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Towards of Quantitative Model of Stacked Actor-Network Dynamics

Peter Kopanov, Faculty of Mathematics and Informatics, University of Plovdiv, Plovdiv, Bulgaria
Ivan Tchalakov, Faculty of Philosophy and History, University of Plovdiv, Plovdiv, Bulgaria

ABSTRACT

This article further develops the stacked actor-networks (SAN) approach in modelling socio-economic and cultural dynamics. Following the Lee and Schiesser application of differential equation analysis in biological and social sciences, the authors used a basic SAN model. This model is composed of three subnetworks where each two subnetworks dominate over the third one to build a quantitative description that identifies three stable states in the dynamics of their interactions – cyclical development, linear, and exponential growth. Describing the latter, the notion of 'technology growth' is introduced that bears on the pattern of hyper-fast growth.

KEYWORDS

Differential Equations, Gabor Exponential Curves, Hyper-Fast Growth, Mathematical Modelling of Complexity, Stacked Actor-Network, Technological Explosion, Types of Growth

1. INTRODUCTION

The paper presents the new results in our continuous efforts of developing stacked actor-networks (SAN) approach in modelling socio-economic and cultural dynamics. Borrowing the concept from software designers, we referred to layering of autonomous networks that shield the processes going on inside yet related to other layers/networks not just by some 'output' (Tanenbaum 2003), but rather by the 'sameness' of the (most of) actors in each layer. In our first paper written together with Donka Keskinova we defined stacked networks as "formally independent networks sharing common set of entities as actors and/or mediators that, however, are acting in each of these networks under different identities" (Tchalakov, Kopanov, Keskinova, 2010, p. 222). In SAN approach, each actor is considered as small 'Ego'-network comprising the identities she is acting under in corresponding layers/networks. Thus, we adhere to a long sociological tradition that recognizes the layered aspect of social reality, or at least consider it as built by autonomous enough sets of social interactions named as 'institutions' (Parsons), 'fields' (Bourdieu), 'regimes of engagements' (Thevenot), etc., and where the same actors are present under different 'roles', 'positions' or 'coordination mechanisms.'

The SAN approach is also sensitive to the heterogeneity of actors involved, since the model allows to consider as actor/mediators not only individuals or collective human actors (firms and other organizations, informal groups, etc.), but also 'nonhuman agents' such as technologies, artefacts, money, etc. (Muniesa & Tchalakov, 2012) (see Figure 1).

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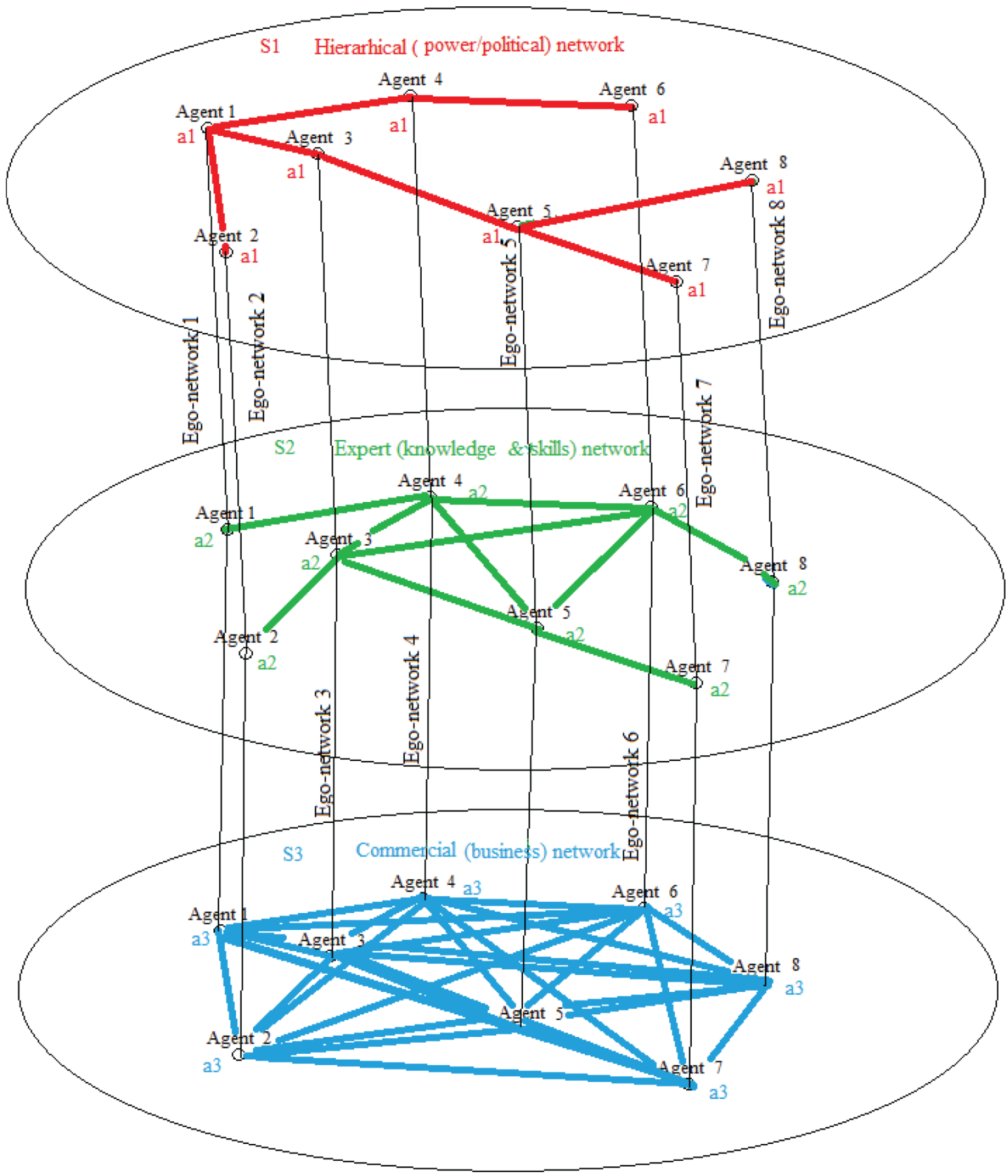
Figure 1. SAN graphical representation, comprising three autonomous types of relationships (with public bodies, knowledge and skills, and with business partners) of a set of commercial companies and their products/services, each represented as 'Ego-network'



Our last paper, published in this journal (Vol.8/4), explored the mathematical foundations of SAN approach using the methods of stochastic finite automata and discreet mathematics (Kopanov and Tchalakov 2016). It offered a mathematical formalization of agent and actor-network, presenting the later as oriented graph described by several primary concepts

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