

# How Theories Support Policy Modelling

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## Abstract

This paper contributes to policy modelling theories and compares game theory, agenda-setting theory and institutional choice theory regarding 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 with 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 totally 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.

## 1. Introduction

This paper contributes to policy modelling theories and compares their different approaches for policy modelling. Policy modelling cannot be defined without the definition of the term policy itself. With regards to policy not much has changed over the last 25 years. Policy is now defined as “a theoretical or technical instrument that is formulated to solve specific problems affecting, directly or indirectly, societies across different periods of times and geographical spaces” (Ruiz Estrada, 2011, p. 524), is typically a set of rules to support the achievements of goals or objectives (Holland & O'Sullivan, 2012) and was proclaimed as “how things are going to be done around here” (House, 1979, p. 160). Of course, the current definition is far more detailed but implies that “a policy should aid decision making” (Holland & O'Sullivan, 2012) also. The policy process in a simplified descriptive stages model divides the process into a series of phases (agenda setting, policy formulation and legitimation, implementation and evaluation) and comprehends with a discussion of some of the factors that affects the process within the stages (Lasswell, 1956). The process of policy making conceptualises problems and finds governmental answers with governmental institutions formulating alternatives and defining policy solutions while these solutions get implemented evaluated and revised (Sabatier, 2007, p. 3). Thus, the hierarchical nature of policy making enables most analyses the use of models along the decision process (House, 1979, p. 160) and are often applied in the form of simulation models (van Egmond & Zeiss, 2010, S. 58). As stated by van Egmond & Zeiss (2010) the past decades have shown that simulation models have become an important tool for policy making and policy decisions. Thus, policy making contributes as the result of scientific, professional and policy interaction (van Egmond & Zeiss, 2010, S. 59). Ergo, policy modelling is defined “as an academic or empirical analytical research work that is supported by the uses of different theories, quantitative or qualitative models and techniques to evaluate the past (cause) and future (effect) of any policy implication(s) on the society anywhere and anytime” (Ruiz Estrada, 2010, p. 1). Ruiz Estrada (2010) divides policy modelling into twelve categories: the domestic and international trade policy modelling; energy, communications, infrastructure and transportation policy modelling; environmental and natural

resources management policy modelling; fiscal and government spending policy modelling; institutional, regulation and negotiation policy modelling; labour, employment and population policy modelling; monetary, banking and investment policy modelling; production and consumption policy modelling; technological and R&D policy modelling; welfare and social policy modelling; economic growth and development policy modelling; miscellaneous policy modelling. But in contrast to the definition of policy, the application of different theories, models and techniques for policy modelling have changed constantly over the last 30-years (Ruiz Estrada, 2010, p. 2) thus scholars interested in the field of policy modelling are including holistically approaches, also (Sabatier, 1991, p. 1).

To compare and analyse different theories the following subchapter defines frameworks, theories and models. For this matter the definition of Ostrom (2007, pp. 24-25) is used. Usage and development of a general 'framework' helps to identify universal variables and the relationships among them for a certain phenomenon or one needs to consider for institutional analysis. The list of variables a framework provides with supplying a metatheoretical language to compare theories is mainly general and can be used to analyse all types of institutional arrangements. The direction among relationships must not be defined to organize and prescriptive inquiry. The interaction or combination elements contained in a framework can generate differences in surface reality and help analysts to provide the best questions to apply first. In contrast to a framework, a 'theory' provides a denser and logically linked connection of the elements and enables the analyst to make general working assumptions about these variables. Therefore frameworks enable theories to specify assumptions for diagnosing a phenomenon, explaining the processes and predicting the outcome. The number of theories which are compatible with frameworks can vary. A framework or a number of theories provide the capacity to undertake systematic, comparative institutional assessments to recommend a reform. To explore the consequences of a theory in a limited set of outcomes a 'model' can make precise assumptions. Analogous to theories and frameworks, multiple models are compatible with most theories. Thus, a model represents a certain situation, is useful for predicting specific outcomes with a highly simplified structure and is beneficial in policy analysis well-tailored to a certain problem. And with regards to a hierarchical policy process, the higher the policy hierarchy is, the inclination for decision making becomes more concerned with the outcome and the impacts of the decision than the inputs, ergo the model (House, 1979, p. 160).

As part of theories contributing policy modelling it is important to take the definition of theories in account for identifying theories to be compared. On one point of view we can observe a constant growth of econometrical models (Granger & Deutsch, 1992) but from another that non-economic variables were never included simultaneously for policy modelling (Ruiz Estrada, 2010, p. 2). Ruiz Estrada (2010) identifies social, political, technological and natural factors as economic variables and states that the absence of non-economic elements may increase the vulnerability for the process of construction, the implementation and the monitoring in the medium and the long run for policy modelling. Therefore unforeseen factors e.g. natural disaster, climate change and poverty expansion should also be included (Ruiz Estrada, 2011, p. 527). Furthermore the philosophy of science and social psychology is always mediated with a number of conditions to tell the observer what to look for and define the categories to be grouped in (Sabatier, 2007, p. 4).

As a literature research we identified studies that have been used in science to complement policy modelling and are able to answer: Which theories guide policy development? Therefore “The Journal of Artificial Societies and Social Simulation”<sup>1</sup> (JASSS) and the “Journal of Policy Modelling”<sup>2</sup> (JoPM) were used. A search with the keyword “theories” identified several theories and the results of the first five pages are listed in Table 1. The first row includes the name of the theory, the second the discipline and the last two the mentions of the theory with a quoted search. For example the “Punctuated Equilibrium” was searched in both journals with quotes and has eight entries in JASSS and four entries in the JoPM. To provide three different perspectives and three different points of views “Game Theory” is our first choice with the highest number of publications. As “Rational-Choice Theory” and “Public-Choice Theory” have both the second and third highest mention it would be the obvious choice. Instead to provide different perspective but still include choice theory as a separate theory the “Institutional-Choice Theory” with an organizational perspective is included. Thus, Agenda-Setting Theory is the third choice to provide political insight. To compare the theories a comparative analysis table of the work group of Ms Wimmer<sup>3</sup> - also available at the eGovPoliNet<sup>4</sup> community - is used.

Table 1 - Theories of policy modelling

Theory	Point of View	JASSS	JoPM
Punctuated Equilibrium	Biological	8	4
Game Theory	Econometrical	232	32
Group Theory	Econometrical	1	2
Rational-Choice Theory	Economical	81	16
Cumulative Prospect Theory	Economical	0	2
Institutional Choice Theory	Organizational	0	0
Public-Choice Theory	Political	20	51
Agenda-Setting Theory	Political	2	4

While it is not possible to look for and see everything (Sabatier, 2007, p. 4) and economic literature is too mathematical and abstract (Ruiz Estrada & Yap, 2013, p. 171) we identified theories with different point of views e.g. political, econometrical and organizational and contribute to science

<sup>1</sup> <http://jasss.soc.surrey.ac.uk/JASSS.html>

<sup>2</sup> <http://www.journals.elsevier.com/journal-of-policy-modelling/>

<sup>3</sup> <http://www.uni-koblenz-landau.de/koblenz/fb4/institute/iwvi/agvinf/personen/maria-wimmer>

<sup>4</sup> <http://www.policy-community.eu/>

by drawing on the notion of different point of views of policy modelling theories and compare their contribution to policy modelling per se, thus, how can these theories complement policy modelling?; and how can these theories supplement information systems with regards to policy modelling?

## 2. Comparative analysis

The chapter ‘comparative analysis’ provides an overview of the theories identified providing policy analysis and governance. Furthermore, applied field, discipline, particular methods and tools supporting the implementation and lessons learned are included.

Aspects for comparison	Game Theory
Metadata	
Name	Game Theory
Developers	<ul style="list-style-type: none"> <li>- Neumann J. (1928) Zur Theorie der Gesellschaftsspiele</li> <li>- Neumann, J. &amp; Morgenstern, O. (1944) Theory of Games and Economic Behaviour</li> </ul>
Publication Date	1928 (First appearance of game theory as a field itself)
Abstract	<p>“This book contains an exposition and various applications of a mathematical theory of games. The theory has been developed by one of us since 1928 and is now published for the first time in its entirety. The applications are of two kinds: On the one hand to games in the proper sense, on the other hand to economic and sociological problems which, as we hope to show, are best approached from this direction.</p> <p>The applications which we shall make to games serve at least as much to corroborate the theory as to investigate these games. The nature of this reciprocal relationship will become clear as the investigation proceeds. Our major interest is, of course, in the economic and sociological direction. Here we can approach only the simplest questions. However, these questions are of a fundamental character. Furthermore, our aim is primarily to show that there is a rigorous approach to these subjects, involving, as they do, question of parallel or opposite interest, perfect or imperfect information, free rational decision or chance influences.” (von Neumann &amp; Morgenstern, 1955)</p>
Reference(s)	<p>Literature on this field has increased significantly and contains more than 100 titles. Only the six most notable references since the second edition are quoted:</p> <ul style="list-style-type: none"> <li>- H. W. Kuhn and A. W. Tucker (eds.), " Contributions to the Theory of Games, I," Annals of Mathematics Studies, No. 24, Princeton (1950), containing fifteen articles by thirteen authors.</li> <li>- H. W. Kuhn and A. W. Tucker (eds.), „Contributions to the Theory of Games, II," Annals of Mathematics Studies, No. 28, Princeton (1953), containing twenty-one articles by twenty-two authors.</li> <li>- J'. McDonald, Strategy in Poker, Business and War, New York (1950).</li> </ul>

	<ul style="list-style-type: none"> <li>- J. C. C. McKinsey, Introduction to the Theory of Games, New York (1952).</li> <li>- A. Wald, Statistical Decision Functions, New York (1950).</li> <li>- J. Williams, The Complete Strategist, Being a Primer on the Theory of Games of Strategy, New York (1953).</li> </ul>
<b>Conceptual aspects</b>	
<b>Discipline(s)</b>	Economical, Sociological
<b>Built on another theory</b>	Mixed strategy based on the concept of probability calculus (1654) by Pierre de Fermat (1607 – 1665) and Blaise Pascal (1623 – 1662), whereas mixed strategy was identified by Hames Waldegrave (1684-1741) in 1713 (Hykšová, 2004).
<b>Main foci of theory</b>	The main focus of the “fully-fledged” mathematical discipline is a detailed formulation of economically problems showing an exceptional broad of application possibilities (Hykšová, 2004), e.g. the two-player zero-sum games and n-player zero-sum cooperative games.
<b>Peculiarities of theory</b>	<p>Game theory provides three different representations, the extensive form, the strategic form and the cooperative form (Shubik, 1981), thus the origins of game theory do not provide cooperative or redistributive payoffs until J. F. Nash (1928) (Hykšová, 2004).</p> <p>Multiple players have decisions that may affect the interests of the other players the basic concepts includes to maximize the possible outcome of self-interested agents (Holland &amp; O'Sullivan, 2012, p. 7). Of course players shouldn't know each other's preferences.</p>
<b>Constraints of theory</b>	<p>Game theory is abstract and deductive model of policy making. Holland and O'Sullivan (2012) highlight the constraints of Fudenberg and Levine (1998):</p> <ul style="list-style-type: none"> <li>- The coordination of agent's beliefs about the play can be pure introspection when multiple equilibria exist.</li> <li>- Difficulty of the common knowledge of rationality of the game itself.</li> <li>- A repeated game can explain the likely outcomes better in later rounds, thus the play is impossible with an introspective theory.</li> </ul> <p>Also, because of the pathological behaviour, Nash equilibrium is not always the indication of a possible outcome (Holland &amp; O'Sullivan, 2012, p. 15).</p> <p>A game in extensive form can specify a game in strategic form; a strategic game can be used to define a game in cooperative form but the reverse does not hold true (Shubik, 1981)</p>
<b>Tools supporting theory</b>	During the work of this paper no tools supporting game theory were found. This doesn't neglect existence, but presence seems rare.
<b>Models supporting theory</b>	<ul style="list-style-type: none"> <li>- The common and private value model (Holland &amp; O'Sullivan, 2012, p. 10f) can be used for auctions e.g. Vickrey auctions.</li> </ul>

	<ul style="list-style-type: none"> <li>- Equilibrium World Trade Model (Johnson, Mahe, &amp; Roe, 1993) can be coupled with game theory to be measured by an estimated political payoff function.</li> </ul>
Methods emerging from theory	<ul style="list-style-type: none"> <li>- L. E. J. Brouwer (1881-1966): Brouwer fixed-point theorem</li> <li>- J. F. Nash (*1928): Nash equilibrium (Holland &amp; O'Sullivan, 2012, p. 7)</li> <li>- V. Pareto (1848-1923): Pareto frontier (de Givry, Kotthoff, Simonis, &amp; O'Sullivan, 2013, p. 8)</li> </ul>
Models emerging from theory	<ul style="list-style-type: none"> <li>- The inspection game is useful for governmental decisions when budgetary and tax rate decisions are made. (Holland &amp; O'Sullivan, 2012, p. 7f)</li> <li>- Auction theory (Holland &amp; O'Sullivan, 2012, p. 7)</li> <li>- De Mesquita (2011) A New Model for Predicting Policy Choices: Preliminary Tests Conflict Management and Peace Science February 2011 28: 65-87,</li> <li>- Baron Gordon Model of monetary policy (Holland &amp; O'Sullivan, 2012, p. 8)</li> <li>- Revenue Equivalence Theorem (RET) (Holland &amp; O'Sullivan, 2012, p. 12)</li> <li>- Combinatorial Auction (Holland &amp; O'Sullivan, 2012, p. P18f)</li> <li>- Mechanism Design Theory (Holland &amp; O'Sullivan, 2012, p. 15)</li> <li>- Public-Private Partnerships Business Model (Ping Ho, 2007)</li> <li>- Political Payoff Function (PPF) (Johnson, Mahe, &amp; Roe, 1993)</li> </ul>
Tools and/or technologies emerging from theory	<ul style="list-style-type: none"> <li>- EUGene: <a href="http://www.eugenesoftware.org/what.asp">http://www.eugenesoftware.org/what.asp</a></li> <li>- Predictioneer's Game: <a href="http://www.predictioneersgame.com/game">http://www.predictioneersgame.com/game</a></li> <li>- Gambit: <a href="http://www.gambit-project.org/gambit13/index.html">http://www.gambit-project.org/gambit13/index.html</a></li> </ul>
Best practice domains where theory is successfully applied	Econometrical, political science (Morrow, 1994; Ordeshook, 2008), biology, computer science, philosophy
Examples of practical use (ref to projects / cases)	<ul style="list-style-type: none"> <li>- S. P. Ho (2007) Game Theory and Policy Making in Managing Large-Scale Projects: Cases of Public-Private Partnerships (PPP), e.g. Eurotunnel (1995), Taiwan High Speed Rail (2007), Infrastructure Policy and Economic Research (IPER)</li> <li>- Fourçan, A &amp; Warin, T. (2001) Tax harmonization versus tax competition in Europe: A game theoretical approach. Cahiers de recherche CREFE / CREFE Working Papers 132, CREFE. University du Québec à Montréal.</li> <li>- De Mesquita, B. B. (1985) Forecasting Political Events: The Future of Hong Kong (with David Newman and Alvin Babushka). New Haven: Yale University Press.</li> <li>- De Mesquita, B.B. (2002) Predicting Politics. Columbus, OH: Ohio State University Press</li> <li>- Dresher, M. (1962) A sampling inspection problem arms control agreements: a game theoretic analysis. Technical Report Memorandum RM 2972 ARPA. The Rand Corporation, Santa Monica, California.</li> </ul>

	<ul style="list-style-type: none"> <li>- Greenberg, J. (1984) Avoiding tax avoidance: A (repeated) game theoretic approach, Journal of Economic Theory, 32(1) p. 1-13.</li> <li>- Ferguson, T. S. &amp; Melolidakis, C. (1998) On the inspection game. Naval Research Logistics 45</li> </ul>
Lessons from practical use	<p>Fourçan and Warin (2001) observed that leaving out tax harmonization will lead to sub-optimal tax equilibrium and free riding behaviours may appear, thus budgetary problems arise and balanced budget may not be achieved. In Conclusion they state that tax competition would not lead to a race to the bottom if countries achieve a sound public finance, because in equilibrium the competition could shift to the lowest tax rate. Greenberg (1984) highlights that the individuals that cheat during tax auditions in equilibrium are arbitrarily small. The problem parameters were the expected payoffs for reporting truthfully and cheating and the probability of being audited. Therefore game theory is useful for policy making and can be stated as internal compliance and internal competition (Holland &amp; O'Sullivan, 2012, p. 8). Furthermore low corporation tax can be a tactical tool to enable foreign direct investment.</p> <p>Ho (2007) states, that due to the complexity management is very critical to project success and the conflict roles of PPP can lead to serious concerns. To improve bid preparation or concept development, other incentive schemes than bid compensation are necessary like legal restrictions on governmental renegotiation power, a good monitoring system that gives government more lead time to replace developers; separation of the developers and the contractors to ensure clearer client-contractor relationships; and the assignment of third party experts serving the board to assure proper monitoring contributing with insider information. Furthermore Ho (2007) highlights the impossibility of ruling out all the possibilities and states the importance of preparation for renegotiation problems, Thus understanding the renegotiation nature can solve problems even before they happen.</p>
Transferability of theory in other application domains or disciplinary contexts	Recent research shows that the range of solution concepts addresses a broader environment including uncertainty, stochastic dynamics and other complicating factors (Holland & O'Sullivan, 2012, p. 6).
Concluding recommendations for application	<p>Holland and O'Sullivan (2012, p. 15) determine four desirable mechanism design properties where an overall equilibrium is reached:</p> <ul style="list-style-type: none"> <li>- Individual Rationality: If agent participation is voluntary no agent takes part in a trade without at least constant utility.</li> <li>- Efficiency: Social welfare must be maximized by maximizing the overall agent utility.</li> <li>- Revenue Maximizing: An agent maximizes his own utility.</li> <li>- Budget Balance: No Money is extracted of the system, thus the sum of all payments are zero except an external benefactor exists.</li> </ul>

	<p>The mechanism design theory tells us when markets can lead to an expected outcome and different institutions should be considered but also offers guidance when market fails.</p> <p>Munck (2001) highlights that game theory has shown little sensitivity to domain specification issues and claims game theorists should focus on clear and consistently criteria for identifying appropriate domains and expand those by developing a broader framework. Game theory can predict future but needs other theories to contribute with a broader aspect of decision making. Furthermore including rational choice into game theory can guide to more precise forecasts (Munck, 2001, p. 204). Thus, game theory is not the almighty policy modelling theory but can contribute extensively when combined.</p>
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<b>Aspects for comparison</b>	<b>Agenda Setting Theory</b>
<b>Metadata</b>	
<b>Name</b>	Agenda Setting Theory
<b>Developer</b>	Maxwell E. McCombs; Donald L. Shaw
<b>Publication Date</b>	1972
<b>Abstract</b>	<p>“In choosing and displaying news, editors, newsroom staff, and broadcasters play an important part in shaping political reality. Readers learn not only about a given issue, but also how much importance to attach to that issue from the amount of information in a news story and its position. In reflecting what candidates are saying during a campaign, the mass media may well determine the important issues—that is, the media may set the “agenda” of the campaign.” (McCombs &amp; Shaw, 1972)</p>
<b>Reference(s)</b>	<ul style="list-style-type: none"> <li>- Bernard R. Berelson, Paul F. Lazarsfeld, and William N. McPhee, Voting, Chicago, University of Chicago Press, 1954</li> <li>- Kurt Lang and Gladys Engel Lang, "The Mass Media and Voting," in Bernard Berelson and Morris Janowitz, eds., Reader in Public Opinion and Communication, 2d ed., New York, Free Press, 1966</li> <li>- Paul F. Lazarsfeld, Bernard Berelson, and Hazel Gaudet, The People's Choice, New York, Columbia University Press, 1948</li> <li>- Joseph Trenaman and Denis McQuail, Television and the Political Image, London, Methuen and Co., 1961</li> <li>- Bernard C. Cohen, The Press and Foreign Policy, Princeton, Princeton University Press, 1963</li> <li>- Jay G. Blumler and Denis McQuail, Television in Politics: Its Uses and Influence, Chicago, University of Chicago Press, 1969,</li> </ul>

	<ul style="list-style-type: none"> <li>- Richard F. Carter, Ronald H. Pyszka, and Jose L. Guerrero, "Dissonance and Exposure to Arousive Information," <i>Journalism Quarterly</i>, Vol. 46, 1969, pp. 37-42</li> <li>- David O. Sears and Jonathan L. Freedman, "Selective Exposure to Information: A Critical Review," <i>Public Opinion Quarterly</i>, Vol. 31, 1967, pp. 194-213.</li> <li>- David Gold and Jerry L. Simmons, "News Selection Patterns among Iowa Dailies," <i>Public Opinion Quarterly</i>, Vol. 29, 1965, pp. 425-430</li> <li>- Guido H. Stempel III, "How Newspapers Use the Associated Press Afternoon A-Wire," <i>Journalism Quarterly</i>, Vol. 41, 1964, pp. 380-384;</li> <li>- Ralph D. Casey and Thomas H. Copeland Jr., "Use of Foreign News by 19 Minnesota Dailies," <i>Journalism Quarterly</i>, Vol. 35, 1958, pp. 87-89;</li> <li>- Howard L. Lewis, "The Cuban Revolt Story: AP, UPI, and Three Papers," <i>Journalism Quarterly</i>, Vol. 37, 1960, pp. 573-578;</li> <li>- George A. Van Horn, "Analysis of AP News on Trunk and Wisconsin State Wires," <i>Journalism Quarterly</i>, Vol. 29, 1952, pp. 426-432;</li> <li>- Scott M. Cutlip, "Content and Flow of AP News- From Trunk to TTS to Reader," <i>Journalism Quarterly</i>, Vol. 31, 1954, pp. 434-446,</li> <li>- Guido H. Stempel III, "A Factor Analytic Study of Reader Interest in News," <i>Journalism Quarterly</i>, Vol. 44, 1967, pp. 326-330.</li> <li>- Philip F. Griffin, "Reader Comprehension of News Stories: A Preliminary Study," <i>Journalism Quarterly</i>, Vol. 26, 1949, pp. 389-396.</li> <li>- Sid Shrauger, "Cognitive Differentiation and the Impression-Formation Process," <i>Journal of Personality</i>, Vol. 35, 1967, PP. 402-414.</li> <li>- Angus Campbell, Philip Converse, Warren Miller, and Donald Stokes, <i>The American Voter</i>, New York, Wiley, 1960, chap. 2.</li> </ul>
<b>Conceptual aspects</b>	
<b>Discipline(s)</b>	Political
<b>Built on another theory</b>	Multiple Stream Theory
<b>Main foci of theory</b>	The main focus of agenda-setting theory is to determine how the mass media affects people with similar media exposure.
<b>Peculiarities of theory</b>	Agenda-setting is the only theory that is able to incorporate mass media studies, public opinion research and public policy analysis (Soroka, 2002, p. 5) and is divided into three categories: (1) media agenda-setting, (2) public agenda setting, and (3) policy agenda-setting (Rogers & Dearing, 1988). Three models complement agenda-setting theory: Awareness model, salience model and priorities model. The core proposition of agenda setting theory is how the public agenda is influenced by news (Carroll & McCombs, 2003, p. 36).
<b>Constraints of theory</b>	Soroka (2002) highlights Swansons (1988, p. 604) criticism that agenda-setting suffers from "inconsistency of conceptualization, method, and result, [...]" because of the integrative theory mentioned in the peculiarities of the theory. Thus, it is not always clear – depending on the author – if e.g. media agenda-setting or e.g. public agenda setting is addressed.

Tools supporting theory	During the work of this no tools supporting agenda setting theory were found. This doesn't neglect existence, but presence seems rare.
Models supporting theory	During the work of this no models supporting agenda setting theory were found. This doesn't neglect existence, but presence seems rare.
Methods emerging from theory	<ul style="list-style-type: none"> <li>- media agenda-setting</li> <li>- public agenda setting</li> <li>- policy agenda-setting</li> </ul>
Models emerging from theory	<ul style="list-style-type: none"> <li>- S. N. Soroka (2002) - Agenda-Setting Model</li> <li>- E.M. Rogers; J. W. Dearing (1988) - illustrated model of the agenda-setting process</li> </ul>
Tools and/or technologies emerging from theory	During the work of this no tools emerging from agenda setting theory were found. This doesn't neglect existence, but presence seems rare.
Best practice domains where theory is successfully applied	Political science
Examples of practical use (ref to projects / cases)	<ul style="list-style-type: none"> <li>- Brosius, Hans-Bernd &amp; Kepplinger, Hans Mathias (1990). The Agenda-Setting Function of Television News. Static and Dynamic Views. Communication Research, 17, 183-211</li> <li>- Gonzenbach, W. J. (1992). A time-series analysis of the drug issue, 1985-1990: The press, the president and public opinion. Int. Journal of Public Opinion Research, 4(2), 126-147</li> <li>- Soroka, S.N. (2002) Agenda-Setting Dynamics in Canada, Vancouver: UBC Press</li> <li>- Shultz, R. (2005) The Agenda Setting Function of Mass Media, Tampa, John Howard, Print Media and Public Opinion: How It All Came Together in Melbourne. Independent Study Project (ISP) Collection, 4-1-2005</li> </ul>
Lessons from practical use	Soroka (2002, p. 10) highlights that Brosius and Kepplinger (1990) state a direction of influence of the public agenda and the German news regarding the issue, thus the media tends to influence the public when television coverage is very high and with a slow increase on issue salience the public opinion leads to issue salience for the media. Gonzenbach (1992) also states that the media leads or can be led on issues at several occasions, thus the direction of casualty cannot be determined (Soroka, 2002, p. 10). Furthermore the interactions of media, public and policymakers are equal to issue dynamics and the rise and fall of issue salience, thus the major agendas are multi-directional (Soroka, 2002, p. 219). Understanding issue attributes and measuring agendas and relationships is key helping to provide tools and models.

Transferability of theory in other application domains or disciplinary contexts	During the work of this no sources of transferability of agenda setting in other application domains were found. This doesn't neglect existence, but presence seems rare.
Concluding recommendations for application	<p>Media has the power to shape and influence public opinion, which is very important to stress out. Policy modelling can use this effect to strengthen public opinion and gather support for policy processes. The important part of this theory is not to manipulate the majority of people but to support the policy process and achieve awareness. We found some examples of agenda setting usage but no tools are available which seems disappointing as agenda setting influences public opinions.</p> <p>With new media forms arising web 2.0 agenda-setting is even more relevant to new horizontal media forms, because of the missing time lag of new information (Berger &amp; Freeman, 2011, p. 19). Also, in a brand-controlled environment communication can serve as a link between brand and virtual brand community, thus practitioners can benefit from shaping the agendas with existing brand loyalists, encouraging them to share the brand agenda with the public (Ragas &amp; Roberts, 2009, p. 59).</p>

Aspects for comparison	Institutional Choice Theory
Metadata	
Name	Institutional Choice Theory
Developer	As institutional choice theory is not based upon one approach and has roots within different disciplines, now author or developer can be named as the founder of institutional choice theory.
Publication Date	-
Abstract	Institutional choice theory provides different perspectives of the process of the commons and theories of the commons system. The roots of the theory are built upon different perspectives and the theory itself is developed since.
Reference(s)	-
Conceptual aspects	
Discipline(s)	Organizational

Built on another theory	Frye (1997) highlights the roots of institutional choice and states that it is built upon cultural, economic and political approaches.
Main foci of theory	Theory of the commons system
Peculiarities of theory	<p>The institutional choice perspective provides important theoretical points of views on the process of the commons and the institutional change and actors choose to invest in rule changes which are based on an analysis of benefits and costs (Klooster, 2000, p. 13). Furthermore institutional choice theory has become the most coherent and influential theory for explaining the evolution and survival of the commons system (Klooster, 2000, p. 1) and institutional choice theory asks two questions (Klooster, 2000, p. 3):</p> <ul style="list-style-type: none"> <li>- What rules are necessary to express the design principles?</li> <li>- Are there any conditions where groups are likely to make rules and can follow those.</li> </ul>
Constraints of theory	<p>Progress of the theory of institutional choice is hard to make because of the different meanings of institutions (Ostrom, 2007, p. 23). As the term institution can almost mean anything, Ostrom (2007) points out that a major confusion between scholars using the term as an organizational entity and scholars who use the term to refer to rules, norms and strategies exists.</p> <p>Because of its roots, institutional choice theory – based on rational choice theory – requires contextual simplification which creates itself several limitations for understanding the change in the commons (Klooster, 2000, p. 3):</p> <ul style="list-style-type: none"> <li>- Contextual thinness. Institutional choice with regards to outside of the community of resources users minimizes or even eliminates considerations of processes and history.</li> <li>- Complexity of tenure practices. It stints on the complexity and ignores issues of environmental perception and social processes determining commons problems.</li> <li>- Consideration of community. The community is disguised as something that might be relevant with its characteristics for commons management.</li> <li>- Confrontation of problems. The relationship between individual incentives and the autonomy of individual motivations are confronted as concerned problems in the contextual community and the nature of institutions as something exceeding rules.</li> <li>- Problems related to individual choices. The institutional change related to individual choices requires attention to factional struggles and subjects of cultural change.</li> </ul>
Tools supporting theory	Institutional choice has emerged from different approaches but the other way round no methods, models and tools are known. We do not neglect that those using institutional choice exist - as other choice theories provide options like

Methods emerging from theory	Theories of Bureaucracy, Rent-Seeking or the Self-Interest Model (Hill, 1999) - but during our research none were identified. Furthermore, Elinor Ostrom provides several frameworks based on institutional choice with several software tools built upon like the MAIA-Tools <sup>5</sup> (Ghorbani, Bots, Dignum, & Dijkema, 2013).
Models emerging from theory	
Tools and/or technologies emerging from theory	
Best practice domains where theory is successfully applied	Legislative and politics in general
Examples of practical use (ref to projects / cases)	- Klooster, D. (2000). Institutional Choice, Community, and Struggle: A Case Study of Forest Co-Management in Mexico, World Development 28(1), p. 1-20.
Lessons from practical use	Klooster (2000, p. 17) suggests the need for an intermediate for explaining the change in the common property management systems. To predict the potential of theory building, groups of individuals are more likely to produce new institutions to govern their commons.
Transferability of theory in other application domains or disciplinary contexts	Visa versa institutional choice can also be used within the disciplines it is rooted from, ergo cultural, economic, political approaches.
Concluding recommendations for application	It appears that the IAD framework will continue with providing policy studies but will improve itself over the years, also (Ostrom, 2007, p. 53) and institutional choice theory itself is the most influential approach to theory building for the commons (Klooster, 2000, p. 3). As the most influential approach to influence public opinion is strange to point out, that no models and tools are available. On the other hand the need for an intermediate can also be used with policy modelling without referring to institutional choice theory. Klooster (2000) highlights the limitations of institutional choice as the same as rational choice theory. Therefore implementing rational choice with the benefits of institutional choice can help and answer the questions Klooster raised (see Peculiarities of theory of institutional choice) and support policy modelling.

<sup>5</sup> <http://maia.tudelft.nl/>

### 3. Contribution to policy modelling

The following chapter provides a general discussion about the theories listed in the tables of chapter 2 – the comparative analysis and highlights a contribution to policy modelling.

Game theory improves the understanding of economic agents' reaction to certain sets of rules and decision making in general (Holland & O'Sullivan, 2012). As stated before game theory like the dominant form of modelling is based on rational choice theory and thus the real advantage is the allowance of deduction (Conte, Hegselmann, & Terna, 1997). Game theory offers a lot of concepts built upon like the Pareto efficiency where inefficient outcomes are avoided. Pareto efficiency is an economic system concept which is used for economic efficiency and income distribution (de Givry, Kotthoff, Simonis, & O'Sullivan, 2013, p. 8). Additionally self-interested agents can use strategic decision making as an integral aspect of individual and firm decisions and improve utility and wealth. Therefore policy makers need to consider those effects during the policy process to understand the possible outcomes of policy implementations better (Holland & O'Sullivan, 2012, p. 24). Holland & O'Sullivan (2012) states that at the time of policy design game theory can offer important guidance to match the expected behaviour with the actual outcome. Despite of the variety of tools available for policy modelling - including the software of -De Mesquita - no significant progress of game theory models have been made since the first publication of Neumann-Morgenstern for capturing the interaction of two or three agents (Moss, 2001). Sniedovich (2010) states De Mesquita's game theory approach as voodoo decision theory with the results only as good as the estimate on which they are based and highlights that a theory should not contradict itself. According to Sniedovich (2010) mathematical modelling of socio-political-economic systems and processes are a very difficult task and even small-scale real-world problems with attributes, goals and variables are not easy to precisely formulate. Furthermore Alfred Marshall developed a theory to handle more agents but *tâtonnement* avoids the interaction of agents instead and trades only take place when all supplies and demands are equal. Thus, Munck (2001) highlights that the strength of game theory leading to a combination of game theory with rational choice theory. Game theory can extensively contribute to policy modelling by combination with different theories.

Agenda setting theory represents a perspective which has only been developed since 1972 and represents the media's ability to transfer attributes of new objectives – from candidates to issues (Berger & Freeman, 2011, p. 12). Unlike the television, the newspaper appears to be setting the agenda (Benton & Frazier, 1976, p. 272). Roberts et al. (2002) identifies bulletin boards as nearly as effective as newspapers. Soroka (2002, p. 18) states that duration, abstractness and dramatic events have positive effects with regards to agenda setting theory. An issue shouldn't be long because after a time people have made their mind and the public's limited attention span can be over. Abstract issues can hardly be visualized and agenda setting effects should be larger for concrete issues. Dramatic events play a significant role in issue salience and thus affect agenda setting processes. Schultz (2005) highlights how the print media of Melbourne has the power to shape and support public awareness, especially the possibility to craft public opinion due to language choice. Furthermore, Schultz stresses out the relationship of news media, politics and public sentiment. Regardless, Berger & Freeman (2011) argue the change of the media from vertical – limited access - to horizontal - unlimited access - and imply further research to define the role of online media. Furthermore social media urges and more research is necessary to identify the role of social media sharing, e.g. agenda melding (Sharp, McCombs, Weaver, & Hamm, 1999), as the audience is no longer passive and people are persuaded as a member of a group (Berger & Freeman, 2011, p. 3). During the research no tools were identified

for policy modelling but agenda setting can play a significant role in public opinion building, thus the policy process.

Institutional choice – like game theory - is built upon rational choice theory and it is relatively unproblematic to identify the origins of values for autonomous individuals but for advocates of institutional choice institutions exists including norms and values raising the question of how to understand the creation of durable institutions to avoid tragedies of the commons (Klooster, 2000, p. 17). It is possible to simulate the resources of common pool institutions with the Institutional Analysis and Development (IAD) framework by Ostrom. Furthermore (Deadman, Schlager, & Gimblett, 2000) argue that numerous parallels exist between the structure of IAD and agent-based simulations. Built upon institutional choice theory no tools are found but built upon the IAD a variety of tools like the MAIA-tools are available. We point out that an intermediate is needed to explain the change in the common property management systems as institutional choice theory is the most influential approach to theory building for the commons. Also, with low uncertainty, actors can use existing institutions to support their policy modelling (Frye, 1997, p. 546)

#### 4. Conclusion

As two of the three theories – game theory and institutional choice theory - are built upon rational choice theory the roots are not deniable. The most intensive research was identified for game theory. Game theory provides tools for policy modelling and models built upon also. But there are limits for the usage of game theory for example with more than three agents to interact. Institutional choice theory has not been researched as intensively and no clear author can be identified. Elinor Ostrom uses a similar approach with using a framework of institutional rational choice. This approach provides tools and models. Agenda setting theory is totally different theory using mass media as agenda setting process. With web 2.0 the mass media and how people get informed has changed, thus, further research is advised. Facebook Twitter and alike may have different effects than bulletin boards and newspapers per se. As pointed out in chapters of the theories, 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.

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