AKSOE 5: Social-, Information-, and Production Networks I

Time: Monday 16:00–18:00 Location: EW 203

AKSOE 5.1 Mon 16:00 EW 203

Efficiency and Stability of Dynamic Innovation Networks — Michael D. König, Stefano Battiston, Mauro Napoletano, and •Frank Schweitzer — Chair of Systems Design, ETH Zurich, Kreuzplatz 5, 8032 Zurich, Switzerland

We investigate some of the properties and extensions of a dynamic innovation network model. In the model, the set of efficient graphs ranges, depending on the cost for maintaining a link, from the complete graph to the (quasi-) star, varying within a well defined class of graphs. However, the interplay between dynamics on the nodes and topology of the network leads to equilibrium networks which are typically not efficient and are characterized, as observed in empirical studies of R&D networks, by sparseness, presence of clusters and heterogeneity of degree. In this paper, we analyze the relation between the growth rate of the knowledge stock of the agents from R&D collaborations and the properties of the adjacency matrix associated with the network of collaborations. By means of computer simulations we further investigate how the equilibrium network is affected by increasing the evaluation time over which agents evaluate whether to maintain a link or not. We show that only if the evaluation time is long enough, efficient networks can be obtained by the selfish link formation process of agents, otherwise the equilibrium network is inefficient. This work should assist in building a theoretical framework of R&D networks from which policies can be derived that aim at fostering efficient innovation networks.

AKSOE 5.2 Mon 16:30 EW 203

Transient innovations - the case of blog hypes — Werner Ebeling[1], •Andrea Scharnhorst[2], and Mike Thelwall[3] — [1]Humboldt University Berlin, Germany — [2]VKS-KNAW, Amsterdam, The Netherlands — [3]University of Wolverhampton, UK

What triggers sudden bursts in public debates on specific topics, such as the recent hype on bird flu, blog discussions about bomb attacks, or the on-going debate on climate changes? How do mathematical approaches from physics contribute to a better understanding of complex communication pattern? In this paper, we look into 'hype phenomena' in on-line communication. We investigate to what extent increasing activity (visible in rapid growth) is related to structural changes in a system. We take as an example hype phenomena in blogs. We present a model based on different types of bloggers to explain hypes as a result of their non-linear interaction. In particular, we introduce the notion of 'transient innovations'. We place 'transient innovations' in a taxonomy of 'innovations' using concepts of complex dynamic systems as trajectories, attractor space. We discuss 'transient innovations' as temporary, but instable changes. The paper is part of the EU-funded research project Critical Events in Evolving Networks, CREEN (www.creen.org) that brings together theoretical physicists, information scientists, and social scientists in their shared effort to study the complex dynamics of the public communication of science and technology, as well as sudden developments within the sciences.

AKSOE 5.3 Mon 17:00 EW 203

Local and Global Dynamics of Production and Supply Networks under Mixed Production Strategies — •Reik Donner[1], Johannes Höfener[1,2], Kathrin Padberg[1], Stefan Lämmer[1], and Dirk Helbing[3] — [1]TU Dresden, Andreas-Schubert-Str. 23, 01062 Dresden, Germany — [2]MPI for Dynamics of Complex Systems, Nötznitzer Str. 38, 01187 Dresden, Germany — [3]ETH Zürich, Universitätstr. 41, 8092 Zürich, Switzerland

The analysis and control of dynamic material flows in traffic, production, and logistics is a subject of contemporary interest. In this contribution, we introduce a generalised input-output model of commodity flows that allows to study the dynamics of production and supply networks under different production strategies. It is demonstrated that production units subjected to a temporally varying demand and/or supply show an amplification of these variations for both push and pull strategies. Using an extended linear stability analysis, we identify under which conditions a consideration of mixed push-pull strategies leads to a suppression of these effects. Our corresponding results have important implications for the strategic planning and control of manufacturing networks.

AKSOE 5.4 Mon 17:30 EW 203

Using MAS to study the propagation of failures in dynamical supply-chains — •Samir Hamichi[1,2], Diana Mangalagiu[1,3], and Zahia Guessoum[2] — [1]Institute for Scientific Interchange Foundation, Turin, Italy — [2]LIP6, University Paris 6, France — [3]Reims Management School, France

Weisbuch and Battiston [1] introduced a simple model of failure propagation on a production network of firms linked by supply-customer relationships. They studied the evolution of these networks under very simple assumptions, identified the conditions under which local failures can result in avalanches of shortage and bankruptcies across the network and characterized the scale free properties of the model.

We pursue the investigation of this model using a MAS approach and introducing features leading to a more realistic behavior of the production networks: 1) the price is linked to the market demand; 2) the behavior of the firms is adaptive i.e. the orders are linked to the price and reliability of the suppliers; 3) the structure of the network is allowed to evolve over time. Our preliminary results show that the adaptive behavior of the firms reinforces the local structure of the economy, the supply-chains changing from large spatial structures towards tree-like structures. We investigate the stability of the production and wealth patterns, the magnitude of the scale-free distribution of firm wealth as well as the influence of the propagation of failures on the global production of the economy.

[1]. Weisbuch, G. and Battiston, S. Production Networks and Failure Avalanches, JEBO (2007, forthcoming).