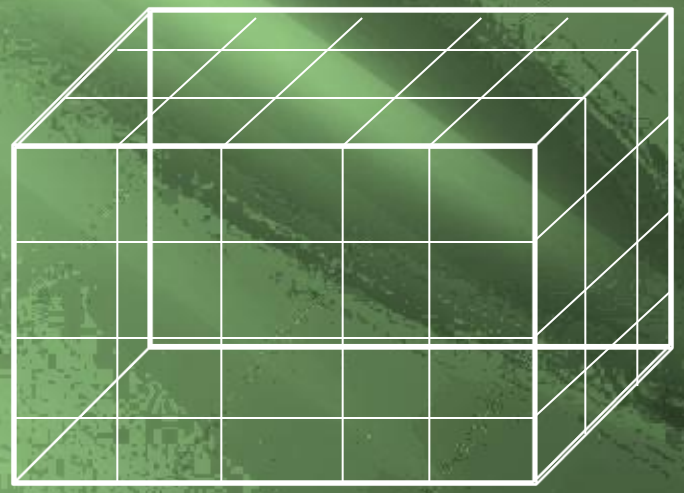


Conflict (cross-consistency) matrix

I	II	III	IV	V
A11	A21	A31	A41	A51
A12	A22	A32	A42	A52
A13	A23			A53
	A24			

General problem volume

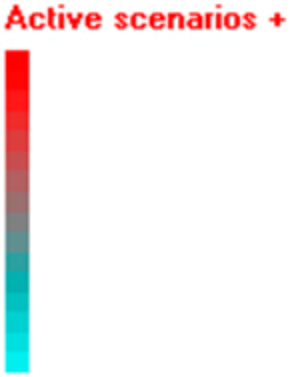
Possible combinations: 3 X 4 X 2 X 2 X 3 X 5 = **720**



Step 3 Scenario building, ranging & naming

I	II	III	IV	V
A11	A21	A31	A41	A51
A12	A22	A32	A42	A52
A13	A23			A53
	A24			

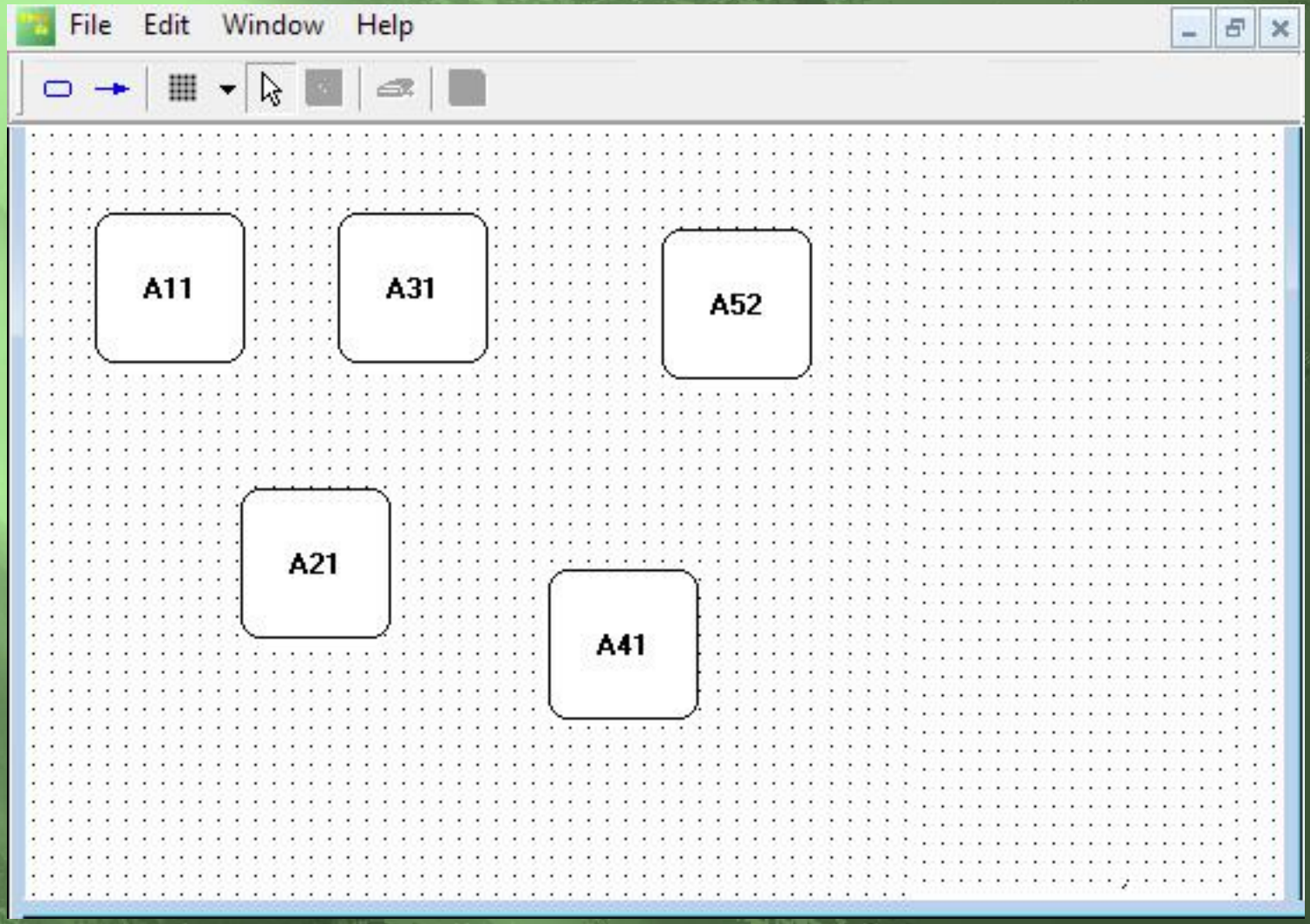
Index	Length	Weight	Name
1	5	40	Scenario1
2	5	35	Scenario2
3	5	85	Scenario3
4	5	45	Scenario4
5	5	80	Scenario5
6	5	125	Scenario6



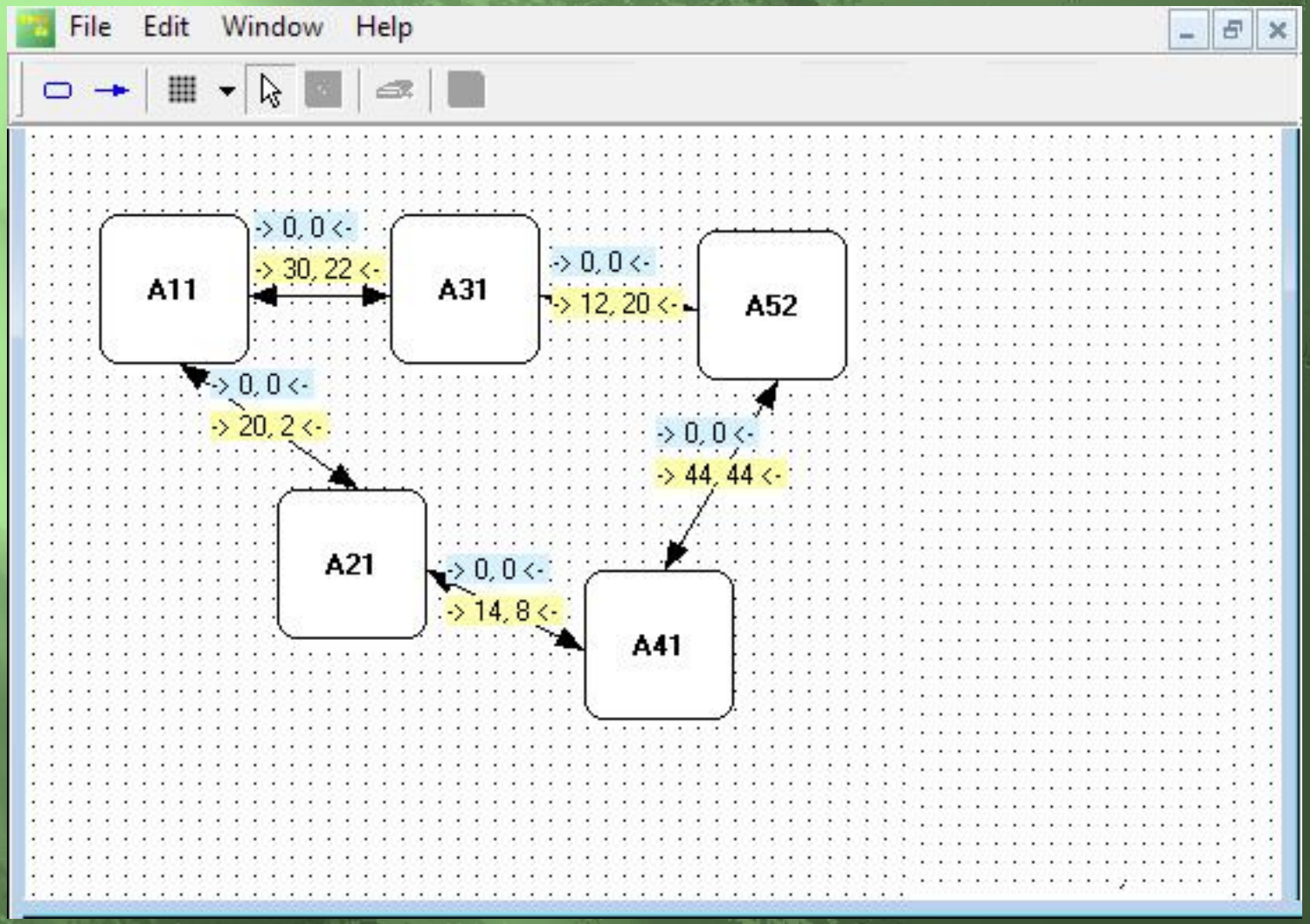
System Analysis

- Intuitive entity-relationship notation;
- Details' consideration;
- Familiar to the military & scientific world.

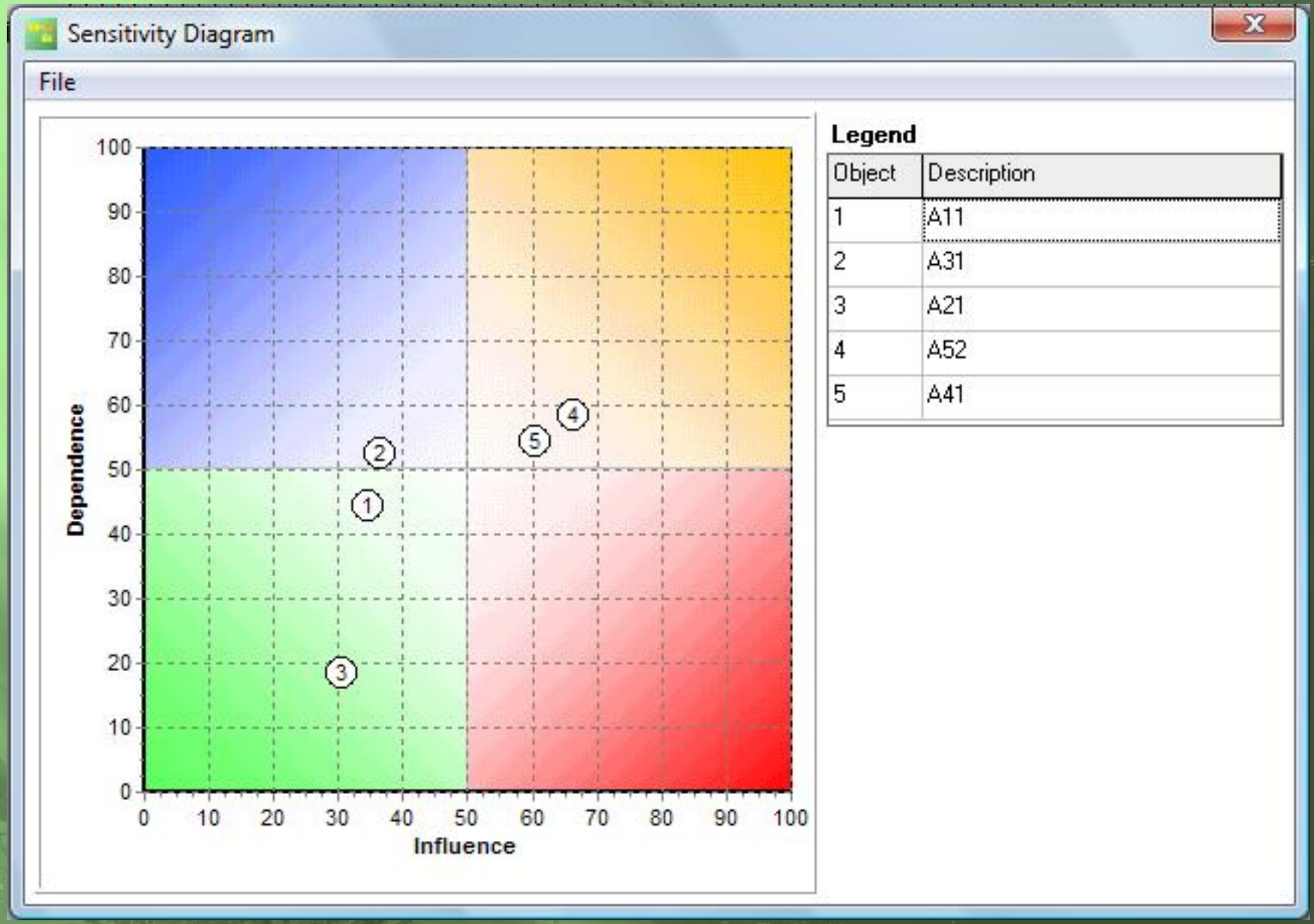
Step 1 Entities definition



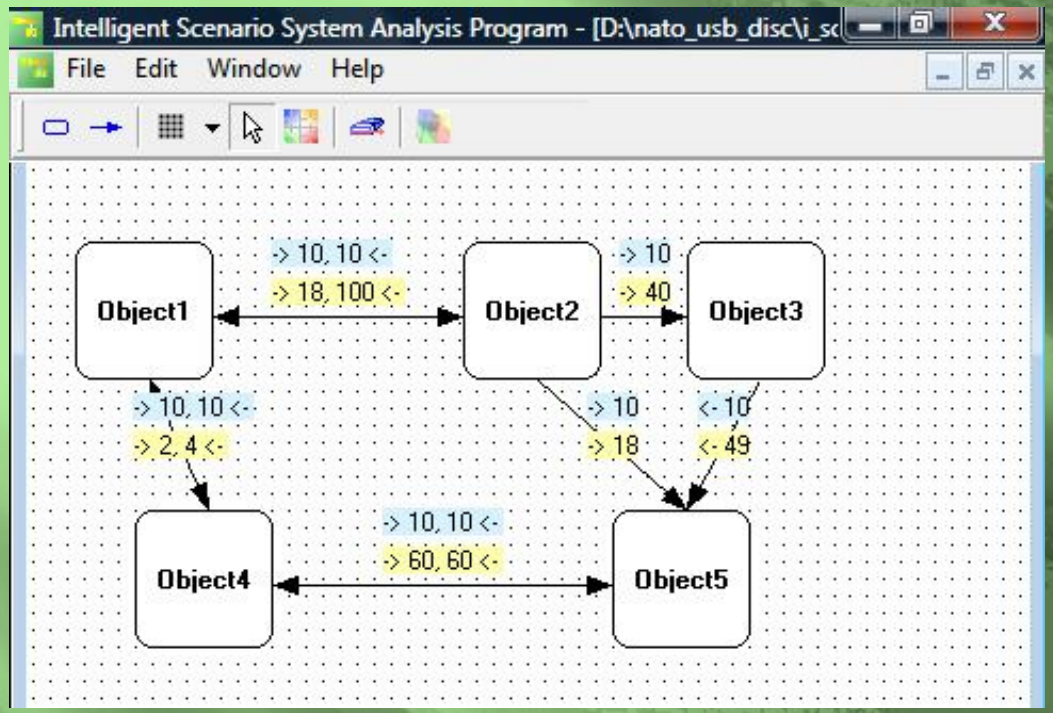
Step 2 Entities binding

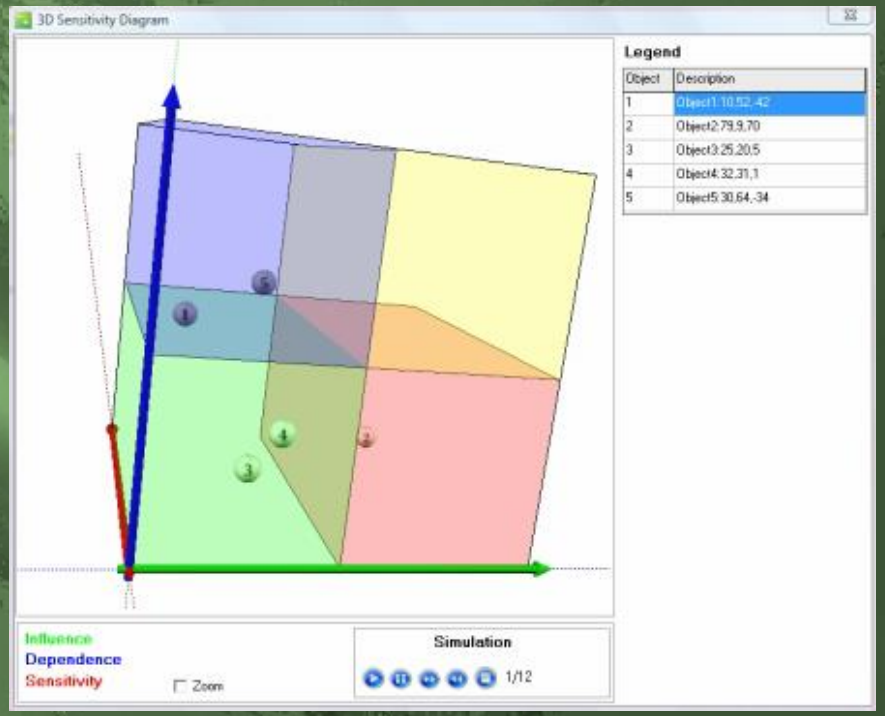


Step 3 Entities classification

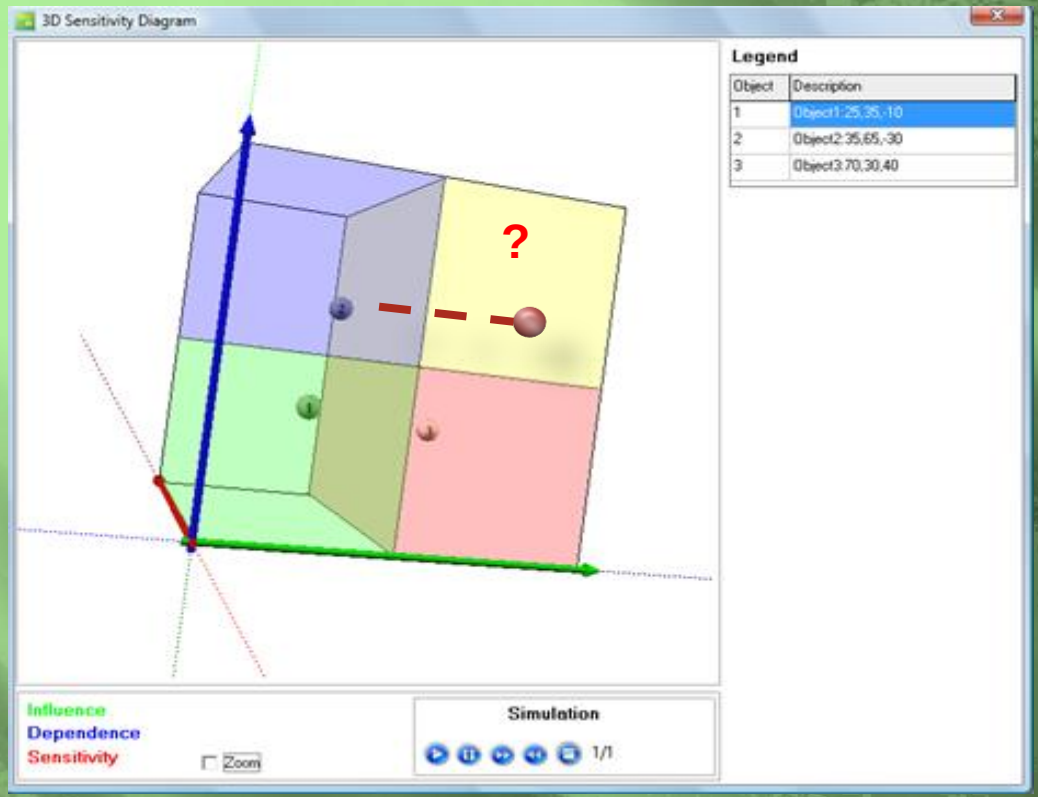


SENSITIVITY ANALYSIS IN 4D

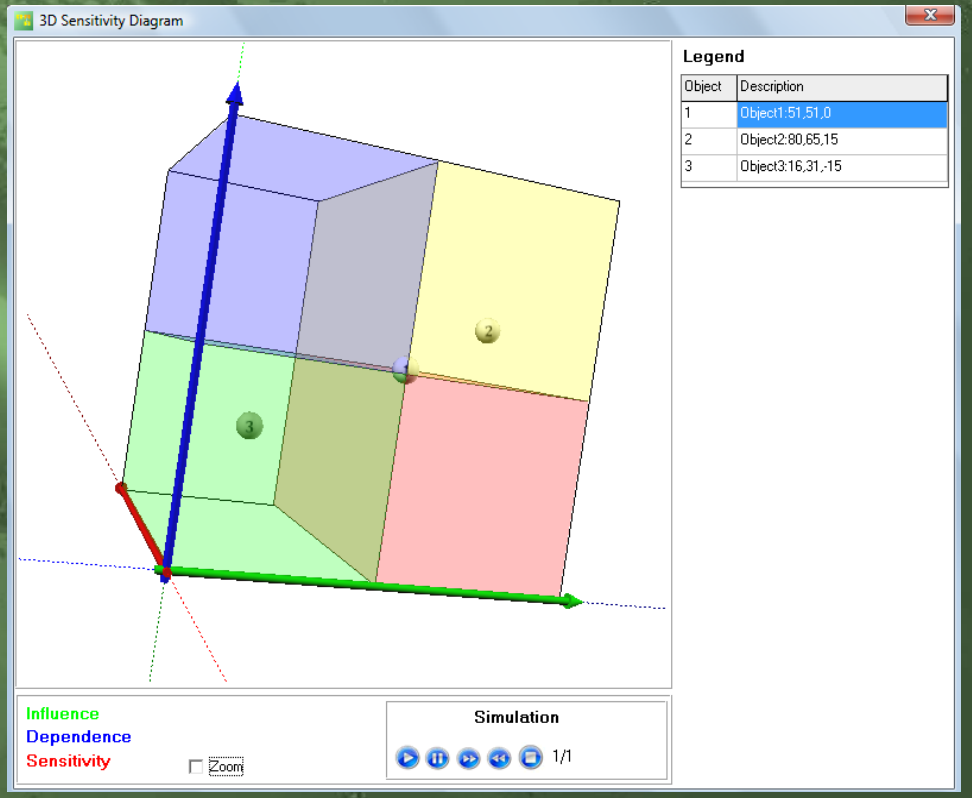




But can we change the experts' believes with I-SCIP SD?



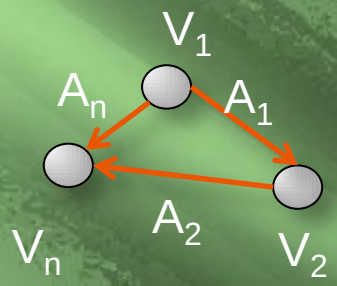
Initial Configuration



New Configuration after Q optimization

An Algebraic Interpretation & Quadratic Optimization Usage

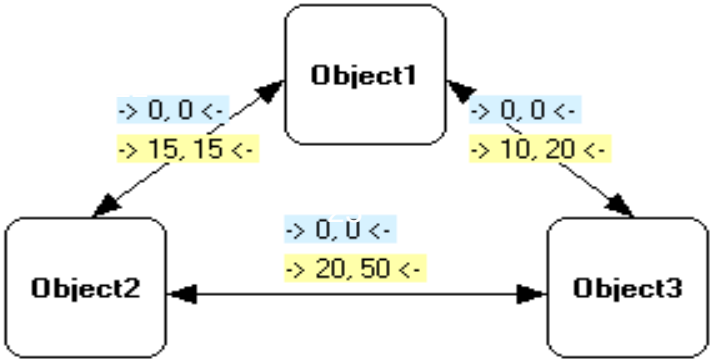
Directed Weighted Graph $G = (V,A)$



$A = \{A_1, A_2, \ldots, q_i, \ldots, A_n\}$ with Q weights, where $Q = \{q_1, q_2, \ldots q_i, \ldots, q_n\}$, $q \in N$, $q \in [1, 100]$

$Z = (\Sigma q_i - \alpha)^2 + (\Sigma p_j - \beta)^2$,
s.t. $0 < \Sigma q_i \leq \alpha$, $0 < \Sigma p_j \leq \beta$
$i=1,\ldots,n$, $j=1,\ldots,m$; α, β - desired position in the cluster set
Minimize $\rightarrow Z$

Example



Minimize the Objective Function Z:

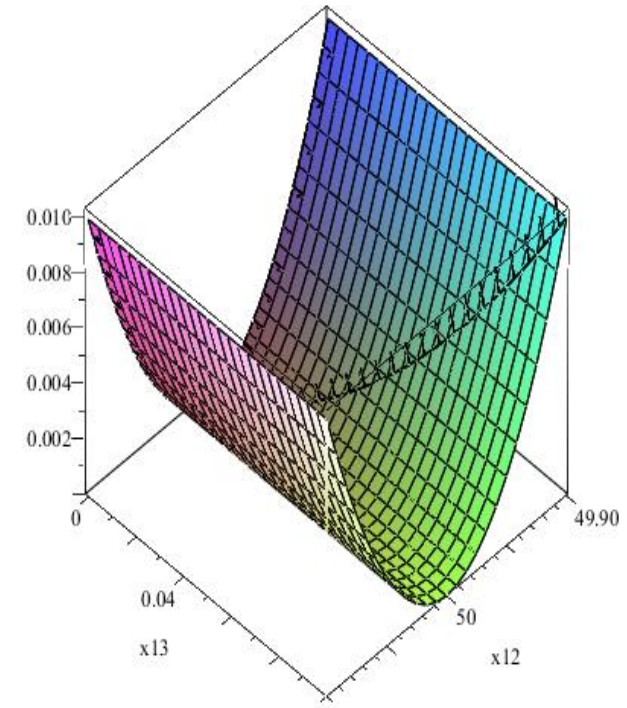
$(x12 + x32 - 65)^2 + (x21 + x23 - 80)^2$

S.t. the following constraints:

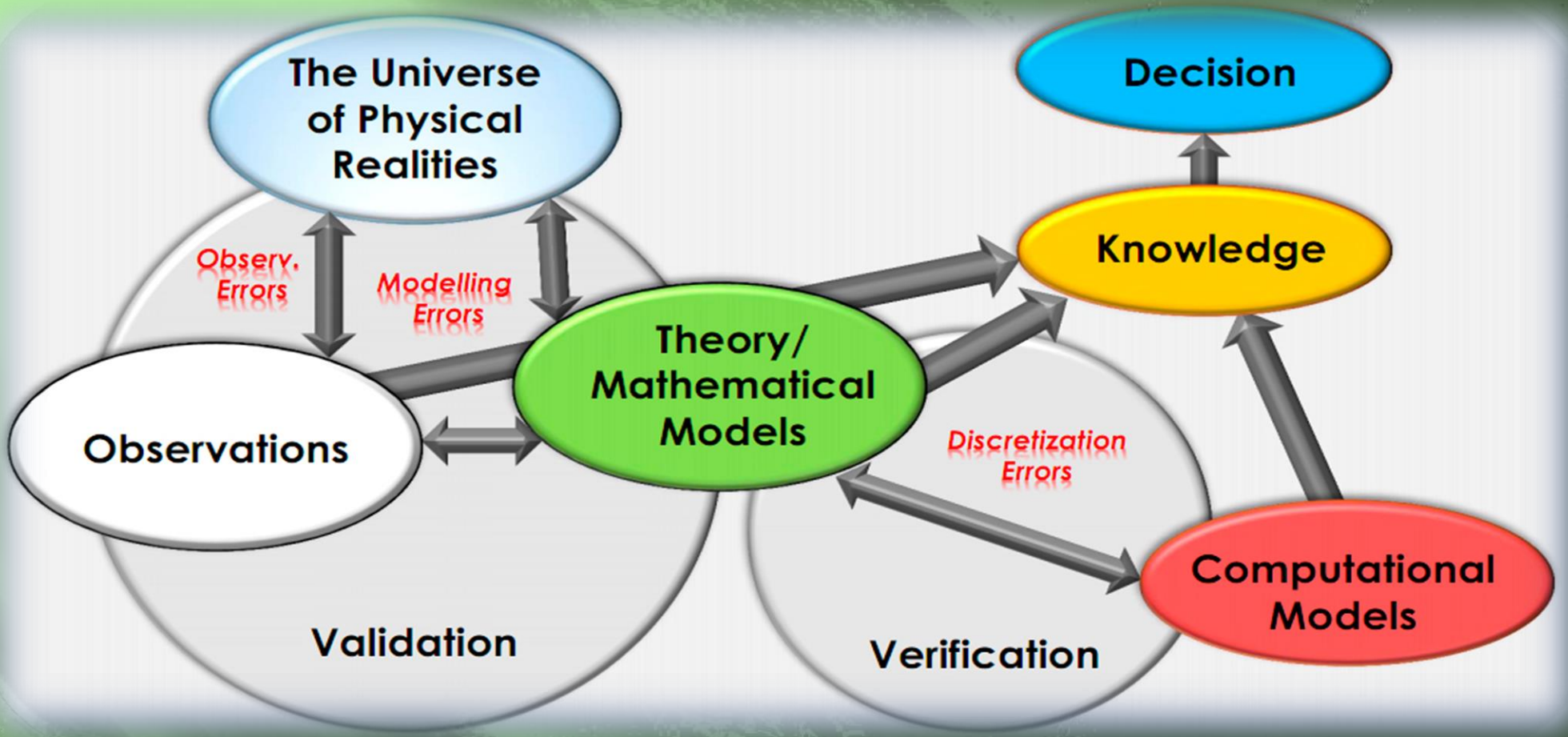
$x12 \in [0, \infty)$
$x13 \in [0, \infty)$
$x21 \in [0, \infty)$
$x23 \in [0, \infty)$
$x31 \in [0, \infty)$
$x32 \in [0, \infty)$
$x21 + x31 \leq 50$
$0 \leq x21 + x31$
$x12 + x13 \leq 50$
$0 \leq x12 + x13$
$x13 + x23 \leq 50$
$0 \leq x13 + x23$
$x31 + x32 \leq 50$
$0 \leq x31 + x32$

Solution:

The following warning was issued while solving:
necessary conditions met but sufficient conditions not satisfied
Objective value: 0.
x12 = 50. x13 = 0. x21 = 50. x23 = 30.
x31 = 0. x32 = 15.

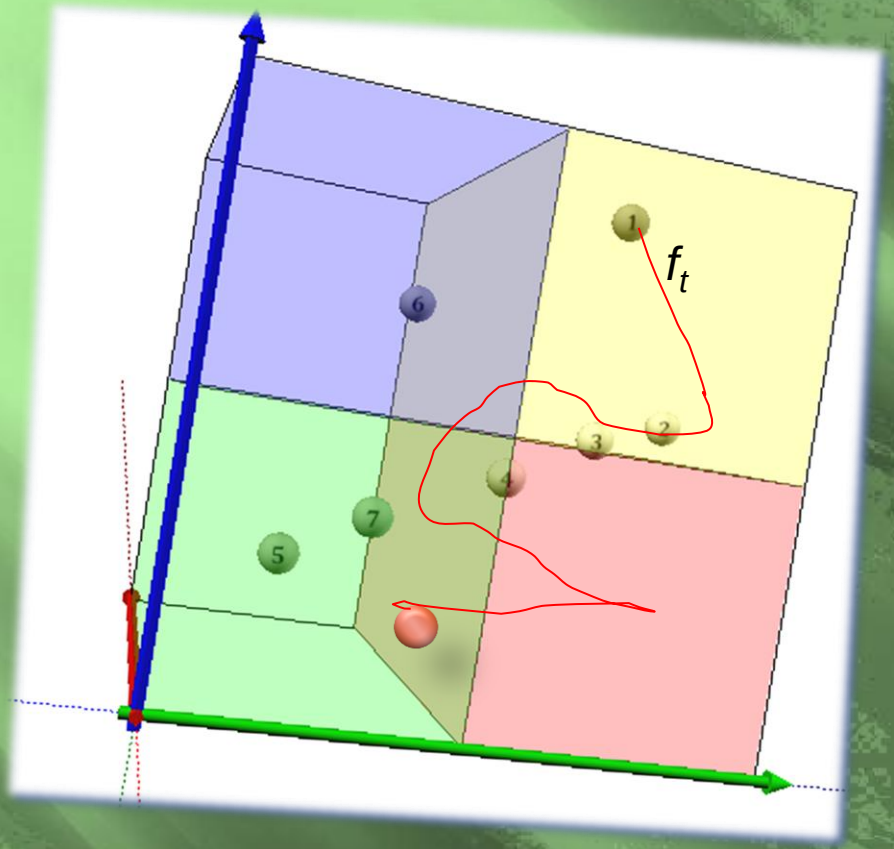


And how certain we are?

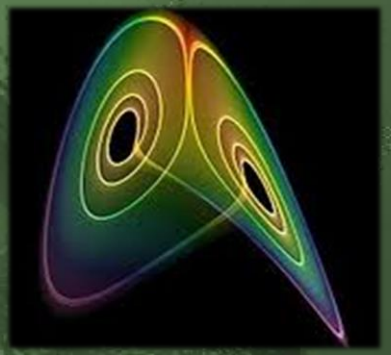


Oden, Moser & Ghattas, “Computer Predictions with Quantified Uncertainty”, SIAM NEWS, November 12, 2010.

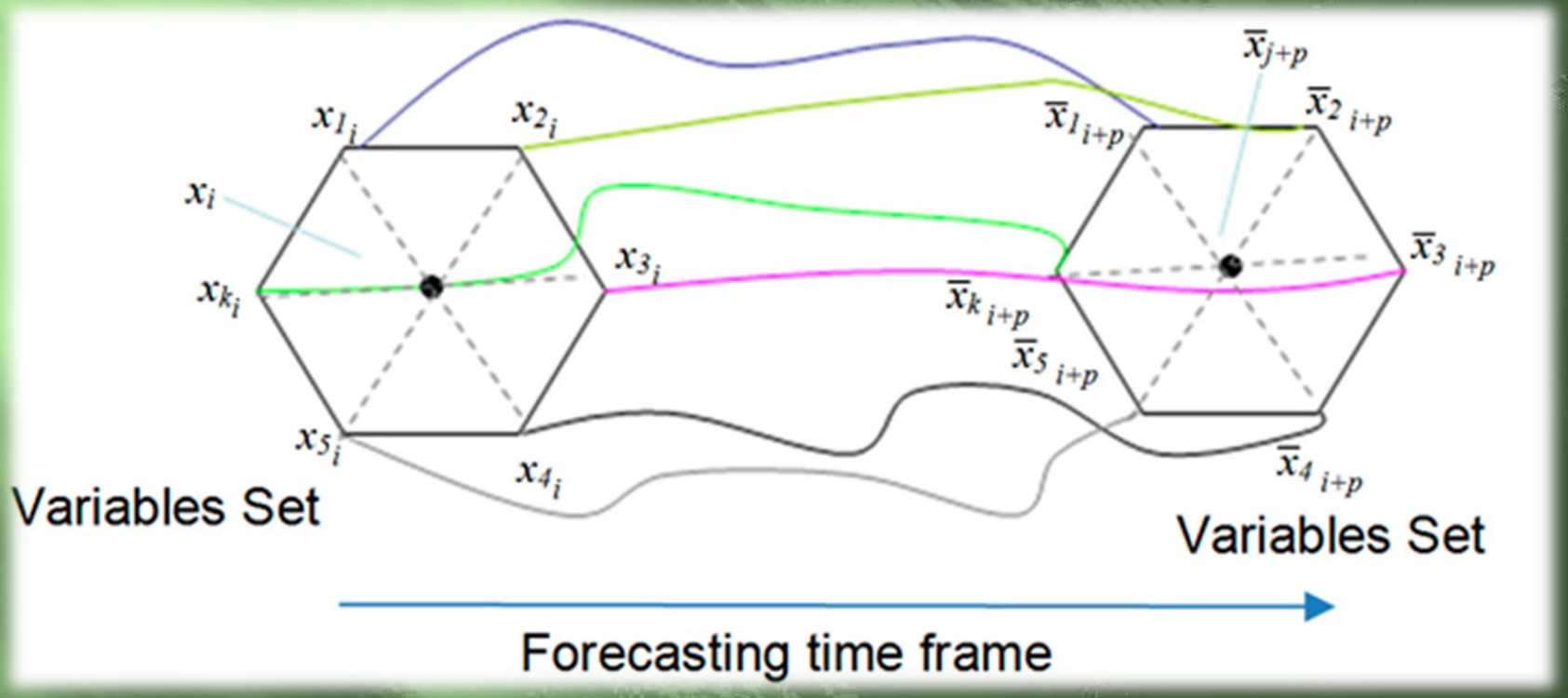
The transition function importance & uncertainty



Example: f_t ~ Lorenz system



Mathematical Scenario Validation & Uncertainty Dynamics Monitoring



$$x_{j+p} = \sum_{i=1}^{M+1} \bar{x}_{k_{i+p}} e^{-\alpha \left\| x_j - x_{k_i} \right\|},$$

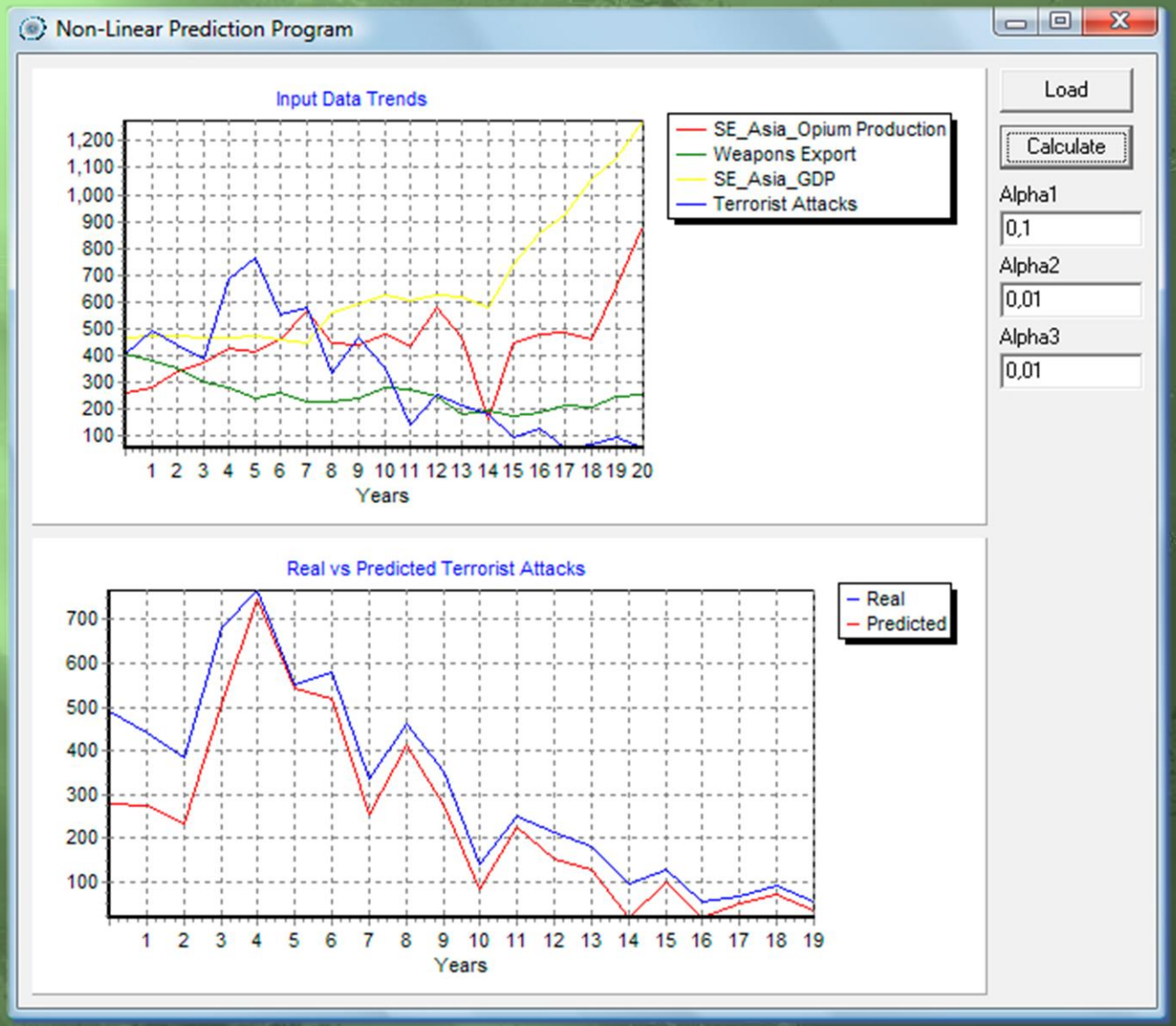
Where:

$\|.\|$ is the Euclidean distance in M dimensional space;
x_{k_i} - k^{th} closest neighbour to x_i;
$i,j > N$, $k + p < N$, N is the first half of data points used for forecasting of the second one;
$\bar{x}_{k_{i+p}}$ - k^{th} closest neighbour to x_i, p steps ahead;

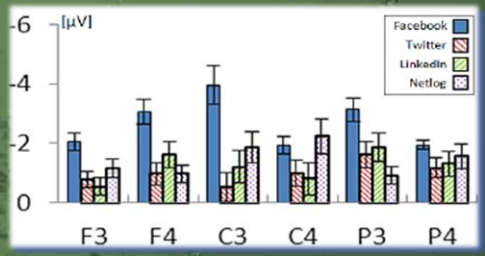
M - work space (embedding in case of single time series reconstruction) dimension;
p - number of steps ahead; α - expert-defined constants defined for the different dimensions M. The notation of space dimension M is used because the real simplex Δ^m dimension m could be initially unknown and $M < m$.
The error ε could be estimated in different ways but what was empirically evident that it is not necessary to consider ε of more than integral cubic degree of accuracy:

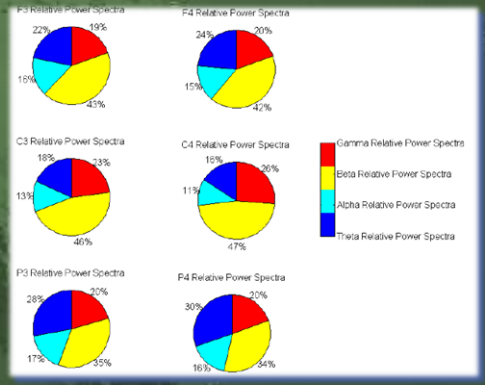
$$\varepsilon = | x_{i+p} - x_i | = O(h^3)$$

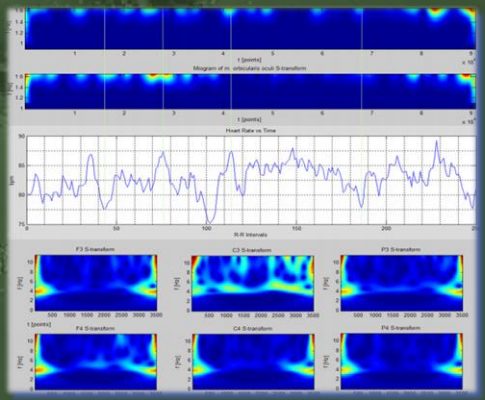
Software Support



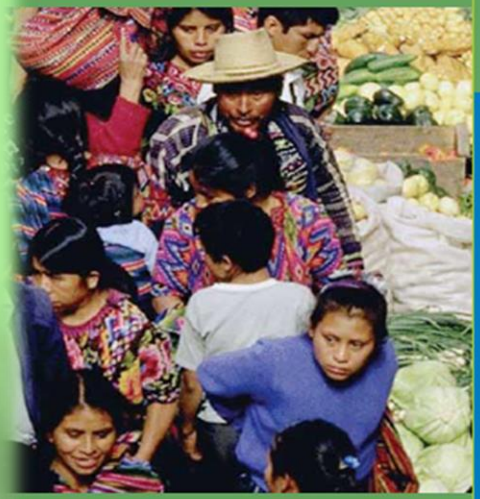
Psychophysiological Validation







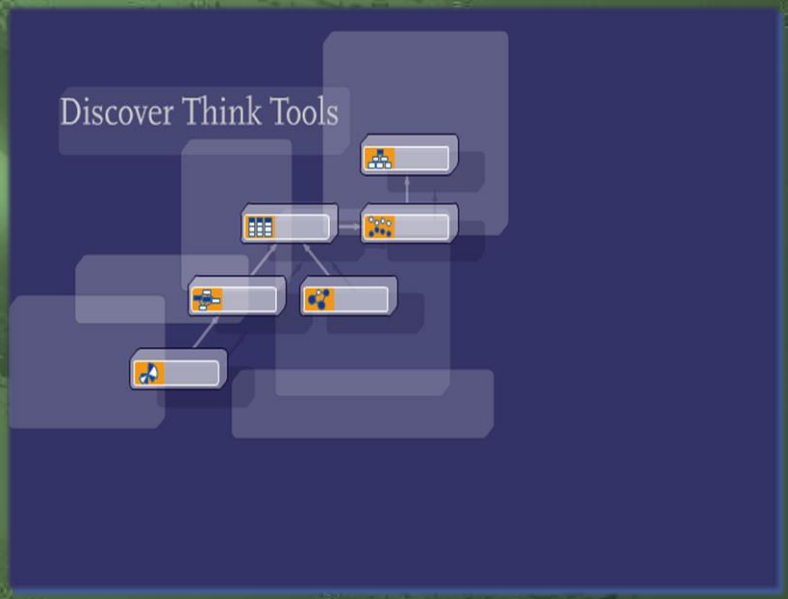
Some Practical Examples



Tools for Institutional, Political, and Social Analysis of Policy Reform

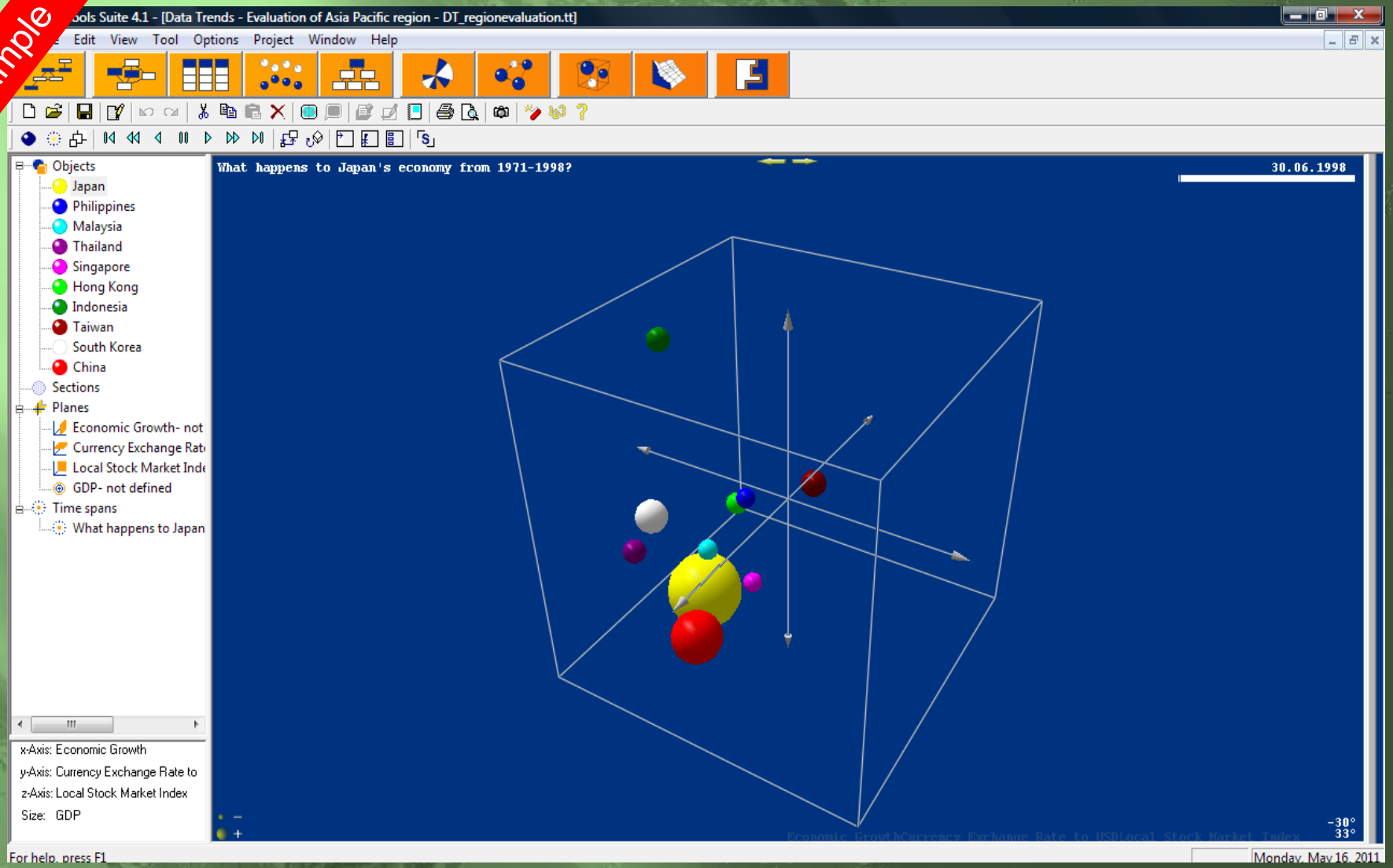
A Sourcebook for Development Practitioners

THE WORLD BANK

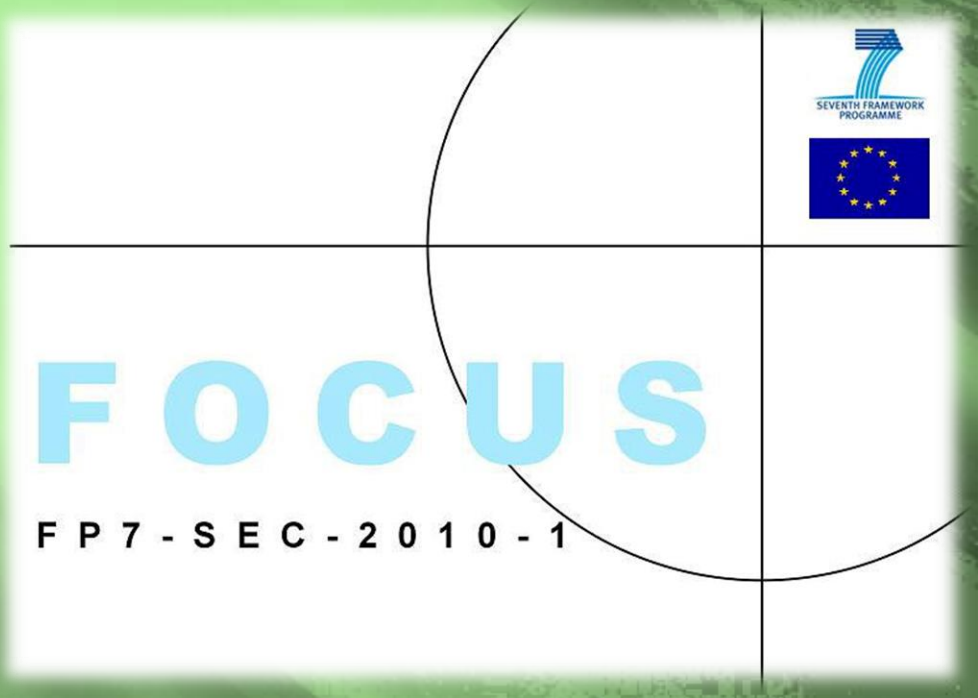


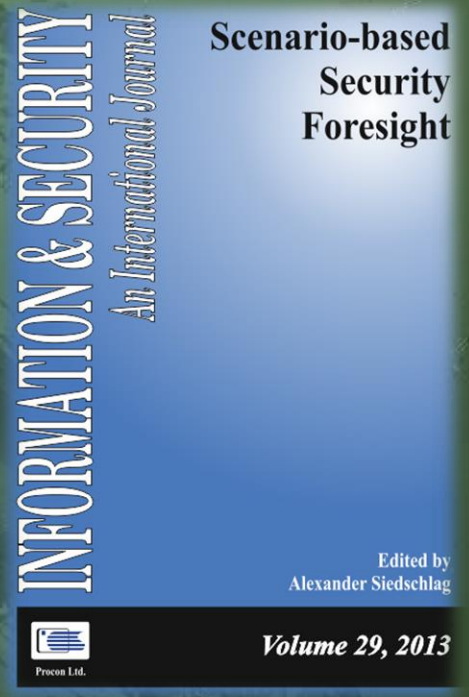
Asia Economy Development

Example



Security Foresight





http://www.focusproject.eu/web/focus/home

http://procon.bg/volume29

EU Network of Excellence SySSec

WP0: Management

WP1: Dissemination

WP2: Education

WP3: Threats on the Future internet

WP4: Malware and Fraud

WP5: Smart Environments

WP6: Cyberattacks

syssec

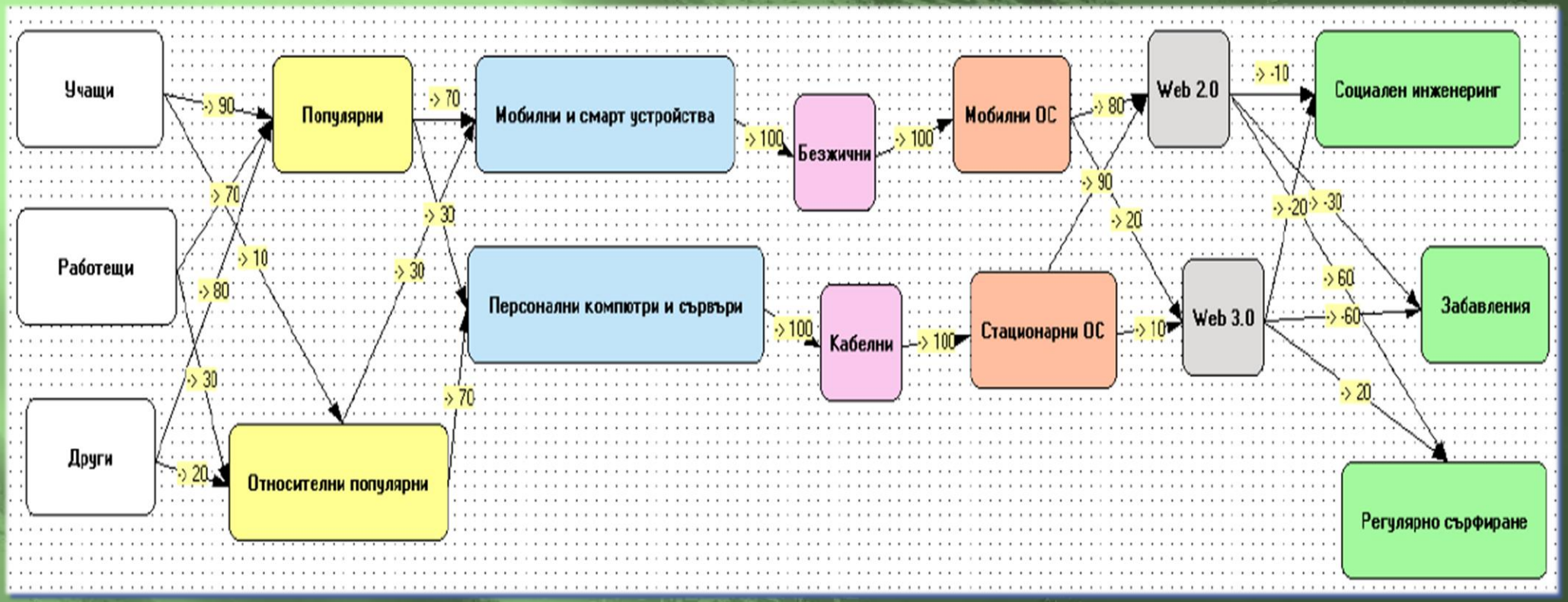
Cyber Threats Identification & Research Roadmap Construction

кражба на акредитиви *лъжлива идентичност* *експлоатация на доверие* *кибернасилие* *фишинг* *социален инженеринг* **Социални мрежи**	*неподходящо съдържание* *софтботи* *измами* *социална изолация* **Компютърни игри**	 *мобилни и смарт устройства* *преносими памети* *облачни технологии* **Устройства и технологии**	*Червеи* *лъжлив антивирус управление чрез сваляния* **Вируси**

Направление / *Източник на заплаха*	Тежест на заплахата	Роля на изследванията и технологиите	Време и потребители
Аспекти в системната сигурност на личностната информация			
Насочени атаки			
Новопоявяващи се технологии			
Сигурност на мобилните устройства			
Полезна сигурност			

syssec

Alternative Futures "Web 2.0/Web3.0 Developments" Morphological Analysis



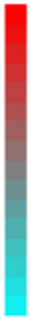
Morphological Analysis
Cross-Consistency Matrix Result

Морфологичен анализ

Потребители	Социални мрежи	Хардуерни технологии	Комуникации	Софтуерни платформи	Уеб стандарти	Дейности
Учащи	Популярни	Мобилни и смарт устройства	Безжични	Мобилни ОС	Web 2.0	Социален инженеринг
Работещи	Относителни популярни	Персонални компютри и сървъри	Кабелни	Стационарни ОС	Web 3.0	Забавления
Други						Регулярно сърфиране

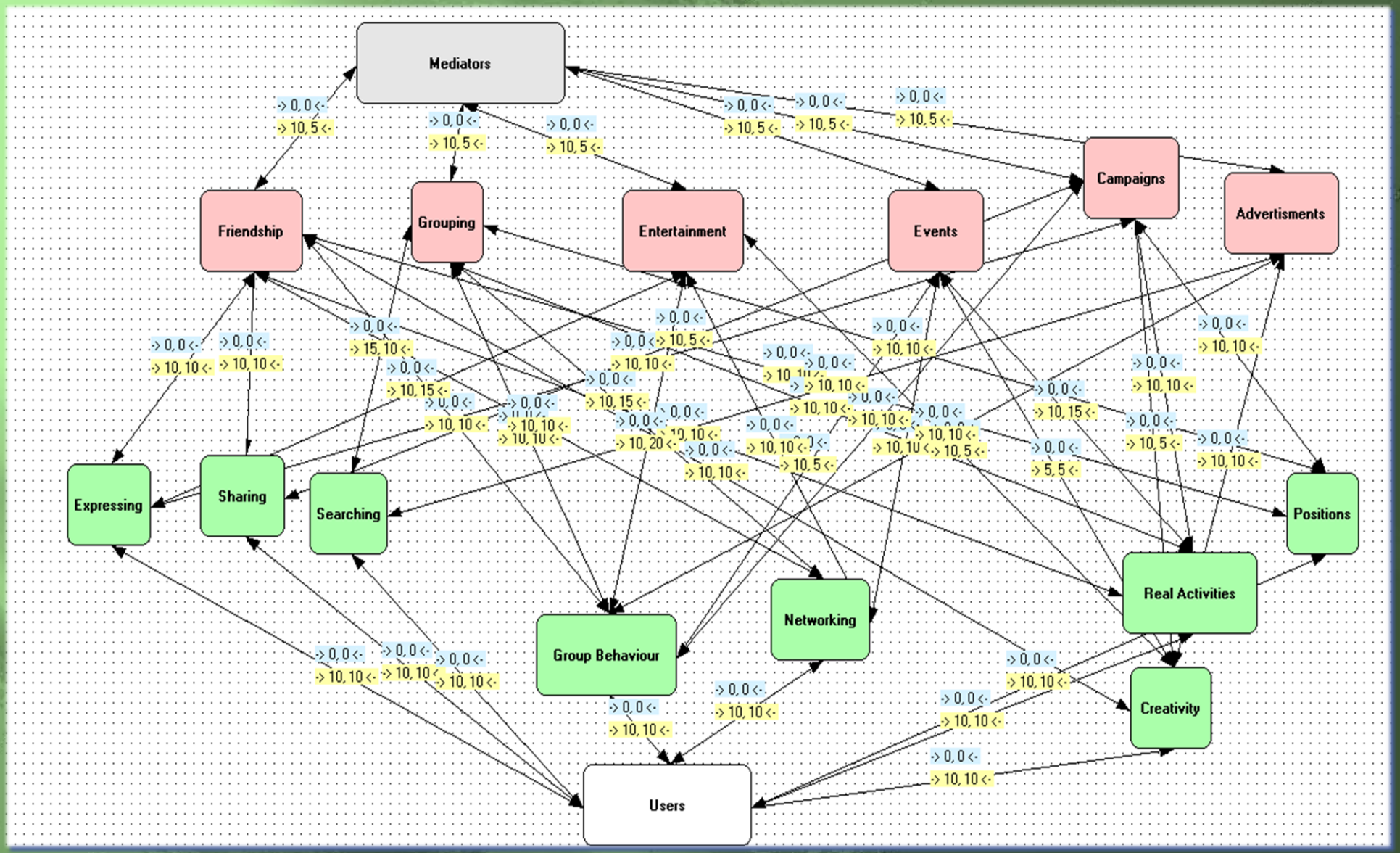
Индекс	Дължина	Тегло	Име
53	7	460	Сцен. 53
54	7	510	Сцен. 54
55	7	490	Сцен. 55
56	7	470	Сцен. 56
57	7	480	Сцен. 57
58	7	400	Сцен. 58
59	7	420	Сцен. 59
60	7	410	Сцен. 60

Активни сценарии

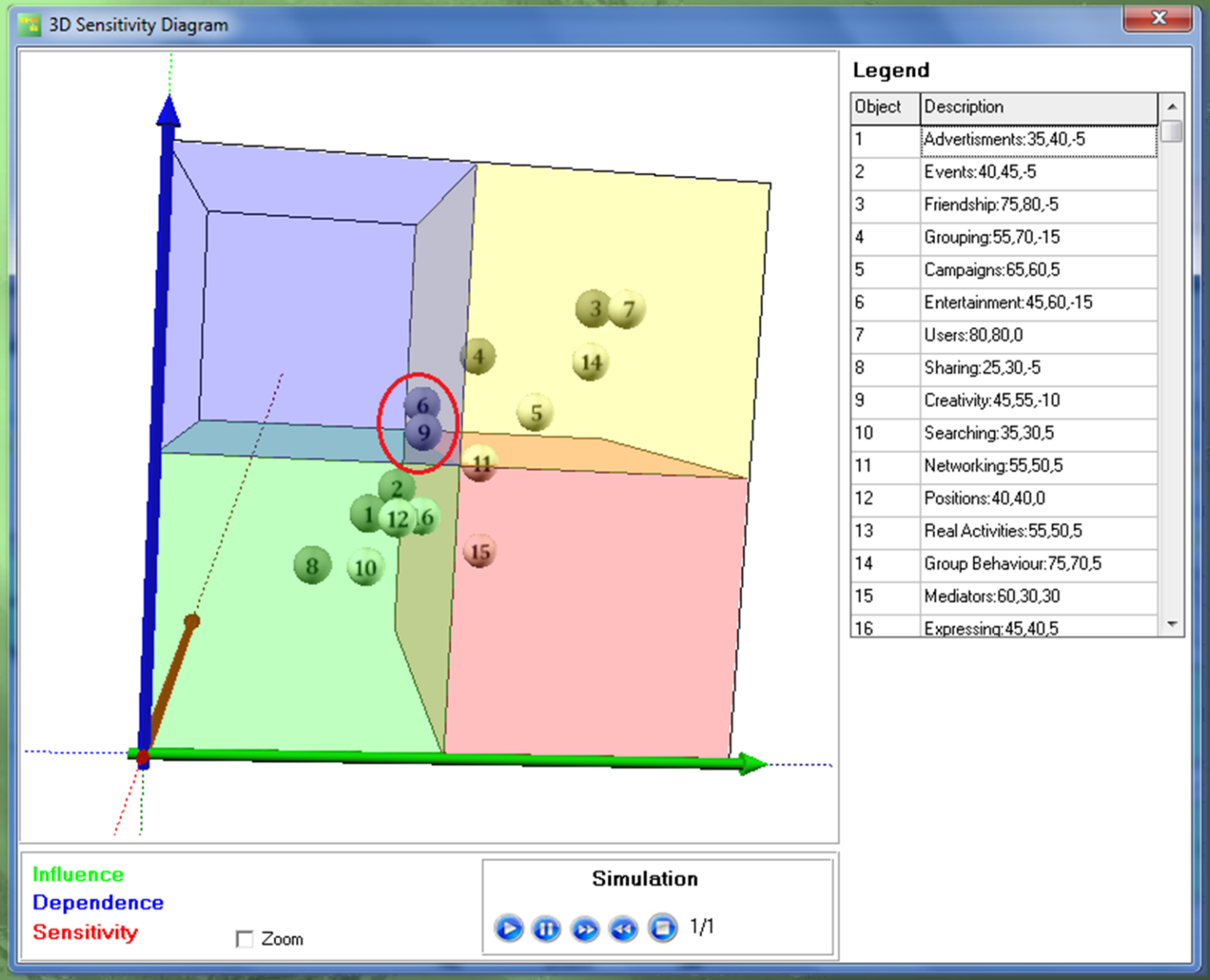


Пасивни сценарии

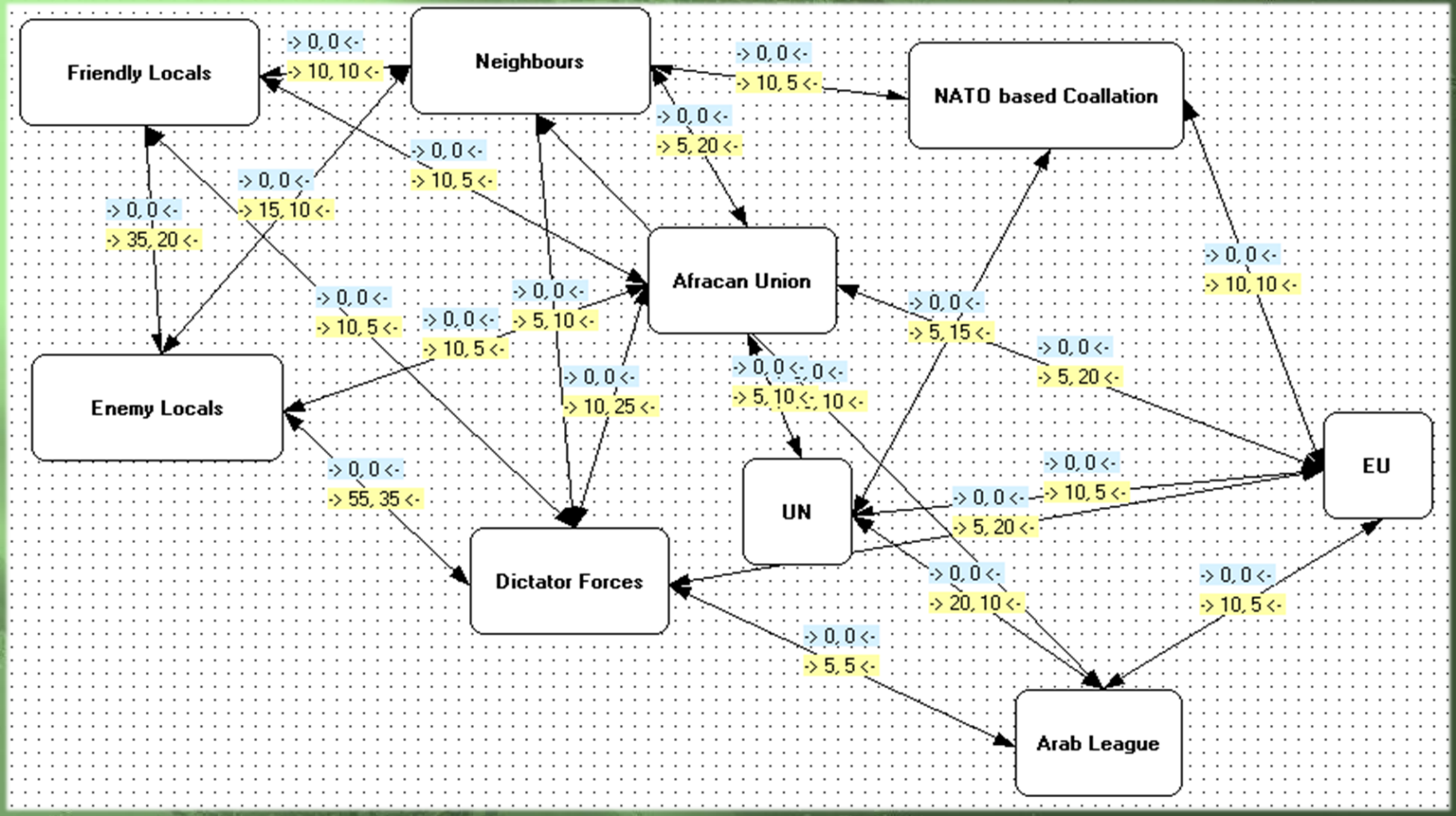
Social Engineering Model



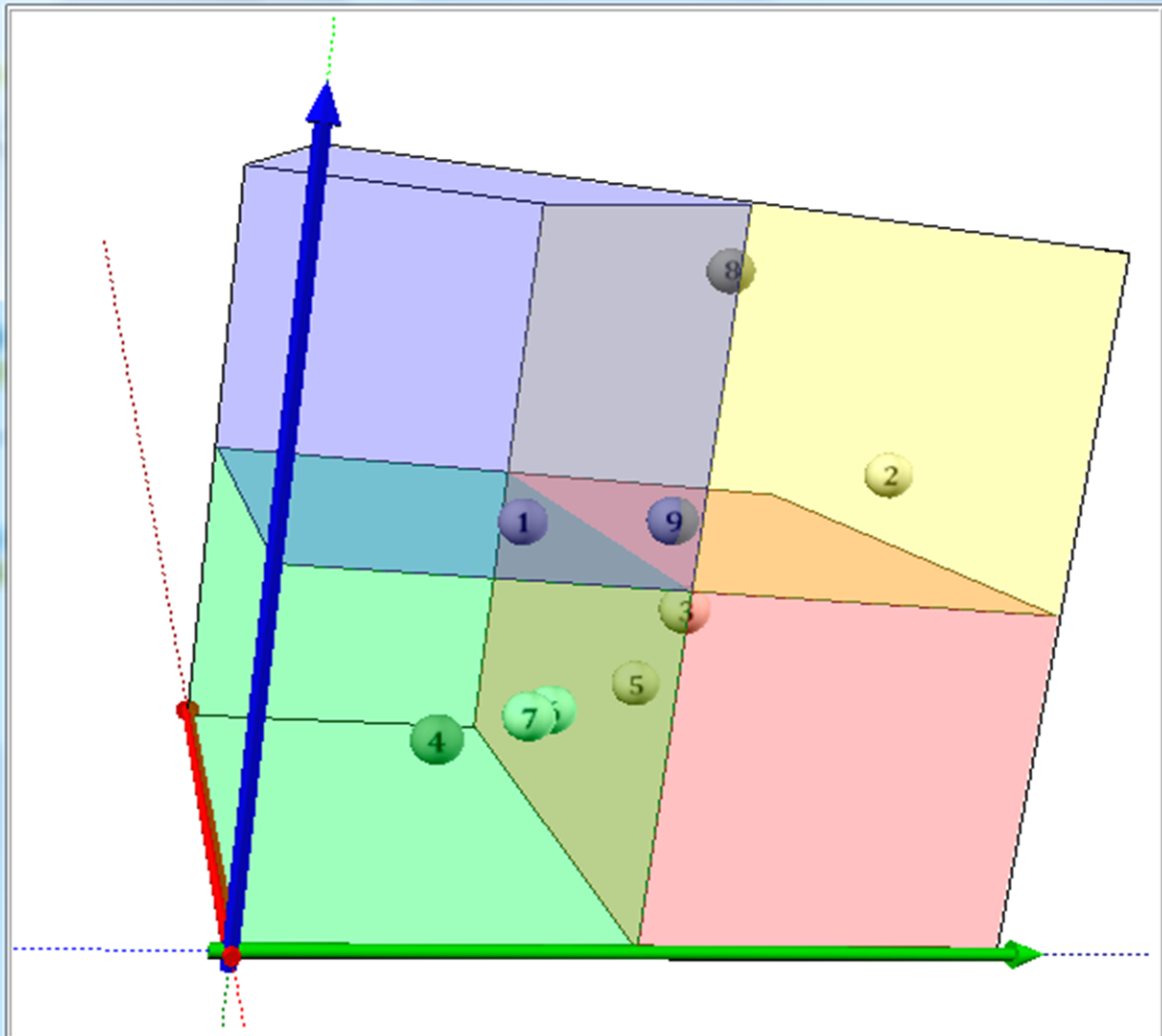
Resulting Objects Classification



North Africa Peacekeeping Expenditure Operation Model



3D Sensitivity Diagram



Legend

Object	Description
1	Friendly Locals:33,54,-21
2	Enemy Locals:87,66,21
3	Neighbours:54,45,9
4	NATO based Coallation:21,25,-4
5	EU:54,29,25
6	UN:37,29,8
7	Arab League:33,29,4
8	Dictator Forces:62,95,-33
9	Afracan Union:50,58,-8

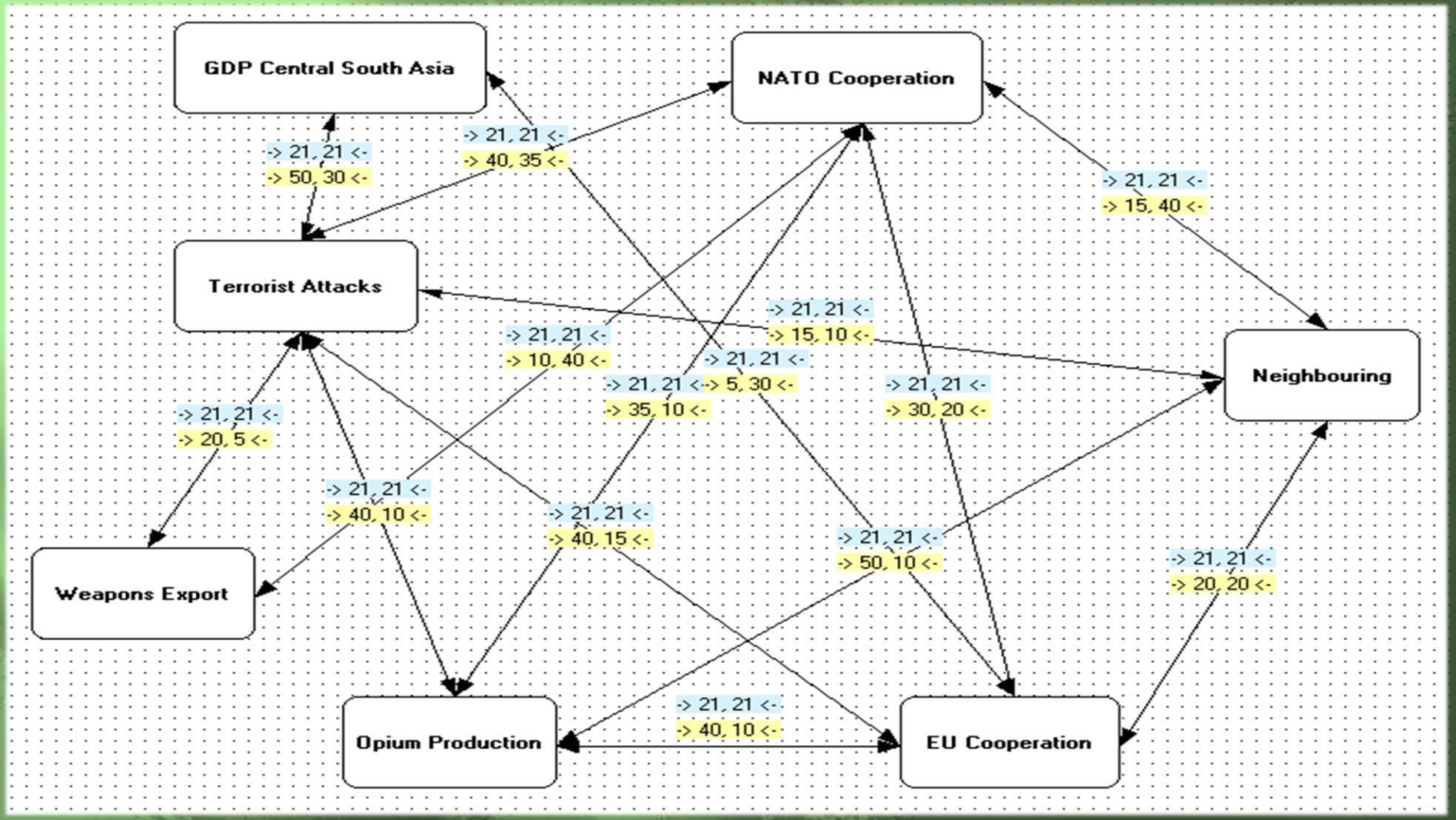
Influence
Dependence
Sensitivity

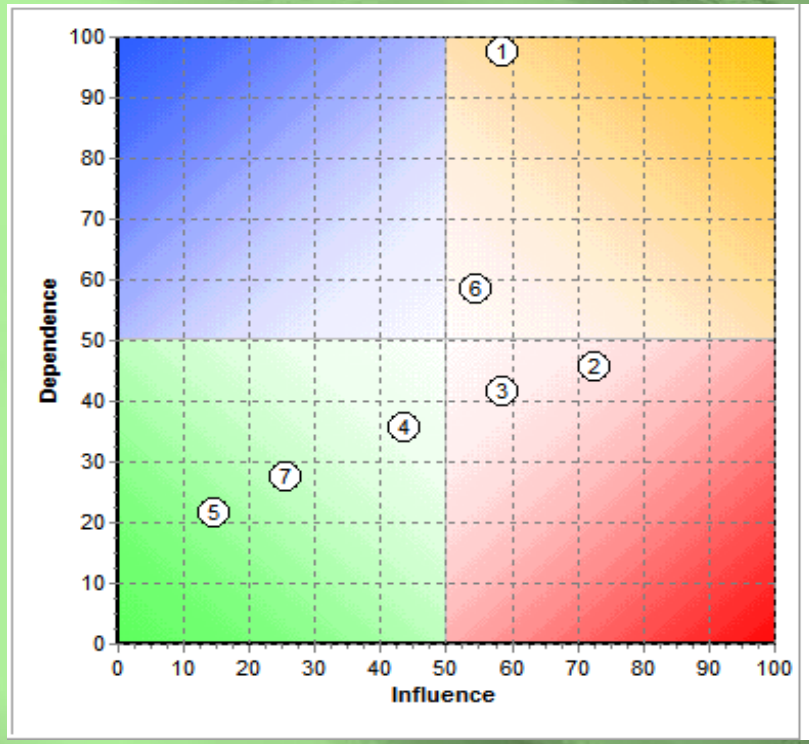
Zoom

Simulation

1/1

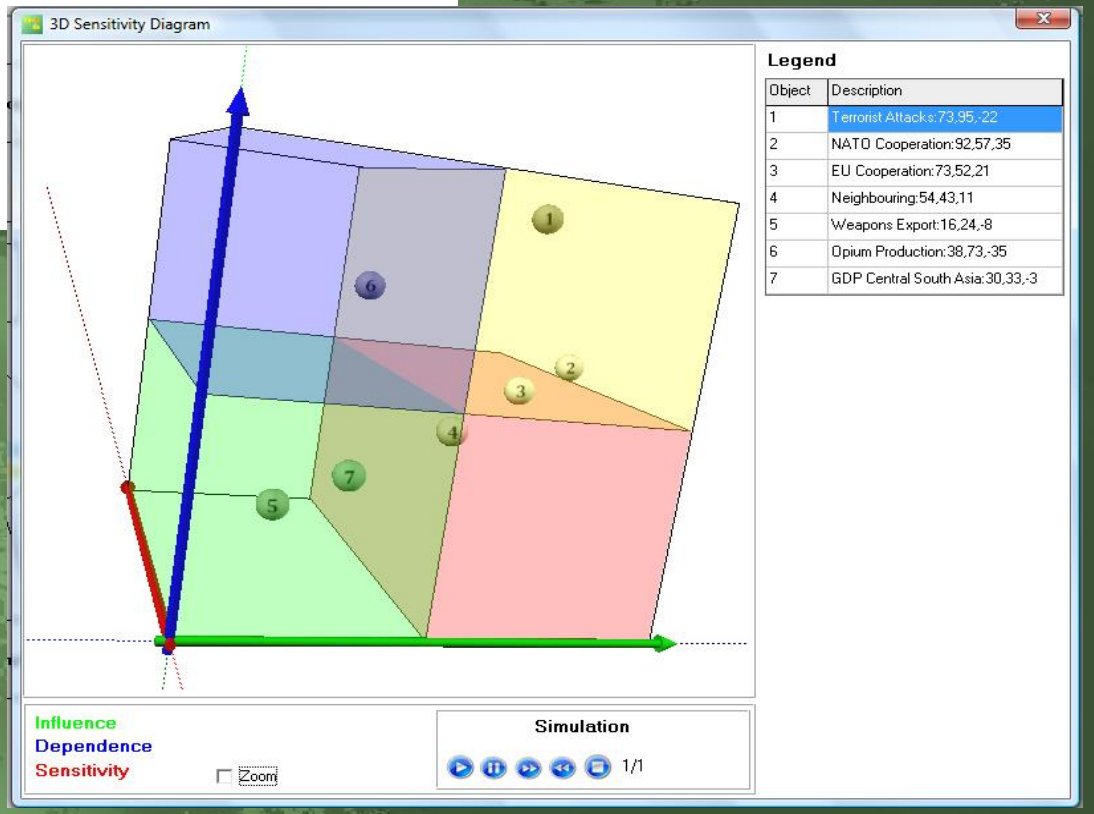
Asia Opium Control 1987-2007



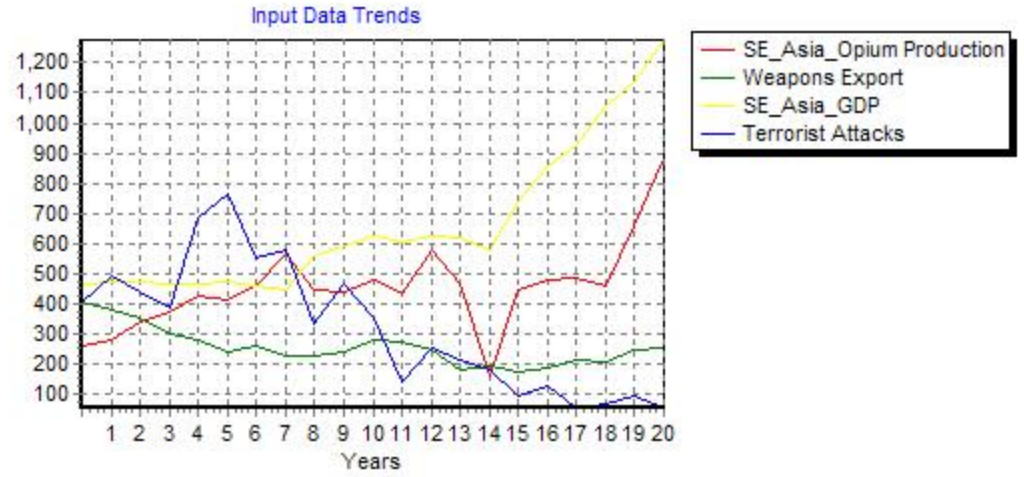


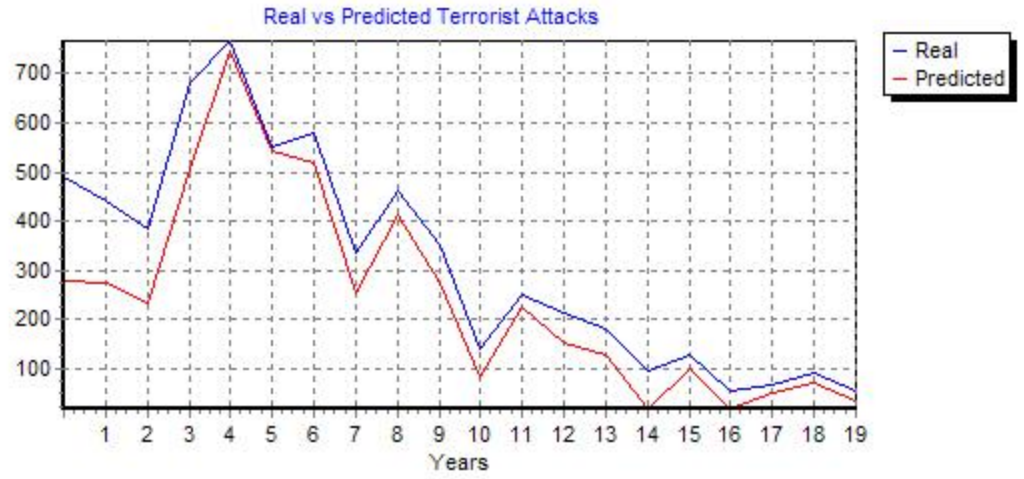
Legend

Object	Description
1	Terrorist Attacks
2	NATO Cooperation
3	EU Cooperation
4	Neighbouring
5	Weapons Export
6	Opium Production
7	GDP Central South Asia



Non-Linear Prediction Program





Load

Calculate

Alpha1

0,1

Alpha2

0,01

Alpha3

0,01

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Thank you for the Attention!

Q & A ! ?