

# System Dynamics

Master's Programme



System Dynamics Group

# System Dynamics

## A SCIENCE FOR OUR TIME

In a world of increasingly complex problems where everything is connected to everything, systems thinking is seen as a necessary **21<sup>st</sup>-century skill** to deepen understanding of the interconnections between system components and how they interact to affect the system's functioning.

System dynamics is a highly versatile **simulation modelling methodology** used to investigate complex problems in a wide variety of domains, including social-ecological-technological systems, business and economics, public health, psychology and sociology, and many more. System dynamics can be applied in any complex system abound with circular feedback relationships and nonlinearities.

Through computer modelling and dynamic simulations, system dynamics helps us understand how observed problem behaviours emerge from within the internal feedback structure of complex systems. Importantly, it allows us to **design and test effective policies** to control and manage these problems, thus improving the system's performance.

Some research questions in system dynamics include:

- How does the depletion of common pool resources (e.g., fish, groundwater, forest, clean air) occur and how can we prevent it?
- How do business cycles in a national economy emerge and how can we dampen them?
- Why do some social systems exhibit political instability and what policies can contribute to their stabilisation?
- What are the drivers of an epidemic, from viral characteristics to human behaviour, and how can we restrain them?



**Facilitated systems modelling with small-scale farmers in Central Region, Zambia by researchers from the System Dynamics Group**

# Modelling Careers

## IN SYSTEM DYNAMICS

Demand for system dynamics modelling has been increasing rapidly, due to the increased complexity of social, ecological, and technical challenges we face today. System dynamicists are hired by consulting firms, research institutions, governmental and non-governmental organisations – or any organization that prioritises predictive analytics and dynamic problem-solving capacity. Prestigious companies such as Boeing and DNV have in-house system dynamics modelers, working on important contemporary issues like the global energy transition.



### **TONE WISNES**

Advisor in Statistics and Analysis at the Department of Climate, Environment and Urban Development, Bergen Kommune

*The System Dynamics program has given me valuable insights into archetypical dynamic challenges that may emerge independent of domain. The training in systems thinking has left me with a broader perspective on how systems interact and with a larger skillset in problem solving.*



### **EMIL ZAHARIA-KÉZDI**

Data Systems Analyst at Millenium Institute

*System dynamics has served me as a solid starting point to approach topics in a transdisciplinary way.*



### **PEI SHAN LOO**

System Dynamics Modeler at Swiss Tropical and Public Health Institute

*System dynamics modelling enables me to gain strong technical skills that benefit me in various ways, especially science communication in changing people's perspectives.*



### **AMANDA KARAPICI**

Researcher at the Alliance for Policy and Systems Research, World Health Organization

*Out of over 1300 candidates who applied for the position at WHO, I believe my system dynamics training was an influential factor in my success.*



### **MAHLA RASHIDIAN**

Researcher at NIVA (Norwegian Institute for Water Research)

*One of my sources of inspiration for entering this field is a quote from Donella Meadows: "The world is a complex, interconnected, finite, ecological - social - psychological - economic system. We treat it as if it were not, as if it were divisible, separable, simple, and infinite. Our persistent, intractable global problems arise directly from this mismatch."*



### **EDUARD ROMANENKO**

Senior Researcher/Modeler at the Energy Transition Outlook Team, DNV

*I have been using SD full-time for all my jobs after finishing my studies with UiB, and no wonder why... there is an apparent need for rigorous, quantitative yet transparent and accessible tools for bringing various pieces into one coherent system architecture. SD is a perfect candidate to fulfill such a role.*



### **KATHELIJNE BAX**

Junior System Dynamicist at TNO (Netherlands Organisation for Applied Scientific Research)

*The program gave me a deep understanding about how to use system dynamics as a tool, and at the same time it enabled me to explore many different domains.*

# Master's Programme

## IN SYSTEM DYNAMICS

As the European hub for system dynamics, the System Dynamics Group in Bergen offers a two-year interdisciplinary master's programme – one of its kind in Europe. The programme is taught in English and results in a **Master of Philosophy (M.Phil) in System Dynamics**.

### Semester 1: Foundations

- [GEO-SD302](#) Fundamentals of Dynamic Social Systems
- [GEO-SD303](#) Model-based Analysis and Policy Design
- [GEO-SD304](#) System Dynamics Modelling Process

### Semester 2: Applications \*

- [GEO-SD308](#) Policy Design and Implementation
- [GEO-SD321](#) Model-based Socioeconomic Planning
- [GEO-SD325](#) Client Based Modelling

### Semester 3: Specialisation §

- [GEO-SD309](#) Model Based Interactive Learning Environments
- [GEO-SD310](#) Writing course and project description
- [GEO-SD330](#) Natural Resource Management

### Semester 4: Independent Modelling

- [GEO-SD351](#) Master's Thesis in System Dynamics

Students have the opportunity to go on **Erasmus semester exchange** to:

- \* New University of Lisbon (Portugal) or University of Palermo (Italy)
- § Radboud University (Netherlands)

Both international and national students are welcome to apply:

- [Citizens from outside the European Union/EEA/EFTA](#) (1 December)
- [Citizens from within the European Union/EEA/EFTA](#) (1 March)
- [Nordic citizens and applicants residing in Norway](#) (15 April)

# Application Areas

## RECENT PROJECTS

### Climate change adaptation strategies

- Transparent Assessments for Real People (WorldTrans)
- Coastal Ocean Assessment for Sustainability and Transformation (COAST Card)
- Towards collaborative local decarbonization (GREEN HEAT)

### Common pool resource management and control

- Seabed mining and management of marine ecosystems: Shaping European Research Leaders for Marine Sustainability (SEAS)
- Transboundary groundwater resilience research

### Public health policy analysis

- Confronting Obesity: Co-creating policy with youth (CO-CREATE); [Paper](#); [Model Interface](#)
- Forebygging av kreft via skolen (FRESKO)

### Socioeconomic and Socioecological development and justice

- Developing synergies between the bioeconomy and regional food systems for a sustainable future (SYNARGI)
- Towards sustainable and resilient EU farming systems (SURE-Farm); [Paper](#); [Model Interface](#)
- Human development drivers of Sub-Saharan Africa's Coexistence Landscapes (ACL); [Model Interface](#)

# System Dynamics Group

The System Dynamics Group is an autonomous research group specialising in system dynamics modelling. We are housed under the Department of Geography at the Faculty of Social Sciences.

## Contact Us

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## Student Activities

MINDS (Mentoring in New Dimensions): [sdminds.contactin.bio](http://sdminds.contactin.bio)

