A Collaborative Approach to Study Policy Modelling Research and Practice from Different Disciplines

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Abstract. An OECD study of 2009 argues that open and inclusive policy making helps to improve policy performance and to meet citizens rising expectations. An important aspect shaping the success of policy making is the use of appropriate tools and instruments to model (public) policy, i.e. to use theories, methods and tools that support the process of transforming data and information inputs into conceptual and formal models, which contribute to transparency, a better understanding of policy options (the causes and effects), and better informed decision-making to improve public performance. Accordingly, policy modelling has recently emerged as a multi-disciplinary research domain advancing distinct approaches to policy development and governance through the use of innovative information and communication technologies (ICT). The complexity encompassed with modelling public policies demands for different - often distinct - political, economic, social and technical disciplines to work together to leverage the benefits of different approaches of understanding policy and designing innovative policy. This paper presents an approach to scientific collaboration in advancing the research field and in collaborating across distinct disciplines, while performing comparative analyses in the area of policy modelling. The comparative analyses are organised in the context of an international network of policy modelling called eGovPoliNet, whose aim is to overcoming the existing research fragmentation between disciplines, thereby driving evolution in the field.

Keywords. Collaborative research, comparative analysis, policy modelling, multi-disciplinary research

Introduction

Policy modelling has a great potential to provide an effective environment for the development and implementation of good governance and improved public performance [1]. Public policy is defined as "courses of action, regulatory measures, laws, and funding priorities concerning a given topic promulgated by a governmental entity or its representatives" [2]. Cochran et al refer to decisions of governments and to governmental actions and intentions when describing public policies [3]. Policy making is argued as a "work that is supported by the use of different theories as well as quantitative or qualitative models and techniques to analytically evaluate the past (causes) and future (effects) of any policy on society, anywhere and anytime" [4]. The complexity encompassed with modelling public policies demands for different - often distinct - political, economic, social and technical disciplines to work together to

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leverage the benefits of different approaches of understanding policy and designing innovative policy. This reflects a multidisciplinary nature of the field. However, traditional fragmentation between disciplines keeps researchers within their own disciplines that develop almost independently from each other. In order to fully address policy modelling challenges, researchers need to bring together their knowledge and share their expertise within a multidisciplinary collaboration.

Katz and Martin argue research collaboration as "working together of researchers to achieve the common goal of producing new scientific knowledge" [5]. While, traditionally, this assumed face-to-face meetings, new channels of academic collaboration became available with the rise of ICT solutions, among them web-based collaborative workspaces, internet discussion lists/newsgroups/real-time chat, screen- and application-sharing, web-based and conferencing, online web-page mark-up, etc. [6]. This enables researchers to organise in teams based solely on their interests and motivation without geographical restrictions. In this way, collaboration in teams becomes the main driving force of knowledge development [7].

eGovPoliNet is a research network to investigate the use of innovative ICT solutions for policy modelling and public governance.[2] It strives for overcoming the existing fragmentation of research of distinct disciplines and aims at improving the knowledge and innovation when it comes to providing a wide and successful deployment of ICT support in policy modelling. Thereby, a number of challenges has to be addressed; for example, appropriate support for non-experts in visualising and simulating policy models, wide adoption of online participation means for strategic decision making and open collaboration, enabling open collaboration and transparency in identifying the crucial features of complex social environments to feed policy models, etc. These challenges provide an opportunity for eGovPoliNet whose members have defined the network's mission as to bringing researchers from distinct disciplines and communities together in sharing research ideas, discussing knowledge assets and developing joint knowledge with a goal of overcoming the existing research fragmentation within the field of policy analysis, modelling and governance. Figure 1 demonstrates the respective

Figure 1. Community value and benefits

community values and benefits defined by the project members for the network participants. Accordingly, eGovPoliNet enables the community members from distinct disciplines to meet and discuss the different approaches to policy modelling and governance supported by ICT, to share new insights and learn from each other, and to collaborate in advancing and innovating the field.
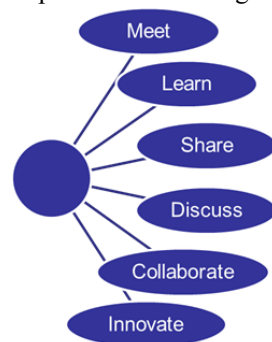
A successful multidisciplinary collaboration requires finding common ground and goals for people and disciplines involved in a collaboration process [8]. For example, a pre-condition for a successful collaboration is a common understanding of key terms, concepts and solutions in a domain [9]. To facilitate the common understanding in policy modelling, eGovPoliNet started developing a Glossary[3] of policy modelling

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[2] eGovPoliNet is a coordination and support action co-founded under Framework Programme 7, Theme 5.6: ICT solutions for governance and policy modelling, http://www.policy-community.eu/

[3] The glossary is available at http://www.policy-community.eu/knowledge-portal

terms (on-going work), which served also to initiate the collaboration among researchers from distinct disciplines. Subsequently, comparative analyses of important concepts shaping policy modelling have been initiated. The collaboration thereof is subject of study in this paper. The research questions driving this work are: What are the lessons learned so far from the comparative analyses, especially in regards to cross-disciplinary collaborations? What are the main characteristics of the collaborative approach to comparative analysis in policy modelling? What are the advantages and disadvantages of a multidisciplinary and collaborative approach to comparative analysis? Accordingly, we first outline the project's approach to comparative analysis in section 1. Subsequently, the collaboration of the network is analysed by assessing qualitative and quantitative indicators. The first indicators are elaborated by summarising the comparative analyses performed in Section 2, while the latter refer to the number of co-authors, institutions, countries, disciplines and professions collaborating within the comparative analysis as analysed in Section 3. Section 4 concludes the paper with a reflection and some outlook of future works of the policy community.

1. eGovPoliNet's Approach to Comparative Analysis

The process of collaboration as presented in Figure 2 shaped the multidisciplinary collaboration in comparative analyses within eGovPoliNet. First, the members representing distinct research disciplines were asked to propose themes that were, in their opinion, relevant to the policy modelling domain. Subsequently, relevant areas for the comparison were discussed among the members, which has led to the following nine topics (pool of themes) for the first round of comparative analyses (cf. Figure 2):

1. Theories of policy modelling
2. Modelling frameworks
3. Comparing simulation models of distinct modelling methods
4. Conceptual and domain models
5. Emerging tools and technologies
6. Technical frameworks and tools
7. Policies and programs framing policy making
8. Comparing projects / cases implementing policy
9. Stakeholder engagement in policy development

The topics were selected to cover different aspects of research and development of the ICT support in the area of public policy modelling and governance. The list of themes, rather than being exhaustive, represented a choice of important areas in the field of governance, participation and policy modelling, which mapped to the partners' competencies and profiles, and was pertinent to the field of study of eGovPoliNet. The comparison included existing approaches, reflected lessons learned and basic principles and recommendations for policy modelling. The teams exchanged their findings in a workshop as well as along regular monthly meetings (cf. Figure 2). As the outcome of the collaboration, papers have been produced that can be shared across the domains.

eGovPoliNet followed a multi-criteria approach [10] in performing the comparative analysis. A set of criteria was established for evaluating and comparing knowledge assets in the relevant themes of the ICT support for governance and policy

modelling by the respective work leader [4] . The criteria included different aspects ranging from general metadata to particular conceptual aspects. Also, a guideline for the comparative analysis was provided. The sets of criteria and the guidelines established for different topics served as a framework for the comparative analyses of different teams. A thorough literature review in the theme provided the foundation for adapting the evaluation criteria and methods for the respective comparative analyses.
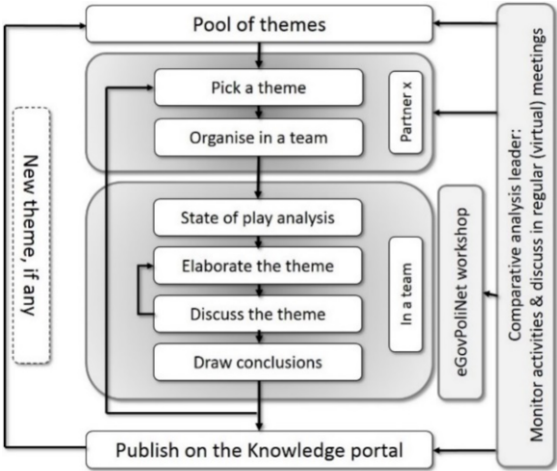

Figure 2. The eGovPoliNet collaborative approach to comparative analysis

2. Comparative Analyses Performed – Qualitative Indications

Among the main objectives of the performed comparative analysis were structuring, integration, comparison and formalisation of the existing approaches in the field of policy modelling with a goal of increasing transparency and accessibility of ICT solutions for governance and policy modelling as well as advancing on efficiency and effectiveness of future initiatives in the field. Table 1 presents a brief summary of the comparative analyses performed with extracted key points and lessons learned[5].

Table 1. Brief summary of comparative analyses performed within the eGovPoliNet collaboration network

No. 1: How theories support policy modelling	
Key points	**Lessons learned**
Compared game theory, agenda-setting theory and institutional choice theory with respect to their roles and contributions in policy modelling	Combination of theories can contribute the most benefits for the research and provide a compensation for the shortcomings of individual theories alone.
No. 2: Frameworks in policy making	
Key points	**Lessons learned**
Identified and compared the main frameworks that are used in analysing policy-making processes Introduced a general classification of frameworks with regard to different degree of depth in the analysis	Frameworks are disseminated across distinct fields, such as public policy, political science, computer science and social sciences. With the growing development in the governance and technology, there is a rising need to develop categorisation criteria to be able to classify frameworks for policy analysis.
No. 3: Simulation models based on distinct modelling approaches	
Key points	**Lessons learned**
Examined different modelling approaches, each suitable for representing different aspects of socio-economic phenomena, such as	Using computer simulations in examining, explaining and predicting social processes and relationships as well as measuring possible impacts of policies should

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[4] Cf. Annex I to technical report D 4.2 available under http://www.policy-community.eu/results/public-deliverables/

[5] Cf. Technical report D 4.2 available under http://www.policy-community.eu/results/public-deliverables/ with the white paper contributions attached in Annex II

economic, demographic and nature processes. Compared simulation models based on different modelling approaches Examined advantages and disadvantages of the different modelling approaches	become an important part of policy making processes. Combination of different simulation modelling theories is not only beneficial for the policy making process but also a necessary as a next step in the evolution of simulation modelling. Such can be achieved by using a "clever" junction of a collection of self-contained mo-dels, each dedicated to a phenomenon to be modelled.
No. 4: Conceptual and domain models	
Key points	**Lessons learned**
Reviewed the field of conceptual and domain modelling and delineated research gaps and opportunities following a systematic literature review.	Currently developed models incorporate incomplete domain knowledge and do not include guidelines for a practical use of the models. Research on domain and conceptual models is immature and requires further investigation as only preliminary results are published.
No. 5: Emerging tools and technologies supporting policy modelling	
Key points	**Lessons learned**
Identified different categories of tools that have a potential of enhancing policy modelling processes, such as visualisation tools, argumentation tools, e-participation tools, opinion mining tools, serious games, persuasive technology, big data analytics, and semantics and linked data. Discussed their potentials and restrictions in policy modelling. Identified different stakeholder groups. Extracted recommendations for how particular ICT tools can be used in policy modelling and in which stage of the process.	Advancements in ICT offer great opportunities for modernising policy making process, where each tool or technology presents a different way for enhancing policy making processes. Policy making processes composed of distinct stages, which can be facilitated by tools and technologies. Necessary to analyse how specific stakeholder groups could use particular tools, and in what ways, to promote understanding of how these tools and technologies can be adopted in policy making processes. Most benefit generated by use of a mixture of suitable ICT tools, based on the stakeholder groups, targeted activity and the policy making stage to be supported.
No. 6: Technical frameworks and tools supporting decision making	
Key points	**Lessons learned**
Provided an overview of technical frameworks involving particular tools and technologies used for implementing simulation models. The analysis did not claim to be exhaustive in identifying all technological frameworks or tools and technologies, but rather served as a basis for the policy makers in identifying the potentials of technology frameworks, tools and technologies in decision making processes.	Identifying / selecting the methodology to develop simulation models is crucial. Comparisons between technologies or tools need to be conducted prior to choosing supporting technologies and tools. Specific situations require specific technologies hence the adoption of a particular modelling tool should not be considered to be set by default. Different existing frameworks should be examined to decide upon the one that will support the model.
No. 7: Framework of comparing policies, strategies and programs in e-government	
Key points	**Lessons learned**
Offered insights into the way trends in technological and societal development influen-ce the process of designing and implementing policies, strategies and programs. Proposed a framework for comparative analysis of policies, strategies and programmes in e-gov. Examined the case of the European Union to evaluate the validity of the framework.	Different policies, strategies and programs were designed to improve the interactions in e-government and provide transparency. The proposed framework can be used to assess these policies, strategies and programs.
No. 8: Analysing projects / cases implementing policy in the field of sustainable / renewable energy	
Key points	**Lessons learned**
Examined theories and methods for policy implementations. Investigated the implementation of policies	A slow progress in switching from fossil fuels and nuclear power to renewable energy sources based on solar radiation, wind or water.

connected to the sustainable energy management and renewable energy sources through different projects and cases.	Necessary to carry out the dialogue across the world about the climate change and different possibilities to accelerate the adoption of renewable energy sources with the special accent on the financial issues. The use of renewable energy sources is expensive and funded by taxpayers and consumers, which is another reason for the slow progress. Necessary to raise awareness of the benefits of renewable energy sources, by including stakeholders and esp. citizens in the respective policy making processes.
No. 9: Stakeholder engagement in policy development	
Key points	**Lessons learned**
Compared examples of policies, where stakeholders were included in the policy modelling process. Discussed the strengths and weaknesses of stakeholder engagement during the phases of problem definition and the policy formulation. Contributes to a better understanding of how different approaches, tools, and technologies can support effective stakeholder participation toward better policy choices and outcomes.	Necessary to match selection of stakeholders and engagement methods to the goals of a policy process. Active involvement of stakeholders in policy modelling processes is an important factor for producing usable, transparent policies; useful for both groups, stakeholders as well as policy makers. Stakeholders and policy makers can collaborate in the wide variety of policy domains as well as various economic and social development. Engaging stakeholders helps establishing or reinforcing trust of citizens toward government.

3. Analysis of the eGovPoliNet Collaboration – Quantitative Indications

This section aims at describing and characterising the eGovPoliNet collaboration network, showing that researchers from different disciplines were engaged in the comparative analyses described in Section 2. This analysis is important with regard to the aims and objectives of eGovPoliNet presented in the introductory section.

For assessing a research collaboration, different authors suggested the assessment of the following aspects: co-authored papers [11], professions of the team members [9], disciplinary focus of the collaborators [12], geographical position of their institutions [12] and the organisational level of the collaboration [9]. We embark on these quantitative indicators for analysing the collaboration of the eGovPoliNet network.

Co-authored papers. A set of articles published as a result of the work of a collaboration network is the most common measure of successful research collaboration [13]. eGovPoliNet collaborations so far resulted in nine comparative analysis papers prepared by 27 authors. The mean number of authors per comparative analysis work (the so-called collaborative index of the network CI [14]) is 3.9. The degree of collaboration[6] DC [15] representing a proportion of multi-authored papers compared to single-author papers is 0.78. For the eGovPoliNet network, the DC is high, which means that the vast majority of papers was produced in a scientific collaboration and not by single authors. However, CI and DC do not differentiate among varying numbers of authors in co-authored papers. For this reason, the collaboration coefficient CC[7] [16] and its slightly modified version MCC[8] [13] are

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[6] DC 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.

[7] 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.

[8] MCC is in the same range as DC.

used. For eGovPoliNet, the CC is 0.58 and the MCC is 0.6, which again evidence a high level of collaboration.

Profession of the team members. eGovPoliNet's comparative analyses were mostly performed by three types of professionals relevant to academic collaboration: researchers (23 out of 27 authors), students (3) and policy modelling practitioners (1). Since the focus of eGovPoliNet is a research community, it comes naturally that most of the team members are researchers, including a smaller number of PhD and graduate students and practitioners. Participation in multidisciplinary comparative analysis teams has proven to be an important environment for students to learn about the approaches of different disciplines and to obtain practical experiences in a scientific collaboration.

Disciplinary focus. eGovPoliNet objectives include a collaboration across disciplines. Table 2 gives an overview of the disciplinary backgrounds authors come from in the nine comparative analyses performed. Only two papers (no. 1 and no. 7) did not involve distinct disciplines as these papers were single-authored.

Table 2. Research collaboration of authors across disciplines in the performed comparative analysis

Research disciplines involved	Comparative analyses performed								
	1	2	3	4	5	6	7	8	9
Information Systems	X		X	X	X	X	X	X	X
Computer science		X	X		X	X			
Social sciences				X					X
Sociology				X					
E-government & e-participation		X	X			X		X	X
Public administration sciences									X
Economics								X	
Organisational and management science		X							X

In working together in comparative analysis, the experts from distinct disciplines provided a unique view for the development and the usage of ICT solutions for policy modelling and governance. Briefly, the field of information systems is mainly dealing with a development of information and knowledge systems and tools that can be used in policy modelling, while computer science is concerned with the implementations of the presented solutions [17]. Social sciences and sociology focus their research on a variety of stakeholders and the interactions among them, for example, how to establish a trustworthy atmosphere in policy modelling process [17]. E-government researches complex digital interactions between a government and its citizens [17], while e-participation describes possible ways of participation and engagement of citizens in policy decision-making [18]. Finally, organisational and economic sciences develop interaction concepts based on effectiveness, productivity, transparency and a quality of services [17], [19].

Another important aspect is the internationalisation of the collaboration network, since the aim of eGovPoliNet is to engage researchers from different institutions from all over the world. Table 3 shows that the teams are internationally spread with the researchers coming from different institutions, ranging from information systems and technology institutes to social science centres and economic departments.

Organisational level of collaboration. The collaboration network of eGovPoliNet is organised at three levels as also indicated in Figure 2 above. First, members within comparative analysis teams established their own organisation. Through the regular monthly meetings and workshops, the teams exchanged and discussed their findings with other teams. Finally, a work package leader monitored the work of all teams.

The indicators presented in this section show that the eGovPoliNet collaboration is by all parameters a good practice example and analysing it can give hints for finding the (possibly hidden) variables supporting collaboration in policy modelling domains and hence enabling the transfer of best practices to other collaborations across disciplines.

Table 3. Disciplinary focus of institutions and countries the authors come from.

Country	Discipline	Performed comparative analysis								
		1	2	3	4	5	6	7	8	9
Germany	E-Government Research Group in a Faculty of Computer Science	▓		▓				▓	▓	
	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									▓

4. Conclusion

To overcome the existing research fragmentation between disciplines within policy modelling, researchers from distinct disciplines need to work together in multidisciplinary collaboration teams, and their research findings need to be integrated to contribute to better understanding in the area of policy modelling. The paper described and evaluated the approach to scientific collaboration among different disciplines, which was applied to comparative analysis in policy modelling of eGovPoliNet. The goals of the comparative analysis were to structure, integrate and compare existing approaches and solutions in the field of ICT support for policy modelling with the aim of increasing transparency and accessibility to best practices, thereby driving evolution in the field. The eGovPoliNet collaboration scheme is multidisciplinary since it involves researchers from a number of different disciplines developing a common understanding out of single disciplinary fields. Researchers interact, discuss and bring conclusions together - a process that is evolution-driven,

since it fosters distinct related areas to draw lessons and conclusions from combining approaches which shall contribute to further evolution.

Two types of research and practice insights can be extracted from the performed comparative analyses: First, lessons and implications derived from the content of the distinct studies on policy modelling as summarised in section 2. Second, implications regarding multi-disciplinary collaboration as shown in the analysis in section 3, which has encountered a number of positive implications of the multi-disciplinary collaboration, such as:

- Experienced researchers share their knowledge with younger researchers.
- Researchers from distinct disciplines get a fast insight into the research of other communities and learn what is important from their point of view.
- Easier and faster contact with the top researchers and a literature insight from distinct fields.
- Better understanding of social and societal behaviour on the global level.
- Increased awareness among researchers that an interdisciplinary approach is necessary to bring the evolution in the field into motion and fill in current research gaps in the field of policy modelling.

However, negative implications were also encountered, such as:

- Collaboration teams from around the globe may find it difficult to meet due to different time zones and distinct scheduling of conferences across communities.
- Differences in understanding key terms and concepts as well as in cultural approaches to research and development are difficult to handle. The glossary of modelling terms helped to facilitate a common understanding across disciplines.
- Difficulties in establishing common research objectives and research questions due to varying viewpoints and expectations of rigor in distinct disciplines.
- Collaboration dependent on the willingness and readiness of individuals to accept a distinct approach and understanding from another discipline. If this precondition was not there, there would be no way of building up new knowledge for complex multi-disciplinary challenges.

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