Chapter 11
Modern Diffusion of Products with Complex Network Models

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ABSTRACT

In modern rapid technological change, how some innovation can diffuse all over is a very fascinating subject. In the past diffusion research, the case studies or analyses based on the economic theory have been dominant. The theory with the classification of adopter categories by Rogers is most famous and thought to be a milestone for the former approach. There are rich case studies why it has been accepted widely so far, however the fact that a more than forty-year-old theory still governs the world sounds a little curious. Thus, new diffusion theory for modern network society is required.

In this chapter, some important matters of complex networks and their models are reviewed shortly, and then the modern diffusion of products under the information propagation using multiagent simulation is discussed. The remarkable phenomena like “Winner-Takes-All” and “Chasm” can be observed, and one product marketing strategy is also proposed.

INTRODUCTION

In recent markets, huge amount of new products have got into circulation. Which product will become a big seller and which one will vanish away is a great matter of concern for all consumers. And in a bitter format fighting category, which format will remain in competition is a very important issue that connects directly to buying intention. Though diffusion research have been down for tens of years, diffusion of technological or other innovation has been a main concern and there are few researches for products yet. Moreover recent decision process of purchase has changed
because of the change of information propagation in modern network society. Thus the construction of modern diffusion model of products in consideration of this point and the search for diffusion conditions is our aim in this chapter.

At first, two important concepts diffusion and complex network are explained and their theory and models are shortly reviewed. Next the construction of product diffusion model is simplified by applying the idea of existing model to the agent-based model. Moreover adding interaction environment using complex networks and some variety of information transfer characteristics, the process of diffusion and the occurrence condition for chasm are inspected and it would be clear that the modeling of product diffusion market by agent-based model is possible and valuable. Finally by extending our model, the effect of network externality in the format competition and its characteristics will be clarified.

BACKGROUND

As you know, recent progress of the Internet is amazing. The penetration of e-commerce and Web 2.0 applications have varied both the form of purchases and the pattern of information propagation. As above, the importance of the relationships between individuals has grown higher. From that point of view, the ideas of complex networks have been required for diffusion research.

In the past diffusion research of products, the case analysis [Anderson, 2006] or the analysis based on the economic theory [Arthur et al., 1996] are dominant. In most of those studies, they suppose the dominant equation which describes the whole phenomena and carry out simulations [Bass, 1969, Rohlfs, 1974]. As opposed to these top-down and macroscopic view, bottom-up and microscopic design approach has been drawing attention these days. Complex system science enabled such a method and it researches the mechanism of the emergence of macro state by the interaction of a large number of micro states. One of the most effective tool of its analysis is an agent-based model and it has been used in several systems including artificial market.

The study of artificial market using agent-based model is concentrating on financial markets such as stock [Chen et al., 1999] and foreign exchange [Izumi et al., 1999] and there are few studies for product market so far mainly because of the variety of consumers. There have been some studies on consumers themselves [Kats et al., 1955, Rogers, 1995] and the interaction between them [Watts, 2003]. Though some studies on format competition on some product market exist [Iba et al., 2001, Uchida et al., 2008], they assume the products are already well diffused or on the way, and they never discuss the process of diffusion.

In real world, all new products are not accepted in consumers and widely diffused, and some are occasionally accepted only to a few enthusiasts, then the diffusion will stop. This phenomenon is called “Chasm” and can be seen very often in real markets [Moore, 1991].

DIFFUSION OF PRODUCTS

Though the research that what product will be purchased by consumers is important for marketing research, it is difficult to determine how to model it or what point of view we should study it. In this section, we define what diffusion is and summarize the diffusion researches in the past and their problems.

What Is Diffusion?

You might wonder what diffusion is in the first place. It is very hard to believe that all the people will come to adopt whatever techniques or products. Then what adoption rate is suitable for enough diffusion.

Rogers, the foremost authority on diffusion research defined it as follows: Diffusion is the