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研究課題名(和文) Theory and Analysis toward Strategic Innovation Diffusion

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研究成果の概要(和文)：本研究の主な目的は、学際的アプローチを使い新興産業におけるイノベーション普及について検証することである。この研究では、限定合理性、制度派理論と探索理論に関する理論を組み立てた。クラウドコンピューティングや遺伝子組換え作物という2つのイノベーションに焦点をあて、前者では、新興国におけるクラウドコンピューティングの普及について、そのイノベーションの特徴と新興国の制度的特徴を分析し、制度要因の重要性を明らかにした。後者では、遺伝子組換え作物の導入に関する国際比較のデータを使い、国による遺伝子組換え作物の導入は目的指向であり、資源依存、社会的比較や関係により引き起こされる過程であることを発見した。

研究成果の概要(英文)：The main purpose of the project is to examine innovation diffusion in an emerging industry using a multidisciplinary approach. In building the theoretical framework of the study, I have drawn upon theories on bounded rationality, institutional theory and search theory. I published one paper on bounded rationality and competition, which helped me further develop my theory on innovation diffusion.

I have analyzed the diffusion of cloud computing in emerging countries by jointly considering innovation traits of cloud computing and institutional characteristics of emerging countries. This study highlights the importance of institutional factors in facilitating the diffusion of cloud computing. Moreover, using cross-national data on the adoption of biotech crops, I found that the adoption of biotech crops by countries is a process oriented towards goals and driven by resource dependence, social comparisons, and relationships.

研究分野：Business Administration

キーワード：innovation diffusion institution

### 1 . 研究開始当初の背景

Innovation diffusion drives business success and economic growth. Although there is an abundant literature on innovation diffusion, we still lack understanding of how innovations can be diffused. This gap results from the common assumption that once adopted, innovations will fully diffuse over time, from a focus on innovations in an already established industry, and lack of integration of multidisciplinary insights on innovation diffusion.

Innovation diffusion is generally defined as the “process through which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003). It has been examined within several disciplines. Researchers from psychology, management, and marketing have identified who are more likely to adopt an innovation. For example, Kennedy and Fiss (2009) show that individuals who have high tolerance for risk and legitimacy pressures are more likely to adopt an innovation. Other micro-level studies have investigated the temporal dimension of diffusion and have categorized adopters as innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003; Mahajan et al., 1990). In addition, these studies have taken a theoretical stance of innovation diffusion as a process of social contagion, which occurs when decision makers imitate the adoption decisions of others (Ryan and Gross, 1943; Burt, 1987)

### 2 . 研究の目的

The main purpose of the project is to examine innovation diffusion in an

emerging industry using a multidisciplinary approach in order to provide implications for diffusing innovations.

Specifically, I analyze the current status of biotech crop industry and cloud industry in order to examine the forces that drive and constrain the adoption and deployment of these innovations across countries.

### 3 . 研究の方法

The study is structured in four phases: (1) literature review and theory development, (2) data collection, (3) empirical analysis, and (4) writing and dissemination of findings. In developing the theory and hypotheses, the study integrates micro, and macro perspectives on innovation diffusion. To align the theory with the level of analysis, innovation data on the biotech crop industry is supplemented with network-level and country-level data. To develop an in-depth and practical understanding of innovation diffusion, interviews with different stakeholders (company and policy maker) and consultation with other scholars from different disciplines is conducted. To disseminate the contributions of the study, both the theoretical and empirical findings are submitted for publication and presented at academic conferences.

In examining the cloud industry, I compare cloud deployment in traditional and modern sectors of emerging markets, and provide some examples of cloud deployment in emerging markets that can become a role model.

Using data on the biotech crop industry, I empirically analyze the diffusion of biotech crop innovations across countries. The

biotech crop industry is a science-driven, knowledge-intensive and regulated sector that has substantially grown since the first commercialization of biotech crops in 1996. The cross-national data on biotech crop innovations are supplemented with economic data from the World Development Indicators collected by the World Bank.

#### 4 . 研究成果

In this project, I focus on two types of innovation—cloud computing and biotech crops. In building the theoretical framework of the study, I have drawn upon theories adopted in international business, marketing, economics, and organization science, including bounded rationality, institutional theory and search theory. I published one paper on bounded rationality and competition, which helped me further develop my theory on innovation diffusion. This paper argues that through heuristics decision makers simplify environments and reduce their cognitive burdens. I build on this argument in formulating the framework of my study on the diffusion of biotech crop innovations.

One type of innovation that I have focused on is cloud computing. I have analyzed its diffusion in emerging countries by jointly considering innovation traits of cloud computing and institutional characteristics of emerging countries. Cloud computing is an innovation that is receiving much attention among companies and policy makers. Yet, we still lack studies about how it is diffused across countries. This study highlights the importance of institutional factors in

facilitating the diffusion of cloud computing, which result in the emergence of new industries and revitalization of traditional industries.

Cloud computing (hereafter: the cloud), which is likened and equated to the Industrial Revolution in terms of technological innovations, structural change and the sources of economic growth, has started to transform economic activities. It is argued that the cloud reduces infrastructure costs and levels the playing field for small and medium-sized enterprises (SMEs), especially in emerging markets (EMs).

Cloud diffusion patterns and associated factors among EMs are highly heterogeneous. For instance, South Korea had over 2,700 secure servers per 1 million people compared with less than 2 in a number of least developed nations (LDCs) such as Afghanistan, Bangladesh, Myanmar and Nepal. The patterns also exhibit a wide rural-urban gap on various indicators as well as differences across various sectors of the economy.

The study analyzes the current status of cloud industry in EMs and examines the fundamental forces driving as well as major constraints facing the use and deployment of the cloud in these countries. The analysis indicates that under-developed regulatory institutions have hindered the cloud's growth in most EMs and that another barrier hindering EMs' embracement of the cloud economy centers around poor infrastructure development required for the cloud economy.

Foreign and local firms can take a

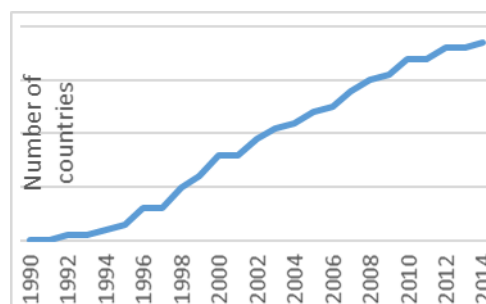
wide variety of measures intended to help the development of the cloud industry and market in EMs. Foreign companies, for instance, could benefit by collaborating with local cloud providers, characterized by lean cost structures and experience in developing low-cost products. For EM-based cloud providers, on the other hand, their ability to deliver value for money in the domestic and regional markets could give them a competitive advantage in foreign markets, especially if they are in a position to reconfigure their resources to operate effectively in other EMs.

In addition to cloud computing, I also examine the diffusion of biotech crops across countries. Using cross-national data on the adoption of biotech crops, I argue that the adoption of biotech crops by countries is a process oriented towards goals and driven by resource dependence, social comparisons, and relationships.

It is widely accepted that the rate of innovation diffusion varies across countries. As Figure 1 shows, while the number of countries adopting biotech crops is increasing over years, there are some countries that are early to adopt while others are rather slow and reluctant to adopt. Moreover, the diffusion of innovations in a regulated industry largely depends on government organizations' decision. This study draws on organization theories to develop a framework for understanding government organizations' adoption of innovations. It focuses on biotech crops as innovations that countries consider for adoption. There are now 37 countries planting biotech crops in 2014.

Drawing upon organization theories, this study argues that government organizations make decisions under the condition of bounded rationality and uncertainty, form aspirations, and receive influence from other governments. Hence, governments' decision to adopt biotech crops will be determined by the gap between their aspiration and performance, and interdependence with other governments. These arguments are tested using data on biotech crops. The analysis indicates that performance-aspiration gap may lead to heuristic adoption or non-adoption of innovation by countries trade relationships may drive the speed of innovation adoption, and developing a global policy system such as biosafety regulation could facilitate the diffusion of biotech crops across countries.

Figure 1. Trend in biotech crop adoption



## 5. 主な発表論文等

(研究代表者、研究分担者及び連携研究者には下線)

〔雑誌論文〕(計 1 件)

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## 6. 研究組織

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