

# **Studies in Fuzziness and Soft Computing**

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Ali Guidara

# Policy Decision Modeling with Fuzzy Logic

Theoretical and Computational Aspects

With a Case Study: Cuban Missile Crisis

Ali Guidara  
Paris, France

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*To my three loves,  
Odile, Sophian, Amin.*

# Preface

This book aims to explore the sub-systemic environment of the decision process in public policy with an approach that constitutes the crossroads of several fields, namely policy decision analysis, complex systems, modeling and simulation, as well as fuzzy logic, an artificial intelligence method.

This multidisciplinary approach is at the core of this research project and constitutes a major methodological innovation in public policy studies.

Classical analytical approaches in public policy are limited to the systemic decision-making level. This is due to the absence of adequate tools, even though the sub-systemic level is fundamental to the decision process. This micro-level environment is influenced by several factors and dynamics that make it a complex system, which requires appropriate methodologies such as modeling and simulation.

Modeling is a conceptual representation of a system which involves identifying the components that constitute the system and their dynamics. Simulation requires an appropriate method and an adequate computing platform. However, to model the sub-systemic environment of the policy decision process, a consistent link between this complex system and the field public policy must be established to bridge the two areas and to validate the approach.

This research consists of the development of a new tool to model and simulate the sub-systemic environment of the policy decision process as a complex system. This tool constitutes an innovation based on several theories and techniques. Furthermore, it proposes to enrich the fields of public policy and decision modeling and simulation with the integration of different, yet complementary fields.

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# Synopsis

The topic of public policy decision-making has received considerable attention by scholars which in turn produced several analytical approaches to explain decisionmakers' choices. However, these approaches are limited to the systemic decision-making level.

The purpose of this book is to introduce the policy decision emergence and the dynamics that drive this emergence at the sub systemic level of the decision process. This level constitutes the breeding ground of the emergence of policy decisions but remains unexplored due to the absence of adequate tools.

The sub systemic environment is a nonlinear complex system made of several entities that interact dynamically. The behavior of such a system cannot be predicted or calculated with linear and deterministic methods but needs modeling and simulation to understand and forecast their dynamical evolution.

Simulation requires the development of a model that represents the system. Additionally, to be representative of the policy decision emergence, the requested model must be based on policy decision-making theories.

A tool of complexity, the Stacey Matrix adapted to the public policy field, inspires a link between complexity and public policy through the multiple streams theory. This approach makes it possible to develop a conceptual model made of variables and factors that represents the sub systemic environment of the policy decision process.

An examination of the conceptual model shows that its components are described by vague and uncertain notions that depend on human reasoning. Therefore, it requires an appropriate artificial intelligence method like fuzzy logic to build the computational model of the policy decision emergence and perform the simulation.

The computational model is a multi-level fuzzy inference system that constitutes the policy decision emergence simulation model (PODESIM) developed in this book. PODESIM is an experimental decision diagnostic tool that allows identifying the sub systemic levers of decision emergence using fuzzy data and decision heuristics. It represents an innovation in computational decision-making and a major advancement in the field of public policy.

The multidisciplinary approach developed in this book constitutes the crossroads of several fields, namely decision analysis, complex systems, modeling and simulation, as well as artificial intelligence. It paves the way for policy decision emergence modeling and simulation by bridging complex systems theory, multiple streams theory, and fuzzy logic theory.



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