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USING AGENT-BASED SIMULATION TO UNDERSTAND COOPERATION IN BUSINESS ORGANIZATIONAL SETTINGS

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ABSTRACT

There is no doubt around the dynamics and uncertainty characterizing organizations and their environments. Consequently, contemporary organizational thinking has evolved to embrace paradigms supported by complexity theory and its principles.

Complexity theory involves the study of many actors and their interactions. One of the central topics regarding interaction between self-interested agents is cooperation. Cooperation is crucial for societies and organizations, since it allows the creation of common goods that no single individual could establish alone. However, this situation itself presents a dilemma, because as the creation of these goods requires an individual effort and the result is shared by everyone, there is the temptation to make an individual contribution as little as possible and receive as much of the result as one can. The problem of how can cooperation emerge in a organization of self-interested individuals is one of the central questions addressed by social sciences, game theory, political science and behavioural and evolutionary economics.

The study of large number of actors with changing patterns of interaction often gets too difficult for a mathematical solution, therefore other type of solutions need to be used. A primary research tool of complexity theory is computer simulation. The basic underlying function of this tool is to specify how the agents interact, and then observe properties that occur at the level of the whole organization. The simulation of agents and their interactions is known as agent-based modelling (ABM) (Miller and Page 2007).

Although agent-based modelling employs simulation, it does not aim to provide an accurate representation of a particular empirical application (Axelrod 1997). Instead, the goal of agent-based modelling is to enrich our understanding of fundamental processes that may appear in a variety of applications. This is the assumptions underlying the proposal described in this paper. To represent the functioning of an organization DEMO's Ψ-theory (Dietz 2006) was used. The Ψ-theory explains how and why people cooperate and communicate. It postulates that the operation of an organization can be expressed by a specification of the commitments that the organizational subjects enter into and comply with. Based on this theory and concepts developed in Game Theory this paper proposes a agent-based simulation with an underlying conceptual model that allows to experiment and analyse the different patterns that emerge when organizational subjects use different kind of strategies to handle commitments to produce organizational output.

1 ABM and Cooperation in Business Organizational Settings

The basic units of the model we propose to systematically study the effects of cooperation in organizations are a set of agents that can be of two particular types: initiators and executors. These two types correspond to the two actor roles described in DEMO Transaction axiom (Dietz 2006). These two roles can either

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represent individual people, groups of people or even different organizations. Each of these roles has a particular set of actions that define their behaviour in the context of a transaction. An initiator agent can request something from an executor. This is the action that initiates a particular transaction. While the transaction is under way, the initiator can also perform one of the following actions quit, reject or accept. On the other hand the executor has the possibility of doing the following actions, promise, decline, state and stop. Combinations of these actions represent different possible paths and results that can happen while the two actor roles interact.

Based on these simple behaviours (set of action) and the level of trust between initiators and executors an agent-based model was implemented in NetLogo. This level of trust constraints the probability that an initiator will request something from a particular executor. It was assumed that both an initiator and an executor can only have a maximum number of simultaneous transactions. If a initiator has reached this maximum number he will only be able to do a new request after one of the current transactions is finished. Also, we have assumed that if an executor is inactive during a maximum period of time he would be eliminated from the environment. This is a consequence of all the initiators refusing to interact with them due to low level of trust. We have conduct experiments with three different levels of trust, namely $t = 100\%$ (scenario 1), $t = 50\%$ (scenario 2) and $t = 20\%$ (scenario 3) and the results for scenario 2 can be depicted in figure 1.

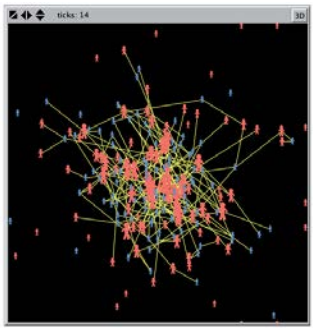

Figure 1: Scenario 2: the executors have a level of trust with t = .5

2 CONCLUSION AND FUTURE DIRECTIONS

In this paper we have addressed the problem related to understanding what are the effects of cooperation in business organizational settings. To model the social interactions between two actors we have used DEMO's Ψ-theory and based on its assumptions and Game Theory concepts we have implemented an agent-based modelling in NetLogo. A very simple instantiation of this model was used to simulate three different scenarios. From this experience it was realized the potential of bringing these concepts together. To be able to reach conclusive insights it would be necessary to include more details and more throughout assumptions.

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