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# Contagion effects of electronic commerce diffusion: Perspective from network analysis of industrial structure

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## Abstract

This study presents a quantitative method for investigating the diffusion of e-commerce adoption using social network analysis methodologies. The contagion effects on innovation diffusion are examined by two different social network models: the cohesion model, which is based on diffusion by direct communication, and the structural equivalence model, which is based on diffusion by similarity of network position. This study then empirically examines a sample of e-commerce diffusion taken from the Taiwan's industrial structure in 2001. The analytical results show that e-commerce diffusion among firms in Taiwan exhibits both contagion effects, but that the mimetic behavior is predicted better by network position than by interactions with others.

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*Keywords:* Electronic commerce; Contagion effect; Cohesion; Structural equivalence; Innovation diffusion

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## 1. Introduction

The accelerated growth of Internet-based commerce and the significant attention paid to it in the media has led to increasing interest among businesses in electronic commerce (e-commerce). Managers are told that the use of e-commerce is already reshaping supplier and customer relationships, streamlining business processes and even, in extreme cases, restructuring whole industries [1]. Meanwhile, the rapid growth of e-commerce attention and adoption has led to many studies on e-commerce-related research. However, most studies have focused on the internal factors affecting the adoption of e-commerce, and comparatively little attention has been given to the mechanisms of e-commerce diffusion among firms within an economy. There is a need to understand the mechanisms that characterize the

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diffusion of e-commerce adoption, to identify the main driving force of firms' intention to adopt e-commerce, and to gather empirical evidence in cases and practices of e-commerce diffusion.

The above research needs can be implemented by investigating e-commerce diffusion within an economy by using social network analysis, which has a well developed set of models for systematically examining the contagion effects of innovation diffusion within a social structure. The measurements and models of social network analysis, although primarily developed for studying sociology, are highly appropriate for applications to explore the mechanisms of innovation diffusion [2–4]. There are two classes of network models, the cohesion model and the structural equivalence model, to examine the contagion effects of two actors that make them socially proximate, so that adoption of an innovation by one actor would trigger adoption by the other. This study will introduce appropriate social network analysis measurements and models to reveal that the social network analysis can be a useful methodology for studying the mechanisms of e-commerce diffusion within an economy, and test them by examining a sample of e-commerce diffusion taken from the Taiwan's industrial structure. Taiwan has a vibrant manufacturing sector, and is aggressively promoting information technology and e-commerce [5], making it a good sample for the purposes of this study.

This study aims to investigate the diffusion of e-commerce adoption by firms in Taiwan, using social network analysis to explain the diffusion mechanisms. This investigation examines the contagion effects on diffusion with two social network models, contagion by cohesion, which is based on diffusion by direct communication, and contagion by structural equivalence, which is based on diffusion by similarity of network position. This study tests and compares the ability of these competing models to explain the mechanisms of e-commerce diffusion among different sectors in Taiwan.

The rest of this paper is organized as follows. Section 2 reviews pertinent literature on adoption of e-commerce by organizations, and the theories concerning innovation diffusion and contagion effects to construct a framework for research on the mechanisms of e-commerce diffusion within an economy. Section 3 then proposes the research hypotheses in relation to the test and comparison of the different contagion effects. Next, Section 4 introduces the measurement and models of social network analysis used to investigate the mechanisms of e-commerce diffusion. Section 5 empirically examines a sample of e-commerce diffusion taken from the Taiwan's industrial structure to test the research hypotheses, and discusses the managerial implications. Conclusions are finally drawn in Section 6.

## **2. Literature review**

This study employs the contagion model derived from social network analysis to examine the innovation diffusion of e-commerce adoption among firms or sectors. Therefore, this section reviews relevant literature concerning the organizational adoption of e-commerce, and the theories regarding innovation diffusion and contagion effects.

### *2.1. Electronic commerce adoption*

The term "e-commerce" emerged recently when businesses began to realize the role of the Internet as a powerful business medium [6]. Kalakota and Whinston [7] defined e-commerce as "the buying and selling of information, products and services via computer networks", with most computer networks belonging to the Internet. Companies are increasingly interested in the application of e-commerce as a means to perform business transactions and to enhance their global competitiveness [8].

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