
ICT-2011.5.6 ICT solutions for Governance and Policy Modelling
FP7-ICT-2011 Coordination Action (CA) project

# Synthesis Report of Knowledge Assets, including Visions (D 4.2)

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|---|---|
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| **Abstract:** | This report presents the work and progress on the development of knowledge assets and on future visions along work package 4 in the second period (15/08/2012 - 14/02/2014). Main works comprise of (1) a comparative analyses of state-of-art solutions for governance and policy modelling using ICT and a common evaluation framework for the analysis; (2) the development of a glossary; (3) the definition of a process for adding knowledge assets to the knowledge portal; and (4) the development of visionary scenarios for ICT in governance and policy modelling. |

## TABLE OF CONTENTS





# LIST OF FIGURES AND TABLES

# ABRREVIATIONS AND ACRONYMS

| Abbreviation | Description |
|---|---|
| CERTH | Centre for Research and Technology Hellas |
| COMPASS | Centre of Methods and Policy Application in the Social Sciences, The University of Auckland |
| DoW | Description of Work |
| ICT | Information and Communication Technologies |
| INNOVA | Innova spa |
| IS | Information Systems |
| KhNU | Khmelnitsky National University |
| MRSU | Moskow Regional State University |
| PUC-PR | Associacao Paranaense de Cultura |
| RG | Rijksuniversiteit Groningen |
| RTD | Research and Technological Development |
| SUNY | The Research Foundation of State University of New York |
| TU Delft | Delft University of Technology |
| TUK | Technical University Kosice |
| UBRUN | Brunel University |
| UCDNUID | University College Dublin, National University of Ireland, Dublin |
| UKL | University of Koblenz-Landau |
| ULAVAL | Université LAVAL |
| UNU-IIST | United Nations University - International Institute Software Technology |
| UTS | University of Technology Sydney |
| VOLTERRA | Volterra Partners LLP |
| VUB | Vrije Universiteit Brussel |
| WP | Work Package |

# 1. INTRODUCTION

Work package 4 aims to "exchange experiences and lessons from current RTD in the field of ICT solutions for participation, governance and policy modelling, as well as from consensus-building in the uptake of innovative e-governance services" (DoW). The main goal is to establish a dialogue, build consensus and draw up a body of knowledge and lessons on ICT solutions in the field. Ultimately, common political agendas will be drawn up to promote the RTD and use of ICTs in the strategic planning and decision-making processes and in parliamentary and government environments thereby contributing to better governance and policy modelling (DoW).

While the first year dealt with the development of a multidisciplinary framework for the policy community's knowledge base (cf. deliverable D4.1), the second period focused on the identification, analysis and comparison of theories, methods, solutions and cases of ICT solutions for governance and policy modelling (cf. tasks 4.2 and 4.3) to contribute to the evolution of the knowledge base (cf. task 4.1). Furthermore, future visions (scenarios) on ICT for governance and policy modelling were developed (cf. task 4.4). To complement the existing knowledge base and to ensure common understanding of terms in the community, the development of a glossary was initiated and further knowledge assets have been added to the knowledge portal (cf. task 4.1).

Deliverable D4.2 sums up the main achievements of work package 4, namely:

- Adding knowledge assets to the knowledge portal
- Developing glossary terms for policy modelling to ensure a common ground of understanding across distinct disciplines
- Performing comparative analyses of thematic areas related to ICT solutions in policy modelling and governance
- Developing visionary scenarios of ICT solutions for governance and policy modelling

The work performed in period 2 will continue in year 3 to enrich the body of knowledge. The structure of deliverable D4.2 is as follows:

Chapter 2 describes the methodologies for the works in period two. This includes the method for developing a glossary for key terms the eGovPoliNet policy community needs to share common understanding. Further on, the conceptual framework for comparative analysis and evaluation of ICT solutions for governance and policy modelling is developed. Finally, the approach to building scenarios for future visions of ICT solutions for governance and policy modelling is explained.

Chapter 3 presents the structure and content of the glossary. An overview of terms defined and published in the knowledge portal is given, as well as work that is currently ongoing to add further terms.

Chapter 4 provides a summary of new knowledge assets added to the knowledge portal that was taken over from CROSSOVER in summer 2013.

Chapter 5 documents the works of comparative analysis of theories, frameworks, projects, models and cases using the framework developed in chapter 2. The chapter also provides the abstracts of the papers developed and an overview of complementary contributions of community members for a collective volume of a book.

Chapter 6 presents six scenarios for future visions of ICT solutions for governance and policy modelling.

Concluding remarks reflect the achievements of works in period two of work package 4. We also give an outlook on further activities of knowledge asset development in the third period.

# 2. BASIC UNDERSTANDING AND METHODS FOR THE WORK

This chapter introduces the methods and conceptual frames for the development of the glossary (2.1), the comparative analyses (2.2) and the scenarios for future visions of ICT solutions for governance and policy modelling (2.3).

## 2.1. GLOSSARY DEVELOPMENT

A common understanding between actors of distinct disciplines that wish to form a community on a jointly interesting domain of study is crucial. Common understanding refers to key terms, concepts and solutions, which otherwise come from single disciplines. It is necessary to understand the domain, to share its aspects, and to successfully participate in research and practical development of the field. The policy modelling field is not different in that sense. The glossary as concept was already introduced in the concept for the knowledge base as presented in D 4.1.

To start harmonise the understanding in the field, partners from distinct disciplines started to develop terms in a glossary after the first period. Before the eGovPoliNet project meeting in Koblenz in December 2012, partners proposed a set of glossary terms to be elaborated upon. The number of terms to be included in the Glossary was an important aspect, since eGovPoliNet has restricted resources. Therefore, in this first iteration, partners suggested the most important terms from their perspective for the domain of policy modelling. At the Koblenz meeting, the first set of terms to be developed was agreed upon. It was also agreed that, in later iterations, the partners would suggest and elaborate on more terms.

In the Koblenz meeting, partners also agreed on a common structure for describing glossary terms as follows:

- Title
- A brief description of the term with references (a few paragraphs)
- Term variants (if applicable)
- List of related terms from the glossary (if applicable)
- References

Except for the text, media content such as images, charts and diagrams could be integrated in the descriptions. UKL provided a collaboration environment for the glossary development in the collaborative workspace. Partners could assign themselves to terms they wanted to describe, based on their expertise.

After subscribing for terms, partners elaborated them following the above structure. Subsequently, other partners reviewed the terms' descriptions commenting them, which triggered author's revision of terms. After author's revision, these terms were reviewed again by the WP 4 leader and if the comments provided by other partners were successfully addressed by the authors, the terms were moved to the voting. Otherwise, comments were provided again and the authors' were asked to make another round of revisions.

UKL implemented a polling mechanism for the glossary terms. When a term was moved to the voting phase, partners were invited to vote. In the virtual meeting of 13th March 2013, partners agreed to request 10 positive votes for a term to be published. As ten positive votes turned out not to be effective, partners agreed during the Koblenz meeting in September 2013 that a term is published when it receives at least eight positive votes. In this case, the term is published in the knowledge portal (i.e. added to the public knowledge base). The iterative process of developing glossary entries for the knowledge base is shown in Figure 1.

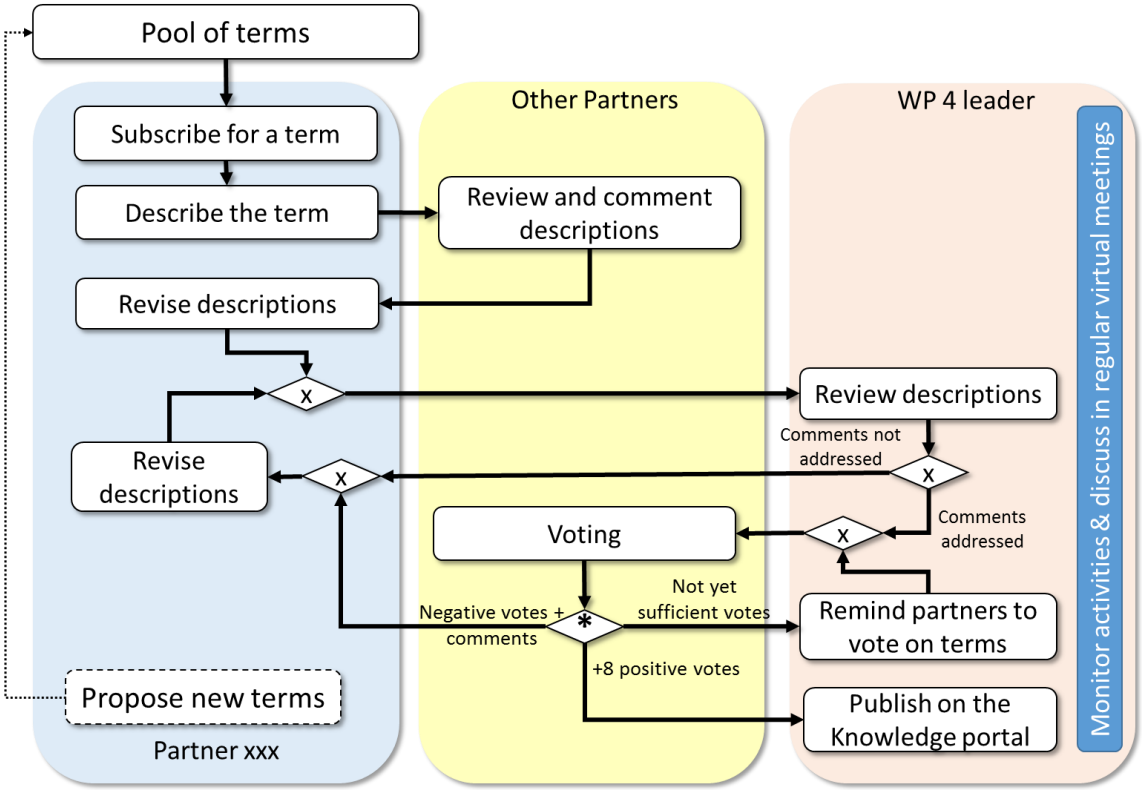


Figure 1: Process for development of Glossary entries

Partners' engagement in developing and discussing glossary entries was monitored and discussed along the monthly virtual meetings (every 2nd week of the month).

In chapter 0, the current status of the glossary development is described.

## 2.2. COMPARATIVE ANALYSIS

For the comparative analysis, eGovPoliNet followed a multi-criteria approach (Belton and Stewart, 2002) to assess and compare relevant thematic knowledge assets such as theories, frameworks, methods, models and cases of ICT use for digital governance and policy modelling. WP4 has established a set of criteria for evaluating and comparing knowledge assets in the different themes. Besides the set of criteria, a guideline was developed for teams to elaborate the comparative analysis. The guideline and set of criteria for selected themes for comparison are provided in Annex I: Comparative analysis – Templates and Guidelines for Analysis.

Along the analysis, each comparative analysis team was requested to study relevant literature in a specific field, to compare several existing knowledge assets in the thematic area, as well as to reflect lessons learnt and recommendations for policy modelling from the group work. The guideline in Annex I: Comparative analysis – Templates and Guidelines for Analysis also contains a set of questions to be answered in each of the analyses. An example of such a set of questions - formulated for the area of theories - is:

- What theories do exist that ground and support policy analysis, modelling and governance? (providing also literature to individual theories)
- Where are the theories applied in particular (practical cases)?

- Which discipline(s) has(ve) developed the theories and which discipline(s) use it?
- Are there particular methods supporting the application / implementation of the theories?
- Are there particular tools that support the application/implementation of the theories?
- What lessons can be drawn from, and what conclusions can be made on the practical applicability of the theories?

For the comparison, the guideline proposes collecting general metadata as well as specific conceptual data per knowledge asset (cf. Annex I: Comparative analysis – Templates and Guidelines for Analysis). Table 1 shows an example for the theme of theories for policy modelling.

**Table 1: Template for comparative analysis of theories for policy modelling**

| Theories / Aspects for comparison | **Th 1** | **Th 2** | **Th x** |
|---|---|---|---|
| **Metadata** | | | |
| Name | | | |
| Developer | | | |
| Publication Date | | | |
| Abstract | | | |
| Reference(s) | | | |
| **Conceptual aspects** | | | |
| Discipline(s) | | | |
| Built on another theory | | | |
| Main foci of theory | | | |
| Peculiarities of theory | | | |
| Constraints of theory | | | |
| Tools supporting theory | | | |
| Models supporting theory | | | |
| Methods emerging from theory | | | |
| Models emerging from theory | | | |
| Tools and/or technologies emerging from theory | | | |
| Best practice domains where theory is successfully applied | | | |
| Examples of practical use (ref to projects / cases) | | | |
| Lessons from practical use | | | |
| Transferability of theory in other application domains or disciplinary contexts | | | |
| Concluding recommendations for application | | | |

The works on comparative analyses started in November 2012. As along the glossary development, partners were asked to propose themes for comparative analysis that were relevant to eGovPoliNet. Subsequently, and particularly at the Koblenz meeting in December 2012, the eGovPoliNet partners discussed relevant areas for comparison and selected the following ones for the first round of comparative analysis (i.e. for period 2 of the project): theories & methods, technical frameworks,

conceptual models, simulation models, tools & technologies, projects / cases implementing policy, policies / strategies / programs, and stakeholder engagement in policy development.

In the meeting that took place in December 2012, as well as during subsequent monthly virtual meetings, members of the consortium with distinct background and access to specific knowledge along the theme selected were grouped into teams. Some external experts, PhD students as well as students of master courses were also engaged in the work. Figure 2 presents the process of forming comparative analysis teams with dedicated themes.

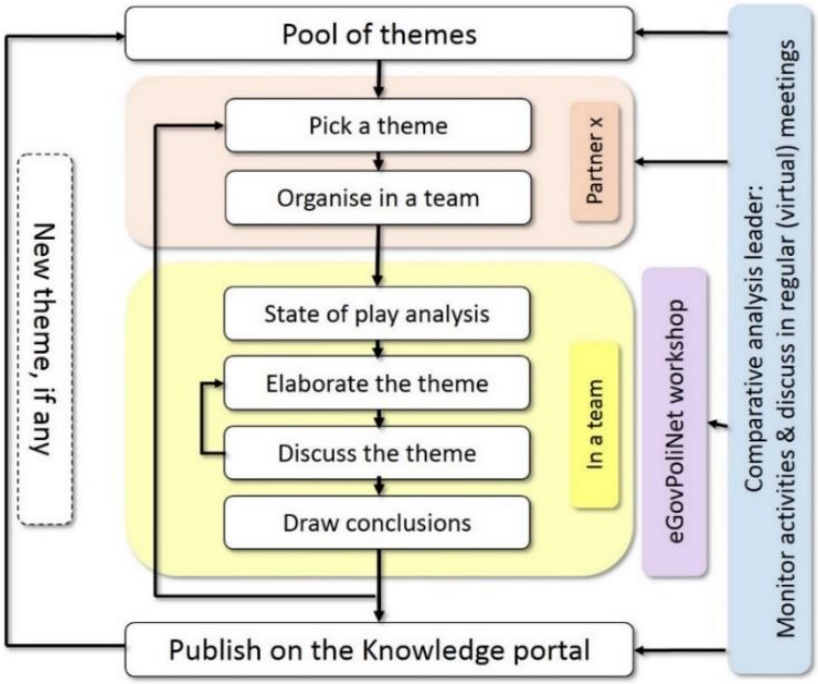


Figure 2: Process of comparative analysis

Partners also agreed during the December 2012 meeting that, in later iterations and if the need emerges, they will suggest and elaborate on more themes. The first list of themes, rather than being exhaustive, represented a choice of most important areas in the field of governance, participation and policy modelling, which mapped to the partners' competencies and profiles of research activities.

Along the elaboration of comparative analyses, each team conducted their own virtual and physical meetings to perform literature research, analysis and discussion of their theme. eGovPoliNet work package 4 conducted regular monitoring of the work and each group reported on the work progress in the virtual meetings every 2nd week of the month. In September 2013, eGovPoliNet organised a one-day workshop along with the IFIP EGOV and IFIP ePart conferences, where each group presented their findings, together with presentations of external attendees. The workshop gathered not only the eGovPoliNet partners but also members of a wider policy modelling community. After the workshop, the groups of eGovPoliNet continued working on the themes. Most of the teams advanced their works to include it into the book edited by eGovPoliNet – see D 3.2.

The current results of comparative analysis are described in chapter 5.

## 2.3. SCENARIOS FOR FUTURE VISIONS OF ICT SOLUTIONS FOR GOVERNANCE AND POLICY MODELLING

eGovPoliNet's WP 4 also aimed at developing scenarios for future visions of ICT solutions for governance and policy modelling. To implement this objective, eGovPoliNet followed the approach of scenario development as proposed in (Bicking, et al., 2006) and (Janssen, et al., 2007). Partners started to bring up initial visions by partners. UKL provided a wiki space for this in the collaborative workspace.

In total, nineteen initial scenarios were developed by partners and discussed in the regular monthly virtual working meetings since autumn 2013. These scenarios were finally discussed in a physical workshop organised within the eGovPoliNet project meeting in January 2014 in Uxbridge. In this workshop, partners were urged to select five scenarios, which they consider the most important and promising. Subsequently, six groups of people further amended the selected scenario with aspects that may have been mentioned in similar scenarios. Each team was also asked to check their scenario to cover the following aspects in the description:

- ICT use in the scenario
- Actors in the scenario
- Particular services for policy development offered
- Benefits of the solution
- Processes and interaction among stakeholders – using ICT

The teams also had to ensure that the selected scenarios address a vision of ICT supported governance and policy modelling in the year 2020.

After the group discussions, each team presented their enhanced scenario in the plenum, followed by comments and discussion. The result of the workshop was a set of six scenarios for future visions of ICT solutions for governance and policy modelling, which were mostly ready to be published on the knowledge portal.

After publishing on the knowledge portal, eGovPoliNet invited a wider audience and community of LinkedIn members to comment and review the scenarios. This resulted in the final six scenarios presented in Section 0.

The process of scenario development in eGovPoliNet is presented in Figure 3.

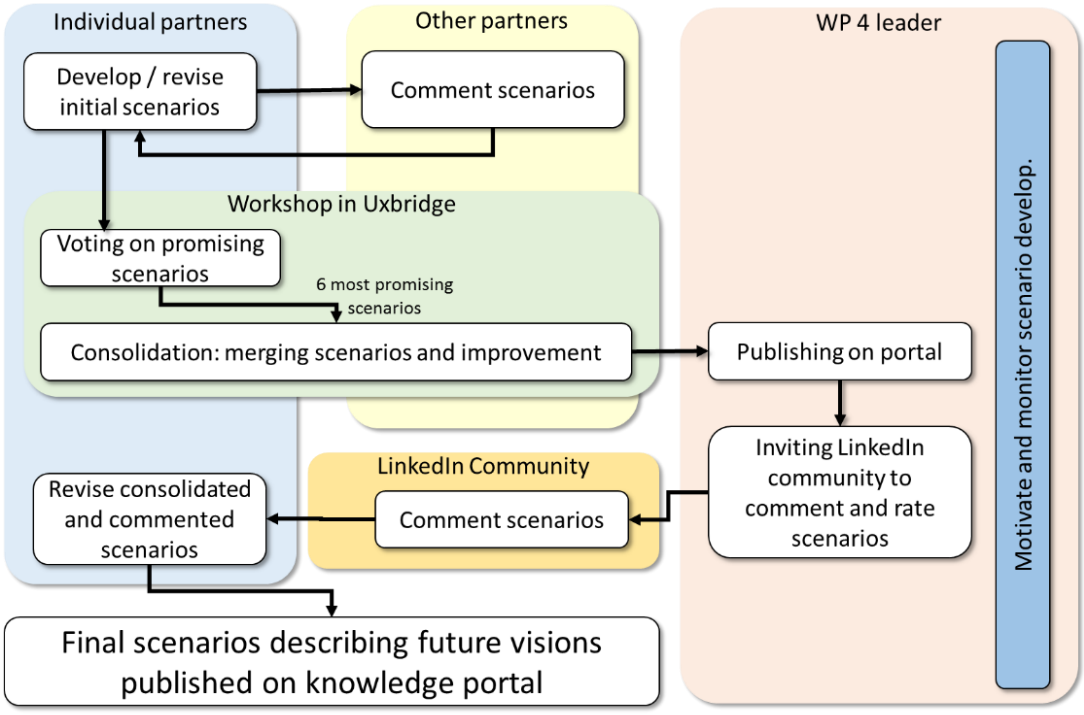


Figure 3: Scenario development process for future visions on ICT for governance and policy modelling

# 3. GLOSSARY

The Glossary development as described in Section 2.1 is an on-going process. Glossary terms can, therefore, be divided into the following categories with respect to their lifecycle:

- **Published**. Term is published on the knowledge portal.
- **Voting**. Term is on the voting list.
- **Review**. Term is in the review phase – partners can comment the term and the author is responsible to revise the description according to the comments received.
- **Assigned**. Term is assigned to a partner to develop the corresponding description.
- **Not assigned**. Term has been identified as relevant for the glossary but has not yet been assigned to a partner for developing the description.

Figure 4 shows the corresponding statistics of Glossary development of early February 2014.

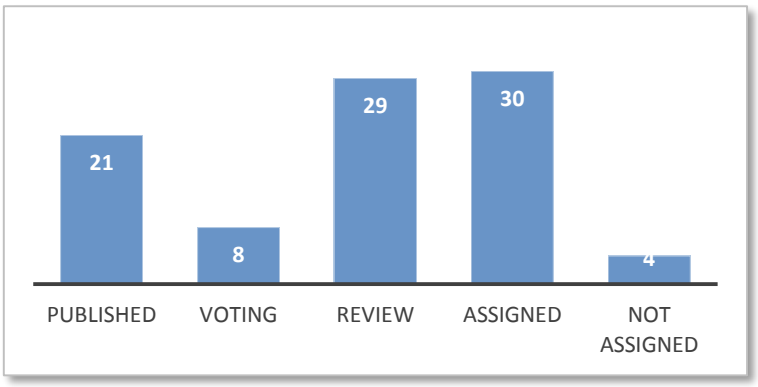


Figure 4: Glossary statistics as of early February 2014

In the subsequent sections, an overview of the terms identified and developed so far is provided. The work on the glossary will continue in the third period of the eGovPoliNet project.

## 3.1. GLOSSARY TERMS PUBLISHED

The glossary terms published on the knowledge portal[1] are as follows:

- Complex Adaptive System
- Good Governance
- Governance
- Network
- Stakeholder Engagement
- Policy Analysis
- Public Policy
- Dynamic Stochastic General Equilibrium Models
- Provenance
- Public Governance
- Democratic Governance
- Econometric Modelling
- Model
- Hierarchic Governance
- Public Participation
- Networked Governance
- New Public Management
- Policy
- Econometrics
- Scenario Building
- Theory

[1] The corresponding descriptions of terms are publicly available in the glossary through the Knowledge portal – see http://www.policy-community.eu/knowledge-portal

In Table 2, the published glossary entry "Public policy" is presented as an example. The whole list of published glossary entries is available under http://www.policy-community.eu/knowledge-portal.

**Table 2: Example of the published glossary entry "Public policy"**

| **Name** |
|---|
| Public Policy |
| **Description** |
| Public Policy is a "set of interrelated decisions taken by a political actor or group of actors concerning the selection of goals and the means of achieving them within a specified situation where those decisions should, in principle, be within the power of those actors" (Jenkins, 1978). Public policy can be considered as: (i) a process; (ii) series of decisions; (iii) limited by internal and external constraints of government's capacity to implement the decisions; (iv) as goal-oriented behaviour.<br><br>A public policy is "a document drawn up by governmental actors to present both their vision of an issue calling for public action and, to some extent, the legal, technical, practical and operational aspects of this action" (Turgeon, 2011). Public policy refer to "the process through which elected representatives decide on a public action designed to deal with an issue considered by certain actors, whether governmental or non-governmental, to require some kind of intervention".<br><br>Public policies in modern political systems are designed to accomplish specified goals or produce definite results, although these are not always achieved (Anderson, 2003). Public policies emerge in response to policy demands, or those claims for action or inaction on some public issue made by other actors—private citizens, group representatives, or legislators and other public officials—upon government officials and agencies. |
| **Related terms** |
| Policy, Policy Analysis, Policy Governance, Policy Informatics, Policy Model, Policy Modelling |
| **References** |
| Jenkins, William (1978). Policy Analysis: A Political and Organizational Perspective. London: Martin Robertson<br>Turgeon, J. and J.-F. Savard (2012)."Public Policy,"in L. Côté and J.-F. Savard (eds.), Encyclopedic Dictionary of Public Administration, [online], www.dictionnaire.enap.ca<br>Anderson, J. E. (2003). Public policymaking: An introduction. Boston: Houghton |

## 3.2. GLOSSARY TERMS ON THE VOTING LIST

The glossary terms currently on voting are as follows:

- Business Process
- Community
- Conceptual Modelling
- Linear Program
- Linear Programming
- Micro-simulation
- Policy Informatics
- Policy Network Analysis

The descriptions of these terms are provided subsequently (following the description template as outlined in section 2.1):

**Business process**

According to Davenport, a business process is "a structured set of activities designed to produce a specific output" (Davenport, 1993). For Hammer and Champy (1993), a process is defined as "a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. A business process has a goal and is affected by events occurring in the external world or in other processes". Smimov argues about a modern business process to be seen as a distributed system where its activities are performed by various employees, on different locations, using a heterogeneous set of IT systems. A business process typically crosses the borders of organisational departments and even companies (Smimov, 2012). However, each business process has to be modelled. To this end, (Smimov, 2012) defines business process models as "key artefacts to represent how work is performed in organisations. These models can help an organisation to document, evaluate, or improve their business processes."

Variants: Business process modelling

References:

Davenport, T.H. (1993), Process Innovation, Harvard Business School Press, Boston, MA.

Hammer, M., and Champy, J. (1993). Reengineering the Corporation: A Manifesto for Business Revolution Harper Business.

Smirnov, S., Reijers, H., Weske, M., and Nugteren, T. (2012), Business process model abstraction: a definition, catalog, and survey, J Distributed and Parallel Databases, V 30, N 1, p. 63-99.

**Community**

The word *community* was derived from the Latin communitas, a broad term for fellowship or organised society. According to Merriam-Webster Dictionary (2013) a community is a unified body of individuals, e.g. the people with common interests living in a particular area or a group of people with a common characteristic or interest living together within a large society.

Community usually refers to a social unit that shares common values (Smith, 2013). Specifically in biology a community is a group of interacting living organisms sharing a populated environment.

Tönnies (2005) distinguishes two types of human association in sociology - community and society. He argues that community is perceived to be a tighter and more cohesive social entity (presence of a "unity of will"). Perfect expression of community is family and kinship. Society, on the other hand, is a group in which the individuals who make up that group are motivated to take part in the group purely by self-interest. As Tönnies proposed, in the real world no group was either pure community or pure society.

Community building is a field of practices directed toward the creation or enhancement of community among individuals within a regional area or with a common interest.

Variants: Association, Centre, Commonality, Company, Nation, Neighbourhood, People, Public, Society, State

References:

Merriam-Webster.com (2013), community. Retrieved April 17, 2013, from http://www.merriam-webster.com/dictionary/community

Smith, M. K. (2001) 'Community' in *the encyclopedia of informal education*, Retrieved April 17, 2013, from http://www.infed.org/community/community.htm

Tönnies, F. (2005), Gemeinschaft und Gesellschaft, Darmstadt: Wissenschaftliche Buchgesellschaft, 8th edition (reprint).

**Conceptual Modelling**

Conceptual modelling is the process of abstracting a model from a real or proposed system (Robinson 2008, p. 3). Mylopoulos (1992) defines conceptual modelling as an activity of formally describing some aspects of the physical and social world around us for purposes of understanding and communication. The outcome of the conceptual modelling process is a conceptual model. Conceptual modelling is an iterative and repetitive process, with the conceptual model being continuously revised throughout the modelling process. However, the main issue in conceptual modelling is to abstract an appropriate simplification level of reality (Pidd, 2003).

Conceptual modelling is a complex process because we do not have measurable criteria for evaluating the value of its outcome - a conceptual model (Pritsker 1987). Therefore, during the process of conceptual modelling, a set of system requirements would be useful to consider. The requirements could provide a basis against which to determine whether the obtained conceptual model is appropriate. Robinson (2008, p. 19) argues four main requirements, which should be fulfilled when measuring the outcome of conceptual modelling:

- validity (a conceptual model can be developed into a simulation model with sufficient accuracy),
- credibility (similar to validity, but from the viewpoint of a client),
- utility (developed model will be useful for the decision making),
- feasibility (conceptual model will be developed into a [simulation] model with respect to available time, resources and data).

In Policy Making, conceptual modelling is carried out by policy analysts who extensively analyse available documents in order to get an accurate overview of the policy domain, i.e. to develop a conceptual model of it. They also collaborate with the stakeholders and the policy modellers to discuss model elements.

Related terms: Model, Modelling, Tool

References:

Mylopoulos J, (1992). Conceptual modeling and Telos, Chapter 2 in Loucopoulos, Peri; Zicari, Roberto: Conceptual Modeling, Databases, and CASE : An Integrated View of Information Systems Development, New York.

Pidd, M. (2003). Tools for Thinking: Modelling in Management Science, 2nd ed. Wiley, Chichester, UK.

Pritsker, A.A.B. (1987). Model Evolution II: An FMS Design Problem. Proceedings of the 1987 Winter Simulation Conference (Thesen, A., Grant, H. and Kelton, W.D., eds.). IEEE, Piscataway, NJ, pp. 567-574.

Robinson, S., 2008. Conceptual modelling for simulation part I: definition and requirements. Journal of the Operational Research Society, 59 (3), pp. 278 - 290.

**Linear program**

According to Luptáčik (2010) it is the simplest and most widely spread model of convex programming. A linear program or linear programming problem is an optimization problem for which we attempt to maximize or minimize a linear function of the decision variables (so called objective function), where the value of the decision variables must satisfy a set of constraints, each of which must be a linear inequality or linear equality.

A linear program is a disarmingly simple object. According to Denardo (2011) its definition entails the terms "linear expression" and "linear constraint". For instance 3x-2.5y+2z is a linear expression where its variables are x, y and z, and the dependence of this expression on x, y and z is linear. A linear constraint requires a linear inequality to take any of the proposed forms, or in other words, a linear

constraint requires a linear expression to be less/greater than or equal to a number. A linear program either maximizes or minimizes a linear expression subject to finitely many linear constraints.

References:

Denardo, E. V. Linear Programming and Generalizations. A Problem-based Introduction with Spreadsheets. 1st Edition. New York: Springer Science+Business Media, 2011. ISBN 978-1-4419-6490-8.

Luptáčik, M. Mathematical Optimization and Economic Analysis. 1st Edition. New York: Springer Science+Business Media, 2010. ISBN 978-0-387-89552-9.

**Linear Programming**

Linear programming describes the family of mathematical tools that are used to analyze linear programs (see definition of linear program in the glossary). The word "linear" results from character of the objective function and the constraints, and the word "programming" results from applications in areas of planning or action scheduling.

Linear programming was first designed as planning and decision tool in setting where a central decision-maker, fully in control of the various quantity variables in the system, has to make consistent or optimal decision. Linear programming was developed by Kantorovich (1939) and Dantzig (1982) as a tool for optimal central decision making, primarily for military purposes.

It is quite clear that the standard linear programming formulation is best suited to problems where a single decision maker optimizes a central welfare function subject to technological and physical constraints. Unfortunately the standard formulation does not appear so well suited to modelling situations where many agents independently maximize their own welfare functions and jointly but inadvertently determine an outcome that can only be affected indirectly by the planner or policy maker.

Variants: Operation Research, Simplex Algorithm, Mathematical Programming

References:

Dantzig, G. B. (1982). Reminiscences about the origins of linear programming, in *Mathematical programming : the state of the art, Bonn, 1982* (New York, 1983), 78-86.

Kantorovich, L. V. (1939). "Mathematical Methods of Organizing and Planning Production" *Management Science*, Vol. 6, No. 4 (Jul., 1960), pp. 366–422.

**Micro-Simulation**

The core of micro-simulation has been defined as "a means of modelling real life events by simulating the actions of the individual units that make up the system where the events occur" (Brown and Harding, 2002), and as "computer-simulation of a society in which the population is represented by a large sample of its individual members and their behaviours" (Spielauer, 2011). This has been broadened to encompass its role in policy so that "micro-simulation models are computer programs that simulate aggregate and distributional effects of a policy, by implementing the provisions of the policy on a representative sample of individuals and families, and then summing up the results across individual units using population weights" (Martini & Trivellato, 1997, p. 84).

Micro-simulation operates at the level of individual units, for example children, each possessing a set of associated attributes as a starting point. A set of rules, typically derived from statistical analyses, is then applied in a stochastic manner to each and every individual to simulate changes in state or behaviour. The primary strength of micro-simulation techniques is their use of actual individual-level data, which allows them to reproduce social reality and the intricacy of policy structures. These data can

come from various sources, which micro-simulation is able to combine into a cohesive whole. The model can then be used to estimate the outcomes of "what if" scenarios (Brown & Harding, 2002, p. 4).

Spielauer (2011) notes that micro-simulation is certainly the preferred modelling choice in three situations: (1) if population heterogeneity matters and if there are too many possible combinations of considered characteristics to split the population into a manageable number of groups; (2) if behaviours are complex at the macro level but better understood at the micro level; and (3) if individual histories matter, that is, when processes possess memory (Spielauer, 2011, pp. 6-8).

References:

Brown, L, Harding A. (2002). Social modeling and public policy: Application of microsimulation modeling in Australia. Journal of Artificial Societies and Social Simulation 5(4)6.

Martini A, Trivellato U. (1997). The role of survey data in microsimulation models for social policy analysis. Labour, 11(1), 83-112.

Spielauer M. (2011). What is social science microsimulation? Social Science Computer Review, 29(1), 9-20.

**Policy Informatics**

Policy informatics is the "transdisciplinary study of how computation and communication technology leverages information to better understand and address complex public policy and administration problems and realize innovations in governance processes and institutions" (Center for Policy Informatics). This approach seeks to strengthen the connections among scholars and between scholars and practitioners who share an interest in how policy relevant information and data are used to formulate, implement, and evaluate public policies (Kamensky, 2012). Policy informatics also encompasses exploration of the implications of new analytical tools and data sources for conducting policy relevant research. The core intellectual focus is to advance research and practice that can enhance our understanding of complex policy and managerial problems.

The latest innovations in information and communications technology and information collection and dissemination capacity are changing the ways in which analysis can support public policy decisions. Policy informatics emphasises theories and research concerning d ecision-making, complexity theory, and visualisation of quantitative and qualitative information, collective intelligence, behavioural economics, and persuasive technologies. For example, availability of large quantities of data, often on whole populations, promoted by open data and social media raises new questions about how analyses are conducted (Helbig et al., 2012). Data visualisation tools expand ability to display and disseminate complex temporal and spatial information. Together, these innovations bring ample opportunities and challenges for developing new theories on complex dynamic social systems and new approaches that might be suitable for analysing how policies affect them (Johnson and Kim, 2011).

References:

Center for Policy Informatics, Arizona State University, link

Kamensky, J. (2012). Policy Informatics is Bridging the Gap Between Researchers and Politicians, Government Executive

Helbig, N., Nakashima, M. and Dawes, S., (2012), Understanding the Value and Limits of Government Information in Policy Informatics: A Preliminary Exploration. In Proceedings of the 13th Annual International Conference on Digital Government Research. pp 291-293. College Park, MD. ACM Digital Library.

Johnson, E. and Kim, Y. (2011) .Introduction to the Special Issue on Policy Informatics, The Innovation Journal: The Public Sector Innovation Journal, Volume 16(1), pdf

**Policy Network Analysis (PNA)**

The Policy Network Analysis (PNA) school has developed a series of micro-level analyses. These analytical frameworks have been used to develop a series of hypotheses about how policy-making outcomes are influenced by the structure of a network and the interactions that occur within a network, including the inclusion and exclusion of certain interests in the policy-making process (Rhodes, 2006). PNA starts with the assumption that - to achieve particular goals - actors within policy networks must exchange resources with each other (Rhodes, 2006). The power-dependent relationships that emerge from this set of interactions define, which actors will become core members of a network; which actors will be positioned in this network with occasional, albeit typically limited, influence; and which actors will be completely excluded from the network (Rhodes, 2006; Hamza, 2013).

Both, network governance school and policy network analysis mainly focus on network governance, however, they look at it on distinct levels. PNA is more concerned with micro-level examinations about the relationships among policy-making outcomes, the structure of a network and the inclusion or exclusion of certain individuals or groups from the network in question (Fawcett & Daugbjerg, 2012). Network governance school has been engaged in a set of macro-level examinations of the changing nature of state-society relationships (Hay & Richards, 2000).

References:

Fawcett, P. & Daugbjerg, C., 2012. Explaining Governance Outcomes: Epistemology, Network Governance and Policy Network Analysis. Political Studies Review, 10(2), p.195–208.

Hamza, K., 2013. The Impact of Social Media and Network Governance on State Stability in Time of Turbulences: Egypt After 2011 Revolution. PhD Thesis. Brussels: Vrije Universiteit Brussel Institute for European Studies.

Hay, C. & Richards, D., 2000. The Tangled Webs of Westminster and Whitehall:The Discourse, Strategy and Practice of Networking within the British Core Executive. Public Administration, 78(1), p.167–76.

Rhodes, R.A.W., 2006. Policy network analysis. In M. Moran, M. Rein & R. Goodin, eds. The oxford handbook of public policy. New York: Oxford University Press. p.425–447.

## 3.3. GLOSSARY TERMS IN THE PHASE OF COMMENTING AND REVIEWING

The glossary terms currently being elaborated and reviewed by partners are:

- Agent-Based Modelling
- Conceptual Model
- Behavioural Change
- Complex System
- Conceptual Model
- Declarative Model
- Forecasting
- Formal Method
- Formal Model
- Innovation Network
- Institutional Model
- Mathematical Model
- Mathematical Modelling
- Method
- Modelling
- Network Policy Governance School
- Network Theory
- New Public Management
- Normative Model
- Open data
- Policy Modelling
- Public Value Management
- Semantic Technologies
- Simulation Model
- Structural Change
- Social Network
- Social Network Analysis
- Web 2.0
- Web 3.0

## 3.4. GLOSSARY TERMS ASSIGNED FOR ELABORATION BY PARTNERS

The following glossary terms have been already assigned to partners for elaboration:

- Agenda Setting Theory
- Artificial Model Data
- Complexity Theory
- Design Thinking
- Discipline
- Dynamic System
- Dynamic Adaptation
- Dynamic Adaptation
- Economic Theories
- Evidence
- Game Theory
- Graph Theory
- Hypothesis
- Institutional Choice Theory
- IT Governance
- Macroeconomic Models
- Macro-Simulation
- Mathematical Programming
- Methodology
- Open Government
- Open Linked Data
- Policy Governance
- Policy Lifecycle
- Policy Model
- Rational Choice Theory
- Stakeholder
- System Dynamics
- Technology
- Traceability
- Verification
- Wicked Problem

## 3.5. GLOSSARY TERMS IDENTIFIED AS RELEVANT BUT NOT YET ASSIGNED FOR ELABORATION

The following glossary terms have been identified as relevant and valuable as knowledge asset. Yet, they have not yet been assigned to partners for elaboration:

- Artificial Model Data
- Economic Theories
- Macroeconomic Models
- Policy Model

## 3.6. PARTNERS CONTRIBUTING TO GLOSSARY DEVELOPMENT

Table 3 indicates the engagement of partners in developing glossary terms. The numbers indicate terms already published on the knowledge portal (exported), terms on voting (i.e. the term is elaborated by the partner and other partners need to vote for publication), terms currently elaborated by a partner or a partner signed in to elaborate the term.

**Table 3: Overview of partners' engagement in developing terms for the glossary**

| | 1 - UKL | 2 - TUK | 3 - TU Delft | 4 - CERTH | 5 - VOLTERRA | 6 - INNOVA | 7 - VUB | 8 - Laval | 9 - UBRUN | 10 - SUNY |
|---|---|---|---|---|---|---|---|---|---|---|
| exported | 5 | 1 | 2 | 1 | 0 | 3 | 5 | 0 | 0 | 0 |
| on voting | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| elaboration | 2 | 3 | 2 | 3 | 0 | 3 | 2 | 1 | 2 | 0 |
| signed in | 11 | 1 | 2 | 0 | 0 | 2 | 2 | 1 | 2 | 1 |
| total | **19** | **8** | **6** | **4** | **0** | **8** | **10** | **3** | **4** | **2** |

| | 11 - RG | 12 - COMPASS | 13 - KhNU | 15 - UNU-IIST | 17 - UCDNUID | 18 - UTS | 19 - EUAK | 20 - ITMO |
|---|---|---|---|---|---|---|---|---|
| exported | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| on voting | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| elaboration | 2 | 0 | 0 | 1 | 2 | 0 | 2 | 5 |
| signed in | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 1 |
| total | **3** | **1** | **0** | **8** | **2** | **1** | **2** | **6** |

# 4. ADDING KNOWLEDGE ASSETS TO THE KNOWLEDGE PORTAL

The knowledge portal of eGovPoliNet is a web-based repository containing the state-of-the-art knowledge in the field of ICT for governance and policy modelling (cf. Deliverable D 2.2). It helps users to transfer expertise between knowledge domains, by classifying and categorising the existing ICT solutions for governance and policy modelling. eGovPoliNet builds upon the existing knowledge base of Crossover. The project's objective is to add new knowledge contents. eGovPoliNet started adding content to the knowledge portal soon after the CROSSOVER portal was enhanced by CERTH through additional functionalities to fulfil eGovPoliNet's needs (cf. Deliverable D 2.2).

Table 4 provides an overview of content added to the knowledge portal during the second period of the eGovPoliNet project. Knowledge assets were added to the different categories: publications, authors, scenarios, comparative analysis, and glossary. The process of enlarging the knowledge base will continue in the third period of the project.

**Table 4: Knowledge assets added to the eGovPoliNet knowledge portal**

| **Publications** | | |
|---|---|---|
| [1] | Reference: | Kaliva, E., Panopoulou, E., Tambouris, E., & Tarabanis, K. (2013). A domain model for online community building and collaboration in eGovernment and policy modelling. Transforming Government: People, Process and Policy, 7(1), 109-136. |
| | Article type: | Journal |
| | Source: | Transforming Government: People, Process and Policy |
| | Authors: | Kaliva E., Panopoulou E., Tambouris E., Tarabanis K. |
| | Organisation: | Centre for Research & Technology Hellas (CERTH) |
| | Year: | 2013 |
| [2] | Reference: | Scherer, S., & Wimmer, M. (2011). Conceptual Models Supporting Formal Policy Modelling: Metamodel and Approach. In proceedings of the JURIX 2011 Workshop on Modelling Policy Making (MPM 2011) , pp. 23-28 |
| | Article type: | Workshop |
| | Source: | JURIX 2011 Workshop on Modelling Policy Making (MPM 2011) |
| | Authors: | Wimmer M., Scherer S. |
| | Organisation: | University of Koblenz-Landau |
| | Year: | 2011 |
| [3] | Reference: | Furdik, K., Sabol, T., & Dulinova, V. (2010). Policy modelling supported by e-participation ICT tools. In proceedings of the 4th international conference on methodologies, technologies and tools enabling e-government (MeTTeG'10) , pp. 135-146 |
| | Article type: | Conference |
| | Source: | 4th international conference on methodologies, technologies and tools enabling e-government (MeTTeG'10) |
| | Authors: | Frudik K., Sabol T., Dulinova V. |
| | Organisation: | Kosice Region |

| | | |
|---|---|---|
| | Year: | 2010 |
| [4] | Reference: | Wyner, A., Atkinson, K., & Bench-Capon, T. (2011). Semantic Models and Ontologies for Modelling Policy-Making. In proceedings of the JURIX 2011 Workshop on Modelling Policy Making (MPM 2011) , pp. 17-22 |
| | Article type: | Workshop |
| | Source: | JURIX 2011 Workshop on Modelling Policy Making (MPM 2011) |
| | Authors: | Wyner A., Atkinson K., Bench-Capon T. |
| | Organisation: | University of Liverpool |
| | Year: | 2011 |
| [5] | Reference: | Gordon, T. (2011). The Policy Modeling Tool of the IMPACT Argumentation Toolbox. In proceedings of the JURIX 2011 Workshop on Modelling Policy Making (MPM 2011) , pp. 29-38 |
| | Article type: | Workshop |
| | Source: | JURIX 2011 Workshop on Modelling Policy Making (MPM 2011) |
| | Authors: | Gordon T. |
| | Organisation: | Fraunhofer FOKUS |
| | Year: | 2011 |

| **Authors** | |
|---|---|
| **[6]** | Kaliva E |
| **[7]** | Panopoulou E. |
| **[8]** | Tambouris E. |
| **[9]** | Tarabanis K. |
| **[10]** | Wimmer M. |
| **[11]** | Scherer S. |
| **[12]** | Frudik K. |
| **[13]** | Sabol T. |
| **[14]** | Dulinova V. |
| **[15]** | Wyner A. |
| **[16]** | Atkinson K. |
| **[17]** | Bench-Capon T. |
| **[18]** | Gordon T. |
| **Comparative analysis** | |
| **[19]** | How theories support policy modelling? |
| **[20]** | Comparative Analysis in the Area of Technology Frameworks |
| **[21]** | Simulation models in policy modelling |
| **[22]** | A comparative analysis on conceptual and domain models for policy making |
| **[23]** | A comparative analysis of tools and technologies for policy making |

| | |
|---|---|
| **[24]** | Comparative Analysis in the Areas of Policies / Strategies / Programs |
| **[25]** | Comparative Analysis in the Area of Projects / Cases implementing Policy |
| **[26]** | Comparative Analysis in the Area of Stakeholder Engagement in Policy Development |
| **Scenarios** | |
| **[27]** | Using air quality monitoring data to track and improve public health |
| **[28]** | Policy decision-making using intelligent simulations and exploiting open and big data sources |
| **[29]** | Public/private innovation policy scenario |
| **[30]** | Agent-based model to Citizens' support in emergency situation |
| **[31]** | Using Smart and Mobile ICT for Developing Governance and Policy |
| **[32]** | Information warfare impact on developing Governance and Policy Modelling |
| **Glossary** | |
| **[33]** | Complex Adaptive System (CAS) |
| **[34]** | Good Governance |
| **[35]** | Governance |
| **[36]** | Network |
| **[37]** | Stakeholder Engagement |
| **[38]** | Policy Analysis |
| **[39]** | Public Policy |
| **[40]** | Dynamic Stochastic General Equilibrium Models |
| **[41]** | Provenance |
| **[42]** | Public Governance |
| **[43]** | Democratic Governance |
| **[44]** | Econometric Modelling |
| **[45]** | Model |
| **[46]** | Hierarchic Governance |
| **[47]** | Public Participation |
| **[48]** | Networked Governance |
| **[49]** | New Public Management (NPM) |
| **[50]** | Policy |
| **[51]** | Econometrics |
| **[52]** | Scenario Building |
| **[53]** | Theory |

# 5. COMPARATIVE ANALYSIS OF ICT SOLUTIONS FOR GOVERNANCE AND POLICY MODELLING

The main objective of the comparative analysis was to structuring, integration and formalisation of existing approaches in the field of policy modelling, increase transparency and accessibility to good and best practice ICT solutions for governance and policy modelling, and advancing on efficiency and effectiveness of future initiatives in the field.

The method for comparative analysis is described in section 2.2. A number of comparative analyses will be included in the eGovPoliNet book "Policy Practice and Digital Science – Integrating Complex Systems, Social Simulation and Public administration in Policy Research", which is edited by Marijn Janssen and Maria A. Wimmer. The book aims at being the first comprehensive overview in which various disciplines will be covered from distinct policy-making perspectives, and covering a wide range of aspects along the axes of technology, participative processes, governance, policy modelling, social simulation and visualisation. The book chapters are complemented by contributions of authors of the eGovPoliNet wider community (cf. deliverable D 3.2).

In the second period, nine comparative analysis were performed, with the following thematic foci:

1. Theories
2. Frameworks
3. Simulation models
4. Conceptual and domain models
5. Emerging tools and technologies
6. Technical frameworks and tools
7. Framework for policies / strategies / programs
8. Projects / cases implementing policy
9. Stakeholder engagement in policy development

The white papers of these comparative analyses are attached to this report – see Annex II: Comparative analysis – White Paper Contributions, and are summed up in the subsequent section. In subsection 5.2, an overview of tentative additional chapters for the book is provided. Before moving to these contents, a summary of collaboration analysis is presented next.

To demonstrate the collaboration across distinct disciplines and around the globe, Table 5 provides an overview of partners and the respective profession of the individuals involved in the comparative analysis, while Table 6 indicates the disciplinary focus of the authors' affiliations and the countries their organisations are located. Table 7 provides an overview of how many authors have been involved in performing a comparative analysis and in developing a white paper, and it shows the discipline the authors come from.

**Table 5: Number of authors and their professions of partner organisations**

| | UKL | TUK | TUD | CERTH | VUB | UL | UBRUN | SUNY | COMPASS | UNU-IIST | EUAK | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Researchers | 2 | 1 | 1 | 5 | 2 | 1 | 2 | 2 | 3 | 1 | 1 | 23 |
| Students (MSc, PhD) | 3 | | | | | | | | | | | 3 |
| Member of other research org. | | | | 2 | | | | | | | | |
| Practitioner | | | | 1 | | | | | | | | 1 |
| Total | 5 | 1 | 1 | 8 | 2 | 1 | 2 | 2 | 3 | 1 | 1 | 27 |

**Table 6: Disciplinary focus of institutions and countries the authors came from**

| Country | Disciplinary focus of organisations | Performed comparative analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Germany | E-Government Research Group | | | | | | | | | |
| | Technology Assessment Institute | | | | | | | | | |
| Slovakia | Economics Faculty | | | | | | | | | |
| The Netherlands | Technology and Policy Management Faculty | | | | | | | | | |
| Greece | Technology Management Group | | | | | | | | | |
| United Kingdom | Information Systems School | | | | | | | | | |
| | ICT industry (SME) | | | | | | | | | |
| Belgium | Public Policy Institute | | | | | | | | | |
| Ireland | Data Analytics Group | | | | | | | | | |
| Canada | Information Systems Institute | | | | | | | | | |
| USA | Technology in Government Centre | | | | | | | | | |
| New Zealand | Social Sciences and Sociology Centre | | | | | | | | | |
| China | Information Systems and E-Government Institute | | | | | | | | | |

**Table 7: Number of authors per comparative analysis and collaboration of authors across disciplines**

| Paper number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Total of authors per paper* | 1 | 3 | 5 | 4 | 7 | 2 | 1 | 5 | 7 | **35** |
| **Disciplines** | | | | | | | | | | No of people per discipline** |
| Information Systems | 1 | | 1 | 4 | 6 | | | 4 | 1 | **13** |
| Computer science | | 1 | 1 | | 1 | 1 | | | | **3** |
| Social sciences | | | 1 | | | | | | 1 | **2** |
| Sociology | | | 2 | | | | | | | **2** |
| E-government & e-participation | | 3 | 1 | 3 | 6 | 2 | | 1 | 6 | **15** |
| Public administration sciences | | | | | | | | | 2 | **2** |
| Economics | | | | | | | | 1 | | **1** |
| Organisational and management sciences | | 2 | | | | 1 | 1 | | 2 | **3** |

* authors may have worked on more than one paper

** multiple instances possible

Analysing the collaborations across partners, the following performance figures indicate the eGovPoliNet collaboration achievements for comparative analysis:

- Number of authors for comparative analysis: 27 (of 11 partner organisations plus 2 external organisations (involved with CERTH)) (cf. Table 5 for the details)

- Countries involved: 11 (7 from Europe, 2 from North America, 1 from Asia, 1 from Oceania) (cf. Table 6 for the details)
- Authors from 8 different disciplines were involved in the comparative analysis (cf. Table 7). For example, the comparative analysis number 3 (thematic focus: simulation models) gathered researchers from information systems, computer science, social sciences, sociology, and e-government and e-participation.
- Mean number of authors per comparative analysis: 3.9 (cf. Table 7 for the details. It should be noted that an author may have worked in more than one paper, hence the sum of authors indicated in this table is 35, while the actual sum of different authors is 27 as indicated in Table 5), which represents the collaborative index (CI) of the network (Lawani, 1980).
- Degree of collaboration (DC) is 0.78, representing a proportion of multi-authored papers compared to single-author papers (Subramanyam, 1983). For eGovPoliNet, this is quite high, which means that the vast majority of papers was produced in a scientific collaboration.
- As CI and DC do not consider the varying number of authors in co-authored papers, a modified collaboration index (MCC) (Savanur, K.; Srikanth, R. , 2009) is calculated, based on the collaboration coefficient (CC) (Ajiferuke, I.; Burrel, Q.; Tague, J. , 1988). The modified collaboration coefficient MCC is 0.6[2], while the CC is 0.58[3]. Both indices show again a high degree of collaboration.

The value of these statistics is in the fact that the eGovPoliNet collaboration is by all parameters a good practice example for cross-disciplinary collaboration. The above analysis could give clues for finding the (possibly hidden) variables supporting collaboration in policy modelling domains and hence enabling the transfer of the best practice to other use cases.

## 5.1. ABSTRACTS OF COMPARATIVE ANALYSES PERFORMED BY EGOVPOLINET

### 5.1.1. Comparative Analysis on How Theories Support Policy Modelling

**Author:** Steve Hartman, *University of Koblenz-Landau, Germany*

**Status:** student work for knowledge portal

This work contributes to policy modelling theories and compares game theory, agenda-setting theory and institutional choice theory with respect to their roles in policy modelling. For that matter a comparative analysis has been done. The most intensive research was identified for game theory. Game theory provides tools for policy modelling and models built upon. However, there are limits for the usage of game theory, for example when it has more than three agents to interact. Institutional choice theory has not been researched as intensively and no clear author can be identified. Agenda setting theory is very different theory using mass media as agenda setting process. Furthermore, none of the chosen theories can contribute to policy modelling extensively without a combination of different theories. We argue that the combination of all three theories can extensively contribute to policy modelling.

### 5.1.2. Comparative Analysis of Technology Frameworks

**Authors:** Sehl Mellouli[1], Jamal Shanin[2], Karim Hamza[2]

*[1]University Laval, Canada, [2]Free University Brussels, Belgium*

[2] MCC is in range between 0 and 1, being 0 for a collection where all papers are single-authored and 1 where all papers are co-authored by all authors from a collaboration network.

[3] CC is in range between 0 and 1, being 0 for a collection where all papers are single-authored. However, it becomes 1 only for the infinite number of authors in the set. Because of this reason, MCC is used.

**Status:** ongoing for book chapter

Public policy scholars and policy scientists have developed frameworks, theories and models to better understand policy processes ( (Sabatier, 1991), (Sabatier, 2007)) and have written various books about policy-making processes ( (McCool, 1995), (Kraft and Furlong, 2007), (Smith and Larimer, 2009), (Birkland, 2010), (Sabatier, 2007)). Most of the literature provides descriptive and explanatory insights that are supported by empirical investigations of various topics, such as agenda setting, minor and major policy change, problem solving, collective action, formal and informal institutions and policy designs. These insights contribute to an understanding of the logic of policy-making processes and the strategies for influencing these processes (Christopher et al., 2012).

The policy-making process can refer to the study of changes in the development of policy and the actors, events and contexts that relate to this development. Different scholars of the policy process have emphasised various forms of processes. For instance, scholars of the policy cycle describe a process that is exercised through a sequence of stages: agenda setting, policy formulation, policy adoption, implementation, evaluation and termination (cf. (Lasswell, 1956), (Brewer, 1974), (Brewer and deLeon, 1983), (DeLeon, 1999)). On the other hand, Frameworks refer to concepts in systems design to support structured and systematic analysis, design, implementation and assessment/evaluation. Frameworks may refer to design frameworks such as enterprise architecture frameworks, particular modelling frameworks in policy development, etc.

The main objective of this work is to identify the main frameworks used to study or analyse policy-making process.

#### 5.1.3. Comparative Analysis of Simulation Models

**Authors:** Dragana Majstorovic[1], Maria A Wimmer[1], Roy Lay-Yee[2]; Peter Davis[2]; Petra Ahrweiler[3]; Ameneh Deljoo[4]

*[1]University of Koblenz-Landau, Germany, [2]Centre of Methods and Policy Application in the Social Sciences, New Zealand, [3]Europäische Akademie zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen GmbH, Germany, [4]Technical University Delft, the Netherlands*

**Status:** ongoing for book chapter

This work presents a comparative analysis in the area of simulation models with respect to their role in public decision-making process. The focus of our research is in the differences between particular simulation models and how to effectively use simulation models in policymaking process. The collection of examined models, rather than to be exhaustive, presents an informative choice of different domain-specific simulation models corresponding to different modelling theories. First, we examine the most popular and widely used simulation modelling theories in order to establish common grounds of simulation modelling in policymaking. Subsequently, we analyse simulation models using comparative analysis framework in order to support extracting major aspects and core information about examined simulation models. The goal is to provide a brief overview of simulation models, present them in a way they are comparable to each other and draw conclusions from the comparative analysis.

#### 5.1.4. Comparative Analysis of Conceptual and Domain Models

**Authors:** Eleni Kaliva[1], Eleni Panopoulou[1], Efthimios Tambouris[1,2] and Konstantinos Tarabanis[1,2]

*[1]1Information Technologies Institute, Centre for Research and Technology Hellas, Thessaloniki, Greece*

*[2]University of Macedonia, Thessaloniki, Greece*

**Status:** finalised for knowledge portal

Conceptual modelling is *the elicitation and the representation of the general knowledge that an Information System (IS) operating in a specific domain needs to know* (cf. (Antoni, 2007), (Rolland, 2007)). Describing a domain of the real world through conceptual models means viewing it in a particular way, i.e. through the assumption that the world consists of concepts, e.g. entities, objects, events, processes ( (Johannesson, 2007), (Antoni, 2007)). In particular, conceptual modelling aims at representing static (e.g., objects, entities) and dynamic phenomena (e.g., events and processes) in a particular domain (Wand and Weber, 2002).

Conceptual modelling is an essential part of IS development (cf. (Wand et al., 1995), (Rolland, 2000), (Bubenko, 2007), (Olive and Cabot, 2007)) which traditionally consists of the analysis, design, and implementation stages. IS analysis transforms a perceived real-world domain (or universe of discourse (Olle et al., 1988)) into a conceptual model, while design and implementation transforms the model, into a design model and an IS eventually (Wand et al., 1995).

Domain Modelling is a term related to Domain Engineering. Domain engineering is a process for developing a set of reusable assets (analysis and design models, software architectures and software components) for a family of IS operating in a particular domain. It differs from the traditional software engineering process as software engineering aims at developing models, architectures and components for a specific IS while domain engineering aims at a family of IS (Czarnecki and Eisenecker, 2000).

In this work, we review the field of Policy Modelling models and delineate research gaps and opportunities following a Systematic Literature Review (SLR) method. SLR is an essential feature of any academic research as it creates a firm foundation for advancing knowledge, facilitating theory development, closing areas where a plethora of research exists, and uncovering areas where research is needed (Webster and Watson, 2002).

#### 5.1.5. Comparative Analysis of Emerging Tools and Technologies Supporting Policy Modelling

**Authors:** Eleni Kamateri[1], Eleni Panopoulou[1], Efthimios Tambouris[1,2], Konstantinos Tarabanis[1,2], Adegboyega Ojo[3], Deirdre Lee[3] and David Price[4]

*[1]Information Technologies Institute, Centre for Research and Technology Hellas, Thessaloniki, Greece, [2]University of Macedonia, Thessaloniki, Greece, [3]INSIGHT Centre for Data Analytics, NUIG, Galaway, Ireland, [4]Thoughtgraph Ltd*

**Status:** submitted for book chapter

Latest advancements in information and communication technologies offer great opportunities for modernising policy making, i.e. increasing its efficiency, bringing it closer to all relevant actors, and enhancing its transparency and acceptance levels. In this context, this work aims to present, analyse and discuss emerging ICT tools and technologies presenting the potential to enhance policy making. The methodological approach includes the searching and identification of relevant tools and technologies, their systematic analysis and categorisation and finally a discussion of potential usage and recommendations for enhancing policy making.

#### 5.1.6. Comparative Analysis of Technical Frameworks and Tools Supporting Decision Making

**Authors:** Sehl Mellouli[1], Karim Hamza[2], Ameneh Dejloo[3]

*[1]University Laval,Canada, [2]Free University Brussels, Belgium, [3]Technical University Delft, the Netherlands*

**Status:** ongoing for book chapter

Policy makers are the persons who take decisions for the well-being of their communities. In order to take good decisions, several technical frameworks and models have been developed in order to help

them in their decision making process. This chapter provides a general overview of five different models that were implemented to support policy-makers in their decisions and the related used technologies to develop these models. This chapter does not claim to be exhaustive by identifying all models and technologies, but can serve as a basis for any developer who intends to develop a simulation tool for policy-makers.

#### 5.1.7. Comparative Analysis framework of Policies / Strategies / Programs in e-Government

**Authors:** Jamal Shanin, *Free University Brussels, Belgium*

**Status:** ongoing for book chapter

This white paper intends to lay out a proposal for a framework for comparative analysis of policies, strategies and programmes in e-government. It first defines the difference between a policy, strategy, and programme in general terms (Section 1), and then offers a critical reflection of the predominant approaches to understanding the relationship between these (Section 2). The paper offers an insight into the way that developed trends in technological and societal development influence the process of policy, strategy and programme design and implementation (Section 3). This white paper then goes on to examine the case of the European Union (and notably the European Commission) to highlight the validity of this framework (Section 4). Concluding the paper, the final section (Section 5) will indicate further areas for research and use of the framework.

#### 5.1.8. Comparative Analysis of Projects / Cases implementing Policy

**Authors:** Dominik Bär[1], Maria A. Wimmer[1], Jozef Glova[2], Anastasia Papazafeiropoulou[3], Laurence Brooks[3]

[1]*University of Koblenz-Landau, Germany* [2]*Technical University Kosice, Slovakia* [3]*Brunel University, United Kingdom*

**Status:** ongoing for book chapter

The twentieth century was the century of population explosion and the burning of fossil fuels, which led to the highest pollution in history causing climate change and biodiversity loss (Helm, 2000). However, the pollution and its consequences have only been recognised in the closing decades and environmental policies are now of high priority to society, companies and policy makers (cf. (Helm, 2000)). In the cause of this, governments all over the world have launched projects to improve the climate situation. The problem scope dealt with in this work is concerning climate change and policies dealing with topics like sustainable energy management and renewable energy sources. Many projects pursue the aim of switching from energy sources like fossil fuels or nuclear power to renewable energy sources like solar, wind or water. Therefore, on the one hand the aim of policies is to replace polluting ways of power production with green technologies and on the other hand to reduce energy consumption by using innovative technologies.

Climate change affects the whole world and is a very huge organisational, technical as well as financial challenge, which is why industrial countries are expected to take responsibility and initiatives to counteract the current climate development. In the cause of this, these countries may serve as role models for other countries to join in improving the climate situation.

In this comparative analysis work, projects and cases are presented, which deal with the above named issues and topics and investigate the policies implemented along these projects and analysed in cases.

#### 5.1.9. Comparative Analysis of Stakeholder Engagement in Policy Development

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**Status:** ongoing for book chapter

Policy choices reflect the interplay of social, economic, cultural, and political considerations. Policy making processes can take many forms that vary in accessibility to outsiders and that give different advantages to the input of experts and other interests. A wide variety of tools and techniques are available for policymaking. These include traditional forms of review and public comment as well as newer approaches that use electronic communication and advanced analytical, modelling, and simulation techniques. Policy effectiveness can be judged from multiple perspectives, such as the extent to which policy goals are achieved, the cost and efficiency of the implementation process, the trade-offs made between costs and benefits, or the acceptance of the policy and the policy-making process by those it affects. All of these demand consideration of stakeholders.

Stakeholders can be defined in the simplest terms as individuals or groups who affect or are affected by a policy. Stakeholder engagement has come to be seen as an important factor in the policy process. Stakeholders can be involved at any point in the policy cycle from framing issues to evaluating results.

This comparative analysis work focuses mainly on stakeholder engagement during problem definition and policy formulation. We begin with a review of the basic elements of stakeholder theory and then follow with discussions of the main purposes served by stakeholder engagement and ways to identify relevant stakeholders for a given purpose. We then discuss the main methods of stakeholder engagement along with their strengths and weaknesses. We offer brief examples of stakeholder engagement and conclude with implications for future research and practice.

## 5.2. TITLE, AUTHORS AND OUTLINES OF PLANNED COMPLEMENTARY BOOK CHAPTERS

The following contributions are planned to be submitted to the book as complementary chapters:

1. Foundations of policy modelling by Chris Koliba, *University of Vermont*
2. Quality of social simulation by Petra Ahrweiler[1] & Nigel Gilbert[2]

   [1]*Europäische Akademie zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen GmbH, Germany,* [2]*University of Surrey*

3. Uncertainty and model integration by Erik Pruyt et al., *Technical University Delft, the Netherlands*
4. Value sensitive design of complex product systems by Andreas Ligtvoet, *Technical University Delft, the Netherlands*
5. Social network analysis by Laurence Brooks[1], Panos Panagiotopoulos[2], Efthimios Tambouris[3,4], Marijn Janssen[5]

   [1]*Brunel University, United Kingdom,* [2]*Quen Mary University of London, United Kingdom,* [3]*Information Technologies Institute, Centre for Research and Technology Hellas, Thessaloniki, Greece,* [4]*University of Macedonia, Thessaloniki, Greece,* [5]*Technical University Delft, the Netherlands*

6. Values in computational models revalued. The Influence of Designing Computational Models on Public Decision-making Processes by Rebecca Moody & Lasse Gerrits, *University of Rotterdam*
7. E-governance and democracy by Tjeerd

8. Management of complex systems: towards agent based gaming for policy by Wander Jager & Gerben van der Vegt, *Gronigen Center for Social Complexity Studies, the Netherlands*
9. Micro simulation and policy modelling through collaboration with policy makers by Roy Lay-Yee & Peter Davis, *Centre of Methods and Policy Application in the Social Sciences, New Zealand*

   Outline: This paper provides an introduction to the method of micro-simulation, which underpins the Modelling the Early Life Course project being undertaken by the Centre of Methods and Policy Application in the Social Sciences (COMPASS) at The University of Auckland. The project is funded by the Ministry of Science and Innovation, now part of the Ministry of Business, Innovation and Employment. Since the inception of micro-simulation in the 1950s, its use for policy purposes has extended from the economic to other domains as data availability and technological developments have permitted. Micro-simulation focuses on modelling individual units and the micro processes that affect their development, be they lives or other trajectories. It comes in various types, for example arithmetical or behavioural, and static or dynamic. It has its own distinctive model-building process, which relies on data and derived parameters. The utility of micro-simulation for policy development lies in its ability to combine multiple sources of information to answer "what if" questions on a complex phenomenon of interest.

10. Passive and active crowdsourcing by Euripidus Loukis et al.
11. Visual Decision Support in Policy Making - Advancing Policy Analysis with Visualisation by Tobias Ruppert, *Fraunhofer, Germany*
12. Challenges to policy-making in developing countries and the roles of emerging tools, methods and instruments by Dmitrii Trutnev[1], Lyudmila Bershadskaya[1], Andrei V. Chugunov[1], Luis Joia (Brazil) - Ramon Gil Garcia – Mexico, Svetlana Grigsalis - Ukraine

    [1]*Saint Petersburg National Research University of Information Technologies Mechanics and Optics, Russian Federation,*

    Outline: Experiences from Sent Petersburg. Tools to evaluate reaction of society on new acts. Challenges/integration of tools in practice, including obstacles and hindrances to exploiting these tools.

13. Comparative cases in social media by Karim Hamza, *Free University Brussels, Belgium*
14. Urban development, policy and governance by Diego Navarra, *CERISDI, Italy, University of Twente, the Netherlands, Studio Navarra, United Kingdom*
15. Application of e-participation principles in simulation exercise for senior executive training: co-ordination in political zoning in Nigeria by Tanko Mamuda, *National Institute of Policy and Strategic Studies, Nigeria*

    Outline: The 'digital divide' remains formidable in scaling ICT-enabled opportunities for effective leadership and development in countries lagging behind. In a diverse and divided country like Nigeria, leadership and development challenges often hinge on effective co-ordination that can benefit from e-participation principles and practice. This paper discusses the application of e-participation principles in simulation exercise for senior executive training. The 'crisis game', a simulation exercise, of the Nigeria's National Institute for Policy and Strategic Studies is treated as case study with the theme of 'political zoning'. The paper utilizes major theories of structuration, institutional and actor-network to ascertain the significance of e-participation for capacity building of policymakers.

16. Open data for policy modelling by Efthimios Tambouris, *Information Technologies Institute, Centre for Research and Technology Hellas, Thessaloniki, Greece, & University of Macedonia, Thessaloniki, Greece*

# 6. FUTURE VISIONS OF ICT SOLUTIONS FOR GOVERNANCE AND POLICY MODELLING

The eGovPoliNet scenarios for future visions look into the year 2020 describing the use of ICT solutions considering current trends and the pace of developments. The scenarios cover the following areas of governance and policy modelling:

- citizens' participation,
- mobile ICT,
- data collection, analysis and integration,
- policy decision-making process,
- simulation models,
- big data,
- innovation policy

Subsequently, the final six eGovPoliNet scenarios for future visions of ICT solutions for governance and policy modelling are presented. The scenarios reflect today's technological trends, although futures development is an uncertain process. Yet, the scenarios enable eGovPoliNet researchers to point to interesting possible visions of the future. The scenarios will subsequently enable eGovPoliNet partners to identify research gaps and grand challenges of policy research, which will be part of the work to be undertaken in the third period of the project.

The partners' engagement in the development of 19 individual visionary scenarios is shown as follows:

| 1 - UKL | 2 - TUK | 3 - TUD | 4 - CERTH | 5 - VOLTERRA | 6 - INNOVA | 7 - VUB | 8 - Laval | 9 - UBRUN | 10 - SUNY |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 1 | 1 | 2 | 0 | 1 | 1 | 1 | 1 | 1 |

| 11 - RG | 12 - COMPASS | 13 - KhNU | 15 - UNU-IIST | 18 - UTS | 19 - EUAK | 20 - ITMO |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 0 | 1 | 1 |

The following partners were engaged in the consolidation and revision of scenarios along the Uxbridge meeting:

1- UKL: Dragana Majstorovic and Maria Wimmer

3- TUD: Marijn Janssen

4- CERTH: Efthimios Tambouris

7- VUB: Karim Hamza

8- LAVAL: Sehl Mellouli

9- UBRUN: Laurence Brooks and Anastasia Papazafeiropoulou

10- SUNY: Sharon Dawes

15- UNU-IIST: Tomasz Janowski

19- EUAK: Petra Ahrweiler

20- ITMO: Dimitrii Trutnev

### 6.1. SCENARIO 1: USING AIR QUALITY MONITORING DATA TO TRACK AND IMPROVE PUBLIC HEALTH

*Consolidated by Sharon Dawes and Anastasia Papazafeiropoulou*

Air quality monitoring provides essential data to help governments and communities improve and assure public health. Monitoring data measures several kinds of pollutants and their distribution across geographic areas. It detects current conditions, identifies problem areas, and is used to forecast short-term changes and long-term trends. For example, burning wood as a source of heating households has become an urgent problem in Athens, as economic pressures have led people to turn to wood as a household heating fuel as the prices for petroleum-based fuels have become unaffordable for many. Wood smoke contains both particulate matter and chemical by-products that have both environmental and human health effects. Similar problems exist in rural areas where wood is a common heating fuel.

Today, real time air quality monitoring takes place in several unconnected ways: through a government-operated network of hundreds of ground sensors located in population centres, from satellite-borne sensors that provide readings in all geographic areas (subject to favourable weather conditions), and from personal monitors owned by citizens. Some citizen owned monitors are stationary (for example, located outside their homes) and others are mobile (for example, attached to inhalers used by people with respiratory conditions).

In the future, all four kinds of monitors will be connected to a central database that produces hourly readings for all areas of coverage. The database is segmented according to data source and each source has a reliability rating that reflects the type and scientific precision of the instrument and the training or expertise level of the operator. The data will be integrated by the national environmental agency into best estimates for defined geographic areas and they are correlated with time of day and the location of population centres, highways, industrial facilities, and natural phenomena such as wildfires. The data will be aggregated at different levels of geography (e.g. zip code, county, region, nation), updated hourly, and made freely available to any interested user.

Scientists and policy researchers, community health advocates, schools, and government agencies of all kinds can use these data for many purposes. Regional and national environmental agencies could conduct policy consultations, inviting all stakeholders who are interested or affected to come together to better understand the nature, causes and consequences of air pollution and to review and advise the government on policy changes that would improve air quality. Scientific visualizations and big data drawn from monitoring networks could be used as input to policy simulations that educate and illustrate the impact of different policy choices. In this example, the data could be used to formulate and evaluate social policies such as offering subsidies for clean-burning fuels, or setting more rigorous standards for wood stoves and fireplaces. These different policy options could be evaluated for cost, effectiveness, popular acceptance, and other factors. The same data, collected over time, can be used to forecast near term health threats and long-term implications such as for climate change. The data offers additional opportunities for policy analysis, scientific studies, urban and regional planning, health care services and other purposes.

## 6.2. SCENARIO 2: POLICY DECISION-MAKING USING INTELLIGENT SIMULATIONS AND EXPLOITING OPEN AND BIG DATA SOURCES

*Consolidated by Efthimios Tambouris and Maria A. Wimmer*

Current decision-making on complex policy directions rely on single policy simulation approaches. The shortcomings of applying single approaches are that not all relevant aspects influencing a policy context may be considered in the simulation. Stakeholders and citizens are also not consulted for their opinions and views on policy options. Furthermore, the extensive data available is currently not integrated in a way to properly inform policy simulation models.

In the future, social and formal simulation approaches are combined to better inform in policy decision-making. For example, micro-simulations embark on existing open data to extract trends of evolution from reliable data. Agent based simulation helps to understand the social dynamics of the actors (propositions, beliefs, relationships, etc.) of a context in regard to the policy under discussion. Macro-simulations support in getting insights into the wider economic impacts of a policy alternative under discussion.

Freely accessible technology platforms offer different tools and building blocks for quickly and easily building up simulation models. Such technology platforms have become the place to explore policy contexts. Even individuals use these facilities to develop their own simulation models and to engage in policy discussions they are interested in. Powerful visualization means are provided to enable better understanding and communication of the key aspects and results of a policy simulation, which is also easily understandable to citizens.

Other platforms have become the place to provide tools, methods and data sources for analysing open data from various resources such as open government data platforms (structured and objective), social media and other web resources providing opinions (unstructured data and subjective opinions). For example, open government data is integrated in micro-simulation to elaborate insights from the past evolution of an aspect. Opinions are gathered for the multi-agent simulation from social media such as Twitter, Facebook etc. where stakeholders and individual citizens express their views. Data of the economic evolution is also extracted from open government data for the macroeconomic simulation. Big data analytics is explored.

Key stakeholders from governments and relevant private (companies) and civic sectors (NGOs), as well as crowds and swarm intelligence, are involved in this process by embarking on open data combined with stakeholder inputs. The process is evidence-driven. Participation platforms enable the policy operators, the stakeholders and the citizens to interact and collaborate on the policy development by providing inputs to scenarios and view, as well as by providing feedback on simulation outputs and policy alternatives suggested in consequence. Intelligent visualization tools support the understanding of simulation outcomes.

New digital media support more open and participative government and effectively involve citizens and key stakeholders in policy decision-making. In this way, decision-making has become more transparent, open and understandable to citizens.

The technology and data platforms have become the point of reference for decision-making officials as well as individuals that use simulations to evaluate the impact of different policies. Simulations help distinct policy options in an intelligent and easy way to understand , in order to support:

- better understanding of policies
- more transparency to policy making process
- stakeholders to be better informed about policy alternatives
- stakeholders and citizens to be involved in policy decision making

- building capacity of citizens and stakeholders to engage in complex policy making therewith using intelligent and innovative policy simulation tools and methods

With the combination of different simulation approaches that integrates open data in simulation modelling and engages citizens, policy decision-making on alternative choices have become more reliable and trustworthy.

### 6.3. SCENARIO 3: PUBLIC/PRIVATE INNOVATION POLICY SCENARIO

*Consolidated by Petra Ahrweiler and Marijn Janssen*

New drug development is an important issue for promoting health and wellbeing in our societies. The scenario points out how to make this process less expensive, safer, less dominated by big pharma players, more integrated, and more successful in reducing the time-to-market. Citizens expect a stream of innovative solutions to healthcare problems and are willing to engage in participating in their development. These new solutions usually come from research and innovation activities in the Life Sciences. Government policies stimulate the quick adaption of innovations but are still strict to ensure public security and safety.

Working with Big Data provided by the governmental Research Observatory of S., two PhD students from biochemistry and pharmacy in the interdisciplinary Life Sciences Research Cluster of the University of Unisa have discovered something, where they are sure that their scientific discovery will turn out to be useful for developing a new drug to cure AIDS. They immediately publish their results in open access and receive confirmation on the novelty of their findings by e-voting of peer review, a new service implemented as norm by European research policy.

They now want to found a firm for developing this idea into a product. The University of Unisa offers help with this plan through its knowledge-based system (KBS) for technology and innovation management, which is an expert system for supporting entrepreneurial activities. Furthermore, the university provides licenses to public databases where the young entrepreneurs can firm information on a big scale to help with demand and market analysis, with patent search and application, and with business plan preparation.

Prominently, it points the young entrepreneurs to the Science, Technology, Innovation (STI) Policy agency at the regional government, GovBIO. This agency has a government fund to support entrepreneurship in the life sciences. GovBIO uses agent-based simulation techniques to simulate the potential, the expected performance and the risk to fail for young companies, before they provide the money. Furthermore, they maintain a participation platform where new projects are discussed within the municipality. The simulations and the public opinion work in favour for our young researchers.

Furthermore, the young firm organises a crowd funding activity where citizens can sign up for supporting the new healthcare product. In return, the supporters can choose whether they will get a discount on the new drug, or a share in the new company. The final finance design needs to be approved by GovBio to avoid potential IP issues and security problems.

Using the governmental start-up money, the university spin-off company UnisaLAB is located in the Science Park of the university, which offers the advantage for the young firm to use the university's world-wide connected lab infrastructure and web resources further on in the product development process, and to use the university's hospital for the extensive clinical testing periods of the new drug, which are automatically compared and checked against international healthcare data. The university offers an integrated ICT landscape for full support of the development activities, especially in high-profile security and IP management.

### 6.4. SCENARIO 4: OPTIMISING EMERGENCY RESPONSE

*Consolidated by Tomasz Janowski and Dmitrii Trutnev*

Natural or man-made disasters (flooding, fire, earthquakes, storms, acts of terrorism, industrial accidents, etc.) take place particularly in densely populated urban areas, affecting large numbers of people in need of timely and organised response from emergency services (police, fire department, medical services, search and rescue, coastguard, etc.) and local authorities.

In the situation of emergency, affected populations, members of emergency services and local authorities have difficulties to properly assess the situation and to react promptly and adequately to it, thus decreasing the effectiveness of the response and recovery efforts and failing to reduce the impact on the affected population.

The new solution supports actors and stakeholders to cope with such disaster cases as follows:

- Any citizen with a mobile phone is a potential source of valuable information to inform emergency response efforts including information about the person's whereabouts, and the recipient of the personalised instructions to aid in rescue and evacuation efforts.
- Emergency personnel are a source of information about performance of emergency relief efforts, and recipients of instructions about optimal performance of their operations.
- Local authorities receive and process information from affected citizens, emergency personnel and other sources, and use such information to coordinate the response and recover efforts.

The new solution supports in two situations:

*Training based on insights from simulations of potential disaster situations*: Early modelling of possible situations of emergency is based on mathematical models of the environment. Expected behaviour of affected population and previous experiences in similar situations are included in such approximations. Simulations are performed in order to collect data and develop, validate and disseminate instructions for citizens and emergency personnel to recommend specific behaviour in emergency situations in order to minimise the adverse impact of such situations.

*Coping with disaster situations to prevent damages and harm*: Reaction to the situation of emergency is based on instantiating in real time the model to the location and circumstances of the actual emergency. The execution of the model helps to to calculate the optimal evacuation (for affected population) and response (for emergency personnel) routes in this situation. It also supports in disseminating relevant information to all affected parties through their mobile phones (localised to the actual geographic positions) and other channels (not localised).

The solution embarks on a number of ICT-supported tools such as GIS, mobile network (positioning and communication), traffic and movement simulation, an extensive knowledge base, an expert system, etc. What is key thereby is that the list of environment types (urban, rural, industrial plants, high-raise buildings, schools, airports, train stations, public places, etc.) and types of emergency situations (flooding, fire, earthquake, storm, act of terrorism, industrial disaster, etc.) needs to be expanded. Sensor networks shall support to automate the discovery of emergency situations and to accelerate the processes of emergency management. The solution also embarks on sources of public data and departmental information (population registries, address databases including points of care, engineering infrastructure schemes, date and place of mass events, public transport positions and routes, etc.).

The added value of the solution is in decreasing the impact of emergency situations on human life and increasing the effectiveness of response and recovery efforts.

## 6.5. SCENARIO 5: USING SMART AND MOBILE ICT FOR DEVELOPING GOVERNANCE AND POLICY

*Consolidated by Laurence Brooks and Sehl Mellouli*

While 2020 is only in 6 years, with the current march of technology, it will probably see another step change in technology. We are already moving into the era of Web 4.0, in which many of the online networks will become increasingly connected and intelligent. We are already beginning to see this in the more commercial world, with personalised advertising already being reality. Equally, one might expect that the next few years will see more individual and community input to policy making, as citizens really engage with governments through ICT.

Although the detailed technology landscape will be uncertain, one thing is going to continue, and that is the move towards greater mobility. Many technology companies are already developing wearable devices; probably the best known of these are 'google glasses' (http://www.google.com/glass/start/), a wearable computer with an optical head-mounted display (OHMD). Currently these are only available via an early adopter programme, as well as being rather expensive. But in the next 6 years, it is expected that this type of device will become increasingly available and affordable. Adding this with the current and developing field of data science/analytics will be a powerful set of tools for supporting future policy development.

The question is how this wearable technology and data analytics is going to affect policy development? For a start, it is likely to enable the members of the community to be more connected and so more aware of what facilities are available, both for use and for interaction with e-government services. For example a group of persons could be cycling along the road and as they go along they are using their google glasses to take a video of the route, marking where the worst potholes are, and sending this directly off to the local authority as a report. This, together with other reports (maybe from social media forums), might form the basis for the repair schedule and then using intelligent analysis of the data, forecast where the next pothole 'blackspot' might occur and so take some preventative actions.

The new solution embarks on business intelligence, data analytics and wearable technologies. It integrates these new, wearable technologies into daily life for citizens and provides new norms for engagement with wearable technologies. Examples of such new forms of engagement are e.g. involvement in voting processes, both in receiving candidate information and participating in e-voting processes, or citizens register on platform propose an issue and launch an e-petition, link to various social media, lobby for support and involve people in the voting process, then to be analysed by the local authorities; use of serious games for people to take various roles in the local environment to see things from different perspectives, then the local authority can use the 'points' from these games to guide policy development.

The solution enables the citizens to feel that they are better listened to and that they can have more of an impact in the local decision making. It enables local governments to send out communication, more focused on specific issues. Another added value is generated for the policy makers through better decision making process, i.e. more timely information, smarter information, more focused information.

## 6.6. SCENARIO 6: INFORMATION WARFARE IMPACT ON DEVELOPING GOVERNANCE AND POLICY MODELLING

*Consolidated by Karim Hamza and Dragana Majstorovic*

Most of the developed Governments, active in reaping the benefits of technology development in Governance and policy modelling, have discovered the threats of this new approach too. They invest massively to cope with the highly complex decision making systems, dramatic changes in economy, technology and information warfare threats plus government's own changing strategies. This creates

challenges with respect to matching decision-making structures and policy modelling. Technologies in policy modelling and governance have more strategic importance for governments and its concepts and tools develop dramatically. This raises the urgencies and importance of protecting government decision-making processes like policy modelling from non-solicited disturbing external or internal interferences.

Security is critical to the success of any technological tools used by Governance and policy modelling. Governance and policy modelling tools are more open to interactions with different "stakeholders" ***Internally*** (within the boundaries of the state, like pressure groups, political parties, business, citizens ..) or ***Externally*** (e.g. other states, multinational businesses, worldwide operating malicious organizations,..) who may influence the decision making process in governance systems; create political pressure or even start a cyber-war, by abusing technological tools used by governance and policy makers. This raises a number of prevention issues to cope with the instability of public decision making processes. This causes increase of the efforts in protecting governance and policy making from being abused by developing a **new dimension of "Information Warfare Strategy",** with the aim to build safeguarding tools; and prevent abusing governance systems and policy making process.

The technology of Governance and policy modelling becomes the information backbone, which creates a strong relation to strategic information warfare; since both are based on information and the use of technology. In addition, governance information systems contain most of the government's and community information and become the main war fields in the future. This requires different set of attention; since not all existing warfare techniques are applicable in handling Governance threats, this should include non-military approaches like Policy, diplomatic and laws. In addition to the increasing presence of threats, like: terrorists, competitors, state enemies and malicious organizations make the threat of information warfare important to governments and private sector attached to Governance information systems. It also raises high attention to develop strategic information warfare to protect dimensions such as Military, Physical, Economic, Political, and Social.

This enforces Governments to develop military as well as non-military tools and mechanisms that can protect Governance systems and policy modelling tools. Application domains encompass fields like Political, Legal and Diplomatic. Interactions between agencies inside and outside the government, in addition to international affairs will be needed to define international legal regulations and political channels to control relevant threats. In the end, it will certainly require a (re)definition of the distribution of responsibilities for international legal arrangements in case of legal disputes.

Governments develop different tools and techniques to handle such situation; by increasing ***Research and Development:*** by Sponsor research, development, and standard creation in computer network defence, increase the resources devoted to cyber forensics, including the distribution of honey pots to trap rogue code for analysis; ***Policy:*** defining policies that deal with different Strategic Information Warfare threats and engage different international parties; ***Laws:*** develop clear laws to criminalize action which threat Governance systems and policy modelling tools specially with internal threat; ***Diplomatic:*** develop allies networks to discover different joint threats that can impact each other Governance through intelligence and early detections systems; ***Awareness and Media:*** create citizen/personal awareness working and dealing with Governance systems and policy modelling tools, on how to protect themselves, how to report violation, be aware of different types of threats and the legal impact of violation.

This leads governance and policy modelling researchers to increase their attention to develop political analysis models that can: assess the condition of the state; evaluate the influence of non-state actors on service provision and security mechanisms inside a society; provide early warning system to organized manipulation of society behaviour through social media and e-participation systems as well as consider other non-Western forms of social organisation, rule-making and conflict resolution models. These analysis models will foster the usage and development of different policy modelling tools like: Social Network Analysis; different simulation tools as: Agent Based Modelling; game theory; multi-agent

systems. Additionally, such type of research involvement increases different values to the society and the state, especially from the point of view of security; safety; information systems reliability; privacy protection and assurance of services.

## 7. CONCLUDING REMARKS

The overall aim of work package 4 is to develop a base of knowledge assets relevant to the community of ICT supported governance and policy modelling. In phase two of the project, key knowledge resources have been developed such as glossary terms, comparative analyses and visionary scenarios. This deliverable documents on the one hand the methods used to develop the knowledge assets. On the other hand, the resulting knowledge assets are documented and/or summed up in this report.

The work performed so far has laid a good ground to support an emerging community of ICT supported governance and policy modelling (cf. D 1.1, D 3.2 and D 5.2). The knowledge portal (cf. D 2.2) with the knowledge assets as introduced in this deliverable are key assets for a community to sustain over the time period of financial support.

During the third period, work package 4 will continue its work to add further knowledge assets to the knowledge portal and to hand over a valuable body of knowledge for the sustaining community. Besides the visionary scenarios, a particular work will be dedicated to generate grand challenges of research in the field, which shall lead to future initiatives among community members to draw up research projects and generate outstanding publications in the field.

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# ANNEX I: COMPARATIVE ANALYSIS – TEMPLATES AND GUIDELINES FOR ANALYSIS

Elaborated by Maria A. Wimmer, Dominic Bär and Catherine Mkude (UKL)

This document outlines a set of aspects and themes identified for the comparative analyses. It serves as basis for the works to be done in work package 4 and provides guidelines and templates containing aspects to be considered and studied in the comparative analysis.

## 1. Theories

- What theories do exist that ground and support policy analysis, modelling and governance? (providing also literature to individual theories)
- Where are the theories applied in particular (practical cases)?
- Which discipline(s) has(ve) developed the theories and which discipline(s) use it?
- Are there particular methods supporting the application / implementation of the theories?
- Are there particular tools that support the application/implementation of the theories?

What lessons can be drawn from, and what conclusions can be made on the practical applicability of the theories?

**Table 8: Framework for comparative analysis in the area of theories**

| Theories<br>Aspects for comparison | **Th1** | **Th…** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |
| Publication Date | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |
| Built on another theory | | |
| Main foci of theory | | |
| Peculiarities of theory | | |
| Constraints of theory | | |
| Tools supporting theory | | |
| Models supporting theory | | |
| Methods emerging from theory | | |
| Models emerging from theory | | |
| Tools and/or technologies emerging from theory | | |
| Best practice domains where theory is successfully applied | | |
| Examples of practical use (ref to projects / cases) | | |
| Lessons from practical use | | |

| | | |
|---|---|---|
| Transferability of theory in other application domains or disciplinary contexts | | |
| Concluding recommendations for application | | |

## 2. Methods

Methods refer particularly to methods of modelling such as agent-based modelling, DSGE, macroeconomic modelling, mathematical modelling etc. Issues to be studied:

- What methods do exist that support policy analysis, modelling and governance? (providing also literature to individual methods)
- Where are the methods applied in particular (practical cases)?
- Which discipline(s) has(ve) developed the method and which one(s) use it?
- Do the methods embark on specific theories (of which discipline)?
- Which tools support the application/implementation of the methods?
- What lessons can be drawn from, and what conclusions can be made on the practical applicability of the methods?

**Table 9: Framework for comparative analysis in the area of methods**

| Methods / Aspects for comparison | **M1** | **M…** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |
| Publication Date | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |
| Underlying theory | | |
| Main foci of method | | |
| Peculiarities of method | | |
| Constraints of method | | |
| Tools supporting method | | |
| Best practice domains where method is successfully applied | | |
| Examples of practical use (ref to projects / cases) | | |
| Lessons from practical use | | |
| Transferability of method in other application domains or disciplinary contexts | | |
| Concluding recommendations for use | | |

## 3. Frameworks

Frameworks refer to concepts in systems design to support structured and systematic analysis, design, implementation and assessment/evaluation. Frameworks may refer to design frameworks such as enterprise architecture frameworks, particular modelling frameworks in policy development, etc.
Particular issues to be addressed:

- What frameworks support policy analysis, modelling and governance? (providing also literature to individual frameworks)
- Where are the frameworks applied in particular (practical cases)?
- Which discipline(s) has(ve) developed the frameworks and which discipline(s) use them?
- What particular theories, methods, tools and model development do the frameworks support?

What lessons can be drawn from, and what conclusions can be made on the practical applicability of the frameworks?

**Table 10: Framework for comparative analysis in the area of frameworks**

| Frameworks / Aspects for comparison | **FW1** | **FW…** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |
| Publication Date | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |
| Supported theory | | |
| Supported method | | |
| Supported models | | |
| Tool support | | |
| Constraints of framework | | |
| Best practice domains where framework is successfully applied | | |
| Examples of practical use (ref to projects / cases) | | |
| Lessons from practical use | | |
| Transferability of framework in other application domains or disciplinary contexts | | |
| Concluding recommendations for application | | |

## 4. Models

Models may refer to different aspects such as simulation models, conceptual models, meta-models etc. In the OCOPOMO[4] project we have e.g. conceptual models for each policy case (domain models) in a kind of ontology in XML, we have simulation models in java code which are declarative and rule-based agent models (again per domain), we have meta-models for the conceptual models and for the simulation models, and we have statistical models represented graphically through charts (again for each domain). Different groups may investigate a rather comparable set of models. First three groups should focus on conceptual models, on simulation models, and on meta-models.

- Provide a comprehensive description and distinction of what types of models do exist (meta-models, domain models, conceptual models, formal models etc.)? Develop a taxonomy of models
- What metamodels support public policy development? (providing also literature to individual metamodels)
- What do conceptual models describe in public policy development?
- On the ground of what particular theories, frameworks and/or methods are models developed?
- What lessons can be drawn from, and what conclusions can be made on the practical use of models?

**Table 11: Framework for comparative analysis in the area of meta-models**

| Meta-models / Aspects for comparison | **MM1** | **MM…** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |
| Publication Date | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |
| Supporting theory | | |
| Supporting method | | |
| Supporting framework | | |
| Tool(s) used to develop the model | | |
| Examples of implementation / use of the meta-model | | |
| Constraints and lessons of the meta-model use | | |
| Examples of practical use (ref to projects / cases) | | |
| Transferability of meta-model in other domains or disciplinary contexts | | |
| Concluding recommendations meta-model | | |

[4] http://www.ocopomo.eu/

**Table 12: Framework for comparative analysis in the area of conceptual models**

| Conceptual models (domain-specific?) / Aspects for comparison | **CM1** | **CM…** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |
| Publication Date | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |
| Based on theory | | |
| Developed through method | | |
| Emerging from framework | | |
| Tool(s) used to develop the model | | |
| Application domain(s) | | |
| Constraints of using the model in a particular way | | |
| Examples of (re)use of the conceptual model (ref to projects / cases) | | |
| Transferability of conceptual model in other domains or disciplinary contexts | | |
| Concluding recommendations on conceptual model development and/or use | | |

**Table 13: Framework for comparative analysis in the area of simulation models**

| Simulation models (domain-specific?) / Aspects for comparison | **SM1** | **SM…** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |
| Publication Date | | |
| Background documents | | |
| Abstract | | |
| Reference(s) | | |
| Tools needed to run the model | | |
| Source of the model | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |

| | | |
|---|---|---|
| Based on theory | | |
| Developed through method | | |
| Emerging from framework | | |
| Tool(s) used to develop the model | | |
| Application domain(s) | | |
| Constraints of using the model in a particular way | | |
| Examples of (re)use of the formal model (ref to projects / cases) | | |
| Transferability of formal model in other domains or disciplinary contexts | | |
| Concluding recommendations on formal model development and/or use | | |

**Table 14: Framework for comparative analysis in the area of specific other domain models**

| Specific other domain models / Aspects for comparison | **DM1** | **DM…** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |
| Publication Date | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |
| Based on theory | | |
| Developed through method | | |
| Emerging from framework | | |
| Tool(s) used to develop the model | | |
| Application domain | | |
| Constraints of using the model in a particular way | | |
| Examples of (re)use of the domain model (ref to projects / cases) | | |
| Transferability of domain model in other domains or disciplinary contexts | | |
| Concluding recommendations on domain model development and/or use | | |

**Table 15: Framework for comparative analysis in the area of specific other models**

| Other models / Aspects for comparison | **OM1** | **OM…** |
|---|---|---|

| Metadata | | |
|---|---|---|
| Name | | |
| Developer | | |
| Publication Date | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |
| Based on theory | | |
| Developed through method | | |
| Emerging from framework | | |
| Tool(s) used to develop the model | | |
| Application domain | | |
| Constraints of using the model in a particular way | | |
| Examples of (re)use of the model (ref to projects / cases) | | |
| Transferability of model in other domains or disciplinary contexts | | |
| Concluding recommendations on model development and/or use | | |

## 5. Tools and Technologies

Tools and technologies look particularly into ICT support in policy analysis, modelling and governance. Tools refer to applications (software) that support the development of models or the policy analysis or the interaction with stakeholders. Technologies refer to particular languages (e.g. XML, OWL) or programming languages (Java, etc.) used to implement tools or for storage or for data exchange. A separation of the two in the comparative analysis is recommended.

Issues to consider:

- What tools and technologies do exist which support policy analysis, modelling and governance? (providing also literature to individual tools and technologies)
- From which domains or disciplines do these tools/technologies originate from?
- On the ground of what particular theories, frameworks and/or methods are tools and technologies developed?
- In which domains are the tools/technologies used?
- What lessons can be drawn from, and what conclusions can be made on the practical use of tools and technologies?

**Table 16: Framework for comparative analysis in the area of tools**

| Tools / Aspects for comparison | **T1** | **T…** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |

| | | |
|---|---|---|
| Release Date | | |
| Abstract | | |
| Reference(s) | | |
| Software (Freeware / Buying Version) | | |
| **Conceptual aspects** | | |
| Discipline(s) /Domain(s) | | |
| Supporting theory | | |
| Supporting method | | |
| Supporting framework | | |
| Examples of use of the tool (main usage domain/activity) | | |
| Constraints and lessons of the tool use | | |
| Examples of practical use (ref to projects / cases) | | |
| Concluding recommendations regarding the tool | | |

**Table 17: Framework for comparative analysis in the area of technologies**

| Technologies / Aspects for comparison | **Tech1** | **Tech…** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |
| Publication Date | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |
| Based on theory | | |
| Developed through method | | |
| Emerging from framework | | |
| Tool(s) used to develop the technology | | |
| Tool(s) used by technology | | |
| Application domain | | |
| Constraints of using the technology in a particular way | | |
| Examples of (re)use of the technology (ref to projects / cases) | | |
| Transferability of technology in other domains or disciplinary contexts | | |
| Concluding recommendations on technology use | | |

## 6. Projects / Cases

In this view, projects and cases may refer either to develop a policy (e.g. engaging in formulating a future policy on energy mix) or to implement a policy (e.g. performing measures to realise the energy mix policy agreed in the council and monitoring its implementation and the impact of the policy).

- Provide a short description of projects developing / implementing public policies. Also outline the objectives of the project.
- From which public policy is the project implemented?
- From what discipline(s) and domain(s) are the projects implemented?
- Provide the types of project example: research based or an implementation, and categorize the projects.
- To what level of complexity can the projects be described?

What tools, technologies, methods, models and frameworks that have supported the development of the project?

**Table 18: Framework for comparative analysis in the area of projects/cases**

| Projects / Cases / Aspects for comparison | **P/C1** | **P/C …** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Project type | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Duration | | |
| Number of people involved | | |
| Discipline(s) | | |
| Domain | | |
| Implementing which policy | | |
| Target users | | |
| Objectives | | |
| Complexity | | |
| Theory(s) used | | |
| Method(s) used | | |
| Technology (s) used | | |
| Model(s) used | | |
| Tool(s) used | | |
| Supporting framework | | |
| Project outcome | | |
| Links to other projects | | |
| Transferability of solutions and techniques | | |

| | | |
|---|---|---|
| Concluding recommendations of the project | | |

## 7. Policies / Strategies / Programs

This view digs into relevant existing policies on policy analysis, modelling and simulation. Do countries have particular policies, strategies or programs to advance ICT use in policy analysis, modelling and governance? The following issues should be considered:

- Describe the policies/strategies that request policy analysis, modelling and governance to be fostered.
- What are the main objectives of the policies/strategies?
- In which domain were the policies / strategies developed?
- What programs are associated with the policies/strategies?

What tools, methods, models and frameworks were used in the development of the policies?

**Table 19: Framework for comparative analysis in the area of policies/strategies**

| Policies / Strategies / Aspects for comparison | **P/S1** | **P/S …** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer | | |
| Publication date | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Discipline(s) | | |
| Domain | | |
| Objectives | | |
| Programs implementing the policy/strategy | | |
| Theory(s) used | | |
| Method(s) used | | |
| Model(s) used | | |
| Tool(s) used to develop the model | | |
| Supporting framework | | |
| Transferability of solutions and techniques to other domains | | |
| Concluding recommendations of the policy/strategy | | |

## 8. Stakeholder Engagement

This view looks particularly into stakeholder involvement in policy development (development as well as implementation projects). Here, engagement in the different steps of the policy lifecycle is investigated. Stakeholders also include the citizens / general public.

The following aspects should be discussed:

- Description of the stakeholder engagement process:
  - How are stakeholders identified
  - How are they selected
  - How and where in the process are they involved
  - What contributions do the stakeholders deliver
- Which underlying discipline is driving the engagement process?
- Are there particular theories and or methods of stakeholder engagement used?
- What tools were used during the engagement process?
- What is the purpose of the stakeholder engagement

What lessons can be drawn from, and what conclusions can be made from stakeholder engagement?

**Table 20: Framework for comparative analysis in the area of stakeholder engagement**

| Stakeholder Engagement / Aspects for comparison | **SE1** | **SE …** |
|---|---|---|
| **Metadata** | | |
| Name | | |
| Developer / Project | | |
| Publication Date / Project timeline | | |
| Abstract | | |
| Reference(s) | | |
| **Conceptual aspects** | | |
| Stakeholder engagement process: Stakeholder identification | | |
| Stakeholder engagement process: Selection of stakeholders | | |
| Stakeholder engagement process: where and how involved? | | |
| Stakeholder engagement process: Stakeholder contributions | | |
| Purpose of stakeholder engagement | | |
| Discipline(s) | | |
| Domain (s) | | |
| Theories used / followed | | |
| Methods applied | | |
| Tools applied | | |
| Projects/cases that applied the process | | |
| Constraints of the process | | |
| Lessons from practical use | | |
| Transferability of the engagement process in other application domains or disciplinary contexts | | |
| Concluding recommendations for application | | |

# ANNEX II: COMPARATIVE ANALYSIS – WHITE PAPER CONTRIBUTIONS

**Annex II.1 to D4.2: Comparative Analysis on How Theories Support Policy Modelling**

**by** Steve Hartman, *University of Koblenz-Landau, Germany*

See: http://195.251.218.39/crossover_platform/Details.aspx?EntityId=821

**Annex II.2 to D4.2: Comparative Analysis of Technology Frameworks**

**by** Sehl Mellouli[1], Jamal Shanin[2], Karim Hamza[2]; *[1]University Laval,Canada, [2]Free University Brussels, Belgium*

See: http://195.251.218.39/crossover_platform/Details.aspx?EntityId=825

**Annex II.3 to D4.2: Comparative Analysis of Simulation Models**

**by** Dragana Majstorovic[1], Maria A Wimmer[1], Roy Lay-Yee[2]; Peter Davis[2]; Petra Ahrweiler[3]; Ameneh Deljoo[4], *[1]University of Koblenz-Landau, Germany, [2]Centre of Methods and Policy Application in the Social Sciences, New Zealand, [3]Europäische Akademie zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen GmbH, Germany, [4]Technical University Delft, the Netherlands*

See: http://195.251.218.39/crossover_platform/Details.aspx?EntityId=831

**Annex II.4 to D4.2: Comparative Analysis of Conceptual and Domain Models**

**by** Eleni Kaliva[1], Eleni Panopoulou[1], Efthimios Tambouris[1,2] and Konstantinos Tarabanis[1,2], *[1]1Information Technologies Institute, Centre for Research and Technology Hellas, Thessaloniki, Greece, [2]University of Macedonia, Thessaloniki, Greece*

See: http://195.251.218.39/crossover_platform/Details.aspx?EntityId=840

**Annex II.5 to D4.2: Comparative Analysis of Emerging Tools and Technologies Supporting Policy Modelling**

**by** Eleni Kamateri[1], Eleni Panopoulou[1], Efthimios Tambouris[1,2], Konstantinos Tarabanis[1,2], Adegboyega Ojo[3], Deirdre Lee[3] and David Price[4], *[1]Information Technologies Institute, Centre for Research and Technology Hellas, Thessaloniki, Greece, [2]University of Macedonia, Thessaloniki, Greece, [3]INSIGHT Centre for Data Analytics, NUIG, Galaway, Ireland, [4]Thoughtgraph Ltd*

See: http://195.251.218.39/crossover_platform/Details.aspx?EntityId=844

**Annex II.6 to D4.2: Comparative Analysis of Technical Frameworks and Tools Supporting Decision Making**

**by** Sehl Mellouli[1], Karim Hamza[2], Ameneh Dejloo[3], *[1]University Laval,Canada, [2]Free University Brussels, Belgium, [3]Technical University Delft, the Netherlands*

See: http://195.251.218.39/crossover_platform/Details.aspx?EntityId=832

**Annex II.7 to D4.2: Comparative Analysis Framework of Policies / Strategies / Programs in e-Government**

**by** Jamal Shanin, *Free University Brussels, Belgium*

See: http://195.251.218.39/crossover_platform/Details.aspx?EntityId=833

**Annex II.8 to D4.2: Comparative Analysis of Projects / Cases implementing Policy**

**by** Dominik Bär[1], Maria A. Wimmer[1], Jozef Glova[2], Anastasia Papazafeiropoulou[3], Laurence Brooks[3], *[1]University of Koblenz-Landau, Germany [2]Technical University Kosice, Slovakia [3]Brunel University, United Kingdom*

See: http://195.251.218.39/crossover_platform/Details.aspx?EntityId=838

**Annex II.9 to D4.2: Comparative Analysis of Stakeholder Engagement in Policy Development**

**by** Sharon Dawes[1], Natalie Helbig[1], Jamal Shahin[2], Catherine Mkude[3], Gerard Cotterell[4], Bram Klievink[5], Zamira Dzhusupova[6], *[1]The Research Foundation of State University of New York, [2]Free University Brussels, Belgium, [3]University of Koblenz-Landau, [4]Centre of Methods and Policy Application in the Social Sciences, New Zealand, [5]Technical University Delft, the Netherlands, [6]UNU International Institute Software Technology, Macao*

See: http://195.251.218.39/crossover_platform/Details.aspx?EntityId=845