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Critical factors in e-business adoption: Evidence from Australian transport and logistics companies

Hong-Oanh Nguyen *

Department of Maritime and Logistics Management, Australian Maritime College, University of Tasmania, Australia

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ABSTRACT

This study develops a discrete variable investment model and applies it in the study of the decision to adopt e-business by transport and logistics companies. The data analysis is carried out in two phases; in the first phase, factor analysis is conducted to identify the principal components influential to the e-business adoption decision; in the second phase, logistic regression is conducted to further analyse the effect of individual components on the adoption decision. The analysis of the data obtained from a survey of Australian transport and logistics companies has found various factors influential to the adoption decision. The first factor relates to service quality improvements brought about by e-business adoption including a higher level of competitiveness, service differentiation, value adding, improved customer services and supply chain integration. The second factor concerns the financial aspect of e-business adoption including large initial investment expense, financial constraints, and costs of operation and maintenance. The third factor concerns expectations about market demand in terms of volatility and growth in demand for freight and logistics services. The analysis and results shed light on the behaviour of transport and logistics companies and the sector's view toward e-business adoption. For example, the decision to adopt e-business should take into account not only the benefits but also the costs of adoption, running and maintenance as well as financial constraints. The model developed by the study can be applied to any sectors or industries, in which companies face discrete investment choices.

1. Introduction

Competition and opportunities in the era of global trade, investment and outsourcing have induced transport and logistics companies to look for different ways to grow and improve their competitive advantage. E-business offers a solution that allows companies to instantaneously share databases, forecasts, inventory and capacity plans, product information, financial data, and almost anything else that they may need to be operationally efficient and effective. Since transportation and logistics involves activities associated with the movement of products and information to, from, and between the members of the supply chain, e-business can help them achieve efficient coordination and integration of all these activities. In a highly competitive business characterised by time constraints and information management, technological effort especially the use of information and communication technologies (ICT) has become vital for services differentiation and diversification (Evangelista and Sweeney, 2006). The result is that competitive advantage in the transport and logistics sector has been shifted to creating value chains whose activities are directly or indirectly assisted by e-business (Disney et al., 2004; Gunasekaran et al., 2002; Landers et al., 2000; Marchet et al., 2009).

E-business has a number of applications that vary in complexity and could be defined as the use of the internet or any other electronic medium for the execution of transactions, the support of business processes and the improvement of collaboration opportunities with other businesses or clients (Matopoulos et al., 2007). Examples of e-business applications include, but are not limited to virtual logistics (Clarke, 1998), virtual warehouse (Landers et al., 2000), electronic marketplaces or logistics brokerage systems (Gudmundsson and Walczuck, 1999). In addition, Karthik et al. (2004) have shown that business to business (B2B) e-commerce enhances time-based delivery performance, while Quirós Romero and Rodríguez's (2010) have found e-procurement has a positive influence on firm efficiency although the effect is insignificant for e-selling.

According to Evangelista and Sweeney (2006), e-business has created new trends in the transport and logistics sector. First, the increasing dissemination of ICT has resulted in the integration of traditional services, such as transportation and warehousing, with information-based services such as tracking and tracing (T&T), booking, freight rate computation, routing and scheduling. Second,

* Tel.: +61 3 6324 9762.
E-mail addresses: o.nguyen@amc.edu.au, o.nguyen@utas.edu.au, noanh68@yahoo.com

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the adoption of e-business has allowed transport and logistics service providers to assume a new role in the supply chain as intermediaries or online e-market places. As web-based intermediaries they add value to transport and logistics services through greater efficiency and information transparency. By running internet portals, they bring together buyers and sellers of transport and logistics services. Third, this has resulted in the emergence of a new category of logistics service providers called fourth party logistics (4PLs) which enable customers to outsource the management of the entire logistics network to a single organisation and to re-engineer supply chain processes.

Porter (2001) argues that e-business can have pervasive impacts on all aspects of market competition because "the basic tool for understanding the influence of information technology on companies is the value chain – the set of activities through which a product or service is created and delivered to customer". These activities include pre-sale enquiry handling, order payment, warehousing and storage, shipping to post-sale service, whose cost and value can be improved substantially through effective use of ICT.

Despite its great benefit, there are costs associated with e-business. It is logical to expect that the decision to adopt e-business should be based on the weighing of its benefits mentioned earlier against its costs including those of ICT equipment and facility, training, maintenance, customer services, etc. The adoption decision should also consider various barriers to e-business adoption such as business uncertainty, financial constraints, incompatibility with the logistics partners' network, data security, accessibility by customers as well as inconvenience caused by the resulting operational changes. This suggests that making the decision to adopt e-business is complex and involves various factors. Therefore, it is imperative to examine the factors that influence the decision to adopt it. Especially this is because no analytical framework has been developed for this purpose.

This paper aims to develop an empirical model and applies it to analyse the decisions to adopt e-business among transport and logistics companies in Australia. The Australian transport and logistics sector has been chosen for application of the model because it has not been able to effectively support the growth of international trade (Nguyen and Tongzon, 2010), and investment in ICT, especially e-business could be the key to improving the efficiency of this sector (Logistics Association of Australia, 2004). Although e-business adoption is quite prevalent among international logistics service providers, the current level of e-business adoption among the Australian transport and logistics companies is relatively low. The sector has the lowest rate of broadband connection compared with all other industries (Australian Bureau of Statistics, 2008). The next section reviews the literature on e-business adoption in the transport and logistics sector. Section 3 presents a discrete variable model of investment. Sections 4 and 5 explain the data collection and analysis methods respectively, and section 6 discusses the findings, contributions and limitations.

2. Literature review

There has been increasing research interests in e-business adoption primarily due to the combination of three factors. First, as globalisation, international trade and outsourcing continue to be one of the key drivers of economic prosperity, there has been increasing demand for transport and logistics services as well as the need to promote this sector, which have resulted in more research interests. Second, the last two decades have seen constant growth in information and communication technologies whose applications have transformed the operation and management of businesses in different sectors including the transport and logistics sector. And third, there is a potentially great need for the transport and logistics sector to use ICT applications because its operations typically spreads across regions and entities, and as such the management of information flows is critical to operational efficiency. As shown below, the second and third have also led to a number of studies looking at the benefits ICT can bring to the sector.

Porterfield et al. (2010) studied the relationship between electronic information exchange and firm performance using econometric analysis of firm-level data. They found information exchange facilitates coordination through sharing order cycles and information and helps foster closer relationships and improve performance. Tan et al. (2010) used structural equation modelling to study the impact on firm performance, caused by the three constructs: electronic data interchange (EDI) capacity, information alignment and relational alignment. The analysis results indicate that EDI capability has a positive impact on information and relational alignment. Information alignment has a positive impact on relational alignment. Relational alignment has a positive influence on firm performance. However, support was not found for either EDI capability or information alignment having a direct effect on firm performance; both affect performance only indirectly via their impact on supply chain relational alignment. Evangelista and Sweeney (2006) studied the use of ICT among small 3PLs and found that the most important benefits of using ICT are error reduction, service quality improvement, customer satisfaction and integration in the supply chain. Similarly, Davies et al. (2007) examined the effect of information exchanges and ICT usage on transport operations of road transport companies in the UK. The results of their survey of 49 general haulage operators revealed that, while many of smaller haulage operators remain dependent on traditional communication and process systems, larger operators, who control the majority of vehicles and freight movements, are progressively developing new ways of working supported by ICT adoption.

The literature has also identified various factors inhibiting e-business adoption. These include large initial cost (Evangelista and Sweeney, 2006; Gunasekaran and Ngai, 2008), running cost and customers not interested or not used to the new service or feature (Australian Bureau of Statistics, 2008; Evangelista and Sweeney, 2006; Samar and Robert, 2004), company size (Davies et al., 2007; Nurmilaakso, 2008), staff's IT skills (Australian Bureau of Statistics, 2008), compatibility and standard of the new system/service, management's support and security (Gunasekaran and Ngai, 2008), uncertain or lower return on investment due to the higher competition level resulting from better access to market information and online brokerage system (Gudmundsson and Walczuck, 1999), and higher product return rate due to online customers unable to inspect the physical conditions of the product (Samar and Robert, 2004).

Despite many studies on different aspects of e-business in the transport and logistics sector, only a few of them have focused on the behaviour of transport and logistics companies in e-business adoption. Gunasekaran and Ngai (2008) conducted an *ex-post* analysis of the success of e-procurement adoption. In their study, the key factors influential to the success of e-procurement were primarily identified based on the literature and divided into four groups including the perceived benefits, perceived barriers, critical success factors in e-procurement and organisational performance with e-procurement. They found the impacts of e-procurement on company performance include improved short-term and long-term organisational performance, networking and lower cost.

Matopoulos et al. (2007) studied the factors influential to e-business adoption decision that can be divided into three groups, "sector factors", "supply chain factors" and "intra-enterprise factors". The results of their interviews with companies in the retailing and manufacturing sectors in Greece revealed that e-business adoption is more affected by supply chain factors and