

Chapter 2

Using Agent Based Simulation and Game Theory Analysis to Study Knowledge Flow in Organizations: The KMscape

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ABSTRACT

Knowledge sharing in organizations, especially the impact of sharing freely versus not sharing, was studied using game theoretic analysis and a Netlogo agent-based simulation model. In both analyses, some agents hoarded knowledge while others shared knowledge freely. As expected, sharing was found to greatly increase the overall amount of knowledge within the organization. Unexpectedly, on average, agents who share acquire more knowledge than hoarders. This is in contradiction to the conclusion from the prisoner's dilemma analysis. This is due to the synergy that develops between groups of agents who are sharing with each other. The density of the agents is important; as the density increases, the probability increases that an agent with a large amount of knowledge to share happens to be organizationally nearby. The implications are that organizations should actively encourage knowledge sharing, and that agent-based simulation is a useful tool for studying this type of organizational phenomena.

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INTRODUCTION

In 1988, Peter Drucker (1988) predicted a fundamental shift in corporations towards knowledge as the basis for competitive advantage. The management of knowledge became a prime concern, and has been the topic of many academic studies and organizational projects (c.f., Davenport & Prusak, 1998; Tiwana, 2002). But knowledge management (KM) endeavors often encounter a variety of problems and challenges (c.f., Gupta, Iyer, & Aronson, 2000; Sharp, 2003; Lin & Kwok, 2006). Invariably, these studies indicate that the problems are due to unforeseen side effects manifested by the *system* being manipulated—namely the organization. Sterman (2000) argues, however, that there is no such thing as a side effect; only effects. The study of structural complexity (e.g., feedback, nonlinearity and delay) and interaction effects (e.g., emergence) is the domain of the science of systems and the science of complexity (c.f., Senge, 1990; Bar-Yam, 1997; Resnick, 1997). The present article applies tools from these fields to the study of knowledge sharing in order to gain new insights into organizational KM.

Problem Statement

A KM system requires that members of the organization share their knowledge. This may simply mean making explicit knowledge accessible to others or transforming tacit knowledge into explicit knowledge for sharing. Brown and Duguid (2000) argue for the importance of this process and its critical dependence on the environment especially the social work situation. Studies have shown that individuals may be motivated to share knowledge in some cases and not share in other cases (Ardichvili, Page, & Wentling, 2003). What are the dynamics of a situation where there is a mix of individuals with different motivations within an organization? What might management do in order to enhance knowledge sharing?

The Present Study

The present study begins by applying a game-theoretic approach to examine the result of interactions between individuals in the organization with different preferences regarding knowledge sharing. Given this basic framework, agent-based simulation is then used to model these interactions in an artificial organization made up of individuals' (agents) that either share knowledge or do not share (hoard) knowledge. The knowledge properties of the organization as a whole *emerge* from the interactions of the individuals.

THEORETICAL BACKGROUND

Motivations to Share Knowledge or Not to Share

There are a number of reasons an individual may be willing to share their knowledge including (Wasko & Farja, 2000; Ardichvili, Page, & Wentling, 2003):

- The desire to be viewed as an expert
- The desire for recognition and credit
- Viewing their knowledge as a public good (which does not belong to them individually)
- Feeling a moral obligation to share
- “Generalized reciprocity”—that is, sharing with one in the community while expecting to be reciprocated by another in the future

However, in other cases, individuals may not be willing to share their knowledge (Ciborra & Patriotta, 1998). There are a number of potential reasons for this (Gilmour, 2003; Schutte & Snyman, 2006):

- Individuals may feel their *proprietary* knowledge is a competitive advantage versus their fellow employees

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