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Pierre Mazzega, Claire Lajaunie, Romain Boulet

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# CHAPTER 1. PUBLIC POLICIES, LAW, COMPLEXITIES AND NETWORKS

**PIERRE MAZZEGA, CLAIRE LAJAUNIE AND ROMAIN BOULET**

P. Mazzega (corresponding author)

UMR5563 GET Geosciences Environment Toulouse, CNRS / University of Toulouse, France;  
Affiliate Researcher SCERG Strathclyde Centre for Environmental Law & Governance, University of  
Strathclyde, Glasgow, Scotland

e-mail: [pierre.mazzegaciamp@get.omp.eu](mailto:pierre.mazzegaciamp@get.omp.eu)

C. Lajaunie

INSERM, CERIC, UMR DICE 7318, CNRS, Aix Marseille Univ., Univ. of Toulon, Univ. Pau & Pays  
Adour, France; Affiliate Researcher SCERG Strathclyde Centre for Environmental Law &  
Governance, University of Strathclyde, Glasgow, Scotland

e-mail: [claire.lajaunie@inserm.fr](mailto:claire.lajaunie@inserm.fr)

R. Boulet

University of Lyon, Jean Moulin, iaelyon, Magellan Research Center, Lyon, France

e-mail: [romain.boulet@univ-lyon3.fr](mailto:romain.boulet@univ-lyon3.fr)

**Abstract.** Whatever the sector - codification and management of legal norms, climate change regime, governance and multilateralism, social-ecological interactions, health, natural resource management - law and public policies form complex systems resulting from the diversity of agents, resources, norms and principles they imply, and from the multiplicity of processes and activities that contribute to the evolution of the state of affairs. The complexity is also demonstrated by the poor control that stakeholders and decision-makers have over the impacts of the instruments deployed and over the responses to their implementation. In such a context, as evidenced by the studies gathered in this volume, the methods deployed to interpret, understand or explain the law or the public policies in action multiply the types of approaches and the means solicited for their study. However, an emerging trend not only provides analytical tools, but also inspires several approaches to phenomena related to law and public policy. It consists in apprehending these phenomena in terms of various networks, supports for change, intricate exchanges, knowledge and innovation, management, but besides essential ingredients of the incessant, sometimes labile, interactions between the systemic components.

**Keywords.** Law, public policy, complex system, networks, evidence

## 1.1 INTRODUCTION

Practice considers it inoperable to use theoretical insights of the systems that it constructs and manages, without any prior assured plan, by interactions of numerous agents or actors according to changing configurations and more or less explicit consultation processes. Formally, theory finds no foundation in the way public policies and law constantly inventing and renewing their modes of action (and inaction), are implemented in practice. These are the ranges of tension that each of the chapters of this collective work undertakes to express. The emerging global vision could be conceived as an

analysis - among many other possibilities - of the policy of public policy, of the normativity of normative legal systems, but seen through concrete applications, located in many specific contexts.

The approaches to law and public policy presented here are the result of works conducted from a perspective that is often strongly interdisciplinary<sup>2</sup>, the dialogue between various scientific cultures and the mixing of methods leading to new perspectives on complex objects of study taken in their empirical reality<sup>3</sup>. They do not reduce the relevance of more traditional approaches - highlighting the links between public policy and administration (Henry, 2004), the public policy cycle (Howlett and Ramesh, 2003), the sociological approach to public action - but they preferentially exploit other concepts - such as complexity (Gilbert and Bullock, 2014), ontology (Sartor et al., 2011), networks, partial order - and implement other methods (like formal models, object-oriented analysis) and tools (social simulation, scenarios, etc.).

The following chapters are part of a field of research that is evolving very rapidly, as we see in a certain distance already taken with, for example, a reference manual published only ten years ago, which takes stock of the methodologies of political analysis (Box-Steffensmeier et al., 2008). As far as the present work can testify, this movement is explained by a shift of the centres of interests towards questions related to the increasing importance of the tangled governance dynamics (which goes beyond a cyclical vision of the life of the public policies, standards and organizations, and transgress a pyramidal organization of legal norms).

Nowadays, research on law and public policies, considered as complex systems are developing at the international level, relying strongly on modelling (see e. g. Ghose et al., 2015; Aldewereld et al., 2016) following innovative methods for concrete implementation. Among the featured areas, law as network of evolutive and interactive norms is now a prominent sphere of study<sup>4</sup>. In a similar way, public policies are now a topic on their own due to the fact that policy can no longer be examined as a linear process, but its study should encompass the complexity of networks of actors, norms and resources involved (Nguyen and Snasel, 2016; Wierzbicki et al., 2016); the interdependency of their application domain, the uncertainty or the weak predictability of their direct or indirect impacts.

This volume results from the Second research workshop on "Complexity and Public Policies" jointly organised by the IAE Lyon School of Management (Jean Moulin-Lyon 3 University), by the Center for Studies and Research of Administrative and Political Sciences (CERSA UMR7106, CNRS and University Panthéon-Assas - Paris 2) and Geosciences Environment Toulouse (GET UMR5563, CNRS and University of Toulouse). This workshop aimed at assessing how law and public policies, taken as complex systems, are studied by various scientific communities (legal scientists, politists, sociologists, mathematicians, computer scientists ...). The main themes examined concern codification, governance, climate change, norms networks, health, water management, conflicts of use, legal regimes conflicts, use of indicators or prospective scenarios.

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<sup>2</sup> If, unsurprisingly, there is no consensus on what inter-disciplinarity is, measures have been proposed for a decade or so, based on bibliometric data and network analysis. For example, Rafols and Meyer (2010) suggest combining two concepts: "disciplinary diversity indicates the large-scale breadth of the knowledge base of a publication; network coherence reflects the novelty of its knowledge integration". For examples of mapping of inter-disciplinarity in academic research, cf: <http://idr.gatech.edu/concept.php> Accessed 25 Feb 2018

<sup>3</sup> In this sense we converge on one of the conclusions put forward by Szostak et al. (2016, p.v) in their book on the organization of interdisciplinary knowledge: "A novel approach to classification, grounded in the phenomena studied rather than disciplines, would serve interdisciplinary scholarship much better. It would also prove advantageous for disciplinary scholarship."

<sup>4</sup> See the Springer books entitled " AI approaches to the complexity of legal systems" published these last years (for ex. Casanovas et al., 2010).

## 1.2 COMPLEXITY FACED BY JURISTS

This book is divided into three parts. The first part “Complexity faced by jurists” intends to illustrate the different paths taken by the jurists when it comes to deal with the complexity of law and a variety of public policies and even to cope with their unexpected effects. It suggests ways and methods to simplify and rationalise the law (Chapter 2), to understand the functioning of institutional organisations involved into the development of public policies and related rules (Chapter 3) or to allow gathering a variety of knowledge and points of view in order to improve decision-making (Chapter 4). Few articles highlight new approaches of law in relation to networks (Chapter 2, Chapter 3).

The Chapter 2 by E. Catta and A. Delliaux demonstrates how public authorities have adopted public policies in order to reduce the complexity of the law by rationalising and simplifying it. Facing a dense and always increasing network of legal norms, itself resulting from the multiplication of distinct public authorities, various public policies of law rationalisation have been adopted to codify the law. It led to the creation in 1999 of the High Commission for codification in order to simplify the law and facilitate the accessibility and the understanding of the law by the citizens in respect of the principle "ignorance of the law excuses not". Thanks to a systemic approach using computer science, and the Agil method, the purpose is to look for relevance rather than exhaustiveness and to allow a coherent codification. The reticular law, form of the modelling of law is also presented, as it offers a new dimension of legal science increasing altogether the flexibility and security of the legal system.

C. Lajaunie and P. Mazzega invite us to examine the capacity of an informal network of organizations to produce answers in response to complex tasks requiring the integration of masses of information designed as a high-level cognitive and collective activity (Chapter 3). Studying how networks dedicated to health or environment in Southeast Asia interact, produce and share information and particularly how they integrate international law in relation to health and the environment at the regional level, through the definition of public policies and rules). Thus, they evaluate the ability to integrate information within a network of networks of organizations by assessing effective (e. g. through the composition of governing boards, the institutionalised partnerships) or potential governance (partial recoveries of roles, missions, or training offers) of themes offered by a group of organizations. For that purpose, they present a method inspired by the Information Integration Theory issued from the modelling of consciousness. They use the analogy between artificial consciousness and a potential organizational consciousness to determine if some network configurations are more favourable than others to accomplish specific tasks.

The Chapter 4 by C. Sibertin-Blanc, O. Théron, C. Monteil et P. Mazzega presents a conceptual framework for integrated agent-based modeling and simulation of SESs in the form of a formal “entity-process meta-model”. The MAELIA project developed an agent-based simulation platform to study environmental, economic and social impacts of scenarios of water and land use and water management in combination with climate change. The platform is dedicated to support decision-making processes of organizations involved in managing water scarcity in the Adour-Garonne basin (south-western France). The purpose of such a framework is to allow building an integrated representation of a system of reference that is agreed upon, and thus well-understood, by everyone on a project involving people with a variety of theoretical or empirical knowledge, viewpoints, concerns and duties. It also considers stakes in project outcomes. The complexity is dealt thanks to the model modularity allowing taking into account different dynamics into the various components of the meta-model and to present them to the decision-makers and the variety of stakeholders involved into water and land use and water management.

### 1.3 COMPLEXITY IN ACTION AND POLICY ANALYSIS

The second part of the book “Complexity in action and policy analysis” is focusing on different field situations mainly in relation with health and water management and draw lessons from field study to improve policy analysis. It shows the necessity of interdisciplinary settings and of the consideration of the different dynamics at play for a better policy response.

In Chapter 5, B. Van Bavel, F. Larkan, J.E. Nally and A. Pruwati present a field study based on 275 household surveys in pilot sites located in three different Regencies of East Java, Indonesia. The sites have been chosen because they had the highest rate of reported cases of leptospirosis within the Province. This study intends to identify environmental and social risk determinants of cases of leptospirosis, a zoonosis of public health importance in Southeast Asia where most countries are endemic for leptospirosis. It highlights two new key factors attributable to changes in the distribution of leptospirosis. In addition to socio-economic and sanitation deprivation, the study insists on the lack of integrated surveillance and mandated notification system. This research reinforces the success of local and adaptive surveillance initiatives and calls for wider integration of efforts and resources across communities, institutions, and sectors. The results of this study can be used to communicate associated impacts of poor domestic environments and demand for healthier circumstances in such deprived communities. Interdisciplinary dialogue is recommended to inform leptospirosis research, strengthen surveillance, and affect public health action.

In the Chapter 6, C. Lajaunie, S. Morand and P. Mazzega are showing, thanks to insights gained from research projects in the area, the necessity to develop process-based scenarios of future health in Southeast Asia. Indeed, the results underlined that biodiversity changes, notably land use changes at regional to local scales are factors of health risks and of emergence of zoonotic diseases. It also confirmed the importance of the spatio-temporal dynamics of the land use land cover in determining the diversity of wildlife and their parasites (using network analyses), with implications for human risk of zoonotic diseases. It appeared necessary to understand the various dynamics at stake and to develop scenarios of future health that are embedded in the socio-ecosystems and integrating the effects of policies and law as factors of change. The purpose is to develop indicators for decision-makers from local to regional (ASEAN) level, along with their uncertainty and caveats about the limitations of their use, including ethical, and prospective proposals of strategic directions for evidence-based policies linked with the possible mitigation of outbreaks and spread of infectious diseases in the ASEAN economic corridor.

In order to determine and detail the complex activities of monitoring, surveillance and warning of the French Institute for Public Health Surveillance (InVS, French Public Health Agency), R. De Gainza and C. Romana design an architectural pattern for a surveillance and early warning system based on the description contained in three InVS reports (2005, 2006 and 2011) as requirements for a Public Health Surveillance and Early Warning System. The conceptual framework of this modelling work implies studying risk exposure situation to environmental health threats of human, animal or vegetal populations and responsibilities of the system in charge of monitoring, reporting and warning in case of unacceptable risks. Based on examples of three environmental health threats, the architectural pattern proposed is a meta-model that can be applied to any case of environmental health threat. The architectural pattern presented in Chapter 7 aims to enable seamless information sharing between institutional actors in charge of surveillance and early warning. It also acts as an interface between expert’s knowledge and operational tasks. The application of this tool to forecast, develop and manage health surveillance and early warning systems could deliver better information and resource sharing, more precise characterization of surveillance and early warning target exposure situations and clearer management options when forecasting risks.

Chapter 8 presented by P. Mazzega, D. Le Queau, C. Sibertin-Blanc and D. Sant'Ana advocates for the need for an explicit and assumed strengthening of the coordination of water stakeholders at all levels of governance in order to reach the expectations of a comprehensive policy in the field of water management and development. For this purpose they propose to develop interdisciplinary and intersectoral collaboration using new hybrid modelling approaches (coupling multi-agent system, geographic information system, equation models, cellular automata, etc.), allows to precisely simulate the scenarios of evolution of water resource management and development, to assess ex ante their social, economic and environmental impacts and to anticipate the contribution of an increased coordination of water stakeholders in a logic of development-friendly actions.

C. Sibertin-Blanc comes back to the dramatic event which led to the death of an opponent to the construction of a dam in Sivens, Tarn (France) insisting on the fact that the violence of the means deployed for the realization of this work and the determination of the opponents presaged the possibility of such a drama whose circumstances are woven by the play of all the actors of this project. Using a formal analytical grid based on the sociology of organized action and on the basis of interviews with actors and the important documentation available, this Chapter 9 proposes an analysis of actors' conflict through model and simulations of this actors' game. This model highlights the over-determined character of the conflict. As such, it could be used, in the case of the realization of a public equipment, in the determination of strategies leading to an acceptable compromise by the actors.

## **1.4 COMPLEXITY AND NETWORKS**

The third part of the book is considering complexity and networks through different perspectives. One chapter invite to use the web of law to exploit new relevant sources of law on the internet (Chapter 10) while another one uses the hypergraph theory in order to show the level of connectivity between the environmental and trade regimes using the modelling of ratification of United Nations multilateral treaties (Chapter 11). The partial order set theory allows the comparison between national sets of indicators of environment and development the analysis, notably for countries with economies having a strong impact on climate change (Chapter 12) while Chapter 13 relies on network theory to study how scholars approach the law as a matter of information.

In Chapter 10, R. Winkels presents a project developing a platform that enables users to find legal information more easily, organize it the way they want and share it with others. The OpenLaws platform is an open source and open data platform designed and operated by legal communities and IT communities. It focuses first on legal professionals, but it is open to anyone. Its goal is to enable users to find legal information more easily, organise it the way they want and share it with others. The project is to create the web of law if it is not available in machine readable form, or extend it use. It uses network analysis of both legislation and case law to recommend potentially interesting new sources of law. The chapter presents results of experiments using analysis of the network of references or citations to suggest new documents. The aim is to allow automatic suggestions based on analysis of existing data and in the future, it could also be based on user-generated data.

Thanks to hypergraph modelling, R. Boulet, A.F. Barros-Plataiu and P. Mazzega compare and analyse (Chapter 11) the trend of ratifications of Multilateral Environmental Agreements (MEAs) and United Nations -based trade agreements. Indeed, the hypergraph-based analysis of the temporal successions of ratifications allows highlighting informal and emerging communities of countries that tends to ratify these types of agreements in the same period of time. The chapter gives insights about the interest to use hypergraph analysis in a legal context. The comparison of the dynamics of ratifications of two regimes - environment and trade - within the United Nations framework shows that they follow parallel evolution, in spite of the strengthening of their intertwining since the 1990s, notably from an

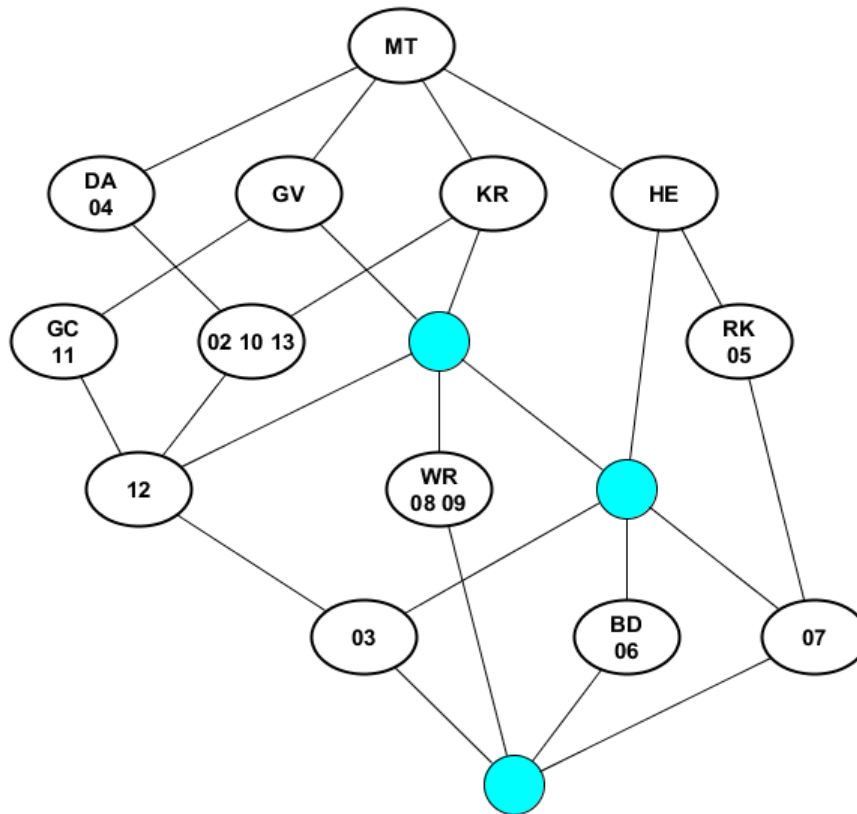
institutional point of view. The UN has a central role in the environmental agenda while for the trade agenda, on the contrary, the role of the United Nations is becoming less and less important, and the multilateral summits had a very limited impact.

Another type of comparison, using the partial order set theory, is presented by P. Mazzega, C. Lajaunie, J. Leblet, A. F. Barros-Platiau and C. Chansardon. Chapter 12 analyses the relative positions (partial order) of a set of countries with consideration for environmental and development indicators. Using data from 2013 on three integrative environmental indicators and two development indicators (human development index and GDP per capita), the analysis mainly covers the countries with economies having a strong impact on climate change - China, the USA, the European Union (member States), India, Russian Federation, Japan, Brazil, Canada, and Mexico. Global findings show that there are two groups of states, the EU and the BRICS, that matter in global environmental politics and related issues, like energy, climate change, health and ocean governance. The analysis of indicators tends to trigger the introduction of new measures to improve a particular situation in a specific field. As such the composition of a variety of indicators followed by the analysis of the comparability of countries can be useful in making international or national decision, or even for the involvement of a growing number of state or non-state actors in solving societal or environmental issues.

Finally, U. Pagallo concentrates on network theory and the law and focuses on the analysis of the law conceived as a set of rules or instructions for the determination of other informational objects, or in other terms, legal information for reality and distinguishes distinguishing three different levels of analysis on legal information “as” reality, “about” reality, and “for” reality. It stresses that network theory can be fruitful either as a support for the deliberation and decisions made by legislators and policy makers, or as a support for scholars and experts about what should be deemed as legally relevant.

## **1.5 A RETICULAR VISION OF THE VOLUME**

On another scale, a reticular vision of the book gives a taste of its content. The choice of keywords has not been guided by any particular principle, has not followed any guideline. Thus, each group of authors is likely to use identical words but whose connotations, or the network of neighbouring concepts is not identical and depends on the culture and sensitivity of each one. Conversely, different names can refer to the same notion, and the same idea can be expressed in numerous and various ways. These observations affect any use of a natural language, as is the case in the description of public policies or regulations, although in the latter case, especially, certain concepts are included in a definition of a normative nature. Thus, the content of this book can be both synthesized and mapped by first gathering the keywords under main topics - in this case conceived as classes of concepts or lists of expressions (the "bags of words" in text mining) here chosen by the editors - then representing how these topics are distributed between the chapters of the book and reciprocally how the chapters cover the topics. This double organization is shown in Figure 1.1 as a Galois lattice, a mathematical structure that is widely used in knowledge representation (Ganter and Wille, 1999; Codocedo and Napoli, 2015).



**Fig. 1.1** Lattice of the main topics (letter labels) and chapters (number as labels) of this book. Topics' labels are as follow: GV= governance, MT= method, GC= global change, HE= health, DA= data analysis, KR= knowledge resource, RK= risk, WR= water resource, BD= biological diversity (see text). Each chapter (identified by its number) addresses the topics with which it is attached by an ascending path. Each theme is addressed by all the chapters with which it is bound by a descending path of the lattice

Apart from its use for reading the book, we present the construction of this lattice because it illustrates some of the key difficulties that arise in the analysis of public policy and law, the provision of methods of knowledge representation, the flexibility of natural language and the need to explain the categories and concepts used (even if other choices can be made). We propose to bring together the topics under two meta-classes: the first, whose label could be "knowledge-oriented keywords" includes the classes "data analysis", "methodology", "governance" and "risk"; the second with the label "resource (and goods) -oriented keywords" includes "global change", "water", "biological diversity", "health" and "knowledge".

Of course, each article produces knowledge on public policies or on the legal norms analyzed, but here "knowledge" is considered as a resource, a component of the studied systems, with specific characteristics (legal complexity, collective consciousness) and requiring specific methods of management (science- policy dialogue, monitoring or warning systems, data management, actors' games, case law, legal order). Under the term "methodology" we group codification, dematerialization of the law, networks (and graphs) analysis, ontologies, constructions of models, scenarios, questionnaires, object-oriented analysis, social simulation, natural language processing or machine learning. We proceeded in the same way for the other classes of key words or expressions. Reading the chapters which follow should assure the reader of the consistency of this categorization.



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