AN INTEGRATED APPROACH TO E-GOVERNANCE,
E-PARTICIPATION AND POLICY MODELLING

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1. FUTURE POLICY MODELLING (FUPOL) IN BRIEF

FUPOL is a research project funded by the 7th framework program of the European Union with a budget of 9 Mio Euro. Its main research focus are new technologies and methods for e-governance, e-participation and policy modeling. The FUPOL consortium consists of 17 partners from 9 countries and comprises innovative multinational companies, leading research institutes, high-level political organizations as well as strong pilot partners. It has a good balance of research partners, IT-industry, governmental partners and political cluster organizations capable to ensure wide-spread dissemination.

2. FUPOL BENEFITS

The FUPOL project has major benefits for:
• Politicians
• Civil servants
• Citizens
• Enterprises

It supports governments in
- Gaining a **better understanding of the citizen’s needs** and businesses activities
- Getting **direct feedback** from all political stakeholders through multi-channel social network analysis based on the communication between politicians and citizens
- Predicting the impacts of policy measures leading to a **more efficient implementation of government policies**
- Taking **better decisions** based on forecasts regarding the potential impact of political decisions
- Achieving a **High-level engagement of citizens** and a wider use of ICT tools resulting in a **higher innovation** potential related to the interaction of citizens with their respective governments.
3. THE INTEGRATED FUPOL APPROACH

FUPOL aims at a completely new approach to traditional politics using advanced technologies. It provides an integrated model, linking an advanced policy lifecycle with ICT.
4. The Policy Lifecycle

The major steps of the policy lifecycle are:

1. Agenda setting: establishing the need for a policy or a change in policy and defining what the problem to be addressed is.
2. Analysis: defining the challenges and opportunities associated with an agenda item more clearly in order to produce a draft policy document.
3. Creating the policy: ensuring a good workable policy document. This involves a variety of mechanisms which can include: formal consultation, risk analysis, undertaking pilot studies, and designing the implementation plan.
4. Policy decision making:
5. Implementing the policy: this involves the development of legislation, regulation, guidance, and a delivery plan.
6. Monitoring the policy: this encompasses evaluation and review of the policy in action, research evidence and views of users. Afterwards there is the possibility to loop back to stage one.

This model has been enhanced in FUPOL with three components:

1. A detailed description of the subtasks in each stage
2. A subtask - technology assignment: This refers to the business process and the usage of certain technologies in each step.
3. The added value created by using the technology

5. The ICT Features

5.1 Data Integration and Storage

Description

One of the most important features of the FUPOL Core Platform is that it provides access to a comprehensive set of data. This includes...

- statistical data from various sources (Eurostat, regional/local data,...)
- semantic data - mainly from social media
- geographical data
- knowledge data
• operational data (user accounts, user activity data, clients, journals, ...)

All this data are stored by the FUPOL Core Platform and made accessible to all tools that might require it (reading and writing).

The following diagram illustrates the various sources and users of data:

The FUPOL Core Platform acting as a multi-purpose data store provides the ability to store-and-forward data between the modules. As we use the same underlying logical structure for all data (i.e. the same ontology for all social media content) data exchange between the modules is supported. For example:

• the idea management system can be fed with ideas originating from Facebook, Twitter, Sina Weibo, Blogs, Emails etc. at the same time - following our principle of multi-channel social media communication
• simulators will be provided statistical data to set their boundary conditions, geographical data (i.e. manually imported from local GIS data) and user data, generating new geographical data (i.e. a map representing the state of the city in 5 years) and statistical data (i.e. the development of the city's CO2 emissions over the next five years)
• all data can be dragged into the visualization module and browsed in order to get a better understanding of the information behind it
• statistical data can be exported to Excel, edited and imported again in order to use it as input for the next simulation cycle
• ...and much more

**Business Value**

The central repository integrates data from multiple source systems and ensures data consistency across all steps of the policy lifecycle. It provides a single common data model for all data of interest regardless of the data's source. Data generated in one policy lifecycle process are used for the next step.

It also supports the improvement of data quality, by providing consistent codes and descriptions, flagging or even fixing bad data.

### 5.2 Unified Integrated User Interface

**Description**

User interface integration in FUPOIL means that two applications are integrated so that a user can carry out an operation that involves two different applications – without having to take into account that he or she is actually running two applications.

**Business Value**

The FUPOIL Unified Integrated User Interface has two major benefits

a) “Unified Look and Feel”

b) Single sign on to all applications

This simplifies the use of the system and improves security through a centralized authentication.
5.3 Policy Indicator Dashboard

Description

The policy indicator dashboard visualizes various indicators and flags if they are below / above thresholds or certain conditions are fulfilled.

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP Growth</th>
<th>Average Income / capita</th>
<th>Green space as a % of total land use</th>
</tr>
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<tbody>
<tr>
<td>2005</td>
<td>1.6%</td>
<td>33,508</td>
<td>45</td>
</tr>
<tr>
<td>2006</td>
<td>1.5%</td>
<td>34,771</td>
<td>45</td>
</tr>
<tr>
<td>2007</td>
<td>1.4%</td>
<td>36,915</td>
<td>45</td>
</tr>
<tr>
<td>2008</td>
<td>1.3%</td>
<td>38,036</td>
<td>45</td>
</tr>
<tr>
<td>2009</td>
<td>1.2%</td>
<td>39,123</td>
<td>44</td>
</tr>
<tr>
<td>2010</td>
<td>1.1%</td>
<td>40,098</td>
<td>44</td>
</tr>
</tbody>
</table>

The dashboard is intended as a tool for decision makers and advisors to set context and perspective when evaluating the current state of policy domains in the city.

Business Value

The policy indicator dashboard is an efficient tool to monitor policies on the management level.

5.4 Social Network Aggregation and Single Window Display

Description

Social network aggregation is the process of collecting content from multiple services such as Facebook, Twitter, Blogspot or the FUPOL opinion map and pulling them together into a single location. This also includes the same channel with different accounts (e.g. facebook pages). Sources are those from the city itself, but also other relevant sources such as citizen initiatives for example. The postings are displayed “single window”, which means postings from various sources are displayed on the same screen. The most valuable sources are Blogs, because they typically contain more specific political discussion.
Business Value

It saves a lot of time, which is typically required to log into all the different sources and read the postings. A multichannel “single window display” enables civil servants, politicians but also companies to better grasp the public opinion.

5.5 Hot Topic Sensing and Topic Summarization

Description

Hot Topic Sensing is a web and social network analytics tool that analyses data from social networks, newspapers, forums, blogs, etc. and identify relevant topics.

The purpose of the HTS is to help with the identification of community needs through Machine Learning and NLP (Natural Language Processing) algorithms. Postings from various social media are analysed and “Hot” topics are extracted.

Topic Summarization: Also a summary of postings is created, which reflects the opinions of the postings in brief.

Business Value

Quick identification of issues, which are not yet on the public-policy agenda. It allows a better recognition of citizen needs “Know the electorate”. Moreover the ICT based method is much quicker than manual methods.
5.6 Community Feedback Platform

Description

The Community Feedback Platform is inspired by crowdsourcing platforms and is designed to enhance cognitive processes in a similar vein as traditional Idea Management Systems (IMS). The purpose of the system is to facilitate the idea analysis and selection processes.

- Create a campaign focused in a desired topic.
- Start ideation process: communities write ideas comment and vote on them.
- Selection promising ideas and ranking from different point of views.
- The best promising ideas can be implemented.

Though similar to a classical IMS, the FUPOLO Community Feedback Platform is augmented with novel features that extend its functionality beyond what is normally associated with an IMS.

- A view on the collected space of citizens expression from different sources of information (blogs, social media, forums)
- Providing the capability to enrich the space by different means such as commenting/voting as a facilitator.
- Analytics toolkit (i.e. computing: trends, topics, sentiments)

Business Value

The Community Feedback Platform enhances the capabilities of Social Network Aggregation and Single Window Display with additional features such as:

- commenting/voting as a facilitator
- Analytics toolkit (i.e. computing: trends, topics, sentiments)

It means greater productivity and efficiency of staff analysing citizen feedback and needs. They are also in a better position to recognize citizen needs through the advanced analytical tools.
5.7 Visualization of Statistical Data

Description

In the described process of policy modelling, the aspect of problem identification plays a key-role for the whole policy design process. The need for getting valid information about certain topics and policy indicators is essential for setting the agenda for a new possible policy. Visualizing these valid and proved data provides a more useful instrument to gather information by comparing, associating, correlating and identifying various data, data-attributes or indicators.

In FUPOL various visualizations are used to visualize:

a) Time-series of single or multi-variable data
b) Geo-located variables and influences on geographical maps
c) The combination of various visualization types, e.g. for comparing and identifying relevant and influencing indicators

FUPOL Value Added Feature:
The challenges and therewith the main contributions are the automatic identification of appropriate variables, namely the main indicators and explanatory influencing variables to be visualized for a specific policy challenge. The second contribution is the alignment of various data and visualization techniques in a visual-cockpit metaphor to provide solutions for comparing and locating values. For the automatic identification of the variables following methods will be implemented in FUPOL:

a) Fuzzy Cognitive Map for policy indicator recommendation: The FCM contains the dependencies between the variables and therefore can be used to select variables to be visualized.
b) Suggest the variables based on the formula how they are calculated
   (example: average income = total income of all groups / number of persons)
c) Multiple regression: Indicators are chosen based on a preceding multiple regression analysis.

Example:

Causes of urban decay as the main indicator and

- Lack of jobs
- High % of absentee landlords
- Low % of homeowners
- Poor quality of schools
- Increased concentration of poor
- Increase in drugs, crime
- Aging housing stock
- Flight of middle class to suburbs
- Corruption
- Aging infrastructure
- Business flight to suburbs

Out of the variables those with a high correlation to urban decay are selected to be visualized together

- Lack of jobs
- Low % of homeowners
- Poor quality of schools
- Increase in drugs, crime
- Aging infrastructure

d) Expert Model: Recommendation of variables based on the usage behaviour (variable choice) of assigned and valid experts. Variables are suggested based on previous user choices.

This means that the “menu” driven approach is registered and used to propose the joint visualization of variables

e) Manual "Menu driven" approach: Variables are selected manually using a “menu”. The menu-approach provides a facetted search technique.

f) Semantic Analysis (quantitative): Statistics for variables appearing together in a text are automatically linked in a statistical visualization.
Business Value

The various methods support users to select the variables really influencing the main indicator used to measure the intended impact of a certain policy. Currently this is done manually. Visualization means a cost reduction, because it enables stakeholders to evaluate data quicker leading to resource rationalisation, greater productivity and efficiency. The combined visualization techniques provide a more time-efficient solving of comparative problem identifications. Moreover the automatic selection transfers some “implicit” knowledge to the users, which they may not have before.

5.8 Visual Social Data Analysis

Description

Besides valid and objective data, the investigation of “subjective values” is important for identifying problems and gathering information about the “social impact”. The method of choice to analyse based on ICT-tools the social impact is Social Network Analysis (SNA). SNA enables analysing social networks and identifying opinion leaders by measuring and mapping the relationships and flows between people, groups, organizations and other connected information or knowledge entities. The nodes in the network are the people and groups while the links show relationships or flows between the nodes. Their interactive visual representation provides a quick comprehension of the relation of topics to influence actors or topics of general interest. Further it provides an explorative approach for navigating through such networks and gathering more knowledge about the related topics. Especially the identification of opinion leaders is important. An opinion leader is an active media user, who interprets the meaning of media messages or content
for lower-end media users. Typically the opinion leader is held in high esteem by those who accept his or her opinions.

In all stages of the policy lifecycle process it is important to know the structure of the social network related to a policy issue and identify opinion leaders, follow them and eventually also contact them directly (peer influencing strategy).

**Business Value**

Decision makers can identify the relevant opinion leaders for a specific topic and approach them directly. Further the visual representation provides the exploration of related topics, e.g. an opinion leader in one topic influences people in other topics. With the visual representation the processes of information acquisition and finding relations are more efficient.

### 5.9 FUPOL Knowledge Database and Visualization

**Description**

In various steps of the FUPOL process model, the acquisition of information and the generation of knowledge play an essential role. The web provides increasing and rising knowledge repositories that enables, e.g. to validate hypothesis for experts, or explores options. The FUPOL Knowledge Database and Visualization uses web-sources, which are interlinked with formal knowledge descriptions in combination with the knowledge provided within FUPOL. Therefore the search and visualization of SemaVis will be enhanced by providing multi-database search abilities and visualizations, in particular to search and explore existing semantic data-sources by an intuitive and interactive graphical user-interface orchestrated by various visualization techniques.

It enables a user to search for knowledge in different external (web) data and internal (FUPOL) sources and combines visualizations in visual cockpit metaphor for various policy tasks. A user is able to view on web-knowledge to validate for example an identified policy problem and gather related implicit information.
Business Value

The visual knowledge database of FUPOL provides a visual search ability for proving the given information and compare to the web-knowledge. The visualization decreases the time-effort of search and exploration and provides an efficient tool for the increasing amount of linked open data. Further the comparison to internal knowledge databases (e.g. FUPOL or other cities) enables in a visual manner a comprehensible view on relevant topics. It enhances the FUPOL process model with open web-data.

5.10 Outgoing Multichannel Social Media Single Window Messaging

Description

This is the capability of posting messages to various channels (social media targets) at the same time without the need to manually post to each site separately. FUPOL supports active social media usage by providing posting messages to various channels (social media targets) at the same
time without the need to manually use those sites directly.

**Business Value**

- Less manual labour - reduced costs, faster, less prone to error
- Content will be stored "forever" - even if it's no longer available on its original site.
- One tool for all - metrics, analysis results and visualizations become comparable.

### 5.11 Opinion Maps

**Description**

Many political debates in a city have a reference to some specific spots. People have opinions on upcoming construction projects, on the place for a new bus station or they just want to tell you that there's some broken traffic light there.

FUPOL provides a tool for georeferenced interaction: the opinion map.

Opinion maps are interactive electronic maps that can be integrated into almost any internal or external web site. So for example the municipality can use the city's existing blog for starting a political debate related to some construction project. The opinion map can be integrated seamlessly into their blog and eCitizens are now able to express their opinions by interacting with that map.

**Business Value**

- Opinions are linked to a specific place - better context.
- Identification of hotspots in your city.
- Involvement of citizens in the city's facility maintenance.
5.12 Simulation and Impact Visualization

Description

The Simulation and Impact Visualization

The simulation enables a virtual evaluation of policies. Therefore the statistical history of indicators is used to generate forecast based on mathematical models, in dependency of identified influencing indicators which can be addressed with a policy. A simulation tool has the advantage that the impact of a policy can be tested in a de-facto laboratory environment and evaluated to decide whether a certain change is desirable or not.

It is important to understand that there is no single “one fits all” simulation software package and methodological approach to policy simulation. In each policy domain there are several ways how to model a given policy. FUPOL currently implements only some simulations based on agent based simulation and system dynamics to show how simulation can be used in the policy lifecycle. However it should be noted that the architecture allows other simulations to be added later on.

The opportunity to evaluate a policy before it is implemented allows the use in two manors:

- Evaluating an identified solution in the analysis phase to ensure that a planned policy will address and solve the problem
Simulating in the monitoring phase, after a policy is implemented, to predict the function of a policy especially if a complex policy needs a longer reaction time.

In the FUPOL policy process the aspect of simulation plays an important role, thus this allows to identify predicted impacts on policy indicators or other influencing factors. After the computation of the simulation, the visualizations of SemaVis allows a detailed analysis to determine the impact of a planned policy. Thereby the development of an identified indicator, which might belong to the problem, will be observed in dependency of an adjustable influencing indicator. For the impact analysis a couple of visualizations and FUPOL features are included:

- Statistical visualization to analyse the impact based on the quantitative data.
- Geographical visualization to illustrate the impact on a map, e.g. the urban growth.
- Policy Indicator Dashboard to provide a simplified impact overview of the key indicators.
- FUPOL Knowledge Database and Visualization for additional information about the simulated situation and the influence on specific indicators.

**Business Value**

Decision makers have the advantage to simulate and analyse a planned policy for its impact, before a policy is implemented. Hence insufficient policies can be avoided and the policy implementation-coasts can be decreased. Additionally decision makers can use the simulation and impact analysis as monitoring tool to observe the impact of policies with long reaction time.

**5.13 Visual Fuzzy Cognitive Map**

**Description**

A fuzzy cognitive map represents a system as a network showing the directed causal relations between its elements through arrows. It graphically represents the beliefs and perceptions a person holds about a specific question or system and is created during interviews. A factor or node in the network stands for a key-factor of the
system. The directed links show the causal relations between factors. The relations between the elements can be used to compute the "strength of impact" of these elements.

FCM can be applied in group sessions or in interviews with single persons, depending on the requirements. In such sessions issues which are highly uncertain or to which conflicting views exist can be easily detected.

The “Visual” element of FCM provides a comprehensible view on the underlying topic and relations. Therefore graph-based visualization with weighting algorithms for the FCM outcomes is used. The comprehensive view on the relations provides more transparency.

From the visualization point of view the FCM describes in its major presentation a graph, i.e. it can be shown as node-graph visualization. Therefore the used data for the definition of the FCM is close to existing graph-based definition formats e.g. GraphML. For the final integration into FUPOL the focus lays on the visualization just as graph with labels for additional explanations on the node and edges. To allow interactivity, a linking between the FCM and the considered model in the background and the simulation as analysis tool is provided. The new FCM will be visualized by the end users and they will be allowed to check the effects of changing the value-force assigned to the different concepts represented in the FCM.

**Business Value**

The major advantage of fuzzy cognitive maps is that they can handle incomplete or conflicting information in the decision making process. It is quite suitable to represent political systems and support related decisions, because frequently important information may be missing, be unreliable or be vague or conflicting. Hence FCMs are a suitable tool to support complex policy decisions. They can be used to visually show complex relationships to stakeholders and decision-makers.