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# Using cellular automata to simulate electronic commerce receptivity in small organisations<sup>☆</sup>

Neja Zupan \*

*Faculty of Organisational Sciences, University of Maribor, Kidričeva cesta 55a, SI-4000 Kranj, Slovenia*

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## Abstract

The focus of the research is to study the dynamics of electronic commerce propagation caused by organisational characteristics in small organisations. A model of opinion dynamics and verbalisation process for studying the receptivity of electronic commerce in small organisations in Slovenia is proposed. The methodology is based on cellular automata approach, diffusion theory, small organisations characteristics and studies on factors affecting electronic commerce introduction and usage in small organisations. The decision of an organisation whether to adopt electronic commerce or not is based on its attitude towards electronic commerce and impressions gathered from interactions with other organisations. Different characteristics of organisations were defined according to the data gathered by interviews and a survey. Several types of electronic commerce diffusion dynamics are evident from the data gathered. The most likely scenario of electronic commerce diffusion among small organizations in Slovenia predicts a decrease in organizations that are less mature in e-commerce and the increase in more mature organizations by 6–8% by the end of year 2006.

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*Keywords:* Electronic commerce; Diffusion model; Cellular automata; Maturity level; Opinion dynamics

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## 1. Introduction

The Internet has evolved from a non-commercial research tool into an interactive broadcast medium with unparalleled reach and interactivity. It is still a subject of major interest, primarily

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\* Tel.: +386 4 237 4282; fax: +386 4 237 4299.

*E-mail address:* [neja.zupan@fov.uni-mb.si](mailto:neja.zupan@fov.uni-mb.si).

because of its potential for global interconnectivity. This interest has led to large investments to expand its capacity and capabilities that caused tremendous growth in electronic commerce. The concept of exchanging data with business partners lead to the development of Inter-organisational systems [1], [2]. In this context a growing body of literature suggests that Internet technologies play significant role in radically expanding the volume and scale of a global electronic commerce (e.g. Ref. [3]).

Consider a group of interconnecting organisations — business partners spread all over the globe. They use traditional trading methods, each having a more or less similar opinions about their trading. But in general opinions may be influenced by other organisations and attitudes may change accordingly. An organisation's attitude influences its business strategy. Let's consider that in a group of trading partners there might be an organisation with a "be first" strategy and an innovation appears, e.g. electronic commerce. The organisation is influenced by new possibilities and their attitude changes. In a group of trading partners this causes a group-wide attitude and opinion formation process. Suddenly there are plenty of possibilities for a change — the spreading of the new way of trading. The propagation of the new way of trading depends on the patterns that appear during the propagation process [4,5].

There is no doubt that electronic commerce has made its way into businesses, but despite the extraordinary amount of popular press coverage of the electronic commerce revolution, many organisations have not travelled far down the path of electronic commerce [2]. How many organisations really use the Internet to do business? How do they use it? And how are they planning to use it? Where do the small organisations fit in the big picture? Uncertainty prevails as soon as we get to the evaluation of the dimension of electronic commerce, its growth rate and its role in the economic growth and development.

We have used the network analysis approach in order to develop a model of electronic commerce diffusion. Our model implements the basic concept of opinion dynamics as proposed by Ref. [6] and builds upon the core results of the research of factors that influence electronic commerce adoption among small organisations conducted by Refs. [7,8]. The methodology is based on the cellular automata approach, diffusion theory, characteristics of small organisations and studies on factors affecting electronic commerce introduction and usage in small organisations. Our model simulates the global consequences of local interactions between the members of observed population. The purpose of this research was to investigate the decision process in small organisations considering the adoption and use of electronic commerce and to uncover the factors that influence this process. At the same time we sought to find out which small organisations are most likely to implement electronic commerce. Information about electronic commerce propagation is important on the national level to see competitive progress of a small economy through information technology growth. Competitive growth is one of the major mechanisms in economic and social development in Slovenia and in Slovenia's progress towards the European Union's contemporary directions on development.

In this research we have treated the electronic commerce as an innovation phenomenon that propagates through a group of companies [9]. Since there is no commonly agreed upon definition of electronic commerce and the contemporary definitions seem to vary with time, we defined electronic commerce as the state of "conducting business on-line". This includes buying and selling products with digital cash and Electronic Data Interchange [10] by using company-based e-mail communication and Internet access.

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