Syllabus

Course Description

Course Title	Network thinking and agent-based modeling
Course Code	27508
Course Title Additional	
Scientific-Disciplinary Sector	ECON-07/A
Language	English
Degree Course	Master in Data Analytics for Economics and Management
Other Degree Courses (Loaned)	
Lecturers	Prof. Roberto Gabriele, Roberto.Gabriele@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/48130
Teaching Assistant	
Semester	Second semester
Course Year/s	1
CP	6
Teaching Hours	36
Lab Hours	-
Individual Study Hours	-
Planned Office Hours	18
Contents Summary	Network thinking and agent-based modeling (ABM) are ways to conceptualize complexity in the phenomena we observe. The main objective is to approach phenomena with a complexity lens and understand how current behaviors and patterns emerge using network models and agent-based models. In this regard, network and agent-based models provide the logic to tackle the complexity of adaptive systems, in the context of business (e.g. innovation and entrepreneurship). The course covers the following topics: Introduction to systems and complexity. Introduction to networks. Introduction to agent-based modeling. Modeling Diffusion dynamics. Application of complexity on timely topics such as

	sustainability.
Course Topics	• Introduction to systems and complexity • Introduction to network analysis • Introduction to agent-based modeling • Complex systems and economics, and management • Modeling Diffusion dynamics • Applications of complexity on timely topics
Keywords	ABM models, complexity, network analysis.
Recommended Prerequisites	Not foreseen
Propaedeutic Courses	
Teaching Format	Frontal lectures, combined with laboratory sessions in which students develop and implement models. Classroom presentations by students on their individual projects.
Mandatory Attendance	Recommended, but not required.
Specific Educational Objectives and Learning Outcomes	Intended Learning Outcomes (ILO) ILO 1 Knowledge and understanding: ILO 1.1 Students will develop specialised knowledge within the economic and business domains, tailored to their areas of interest and essential for addressing decision-making and managerial challenges in both public and private organisations. This learning outcome emphasises an interdisciplinary approach to problem-solving and organisational analysis. ILO 1.2 Within the Business Analytics track, students will acquire knowledge of tools and methodologies essential for analysing and interpreting corporate and organisational data. This includes understanding business performance measurement, business models and their evolution, decision-support techniques, and performance measurement systems aligned with digitalisation and sustainability processes. Furthermore, students will develop competencies in managing marketing processes, with particular emphasis on digital and interactive marketing, and assessing the impact of digitalisation on marketing activities. ILO 2 Applying knowledge and understanding:

	ILO 2.1 Students will demonstrate the ability to analyse business-related issues that underpin data-driven decision support by applying statistical models and computational modelling techniques. This outcome focuses on integrating quantitative methods to evaluate and optimise organisational decision-making processes. ILO 2.2 Students will demonstrate the ability to utilise and apply models designed for market analysis and for the formulation of economic policies. This outcome emphasises the integration of theoretical and empirical approaches to support evidence-based policy development and strategic decision-making. ILO 3 Making judgements: ILO 3.1 The student acquires the ability to apply acquired knowledge to interpret data in order to make directional and operational decisions in a business context. ILO 3.2 The student acquires the ability to apply acquired knowledge to support processes related to production, management and risk promotion activities and investment choices through the organisation, analysis and interpretation of complex databases. ILO4 Communication skills: ILO 4.1 The student acquires the ability to communicate effectively in oral and written form the specialised content of the individual disciplines, using different registers, depending on the recipients and the communicative and didactic purposes, and to evaluate the formative effects of his/her communication. ILO 5 Learning skills: ILO 5.1 The student acquires knowledge of scientific research tools. He/she will also be able to make autonomous use of information technology to carry out bibliographic research and investigations both for his/her own training and for further education. Furthermore, through the curricular teaching and the activities related to the preparation of the final thesis, she will be able to acquire the ability - to identify thematic connections and to establish relationships between methods of analysis and application contexts;

	- to frame a new problem in a systematic manner and to implement appropriate analysis solutions; - to formulate general statistical-econometric models from the phenomena studied.
Specific Educational Objectives and Learning Outcomes (additional info.)	No additional educational objectives.
Assessment	There are no differences between attending and non-attending students. The assessments consist of a project work and a final written exam. Assessment 1: The final written exam will contain conceptual questions related to theoretical topics and/or brief applications of the studied methods (ILOs 1.1-1.2, 5.1). Assessment 2: The project work can be organized in groups. A project topic will be assigned to the students, and the results of the project will be discussed during a final presentation (ILOs 2.1-2.2, 3.1, 3.2, 4.1).
Evaluation Criteria	Project work, including final presentation: 50% Final exam 50% Assessment criteria: clarity of the project work and presentation, correct application of the modeling framework and simulation approach, showing critical views on the topic of the project work, and sound argumentations.
Required Readings	· *Wilensky, U., Rand W. (2015). An Introduction to Agent-Based Modeling: Modeling Natural, Social, and Engineered Complex Systems with Netlogo. The MIT Press.* · *Holland, J.H., 2014. Complexity: A very short introduction. Oxford.* · *Mitchell, M., 2009. Complexity: A guided tour. Oxford university press.* *Other reading materials will be provided during the course.*
Supplementary Readings	*Arthur, W.B., 2021. Foundations of complexity economics. Nature Reviews Physics, 3(2), pp.136-145.* • *Newman, M., 2018. Networks. Oxford university press.*

	• *Garcia, R., 2005. Uses of agent-based modeling in innovation/new product development research. Journal of Product Innovation Management, 22(5), pp.380-398.* • *Arthur, W.B., 1999. Complexity and the economy. science, 284(5411), pp.107-109.* • *Rogers, E.M., 2010. Diffusion of innovations. Simon and Schuster.* • *Schelling, T.C., 1969. Models of segregation. The American Economic Review, 59(2), pp.488-493.*
Further Information	No additional information.
Sustainable Development Goals (SDGs)	Good health and well-being, Quality education, Decent work and economic growth, Affordable and clean energy, Gender equality