The Scenario Method Application

An Overview with Examples

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- The Scenario Method
- Some Practical Examples
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The Great Complexity of the World Around Us
Building Context
The Scenario Method

Scenario 1

Scenario 2

Scenario k

Plausible Future
The Scenario Generation Process

- Present situation
  - Alternative future 1
  - Alternative future n

  Morphological Analysis
  System Analysis

  Scenario 1
  Scenario k

  Validation
  Results Assessment
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
Proper threats identification is context dependable

Ranking is inevitable

Overlapping is difficult to surmount
Ranking & Contextualization

Threats

Ranking

- Level 1
- Level 2
- Level 3
- Level 5
- Level 6
- Level 7
- Level n

Contextualization

- Scenario 1
- Scenario 2
- Scenario k
- Scenario 3
Techniques:

- Morphological analysis;
- System analysis;

Working environment:

- MS Office/OpenOffice;
- Intelligent Scenario Computer Interface Program (I-SCIP).
Complete task consideration;

Wide used for classification tasks;

Familiar to the security & social sciences.
Step 1  Dimensions & alternatives definition

A11  A21  A31  A41  A51
A12  A22  A32  A42  A52
A13  A23  A33  A43  A53
A24  A24  A24  A24  A24
Step 2  Alternatives binding
## Conflict (cross-consistency) matrix

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
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<td>A41</td>
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<td>A23</td>
<td></td>
<td>A42</td>
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<td>A24</td>
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Possible combinations: $3 \times 4 \times 2 \times 2 \times 3 \times 5 = 720$
### Step 3: Scenario building, ranging & naming

<table>
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<th>Index</th>
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<th>Name</th>
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<td>40</td>
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<td>Scenario2</td>
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<tr>
<td>6</td>
<td>5</td>
<td>125</td>
<td>Scenario6</td>
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</table>
Intuitive entity-relationship notation;

Details’ consideration;

Familiar to the military & scientific world.
Step 1

Entities definition
Step 3

Entities classification

![Sensitivity Diagram](image)

Legend:

<table>
<thead>
<tr>
<th>Object</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>A11</td>
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<tr>
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<td>A31</td>
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<td>3</td>
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</tr>
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<td>4</td>
<td>A52</td>
</tr>
<tr>
<td>5</td>
<td>A41</td>
</tr>
</tbody>
</table>
SENSITIVITY ANALYSIS IN 4D

Diagram showing relationships between objects with numerical values and a 3D sensitivity diagram.
But can we change the experts’ believes with I-SCIP SD?

Initial Configuration

New Configuration after Q optimization
Directed Weighted Graph  \( G = (V,A) \)

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

\[
Z = (\sum q_i - \alpha)^2 + (\sum p_j - \beta)^2,
\]

s.t. \( 0 < \sum q_i \leq \alpha, 0 < \sum p_j \leq \beta \)

\( i=1, \ldots, n, j=1, \ldots, m; \alpha, \beta \) - desired position in the cluster set

Minimize \( \rightarrow Z \)
Minimize the Objective Function $Z$:

$$(x_{12} + x_{32} - 65)^2 + (x_{21} + x_{23} - 80)^2$$

S.t. the following constraints:

Solution:

## The following warning was issued while solving:

necessary conditions met but sufficient conditions not satisfied

Objective value: 0.

$x_{12} = 50$. $x_{13} = 0$. $x_{21} = 50$. $x_{23} = 30$.

$x_{31} = 0$. $x_{32} = 15$. 

$x_{12} \in [0, \infty)$

$x_{13} \in [0, \infty)$

$x_{21} \in [0, \infty)$

$x_{23} \in [0, \infty)$

$x_{31} \in [0, \infty)$

$x_{32} \in [0, \infty)$

$x_{21} + x_{31} \leq 50$

$0 \leq x_{21} + x_{31}$

$x_{12} + x_{13} \leq 50$

$0 \leq x_{12} + x_{13}$

$x_{13} + x_{23} \leq 50$

$0 \leq x_{13} + x_{23}$

$x_{31} + x_{32} \leq 50$

$0 \leq x_{31} + x_{32}$

$x_{12} \in [0, \infty)$

$x_{13} \in [0, \infty)$

$x_{21} \in [0, \infty)$

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$x_{12} + x_{13} \leq 50$

$0 \leq x_{12} + x_{13}$

$x_{13} + x_{23} \leq 50$

$0 \leq x_{13} + x_{23}$

$x_{31} + x_{32} \leq 50$

$0 \leq x_{31} + x_{32}$
The transition function importance & uncertainty

Example: $f_t \sim$ Lorenz system
Mathematical Scenario Validation & Uncertainty Dynamics Monitoring
\[ x_{j+p} = \sum_{i=1}^{M+1} x_{k_{i+p}} e^{-\alpha \| x_j - x_{k_i} \|}, \]

Where:

\( \| \cdot \| \) is the Euclidean distance in \( M \) dimensional space;

\( x_{k_i} \) - \( k^{\text{th}} \) 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;

\( x_{k_{i+p}} \) - \( k^{\text{th}} \) 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; \( \alpha \) - expert-defined constants defined for the different dimensions \( M \). The notation of space dimension \( M \) is used because the real simplex \( \Delta^m \) dimension \( m \) could be initially unknown and \( M < m \).

The error \( \varepsilon \) could be estimated in different ways but what was empirically evident that it is not necessary to consider \( \varepsilon \) of more than integral cubic degree of accuracy:

\[ \varepsilon = |x_{i+p} - x_i| = O (h^3) \]
Psychophysiological Validation
Some Practical Examples

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

A Sourcebook for Development Practitioners
Asia Economy Development

Example

What happens to Japan's economy from 1971-1990?
EU Network of Excellence SySSec

- Industry
- Academia
- Other Stakeholders

Community

- Center of Research Excellence
- Center of Academic Excellence (Education)

WP0: Management
WP1: Dissemination
WP2: Education

WP3: Threats on the Future internet
- WP4: Malware and Fraud
- WP5: Smart Environments
- WP6: Cyberattacks
Cyber Threats Identification & Research Roadmap Construction

- Threats:
  - Malware
    - Malicious antivirus
    - Management through spreading
  - Social networks
    - Social engineering
    - Phishing
  - Mobile and smart devices
    - Mobile apps
    - Cloud computing

- Sources of Threats:
  - System security incidents
  - Targeted information
  - New emerging technologies
  - Security of mobile devices
  - Useful security

- Impact:
  - Severity of the threat
  - Role of research and technology
  - Time and users
Alternative Futures “Web 2.0/Web3.0 Developments” Morphological Analysis
### Морфологичен анализ

#### Cross-Consistency Matrix Result

<table>
<thead>
<tr>
<th>Потребители</th>
<th>Социални мрежи</th>
<th>Хардуерни технологии</th>
<th>Комуникации</th>
<th>Софтуерни платформи</th>
<th>Уеб стандарти</th>
<th>Дейности</th>
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<td>Мобилни и смарт устройства</td>
<td>Безжични</td>
<td>Мобилни ОС</td>
<td>Web 2.0</td>
<td>Социален инженеринг</td>
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<tr>
<td>Работещи</td>
<td>Относително популярни</td>
<td>Персонални компютри и сървъри</td>
<td>Кабелни</td>
<td>Стационарни ОС</td>
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<td>Забавления</td>
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<tr>
<td>Други</td>
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<tr>
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<td>Сцен. 60</td>
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**Активни сценарии**

**Пасивни сценарии**
Social Engineering Model

Diagram showing relationships between concepts such as Friendship, Grouping, Entertainment, Campaigns, Expressing, Sharing, Searching, Group Behaviour, Networking, Real Activities, Positions, Creativity, and Users.


Minchev, Z. CAX application for simulation and training in support of CIMIC. The Bulgarian academic experience, Amsterdam, the Netherlands, MCC 2011 Conference, October 17-18, 2011, Published in Military Communications and Information Technology: A Comprehensive Approach Enabler, Military University of Technology, Warsaw, Poland, 71-81, 2011.


A Study on IT Threats and Users Behaviour Dynamics in Online Social Networks, DMU03/22 Project Web Page: http://www.snfa ctor.com
Thank you for the Attention!

Q & A!