論文審査の結果の要旨

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This dissertation presents a study of organizational knowledge management (KM) with agent-based modeling and behavioral experiments. A basic KM game and an extended KM game are developed to serve the ultimate purpose of establishing a new field of study on evolutionary and behavioral KM.

To be specific, there are three primary original achievements, which include:

1. An integrated KM methodology combining agent-based modeling and behavioral experiment is developed and verified;

2. The impact of microscopic KM effort on macroscopic outcomes on organizational performance and structure topology is elucidated;

3. KM policy took consideration of environmental uncertainty and human bounded rationality are evaluated by revealing a non-monotonicity and scarcity heuristics.

Moreover, this study further offers additional contributions which include:

1. A fair and effective incentive system is successfully designed and induced to the KM game;

2. Administrative interventions for long-term optimization (e.g. promoting innovation, cooperative culture, and overall organizational performance) are identified.

The dissertation overall consists of seven chapters. Chapter 1 outlines the background of the study, problem statements, research objectives, and originality of the work. It states that this study lies in the field of knowledge management (KM) which has been formally established as a discipline in 1990s to achieve organizational objectives by making the best use of knowledge. Conventional KM approaches are neither effective nor capable to handle growing complexities and unfathomability due to three major inadequacies, namely (1) ignorance of the environmental uncertainties, (2) negligence of human bounded rationality, and (3) missing micro-macro links for gaining holistic picture and understanding causalities on evolutionary and emergence perspectives. Therefore, primary goals of this study aim at developing a methodology for evolutionary and behavioral KM; elucidating the microscopic KM impact on the macroscopic organizational outcomes; and evaluating KM policies with a consideration of environmental uncertainty and agents' bounded rationality. Additional goals are to induce a KM incentive system, to investigate how agents' social interactions impact the organizational outcomes, and to explore various administrative interventions and corresponding effectiveness.

Chapter 2 firstly reviews the literature of KM as a self-contained discipline. It

further highlights the significance of knowledge as fundamental source for value creation and competitive advantages in the rapidly proliferating knowledge-based economy. KM is important because it facilitates decision-making, builds learning culture, and improves organizational performance ultimately. Secondly it extends the KM notion with complexity theory, behavioral economics, and micro-macro link sociology theory moving towards a transdisciplinary development.

Chapter 3 proposes an integrated KM approach and presents the establishment of the research roadmap for achieving the objectives mentioned in the Chapter 1; secondly it articulates the design rationale of a basic KM game and an extended KM game which are regarded as abstract or toy models of complex organizational KM reality; thirdly it argues the inevitable choice of integrating ABM simulation with behavioral experiments; lastly it explains the relationships between the basic KM game and the extended KM game.

In Chapter 4, the basic KM game is developed, a conceptual framework is illustrated, the implementation in both ABM simulation and behavioral experiments are explained in details, results elucidate the microscopic KM effort impact on macroscopic outcomes under both exogenous KM policy and environmental influences; a non-monotonicity in steady-state organizational performance alongside the enhancement of social network connectivity; and a scarcity heuristics on agents' KM decision-making are revealed and discussed.

In Chapter 5, the extended KM game is developed with an inducement of a KM incentive system to explore how agents strategically make KM decisions under two dilemmas, namely loss aversion vs. risk seeking and competition or cooperation, and to investigate how the social interaction and interdependency of agents impact the organizational outcomes. Likewise, the extended KM game is implemented in behavioral experiments then preliminarily prototyped in the ABM simulation. Various administrative incentive interventions that are suitable for optimizing certain situations coping with agents' endogenous social interactions are explored and evaluated.

Chapter 6 discusses the advantages of the integrated KM methodology, and how it can particularly serve the purpose of coping with growing complexity, environmental uncertainty, human bounded rationality, micro-macro links, and incentive system design.

Last but not least, Chapter 7 concludes the dissertation by summarizing the achievements, significance, and suggesting possible opportunities for future work. It shows that this study is the first of its kind combining ABM simulation with behavioral experiments in the KM literature. The developed integrated methodology is capable in dealing with growing complexity, elucidating causal relationships, and offering a pragmatic platform for policy-makers to design and test the effectiveness of interventions without sacrificing overhead cost and cause panic or interruptions to

daily operation. In the future, the KM game will be further improved by incorporating the freewill, learning, and adaptation of the administrator, hence the co-evolution between the organization and member agents can be realized. Furthermore, the knowledge should enhance agents' cognition, behavior, and performance, meanwhile agents should re-shape, reuse, and renew the knowledge, whereas the organization whether through the administrator or itself should actively adjust the conditions that facilitate the dynamics and growth, so that the co-construction of the reality among knowledge, agents, and the organization will also be possibly achieved.

本論文の内容において、論文提出者が主体となって知識管理ゲームの設計と拡張、知識管理ゲームにおけるマルチエージェントシミュレーションと行動学実験の実施を行ったものであり、知識管理の研究分野において、本研究の学術上の独創性と有用性は十分である。本論文は博士の学位論文として合格と認められる。したがって、論文提出者に博士（環境学）の学位を授与できると認める。

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