Exploratory Simulation of Collective Creativity in Open Innovation Socio-technical Ecologies

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Extended Abstract

Sustaining Open Innovation Communities (e.g., Open Source Software, Scientific Commons for Open Science) requires better understanding how collaborative efforts yield collective creativity. One of the significant problems in understanding emergence of collective creativity involves how collectives govern and coordinate the actions of individuals to maximize innovation output. Yet, relatively little is known about desirable organizing processes in open innovation communities. To this end, we examine the impact of governance mechanisms and conflict management styles on collective creativity in open source ecologies. Systems model of creativity and proxy metrics for measuring potential for collective creativity are utilized to conduct a simulation study of open innovation socio-ecologies. Findings suggest that decentralized coordination schemes such as emergent selection such as found in utility communities and moderate degrees of assertiveness and cooperation for conflict management result in higher incidence of innovation.

This study is based on the observation that conflict theory provides a sound framework by which collective creativity can be examined. The observation is predicated on the premise that group dynamics and conflict are strongly interrelated in that high levels of diversity among team members can potentially cause conflicts as a result of communication (Kraut and Streeter, 1995) and coordination difficulties (Kirton, 1976, 1989). We choose Open Source Software (OSS) communities as a testbed to study, develop, and explore models of innovation in such collective production communities. OSS communities accentuate emergent selection because individuals are given some control, which stimulates and motivates them (Von Hippel, 2005), so that individuals are adaptive as opposed to optimizing. Contributions compete for adoption and unanticipated innovations emerge as a result of interactions between the culture, organization, and the technology. Given these observations, the objective of this study involves using a computational model

- to explore and improve our understanding of the structural and behavioral conditions, that is, the simplest set of assumptions, for the emergence and sustaintment of creativity in open innovation communities under alternative community cultures and conflict management styles.

More specifically, we present an agent-based computational model of conceptually grounded hypothetical OSS community to test propositions and generate hypotheses pertaining to the impact of (1) governance mechanisms and cultures and (2) conflict management styles of project leadership. Based on the developed model of the hypothetical OSS community, we examine the impact of variation of OSS community
culture in terms of their decision-making and coordination styles. We specifically consider three alternative styles that are observed in existing OSS communities: (a) exploration-oriented, (b) utility-oriented, and (c) service-oriented (Ye et al. 2005). We then focus on the following questions: What types of coordination and decision-making styles are associated with higher incidence of collective creativity in OSS community projects and which specific conflict management style participants utilize to improve cyber-enabled innovation?

OSS community model is simulated (see Figure below) under different scenarios to examine emergent patterns in the project space. These emergent patterns not only provide qualitative insight, but also help achieve face validity to instill confidence for the operational validity of the model.

![Figure showing emergent patterns at different times](image)

(a) time =100  (b) time =500  (c) time =1000

Observed results reinforce and extend earlier findings on the wisdom of collectives, which suggest that aggregation of decisions of individuals in collectives consistently outperform experts in terms of prediction accuracy concerning likely outcome of future events. When they become stable, utility-oriented communities lend themselves to a climate with higher degrees of boldness and receptivity as compared to exploratory and service-oriented communities, which utilize central or council style decision-making styles. In both the exploratory and service communities, the avoidance (low assertiveness and low cooperation) style in conflict management leads to higher degrees of differentiation in project structure. In the case of low assertiveness and high cooperation style (i.e., accommodation) the project structure becomes well integrated. On the other hand, the integrating style, which is characterized by moderate to high levels of cooperation and assertiveness, performs better in achieving integrated differentiation.

References