

Process Simulation for E-Commerce Systems

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INTRODUCTION

As a modern way to conduct business in the global economic environment, e-commerce is becoming an essential component integrated with traditional business processes in enterprises. To reduce risks and increase profits in e-commerce investments and to provide the best services to their customers, enterprises have to find appropriate ways to analyze their e-commerce strategies at the business planning stage. Strategic management tools are designed for enterprises to evaluate their business strategies, and can be used to evaluate an e-commerce business plan, as well. For example, the SWOT (strengths, weaknesses, opportunities and threats) analysis is regarded as a popular way to conduct an e-commerce business plan evaluation, with business environmental scanning based on internal environmental factors (strengths and weaknesses) and external environmental factors (opportunities and threats) (Turban, King, Lee, & Viehland, 2003). To facilitate the application of the strategic management tools, different forms of applications are adopted, such as checklist (OGC, 2004), rating system (UNMFS, 2004), expert system (PlanWare, 2004) and so forth. Among these, computer-driven business simulation tools enable participants to run with virtual business processes, experiment with different strategies and compete with other supposed companies or plans in a virtual business environment. As an example, the *Marketplace* (ILS, 2003; IDC, 2004) is a business simulator for integrative business courses that provides decision content, including marketing, product development, sales force management, financial analysis, accounting, manufacturing and quality management. Regarding the application of

computer simulation in e-commerce, the *Marketplace* strategic e-commerce simulation is specifically designed, and it illustrates the business concepts of an e-commerce environment, as well (ILS, 2003). For an e-commerce system simulation, Griss and Letsinger (2000) studied agent-based flexible e-commerce systems with an experimental multi-player shopping game to experiment with alternative individual and group economic strategies, and to evaluate the effectiveness of agent-based systems for e-commerce. Both academic and professional practice have proved that using computer simulation is an effective, efficient and economical way for e-commerce business plan evaluation.

However, it is hard to conduct simulation based on the flowchart of business processes within the current e-commerce simulation environment as mentioned above. This actually provides a limitation for applying e-commerce simulation. In fact, computer simulation has tackled a range of business problems, leading to improving efficiency, reduced costs and increased profitability since the 1950s (Robinson, 1994). Simulation tools are on the increase in various application areas (Google, 2005) and process-oriented simulation has been increasing in popularity for business management (Swain, 2001). We believe that a process-oriented simulation for e-commerce system evaluation is more directly perceived through the human sense, and our interest is to conduct a quantitative approach to e-commerce system evaluation based on the theory of process simulation.

The e-commerce system simulation is an integrative procedure to run a business processes-oriented simulation program based on both internal and external business environmental factors to demonstrate the actual results of

Table 1. A statistic analysis of C&D waste disposal in Hong Kong (EPD, 1999/2002)

Year	Amount of Waste at landfills (ton)		Percentage of C&D waste (%)
	C&D waste	Total waste	
1998	7,030	16,738	42
1999	7,890	17,932	44
2000	7,470	17,786	42
2001	6,410	16,686	38

implementing an e-commerce business model by using computer-driven software toolkits. The e-commerce system simulation is an effective, efficient and economical approach, and can be used to experiment and evaluate different e-commerce business models or plans. The adoption of e-commerce system simulation can reduce potential risks in e-commerce system development, such as the huge amount of initial investments of time and money, and the long period from business planning to system development, then to system test and operation, and finally to exact return; in other words, the proposed process-oriented e-commerce system simulation can help currently used system analysis and development methods to tell investors in a very detailed way about some keen attentions, such as how good their e-commerce system could be, how many investment repayments they could have and in which area they should improve from initial business plans.

The definition of the proposed process-oriented e-commerce system simulation normalizes its procedure to apply a process simulation to experiment with an e-commerce model. In this regard, this article focuses on the adaptation of an e-commerce model into a process simulation environment by using an experimental case study. Results from this article include the conception of e-commerce system simulation, a comprehensive review of simulation methods adopted in e-commerce system evaluation and a real case study of applying simulation to e-commerce system evaluation. Furthermore, we hope that the adoption and implementation of process simulation approach can effectively support business decision-making, and improve the efficiency of e-commerce systems.

BACKGROUND

Generally speaking, construction and demolition (C&D) waste can be reduced by using innovative construction techniques and management methods. Although these approaches have proven to be effective to some extent, most of them are still in a stage of research, and contractors usually do not like to invest in high-cost techniques. For example, surveys show that local constructors in

Hong Kong feel it is expensive to use new machinery and automation technology (Ho, 1997); most local constructors agree to adopt alternative low-waste but high-cost techniques only when they are demanded by the designers, the specifications or the clients (Poon & Ng, 1999). As a result, C&D wastes are normally not controlled effectively on sites in Hong Kong. According to statistical data, C&D debris frequently makes up 10%-30% of the waste received at many landfill sites around the world (Fishbein, 1998), but this figure has been more than 40% in recent years in Hong Kong. So there is an urgent need to deal with the problem and to find a practical solution for C&D waste reduction in Hong Kong.

To deal with the serious problems in C&D waste management in Hong Kong, this article proposes an e-commerce model called Webfill for C&D waste exchange to enhance efficiency and effectiveness of the currently used charge system—that is, Trip-Ticket System (TTS) for C&D waste disposal—and accordingly, to reduce the total amount of C&D waste disposed to landfills in Hong Kong. To test whether the Webfill can provide an ideal result in e-commerce for C&D waste reduction, a simulation-based comparison between the existing TTS and enhanced TTS is conducted. With a full view of reducing C&D waste in Hong Kong, the Webfill as a waste exchange model can only work for reducing existing C&D waste; the control of waste generation cannot be expected. As a result, this article only focuses on the e-commerce model for C&D waste reduction at the post-construction stage and the process of e-commerce simulation.

E-COMMERCE SYSTEMS AND SIMULATION

Online Waste Exchange

The concept of waste exchange systems for exchanging industrial residues and information and for reducing the waste volume was introduced in the 1970s (Middleton & Stenborg, 1972; Mueller et al., 1975). In recent years, Web-based services for waste material and equipment trade and information exchange have been developed based on the

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