Integrated Platform for Processing and Traceability of Information within Collaborative Policy Modelling Process in OCOPOMO

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Abstract

In this paper we provide an integrated platform composed of several ICT tools enabling traceability of information between individual steps of collaborative policy modelling process proposed by the OCOPOMO project. This process combines collaborative creation and analysis of narrative scenarios with agent-based simulation models. The policy model for a given domain is created iteratively, by means of cooperation of several stakeholder groups (decision makers, policy analysts, companies, NGOs, the general public). In order to provide modellers and stakeholders with the correct and case-specific information we have designed an integrated architecture supporting processing, sharing and traceability of evidence-based information between simulation models (with rules and agents), conceptual models of the current case and related background data. Thus, users are able to work with this information in a specific policy development process with the appropriate set of tools.

Keywords: ICT tools, integrated platform, policy modelling, social simulation, e-Governance

1. Introduction

The main outcome of the fact that Information and communication technologies (ICTs) are intensively used in the area of e-Government is their potential to support an active and beneficial engagement of citizens in decision-making within democratic processes. One of the main functions of the advanced e-Governance solutions is to provide effective co-operation and information exchange between involved parties, governmental bodies, citizens and businesses, during the policy initiation, development, implementation, monitoring and evaluation. Involvement of the broader public in such process is important for achievement of stakeholder-centred government providing significant benefits.

The focus of our research is on design, development and provision of ICT tools and technologies that are capable to gather stakeholder opinion in an open discussion and transform it to a shared knowledge. According to the EU FP7 ICT Programme initiative related to policy modelling, any toolkit should be able to perform simulations integrating all possible variables, parameters, relations, and scenarios necessary to forecast policies potential outcomes and impacts. Therefore, e-Government applications should extend the paradigm of service provision towards a broader active participation of wider public and various interest groups in a collaborative policy creation. This can be achieved by combination of analysis of statistical methods, scenario and agent-based social simulations, with the support of statistical methods and agent-based social simulation [1]. From the technological perspective, the proposed solutions are usually built on already known and proven technologies, which typically include rule-based or agent-based modelling platforms [2], tools and interfaces for visualised social simulations, knowledge representation models, and web-based e-Participation tools with Web 2.0/Web 3.0 principles of social semantic web. The main innovation is in integration of such multidisciplinary tools within one comprehensive platform used for evidence-based collaborative policy modelling.

The design of a software platform and methodology providing an environment for modelling policies in a collaborative manner is in the focus of the European R&D project OCOPOMO (Open COllaboration for POlicy MOdelling, http://www.ocopomo.eu). OCOPOMO is co-funded by the
European Commission under the 7th Framework Programme. It is coordinated by the University of Koblenz-Landau, the project consortium consists of 10 partners from 5 European countries (the UK, Germany, Slovakia, Poland, Italy). The three-year project (started in 2010) was tested on pilot applications in Italy, Slovakia, and the UK.

The remaining part of the paper is structured as follows: Section 2 describes OCOPOMO-related approaches. Section 3 describes collaborative process of policy modelling defined by OCOPOMO. Section 4 provides description of architecture and tools (modules) within the OCOPOMO platform and section 5 provides integration details on tools and the traceability of information shared between them.

2. Related approaches and projects

The use of collaborative policy modelling approaches in the e-Governance area is a multidisciplinary problem, which includes different policy modelling approaches, scenario-based development of foresights, and applications with collaborative features. Standard approaches to policy modelling were based on general modelling and analysis of economy at the macro level. Some recent approaches are based on micro foundations, where modelling is performed using simulation of behaviour of representative agents. These agents are independent actors that are taking decisions to maximize their utilities over an infinite time horizon. Micro and macro modelling approaches are complementary, whilst macro approach is top-down and micro approach employs bottom-up approach with data gathered from observations of individual agents. Each of the interaction types can be modelled by a set of rules that may emerge from an observed behaviour of agents and their gained experience [3]. Simple rules of social influence among individuals may lead to the emergence of complex patterns of evolution of the system. In a policy modelling system applied to e-Governance, it is especially important to capture complex patterns that may lead to strategic planning. Some other approaches based on the agent-based modelling and simulation methods can be found in [9] or [10].

One of the useful foresight techniques is the method of narrative scenarios, which is used for representation of definitions and explorations of possible futures in a given domain. The scenario-building procedure aims at exploration of different perspectives of the future (alternative trajectories) to gain more insight into possible opportunities and threats [4]. For successful application of agent-based approach in policy modelling, it is important to support open and free information exchange between participating actors, with their individual goals, interests and preferences. Moreover, active participation of actors in this process can lead to useful collaborative result in the form of consensus-based policy model [5]. The interaction between policy modelling actors requires a proper suite of collaborative tools enabling presentation of stakeholders’ ideas, discussions and negotiations between actors, voting on open issues and decision making. Individual goals, interests and preferences can be identified [6] and confronted with actual status of policy model, expressed in a set of relevant narrative scenarios. In this sense, e-Participation is used for involvement of citizens in governance, as well as to facilitate effective decision making and improvement of public policies. From the pool of agent-based policy modelling tools, built on the platform of multi-agent systems (MAS), probably the most popular open-source software platforms for developing MAS are Repast and JADE [7]. Content management systems can be used for maintenance of shared policy models, narrative scenarios and supporting documents, with the examples like Alfresco, Apache Lenya, Drupal, Plone, etc. Collaboration platforms support communication between participants and collaborative work upon shared artifacts, examples of existing solutions are Alfresco Share, eGroupWare, or OpenGroupware.org.

Several projects related to governance and (collaborative) policy modelling are being implemented within the EU FP7 ICT Programme. A support action project CROSSROAD (http://crossroad-eu.net) aims to build a roadmap for ICT research in the field of governance and policy modelling, to be supported by the results derived from other FP7 projects in the area of e-Government and policy making. COCKPIT Project (Citizens Collaboration & Co-Creation in Public Service Delivery, http://www.cockpit-project.eu/) aims to define a new Governance model, which actively engages and empowers citizens in public service delivery decision making process. PADGETS Project (http://www.padgets.eu) aims at bringing together two well established domains, the mash-up architectural and developmental approach of Web 2.0 for creating web applications (gadgets) and societal modelling and simulation methodologies, in analysing complex system behaviour. Research goals of IMPACT project (http://www.policy-impact.eu/) go beyond the state-of-the-art of computational models of
argumentation about policy issues and produce new methods using data-mining techniques and advanced user interfaces and visualisations. Project +SPACES (http://www.positivespaces.eu/) aims at policy making simulation in virtual spaces using existing virtual worlds as the societal sandbox for modelling real world behaviour. Project UBIPOL (http://www.ubipol.eu) intends to develop a ubiquitous platform that allows citizens to be involved in policy making processes regardless their current locations and time using context aware knowledge provision. WEGOV (http://www.wegov-project.eu/) aims at development of a toolset that allows full advantage to be taken of a wide range of existing and well established social networking sites to engage citizens in two-way dialogs as part of governance and policy making processes. E-Policy (http://www.epolicy-project.eu/node) aims at supporting policy makers in their decision process across a multi-disciplinary effort focused on engineering the policy making life-cycle according to individual aspects, extracted from the web in order to find social impacts through opinion mining techniques. FuturICT (http://www.futurict.ethz.ch/FuturIcT) is a project proposal developed with the EU FET Flagship initiative for large projects, which tackles some similar issues as OCOPOMO – agent-based modelling used for preparing long-term strategies, but with ambitious goal to run Earth-like simulation with 10 billions agents. In comparison with the research projects (of comparable size and resources) OCOPOMO also provides support for traceability of process and user specific information combining the evidence-based approach and agent-based modelling within one integrated platform.

3. Process of collaborative policy modelling in OCOPOMO

The process of policy modelling specifically addressed by the OCOPOMO analysis is based on narrative scenarios and related formal policy models that are constructed and modified collaboratively, by several groups of involved persons using proper e-participation tools for information exchange and communication. In general, the proposed platform supports iterative and collaborative creation of policy models and respective scenarios. To design the architecture of a software platform capable to provide the required functionality, the scope of such system needs to be specified. The scope of the proposed system can be described by a set of information artefacts that are exchanged in several supported phases of the policy creation process. Three basic types of information artefacts were identified: Scenario, Simulation model, and CCD (Consistent Conceptual Descriptions).

Scenario is a main artefact manipulated in the process of policy development that contains a description of the policy proposal. The scenario is a narrative, unstructured or structured text of a perceived view or understanding of a policy topic under discussion. It may cover an existing world status, own models of stakeholders or an output of simulations. Based on the processing stage we have:

- Initial scenario - provided to stimulate the process of policy modelling;
- Evidence-based user generated scenario - developed (collaboratively) by users (human actors) as a result of discussion, exchange of opinions, views and expectations;
- Model generated scenario - computed as a result of running a simulation model, produced in the form of text-based transcription of a simulation run.

Simulation model is a simplified representation of objects, phenomena, and processes in a domain of interest. Typically, the model consists of parts, interactions between the parts, and inputs of a defined quantity and nature, mostly represented by the agents, environment, and their interactions. The simulation model can be activated to produce an output by simulation runs.

Consistent Conceptual Description (CCD) is a knowledge representation schema that captures descriptions and perceptions of users (stakeholders) in a structured, formal, and machine-readable way. For example, CCD can be constructed by means of knowledge-based structures like ontology, rule-dependency graphs, etc. CCD plays a role of an intermediary structure between scenarios and simulation models, allowing forward and backward transformations of knowledge between them.

The core objective of OCOPOMO is to ensure conceptual consistency between the scenarios created by stakeholders, background information on the case, and the corresponding simulation models developed by policy modellers. For this aim the OCOPOMO process (depicted in Figure 1) has been designed:

A. Policy initiation - definition of an initial scenario and collection of background materials.
B. Scenario development - initial version of policy and background materials are used for creation of evidence-based user-generated scenario(s).
C. **Creation of conceptual models** - user-generated scenarios (as well as other important background materials) are conceptually annotated according to the CCD meta-model in order to create conceptual model of the current policy issue. Output of this step, i.e. CCD model, is an important link between input materials and simulation models.

D. **Model programming** - implementation of simulation model according to the current CCD model of policy, which is used for generation of code stubs. The output of this step is simulation model, which can be used for simulation using selected simulation backend.

E. **Simulation** - running of simulation in the simulation tool (backend) and generation of simulation output (log), as well as creation of simulation-based model-generated scenario related to the current iteration of the policy process.

F. **Evaluation** - Comparative evaluation of evidence-based user-generated scenario versus simulation-based model-generated scenario. The result of this step is decision on the next step of the process. If the current iteration of the policy model is of sufficient quality, the process is finished and final policy model is created, otherwise a new iteration is started with another version of scenarios developed by users (with the latest knowledge of simulation in mind).

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**Figure 1. Collaborative policy modelling process applied by OCOPOMO**

The process is iterative - phases from B till F. Alternative policy proposals, consisting of narrative scenarios and related simulation models, are produced and discussed in the collaborative environment. The context of the system is defined by external entities that can interact with it by sending or receiving data. The external entities correspond to the prospective users of the platform, i.e., stakeholders that are involved in the process of collaborative policy development. Two main groups of system users can be distinguished according to the level of intentional involvement in the policy creation: direct participants and supportive actors. The direct participants, who are intentionally involved in policy creation and have their own preferences, ideas, or proposals of how the newly created policy should look like, include the user roles such as a politician (or any responsible decision-maker), civil servant (assistant to decision-maker and/or provider of relevant supporting materials), and stakeholders (end users such as citizens, organizations, interest groups, who actively participate in the process). The second group of users, which provides a methodological or technical support to the direct participants, includes user roles like facilitator, analyst or modeller. Facilitator is a mediator, who methodologically controls the collaboration space (e.g. maintains development process, providing initial text descriptions, supporting materials, invites stakeholders, assigns user accounts, controls iteration cycles, etc.). Analyst performs qualitative analyses of narrative scenarios, discussions, comments, simulation results, and provides a formal representation of extracted knowledge. Modeller is an expert that constructs formal policy models according to a given knowledge representation (from scenarios and other sources), creates simulations and provides constructed models for participants.

4. **OCOPOMO platform – a system for support of collaborative policy modelling**

In accordance with the analysis of system requirements, the functional architecture of the platform was proposed within a structure of three main layers of tools, system core, and data storages. Each of the layers consists of a set of functional components (called managers) presented in Figure 2.
The **Tools** layer provides components that are responsible for maintenance of particular tools within the system, together with respective user interfaces. This layer is structured into three parts: 1) Communication subsystem - covers communication, collaboration and cooperation-based features of the presented platform; 2) Scenario subsystem - provides functions for generating narrative scenarios of policy proposals, includes document management and text analysis mechanisms, context enhancements and semantic annotations; 3) Simulation subsystem - providing functionality, which is important for modellers in order to work with CCD and simulation models (including simulations).

The **Core** layer is dedicated to processing all the data exchanged inside the system. It supports the Tools layer with any business logic related to the information resources, metadata and processes that may be required by the scenario, communication, or simulation subsystems. The functionality of broader scope than an individual tool, namely the federated search, system-wide notification, initiation and maintenance of processes, and management of user profiles is also provided.

The **Data** layer provides an infrastructure for persistent storage, management, secure access, sharing and versioning of particular content of any required type. It may include relational databases for structured data, XML-based semi-structured data for knowledge representations and semantic annotations, file systems for textual or multimedia documents, various indexes enabling the retrieval of data, as well as storage of system properties and global settings.

**Figure 2. Structure of OCOPOMO platform functional components**

In practical cases, it is important to find suitable application of functional components using existing tools, as well as to find a compromise for different set of users (if the process is more complicated and multidisciplinary). Therefore, we applied the functional architecture view to the OCOPOMO process and mapped functional blocks and identified relevant technologies to particular steps in order to optimize the proposed approach. For this reason, the OCOPOMO managers are divided into the following four installation modules, according to provided functionality and deployment environments:

- **Collaboration and Scenario Editing tools (CSET)** - installation module based on Alfresco Share, which provides most of the e-Participation (communication subsystem) functionalities (especially its user interfaces). It is mostly important as web interface for collaborative parts of the process, where users are included in creation of specific outputs.

- **Content Management Server/System (CMS)** - installation module based on Alfresco CMS, which provides mostly the services for management of different resources (content, notifications, process activities, etc.) using defined standard interfaces.

- **Consistent Conceptual Description Tool (CCD Tool)** - installation module based on Eclipse Framework, which provides tool for modellers in their work on CCD models.

- **Simulation environment (SE)** - installation module based on Repast agent-based simulation tool (which was selected also due to fact that it is Eclipse module as CCD tool) for preparing and running of simulation models.

As we can see, the main distinction is in deployment frameworks – there are Alfresco-based modules (CSET, CMS) and Eclipse-based modules (CCD Tool, SE).

**CSET** is a set of collaboration tools based on the Alfresco Share software (http://www.alfresco.com), which provides collaborative content management around projects and activities. Each policy modelling project is represented as a collaboration space – site, consisting of site components. Default configuration of the policy modelling site currently consists of several components. Dashboard provides overview information about the current project and access to the most recent content and activities. User can configure layout of the dashboard page and displayed components (dashlets). User interface of the Chat manager is designed as a dashlet. Document and
Wiki pages provide interfaces for the Document manager. Scenario texts and background materials can be edited externally and uploaded into the Document library, or can be edited online as a Wiki page. Discussion Forum and Calendar parts provide their standard functionality in a shared fashion. Polling is related to creation of polls using forms engine of CSET. For development, JavaScript API and REST services are used, with FreeMarker templates applied to Spring Surf components of Alfresco Share.

CMS is responsible for all the content produced during the collaboration work on policy modelling scenarios and stored on the OCOPOMO Content Management Server, which is actually based on the technology of Alfresco Content Repository (ACR). The managed content includes all information artefacts produced by the collaboration tools, i.e. documents, wiki pages, discussion forum’s messages, calendar events, chat history, polling posts, etc. ACR stores content in a relational database and manages full-text index. Additionally, it provides interfaces for functionalities like definition of the content structure (modelling), query of the content and metadata, access control, versioning, content renditions, locking and working version management, and import/export of content and metadata. The content is modelled in the repository as a node construct, which associates metadata and binary or textual content. Each node has an assigned content type that defines which metadata properties should be defined for that node. In addition to the node types, Alfresco repository supports aspect-oriented modelling, i.e. constrains for the nodes can be defined in the aspect, which can be dynamically added or removed to the node definition. Services of ACR can be divided into the following groups:

- Content services - tagging (arbitrary user-generated tags or formally defined classification schemes), content transformation (conversion of the content from one format/type to another), metadata extractions (synchronization of document metadata with the node metadata properties).
- Control services - workflow processes, which can involve human interactions through allocation of tasks (implemented by integrated jBMP engine - http://www.jboss.org/jbpm).
- Collaboration services - Persons API (user profile management), activities (continuous personalized feed of activities performed by other users or by the OCOPOMO system), as well as application logic and data layer backend for CSET (discussions, documents, etc.).

The functionalities provided by the services are accessible for clients through direct REST APIs or standardized CMIS (Content Management Interoperability Services), which defines two protocols to access the CMIS compliant repository: 1.) REST-like protocol based on AtomPub, 2.) SOAP.

CCD Tool is a conceptual tool, which connects narrative texts of stakeholder-generated scenarios (evidenced through background documents of the policy to be discussed) and formal policy models (generating model-based scenarios) by the introduction of Consistent Conceptual Description (CCD) as "modelling/conceptual middle-layer". CCD enables stakeholders in the OCOPOMO process to understand the policy context and to support semi-automatic transformation of text fragments into formal statements and agent descriptions. Thereby, the CCD is exposed to be consistent, conceptual, and descriptive ontology-based definition of agents, their relationships, functions, behaviour rules, inputs, and outputs. The CCD Tool supports the following creating, editing and saving CCD for the current case, linking concepts of the CCD with background documents, and creating the formal policy models that can be further programmed in SE.

The CCD Tool consists of different components to support traceability of the simulation results back to relevant evidence, i.e., to link text (using annotations) with the generated code that creates the simulation results. The main parts of CCD tool, which is implemented as an Eclipse IDE plug-in using EMF (Eclipse Modeling Framework) and GMF (Graphical Modeling Framework), are:

- Annotation tool - used for annotation of scenarios (which are provided as PDF files or HTML wiki pages in Alfresco) for the creation of case-specific CCD models. It enables to annotate and link background information (e.g. statistics, stakeholder scenarios, domain facts) with relevant actors, objects and actions documented in a CCD file. An annotation points are connected using URL, start position and length. The annotations are stored directly in the CCD file. The PDF annotation feature is developed using the JPedal library and is connected with Alfresco CMS by means of the CMIS interface. The user interface of the PDF-HTML Eclipse plug-in is presented there. It enables the annotation of PDF documents and HTML wiki pages that are stored in a remote Alfresco installation. The usage of Alfresco Repository is provided by standard CMIS services.
- Modelling tool - used for creation of CCD meta-model, which is used for annotation, as well as for modelling of the current policy case. Therefore the relevant actors, objects, their
relations and actions are identified by the modeller and documented in a CCD file (defined as XML format). The structure of the file is defined in a meta-model that defines components of the CCD. The meta-model consists of the actors (representing actor categories in a policy case, e.g., households), objects (representing object categories in the policy case, e.g., policies), relations between actors and objects, actions that are executed by actors, and instances (representing particular actors or objects in the policy case).

- Transformation tool - used for transformation of case-based CCD model into code stubs of simulation model. The information is linked from scenario text and background documents, through CCD model, to simulation code (agents and their rules).

SE - comprises parts of the toolbox primarily dedicated to policy modellers. It consists of IDE for editing, debugging and executing policy simulation models, and a facility for inspecting, analysing and commenting simulation outcomes (Simulation Analysis Tool). Although it should be possible to employ these tools in a stand-alone way, the preferred way of use is in an integrated manner as a part of the OCOPOMO process, e.g., IDE imports model code stubs generated by the CCD Transformation Tool, policy modeller extends and specifies more precisely the model code, simulation outcome data is transferred to the Simulation Analysis Tool (where policy modellers can comment, analyse and edit the data, thus creating the model-based scenarios), and then model-based scenarios are fed back to the CSET. In order to achieve better integration, the IDE of SE is also designed as an extension of the Eclipse platform. The main parts of the module are Repast and DRAMS. Repast is selected simulation backend, DRAMS is the rule-based system developed within the project, which provides declarative rule engine functionality to agent-based simulation models executed in Repast [8].

5. Processing and traceability of information within the OCOPOMO platform

The aim of the OCOPOMO project is to support agent-based simulation of policy models and evaluation of potential alternative policies of complex social and macro-economic models. We will describe simple user scenarios, which show how ICT tools support collaborative policy modelling. All mentioned modules and their relationships are shown in Figure 3.

![Figure 3. Structure of functional components of the OCOPOMO platform](image)

In general, when a new policy is to be created, the policy modeller should create an initial scenario in collaborative space (as wiki page) and he/she should also add background documents related to this scenario. Stakeholders and policy modellers are able to modify initial scenario and add additional background materials. They are also able to discuss the specific issues related to these documents. Discussions will evolve into evidence-based stakeholder scenario (or user-generated scenario according to the scheme on Figure 1). All these documents are then used as a basis for creation of simulation models by modellers. Simulation runs generate logs, which are then analysed by analyst and translated into model-generated scenario. Stakeholders and policy modellers are thus able to compare user-generated and model-based scenarios.

Evaluation of scenario generated from simulation and its comparison to user-generated scenario is the critical step (see Figure 1 - step F). In order to achieve user friendly ICT-based support for this step, we have defined the following user scenarios:
• OCOPOMO user can navigate from model-generated scenario backward to user-generated scenario and related background materials, and vice versa.

• OCOPOMO user can explore related CCD concepts and fired rules for viewed scenario part as annotations.

Implementation of both user scenarios puts traceability requirements on all individual modules. It means that each module should store link to source content from the previous module. The OCOPOMO process starts by creation of the initial scenario and collection of background materials (see OCOPOMO process - step A). CMS assigns unique ID for all imported (or newly created) documents. This ID with version number exactly identifies specific document. Therefore, we can simply reference all the documents.

The main component, which provides interfaces between Alfresco and Eclipse, is the Content Repository Client. It downloads document with specific ID and under specific version from CMS and makes it accessible to modellers on the Eclipse platform. Modellers can annotate relevant text snippets (of scenario or background document) and link them to CCD model concepts using annotation tool (PDF, HTML, TEXT). The example of PDF annotation tool is shown on the left-hand side of Figure 4.

Every CCD model concept is identified by UUID. Transformation tool transforms CCD model into DRAMS simulation model with references to original CCD. Simulation runs generate logs that are used for creation of model-generated scenario. Then, Simulation analysis tool allows users to link information from simulation log to model-generated scenario in order to create its annotated version. This annotated scenario is then automatically uploaded to CMS with all necessary information about annotations, i.e., links to related user-generated scenarios and background documents.

The traceability of information between scenarios, simulation models, and their elements (agents, rules, annotated texts, etc.) is important for useful presentation of shared knowledge on current case. The presented user scenarios are able to achieve this functionality by providing in-text annotations. The right-hand part of Figure 4 shows in-text annotations, which were created by the CCD Tool. The figure presents text from pilot application (related to creation of strategic policy on usage of renewable energy sources). In text part we can see in-text annotations (highlighted strings of text). When the mouse goes over the annotation, the context-based menu is displayed and the user is able to see annotation information or related documents (with specific annotation). Under the text part is table presenting the aggregated and sorted CCD concepts occurring in the current document. This functionality provides simple and transparent navigation between background or scenario documents and CCD concepts.

Due to the fact that the process is iterative and multi-user, it is necessary to synchronize the content on Alfresco side with Eclipse installation of current user. This is achieved by the synchronized services provided by Content Repository Client. On the Alfresco side, traceability was implemented in order to support such feature. Another important feature, which is implemented as a support for sustainable traceability is the mechanism, where the Simulation Analysis Tool provides modification of model-generated scenario without loosing the annotation between simulation logs and text of the scenario.

At the end of this section, we add some details on its practical applications within OCOPOMO project. Evaluation of the proposed architecture was based on pilot applications (in two phases during 2012 and at the beginning of 2013) in three different environments: in Slovakia with the policy for
exploiting renewable energy resources, in Italy for policy on optimal allocation of EU structural funds, and in the UK on housing policy in London. The run of the pilots was then evaluated using the evaluation framework with the matrix combining the particular process steps (scenario development, CCD and policy modelling, preparing the simulation, etc.) and evaluation of their support by the OCOPOMO from technical, methodological and governmental points of view, with the evaluators from the all groups of users (modellers, policy makers, stakeholders, etc.). This complex evaluation shows that OCOPOMO platform speed-up the scenario development phase and is very effective tool in provision of information from the simulation results back to the stakeholders. In this way it was proved that the collaborative platform is helpful in understanding of created policies, their consequences and transparency of possible outputs (with significant benefits like shared and reusable knowledge on cases and reduction of time for preparation of the new policy).

6. Conclusion

The presented architecture of the OCOPOMO integrated platform has been designed with the aim to support collaborative policy modelling processes in all phases – from creation of narrative scenarios, annotation of the scenarios, to construction of formal agent-based policy models, iterative simulation, and evaluation – with all its specific requirements for traceability of information between particular phases and their created documents. The proposed approach can be (in an adapted manner) applied also in the private sector, e.g., for design, collaborative development and evaluation (in terms of impact and potential future scenarios) of company strategies.

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8. References