Glossary

**ABSM (or ABM or ABCM):** Acronym for Agent-Based Simulation Modelling, a relational methodology enabled by object-languages, able to simulate many kinds of complex social (and natural) phenomena. It can take into account also recursive interactions of multiple types, agents’ autonomous behaviors, emergent and “immem- dent” effects.

**ANN:** Acronym for Artificial Neural Networks, a relational methodology based on a network of inputs, latent, and outputs nodes, governed by threshold and feedback effects.

**Absorptive Capacity:** Organizational capacity to access and utilize some form of external knowledge. It could be referred also to an inter-organizational network or a local system.

**Adjacency Matrix:** NxN square matrix representing a network of size N (number of nodes). Elements in the matrix cells reflect the presence/absence of a relation (or its intensity in case of valued networks).

**Affiliation Network (2-Mode Network, Bipartite Graph):** Network defined by two sets of nodes commonly named “events” and “attendants”. Links can exist only between nodes of different sets.

**Assortativity:** The degree at which highly connected nodes link to other highly connected nodes, and lowly connected to other lowly connected nodes.

**Attractor:** It is a system (or network) state in which a system gives the same output or a network keeps its elements into the same active or inactive state. An attractor can be cyclic, when it is composed by more than one state.

**Boolean Network:** A network whose dynamics is governed by Boolean functions, until an attractor is reached. It is one of the two ways in which the NK simulation modelling is articulated (see Glossary).

**Clique:** Prototypical network structure consisting of a subset of nodes of a graph. A clique is defined by the attribute of “completeness”, that is, every two distinct vertices must be connected by a link. Cliques in directed networks can be strong (each couple of nodes has to be connected by a reciprocal tie) or weak (ignoring reciprocity).

**Configurations:** Usually they refer to some specific topology, but in ERGM (see Glossary) they refer to the elementary structures on which a specific model is built. In the biological literature they are usually called “motifs”.

**Constructivism:** An epistemological approach according to which while observing-describing reality it is unavoidable intervening on reality, a property that would prevent to access its deep characteristics and would make subjective and scarcely trustful its representation. Constructivism juxtaposes to various forms of realism and representationism (above all, positivism).
Core-Periphery: A network property characterized by the existence of a (supposedly small) set of highly connected nodes and a large set of lowly connected nodes.

Dyad: Couple of nodes which can be connected by an edge or can be unconnected.

Edge, Tie, Arc, Link: Synonyms to express a connection linking a couple of nodes. Edges can be directed or undirected, binary or unvalued, depending on the nature of the network. The use of a term respect to another depends on the approach to network study: “arc” is used in graph theory; purely statistical approaches prefer the terms “edge” and “tie”; “link” is frequently used in complexity-related perspectives.

Ergm: Acronym for Exponential Random Graph Model, which is a family of methods to understand network formation.

EURJVS (European Union-Subsidized Research Joint Ventures): Consortia of organizations which: i) are dedicated to R&D in specific and pre-agreed topics; ii) are partially subsidized by the European Union FPs; iii) last for a precise time span.

Fitness Landscape: A network of points with different fitness values, connected by variations of one or more elements of a string. It is one of the two ways in which the NK simulation modelling is articulated (see Glossary).

FPs (Framework Programmes For Research And Technology Development): EU Funding schemes created to promote, support, and foster R&D between public and private actors in the European Research Area. Specific issues, topics and type of actions vary between funding periods. EURJVs are one of the type of actions included in the FPs. Current FP (2014-2020) has assumed the name “Horizon 2020”.

Geodesic: A distance measure corresponding to the shortest path between a couple of nodes. It is calculated by counting the number of ties which define the path; if there is no path between the couple of nodes, the geodesic can be defined as infinite.

Hamming Distance: It is a measure of the heterogeneity of two binary strings, and it counts the number of bits that, being in the same position, have a different value.

Hierarchy: A network characterized by a certain degree of (direct and indirect) asymmetry among its dyads or by a high degree of direct centrality among its nodes. The archetype of hierarchy is a perfect out-tree (see Glossary) whose links represent decisions.

Industrial Clusters: Geographically delimited areas where firms and other kinds of organizations are densely interconnected and specialized on one or few (generally interrelated) industries.

Inter-Organizational Networks: Networks (multiplex) whose nodes are constituted by organizations.

KIDS: Acronym for “Keep It Descriptive, Stupid”, which addresses to an approach to ABSM (agent-based simulation modeling) centered on the idea that a model should be descriptive, that is, as most realistic as possible. This choice would substantially enlarge model’s predictive capacity. It is opposed to KISS principle (see Glossary).

KIERS: Acronym for “Keep It Enough Realistic, Stupid”, which addresses to an approach to ABSM (agent-based simulation modeling) stressing the crucial choice of the appropriate level of abstraction, and the choice of pertinence, that is, of selecting the facts, events, variables really influencing a given set of issues. It is alternative to the KISS and KIDS principles (see Glossary).
**KISS:** Acronym for “Keep It Simple, Stupid”, which addresses to an approach to ABM (agent-based simulation modeling) centered on the idea that a model should be as simplest as possible, that is, as abstract as possible, so to be also as most generalizable as possible. Besides the gains in generalizability, there are also those in design, experimenting, and interpreting results. It is opposed to the KIDS principle (see in Glossary).

**Knowledge Networks:** Various types of socio-economic networks whose nodes exchange some form of information or knowledge. R&D collaboration networks among individuals or organizations, like EURJVs (see Glossary) are examples of knowledge networks.

**Multiplex:** Network defined by one set of nodes and two or more sets of links. Links of different sets represent qualitatively different relations connecting the nodes. Each type of link generates a potentially different topology.

**Nash Equilibrium:** A decisional situation in which no decision maker has advantage to change his decision, given the rational decision assigned to the other decision makers. Defined within non-co-operative game theory, it suffers of all its restrictions.

**Neighbor:** A node which is connected to the focal node by a link. The set of a node’s neighbors is called “neighborhood”.

**Network Trajectory:** The states through which a network passes during its dynamics from an initial state to its attractor.

**NK Simulation Modeling:** A way to model network dynamics based on Boolean functions. The main proponent and pioneer of this methodology has been Stuart Kauffman. The conceptualization of complexity as an intermediate stage between an ordered and a chaotic regime, and the studying of the circumstances under which it occurs are some of the main suggestions of this methodology.

**Node’s Attribute:** Variable defining a non-relational (individual) attribute of a node. It can be used: i) to select a sub-network; ii) to interpret outputs of the application of relational techniques; iii) to investigate the influence of individual factors on relational factors and vice versa.

**Ontology:** In the philosophical tradition it addresses to the problem of understanding what is “real” and what is not, and if it is possible to distinguish different degrees of “realism”. A typical issue concerns whether mathematical objects, like numbers or geometrical objects, are real or not, and eventually what is its degree of realism respect to other objects, like tables, horses, etc. A more prosaic and popular usage of this word addresses to claim some specificity of a certain category of objects.

**Out-Tree:** A network characterized by maximum connectivity, efficiency, least-upper boundedness, and (direct and indirect) dyadic asymmetry between its nodes. It is the archetype of hierarchy.

**Path:** A sequence of edges which connects a sequence of nodes. In general, nodes can appear only once in the sequence (distinguishing paths from “walks”). Paths can be undirected or directed – depending on the nature of the network – and, in the case of directed networks, strong (considering the direction of the edges in the sequence) or weak (not considering the direction of the edges).

**Pragmatism:** An epistemological perspective according to which knowledge can be useful even if its foundations are not precise and complete. It juxtaposes to various forms of realism, to representationism, and any form of foundationalism. It is rather consistent and overlapped with constructivism (see Glossary).
**Recursiveness:** It is a fundamental property of complex dynamic networks: it means that interactions (or network flows) follow a cycle, which is repeated with (often nonlinear) feedback effects.

**SAOM:** Acronym for Stochastic Actor-Oriented Models, a category of network analysis methods able to estimate network dynamics.

**Scale-Free (or Power-Law) Network:** Network topology whose most relevant characteristic is the nodes’ degree distribution which decays as a power-law: the probability of finding a node with degree $x$ is expressed by the function $P(x) = x^{-\alpha}$ with $\alpha$ ranging between 2 and 4.

**Small-World Network:** Network topology whose most relevant characteristics are short average distances and high global clustering.

**Star:** Prototypical network structure consisting of a subset of nodes of a graph. The star is defined by a central node – which is connected to all the other nodes – and the remaining N-1 nodes, which are only connected to the central node.

**Sub-Network:** A sub-sample of a network. It is composed by a set of nodes which are selected according to theoretical and/or pragmatic criteria and the set of links connecting them.

**Unvalued (or Binary or Dichotomous) Network:** Network whose links are expressed in binary form (1/0) representing the presence/absence of the relation.

**Valued Network Or Weighted Network:** Network whose links are expressed by discrete or continuous quantities representing the intensity of the relations.