A model for electronic commerce success

Mohammed Quaddus\textsuperscript{a,}\textsuperscript{*}, Didi Achjari\textsuperscript{b}

\textsuperscript{a}\textit{Graduate School of Business, Curtin University of Technology, G.P.O. box U 1987, Perth, WA 6845, Australia}

\textsuperscript{b}\textit{Gadjah Mada University, Yogyakarta, Indonesia}

Abstract

This paper attempts to develop a framework for electronic commerce (e-commerce) success. Key factors impacting e-commerce are identified from a detailed literature review. These factors are then differentiated according to their contribution to the success of e-commerce and according to the locus of impact. The final model is then cast in a structural equation modeling framework comprising four exogenous variables (internal driver, internal impediment, external driver and external impediment) and one endogenous variable (e-commerce success) with 24 observed variables. Data are collected via a questionnaire-based survey from large Australian companies. The study results suggest that increased benefits (both internal and external) from the use of e-commerce significantly predict the perceived and/or expected success of e-commerce. However, lowering of impediments (internal and external) does not significantly affect the success of e-commerce.

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1. Introduction

Electronic commerce (e-commerce), Internet-based or otherwise, is changing the way organizations perform their tasks, interact with customers and, in general, do their business. E-commerce is not only the buying and selling of products via electronic means, it involves all other activities to support the sale process (Applegate, Holsapple, Kalakota, Radermacher, 2000).
As such, the current study adopts the definition of e-commerce provided by Wigand (1997) and Kalakota and Whinston (1997) vide “electronic commerce includes any form of business activity conducted via electronic means, which might range from products/services information to selling and/or buying products”. Undoubtedly, e-commerce is changing the business process and it is also changing the organizational structure to support the new process. Among the myriad of computer- and telecommunication-based applications in the modern era, the advent of e-commerce is having the biggest impact on organizations and their customers.

To take advantage of e-commerce, during the late 1990s many companies expanded their business activities to reach new customers and/or to offer new opportunities to their existing customers. During the same time there has been exponential growth of new start-up companies embracing e-commerce technologies, popularly known as dot-com companies (Lovelock, 2001). However, there have been substantial failures amongst these companies and it is now time to look back and learn from the mistakes of the past.

The literature provides a sketchy picture of the reasons for the failures. Janenko (2003) examines the illusion of automated success as the primary reason for the dot-com doom. According to him, many companies automated many aspects of the business processes via web sites and thought that success would automatically follow. Varianini and Vaturi (2000) found similar reasons for failures. The authors also offer some factors of success such as maintaining a constant flow of market information, flexible organization, establish up-front objectives, strong emphasis on marketing. Lovelock (2001) found a number of reasons for dot-com meltdown: poor revenue/cost/profit model, no competitive advantage, lack of benefit to consumers, problems in organization and execution, ineffective warehouse management and fulfillment and web site conflict with existing business partners. Agrawal, Arjona, and Lemmens (2001) find ‘fatal attraction’ as the primary symptom of e-commerce failures. In their comprehensive data analysis, the authors found that at least 6 months before the collapse all companies attracted significant number of visitors to the site, but they did not purchase enough. The authors stress the importance of attracting, converting and retaining visitors as the measures of e-commerce success.

It is therefore evident that companies embarking on e-commerce had not planned well (in terms of appropriate business models) to start with. They also did not have a good measure of e-commerce success. There appears to be no comprehensive model of e-commerce success and its empirical study. This important gap is addressed in this paper.

In spite of the need to assess the impact of e-commerce, the available measures have proved inconclusive. This results in difficulties when assessing the performance of e-commerce relative to alternative strategies (Rose, Khoo, & Straub, 1999). Some use technical measures such as page hit and view (Kroll, 2000; Rose et al., 1999). Others use strategic assessments, for example the firm’s goal attainment and competitive advantage. These inconclusive assessments call for more comprehensive e-commerce measures that can accommodate multiple criteria for success.

In this vein, the current study aims to develop a framework for assessing e-commerce success. In doing so, the factors affecting e-commerce success are identified. The success resulting from the interplay of these factors is then measured using multiple criteria derived from prior studies. The framework provides four scenarios for factors affecting e-commerce success. They are classified depending on whether they are drivers or impediments of e-commerce success, and whether the impacts are internal or external to the organization.
This paper is structured as follows. The first section presents the theoretical background for developing a framework of e-commerce success. This is followed by the elaboration of both drivers and impediments of e-commerce, followed by hypothesis development. Then, the target sample, measures and the data analysis method are explained in the research method section, followed by presentation of the findings. Finally, the paper concludes with the discussion of the implications of the results.

2. Theoretical perspective on factors affecting e-commerce success

It is argued that the success or failure of e-commerce is largely determined by the ability to minimize the impediments and to maximize the drivers. Therefore, these drivers and impediments have been included in the framework. To obtain a comprehensive understanding of e-commerce impacts, these dimensions need to be differentiated further according to the locus of impact: internal or external. The internal impacts include benefits and impediments to the company using e-commerce. The external impacts consist of both benefits and impediments to external parties such as customers and suppliers. The high level framework is presented in Table 1.

2.1. E-commerce drivers and impediments

The literature suggests a variety of positive impacts by adopting e-commerce, as well as many of its inhibiting factors. On the positive side, cost saving is the most cited. E-commerce enables firms to reduce telecommunication costs, minimize warehousing expenses, and cut down the distribution chain. Firms also benefit by extended global reach. Table 2 shows past research on e-commerce and corresponding drivers and impediments identified by researchers.

The literature suggests that financial consideration is an inhibitor for the adoption of e-commerce (PricewaterhouseCoopers, 1999). Computer and networking technology is still
Table 2
A summary of research on the factors affecting success of electronic commerce

<table>
<thead>
<tr>
<th>Authors</th>
<th>Research approach</th>
<th>Sample</th>
<th>Industry</th>
<th>Contribution to the success of electronic commerce</th>
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<tr>
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<td>Internal drivers</td>
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<td>Steel company</td>
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<tr>
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considered expensive. Therefore, many companies, especially SMEs, cannot afford the total costs of ownership of e-commerce (De’ & Mathew, 1999; Nath, Akmanligil, Hjelm, Sakaguchi, Schultz, 1998). In addition, legal and liability issues related to the borderless nature of e-commerce add to its complexity.

2.2. E-commerce success framework

It has been argued before that companies adopting e-commerce need to assess the impact of e-commerce, i.e., e-commerce success. A business performance measurement approach is used to frame the measurement for e-commerce success (Venkatraman and Ramanujam 1986; Kaplan and Norton 1992). Venkatraman and Ramanujam (1986) present a model of the domain of business performance. Their model highlights the multi-dimensional nature of business performance measurement, which can be very narrow in scope (based on financial performance only) or extremely wide covering organizational effectiveness. Kaplan and Norton (1992) argue that business performance must be measured from four different perspectives, viz., financial, customer, innovation/learning, and internal business perspectives.

In line with Venkatraman and Ramanujam (1986) and Kaplan and Norton (1992), two perspectives, namely operational and strategic, are used to frame the measurement of e-commerce success.

Prior studies suggest that there are no conclusive measures of e-commerce success. Some computer-reported measures are considered more objective (Straub, Limayem, & Karahanna, 1995). An example of this is the ‘hit’, which is regarded as an operational measure. However, the use of the hit measurement can be misleading (Ayres, 2000). Using the hit as a measure, the number of people visiting the web site is based on the number of IP addresses that download pages from a site. A problem arises when visitors use the Internet in public facilities such as offices and schools, since it will only record one individual from that individual IP address, regardless of the number of people in that particular place visiting the same site.

Due to the limitation of the ‘hit’, other techniques have been devised. ‘Page view’ is considered to be better since it incorporates a time dimension. It shows the number of pages downloaded by visitors over a given period (Kroll, 2000). Alternatively, ‘stickiness’ can also be used to measure a Web site’s performance. It tells us how long each visitor remains on a site (Kroll, 2000). Finally, the ‘conversion rate’ is most comprehensive. The metric is obtained by dividing the number of visitors over a period with the number of visitors who transact, such as purchasing (Gurley, 2000).

The strategic perspective on measuring e-commerce success is also considered through two alternative measures. First, Sethi and King (1991) assess the competitive advantage that results from the use of IT applications. Since e-commerce is an extensive form of IT application, which is likely to affect the organization in many ways, ‘extent of competitive advantage due to e-commerce’ is used as a measure of success. DeLone and McLean (1992) measured IT success in terms of the firm’s goal attainment. This measure is adapted as a measure of e-commerce success, i.e., extent of the contribution of e-commerce to meet organizational goals.

In summary, rather than depending on one approach, the current study combines both operational and strategic approaches to measure e-commerce success. Thus, e-commerce success is framed with four operational and two strategic measures. Combining the key factors (drivers
and impediments) affecting e-commerce success and the measures thereof underpin the framework.

3. E-commerce success: description of the key factors

3.1. Internal driver

The higher the internal driver, the more successful the e-commerce. The internal driver is defined as the perceived/expected benefits in using e-commerce.

3.1.1. Cost leadership

The greater the cost saving gained from the use of e-commerce, the higher the internal driver. The literature shows that e-commerce can reduce the costs associated with information processing needed to perform the company’s primary process (Auger & Gallaugher, 1997; Benjamin & Wigand, 1995; Grover & Ramanlal, 1999; Malone, Yates, & Benjamin, 1987; Ng et al., 1998; Poon & Swatman, 1999; Venkatraman, 2000; Wigand, 1997). Such cost savings can be attained by using net-based catalogs and automatic credit card authorization, thus minimizing human error (Auger & Gallaugher, 1997). Chan and Swatman (2000) demonstrate that e-commerce can reduce inventory costs. The presence of e-commerce reduces the layers of intermediaries that in turn reduce distribution costs (Benjamin & Wigand, 1995; Ghosh, 1998; Ng et al., 1998; Riggins, 1999). Some authors argue that e-commerce is a low-cost marketing medium since it enables firms to disseminate information regarding products and services globally at minimum cost (Auger & Gallaugher, 1997; Nath et al., 1998; Poon & Swatman, 1999; Strader & Shaw, 1997).

3.1.2. Reputation

The higher an organization’s reputation gained from its presence on the Internet, the higher the internal driver. E-commerce is reported to have an ability to increase the company’s reputation (Auger & Gallaugher, 1997; De’ & Mathew, 1999; Nath et al., 1998; Poon & Swatman, 1999). This is even more prevalent for larger businesses than smaller ones (Auger & Gallaugher, 1997). A study by Nath et al. (1998) reveals that the presence of an organization on the Internet may be triggered by a similar action by their competitors. It might be considered that a company’s image will be undermined if it does not follow a competitors’ action.

3.1.3. Market

The broader the market gained from the use of e-commerce, the higher the internal driver. The Internet has opened new opportunities to access a broader market. E-commerce can help firms to sell products and services to overseas markets more easily (Nath et al., 1998; Riggins, 1999). Furthermore, Auger and Gallaugher (1997) reveal that Internet consumers are more affluent and educated than average people. Indeed, they are a potential target market for particular products and services such as computer hardware and software, insurance, and banking. Also, e-commerce allows firms to ‘learn’ about their consumers’ preference when tracking visits to particular web sites. In doing so, sometimes consumers and visitors are asked to fill in questionnaires or membership forms. Alternatively, firms use particular software such as ‘cookies’ to collect such
information. Often, consumers and visitors are not aware that they are under surveillance and that their actions can be tracked. In addition, information collected using these techniques can be used to conduct market research (Auger & Gallaugher, 1997; Ng et al., 1998; Poon & Swatman, 1999).

3.1.4. Business entry

The greater the equality of entry, the higher the internal driver. It is considered that e-commerce has a low barrier to entry even for small businesses (Nath et al., 1998). Since there is no single party who can claim to be the owner of the Internet, it is open to everybody including business.

3.2. Internal impediments

The lower the internal impediment, the more successful the e-commerce. An internal impediment is defined as a perceived or likely constraint in using e-commerce.

3.2.1. Finance

The lower the financial concern with respect to the use of e-commerce, the lower the internal impediment. The Internet is believed to be able to deliver goods and services more cheaply. This provokes consumers to seek bargains on the Internet. However, this phenomenon does not necessarily mean more profit for the businesses concerned. While the number of transactions might accumulate, there could be a decrease in profit margin per transaction (Benjamin & Wigand, 1995). Another financial concern regarding the implementation of e-commerce is the total cost of ownership (De’ & Mathew, 1999; Nath et al., 1998; Saunders, 2000) including setup costs, connection costs, hardware costs and maintenance costs resulting in risk aversion.

3.2.2. Risks

The lower the risks of e-commerce, the lower the internal impediment. Kalakota and Whinston (1996) define a security threat as “a circumstance, condition or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, denial of service, and/or fraud, waste and abuse”. Online businesses have certain security risks, such as viruses and hackers, due to the presence of a web server on their sites (Saunders, 2000). Further risk factors include the fact that the web-based databases might be copied, stolen, altered or destroyed by unauthorized users. The results might range from spoilt reputation to serious damage, even loss of a whole database (Saunders, 2000). Although many techniques such as a firewall can be used to protect an online database, the risks are still there since hackers will always attempt to find security loopholes. Indeed, the real threat often exists within business boundaries rather than from external sources (Rose et al., 1999).

Another impediment is that online businesses often find it difficult to monitor the use of the web site (Auger & Gallaugher, 1997). Although statistics from the visitors who log onto a web site may help, visitor information remains unknown. Some companies require registration procedures before granting an authorization to visit a web site to enable cookie placement on the user’s computer. This mechanism allows the company to analyze the visitor’s pattern of use.
3.2.3. **Expertise**

The easier it is to find experts in e-commerce, the lower the internal impediment. E-commerce involves the skills of web developers, content providers and customer service professionals (Nath et al., 1998). It is expensive to retain these skills internally. Outsourcing, therefore, then becomes a potential answer to such problems.

3.3. **External driver**

The higher the external driver, the more successful the e-commerce. The external driver is defined as the perceived/expected benefits to external parties as a result of the company using e-commerce.

3.3.1. **Product pricing**

The cheaper the products and services are priced on the Internet compared to their retail shop price, the higher the external driver. Theory suggests that online shops might be able to deliver better value for money on products and services than retail shops due to cost savings. Strader and Shaw (1997) argue that the presence of an e-market for products and/or services such as books, music and airline tickets, has reduced the likelihood of consumers being overcharged due to limited information regarding other prices. This notion is supported by their subsequent study (Strader & Shaw, 1999). Additionally, Brynjolfsson and Smith (2000) found that internet prices are lower than retail outlet prices depending on the products’ cost structures and product types. Conversely, according to Palmer (1997), although the mean web store price is the lowest, price differences between a web store and other formats such as catalog and cable TV are not significant.

3.3.2. **Time spent**

The higher the time saving from the use of e-commerce, the higher the external driver. One benefit of e-commerce for consumers is time saving (Lynch & Lundquist, 1996). Kalakota and Whinston (1997) use ‘time compression’ as an expression to illustrate the capability of e-commerce in shortening the business cycle. As such, time required in certain processes of product purchasing, including order time, processing time, queuing time and payment time could be reduced considerably. In doing so, many web sites are offering facilities, for instance online catalogs, shopping carts and online payments. For particular products such as software, these web sites are often able to deliver the product online (Riggins, 1999).

3.3.3. **Convenience**

The more convenient the e-commerce, the higher the external driver. For some people, doing transactions online is considered more convenient than at the ‘bricks and mortar’ shop because of flexibility of business hours. E-commerce allows businesses to open their virtual outlets 24 h × 7 days a week (Saunders, 2000), so consumers can shop at their convenience. Furthermore, some online businesses offer online payment mechanisms using credit cards. However, it is recognized that many people are concerned about the use of credit cards in online payment. Therefore, financial transaction systems to overcome that problem have been developed, for instance by using ‘internet payment systems’ (Shon & Swatman, 1998). Another e-commerce convenience is
the possibility of delivering streamlined transactions as well as personalized service (De’ & Mathew, 1999; Ghosh, 1998; Venkatraman, 2000). Customers can accomplish transactions simply in one click. The need for repeated information and multiple forms can be minimized using ‘software agents’ that automate tasks (Riggins, 1999).

3.3.4. External relationship

The better the external relationship, the higher the external driver. The presence of e-commerce can lead to better and easier interaction with customers as well as suppliers (Ghosh, 1998; PricewaterhouseCoopers, 1999). Customer service functions can benefit from the interactive nature of web-based applications that facilitate customer feedback and enquiries through various means, for example e-mail and online survey (Auger & Gallaugher, 1997; Riggins, 1999). To provide such easy, 24 h-a-day availability, with the possibility of quick response, online businesses may offer an online help desk—such as an FAQ facility—to answer customer enquiries with less direct human involvement. An online survey by PricewaterhouseCoopers (1999) revealed that two of the most significant potential benefits of e-commerce realized by small and medium enterprises (SMEs) are customer-focused service and information exchange. The study results suggest that there is a growing awareness of the possibilities of enhanced and more efficient customer-supplier relationships (B2B) among SMEs.

3.4. External impediment

The lower the external impediment, the more successful the e-commerce. The external impediment is defined as perceived/expected impediments faced or likely to be faced by external parties in dealing with the company using e-commerce.

3.4.1. Customer expense

The lower the cost of participation in e-commerce, the lower the external impediment. To be able to participate in an e-market, consumers have to get access to the Internet. While some consumers may use free access in the office or at school, others have to pay an Internet connection fee and telephone charges which vary among service providers. Strader and Shaw (1999) who named these costs ‘market costs’, stated that in an e-market, consumers bear some market costs that they do not bear in the ‘brick and mortar’ market. In addition, they argued that the extent to which these costs can be minimized would determine the choice between an e-market and a traditional market. A similar view was presented by Keeney (1999) who addressed the role of ‘value proposition’—which includes the benefits and costs of ordering products online—to influence the purchasing mode.

3.4.2. Delivery time

The faster the delivery time, the lower the external impediment. Compared to other retail formats, the online store seems to lag behind in terms of the delivery of products and services (Palmer, 1997). Most products cannot be delivered immediately with the exception of digital products such as software, which can be downloaded and used almost instantly. Hence, to compete with retail shops or other formats, online businesses have to minimize delivery times. Otherwise, many customers seek the medium which offers the quickest delivery.
3.4.3. Transaction risks

The lower the transaction risks, the lower the external impediment. Undoubtedly, many people are reluctant to shop online due to ‘perceived’ security issues (Auger & Gallaugher, 1997; Furnell & Karweni, 1999). The Internet is often seen as an unsecured place to conduct business transactions. When transaction data are sent through the Internet, there is always a chance that someone will eavesdrop and intercept that information to use it for their interests (Nath et al., 1998). Credit card fraud is a classic example. It is argued that such problems mostly tend to be a managerial rather than a technological problem (Rose et al., 1999). Another risk that may hinder B2C e-commerce is privacy. The challenge is to convince customers that their information details are safeguarded, strictly confidential and will only be used for delivering superior value to them (Rose et al., 1999). Further, cyber privacy intrusion in the form of unsolicited e-mails and the use of cookies to track user’s behavior may be seen by many as disincentives to the use of e-commerce.

3.4.4. Access

The higher the Internet access speed, the lower the external impediment. To attract visitors’ interest, web sites often use high-resolution graphics, video and audio streaming, which are usually large files. Therefore, high-speed Internet access is required, which unfortunately is not always easy to obtain (Auger & Gallaugher, 1997). Otherwise, web site response might be slow, delayed and disrupted leading to visitors’ dissatisfaction. Indeed, Rose et al. (1999) argue that technological impediments are not merely a matter of file size. Also pertinent are technological configuration, network infrastructure and bandwidth connection.

4. Hypotheses development

Based on the extensive review of the literature on the factors related to the success of e-commerce, the following hypotheses are presented:

H1. There is a positive and significant relationship between the internal driver and e-commerce success.

H2. There is a negative and significant relationship between the internal impediment and e-commerce success.

H3. There is a positive and significant relationship between the external driver and e-commerce success.

H4. There is a negative and significant relationship between the external impediment and e-commerce success.

5. Research method

The research model as depicted in Fig. 1 was developed according to the hypotheses stated above. The data were analyzed using Lisrel 8.3 software.

In terms of the variables, there are four exogenous variables (Ksi) and an endogenous (Eta) variable. The first exogenous variable is the internal driver (ID) that includes the high-level
variables—cost leadership, reputation, market and business entry. However, ID is eventually measured by nine observed variables (ID1…ID9). The second Ksi is internal impediment (II) which contains high level variables such as financial risk and expertise. It is eventually measured by six observed variables (II1…II6). The third latent variable is external driver (ED) which includes product pricing, time spent, convenience and external relationship. ED is measured by nine observed variables (ED1…ED9). Finally, the exogenous variable external impediment (EI) comprises the high level items: customer’s expense, delivery time, transaction risk and access. However, EI is eventually measured by six observed variables (EI1…EI6). The only endogenous variable in this model is e-commerce success (ECS) which is measured by observed variables: competitive advantage, firm’s goal, conversion rate, page view, stickiness and hit (ECS1…ECS6). The full model thus has 36 observed variables.

Before conducting the full SEM analysis, it was necessary to examine the measurement properties of the model. This stage was effected using one-factor congeneric measurement model (Holmes–Smith, 2000). In doing so, an iteration using LISREL was performed on each construct. This procedure was expected to produce robust constructs that included tests of construct reliability ($\rho > 0.50$), convergent validity (parameter $t$-value > 1.96) and discriminant validity. Each construct was examined to find the non-significant parameter, which could be fixed at zero or deleted. This phase thus produced parsimonious constructs with reasonable fit indicators such as RMSR, GFI and normed chi-square.

5.1. Sample and procedure

The sample for this study was obtained from Australia’s Business Who’s Who Directory September 2000 edition. The selected sample companies that had homepage and/or e-mail address
as a proxy for e-commerce existence were invited to participate in both the pilot test and main survey. The pilot test was conducted in order to assess the research instrument. In this phase, 32 companies in Western Australia were selected. Responses from eight companies were received of which one was incomplete. Following suggestions received, minor revisions were incorporated.

In the main survey, the top 1000 Australian companies, based on annual revenue, were selected from the directory. The mail questionnaire was sent to each company with a letter explaining the purpose of the research and a reply paid envelope. The target respondents were IT managers and/or CEOs. 101 responses were returned. However, two responses were incomplete. In addition, there were 22 undelivered questionnaires and three companies declined to participate.

To improve the response rate, reminders were sent to 593 companies. This resulted in 41 undelivered questionnaires, while 14 companies declined to participate, two responses were incomplete and 23 constituted usable responses. Therefore, 122 usable responses were obtained from the main survey. Responses from the prior stage were added to the main survey to provide a final sample of 129 responses (13.3% response rate).

The returned questionnaires showed that the responses were mostly in the context of the entire company (87.1%) rather than their specific business unit (12.9%). In terms of business types, 43.4% of respondents performed both B2B- and B2C-type e-commerce. Meanwhile, respondents conducting B2C only and B2B only accounted for 10.1% and 24.8%, respectively. Further, the majority of participants (56.3%) have been using e-commerce for 1–3 years; the remaining participants have been using it for less than 1 year (17.5%) and more than 3 years (26.2%). Next, the responses demonstrate that 36.5% were able to conduct online orders and online customer service, 29.8% have web sites without any advanced capability, 26% of the participants are able to perform complete transactions and receive payment over the web, and 2.9% of the participants only have very basic internet capabilities. In regard to the payment systems, most respondents (52.1%) still rely on conventional methods of payment, but some (27.7%) do online orders. Only a few participants (2.1%) asked customers to have membership before they can make order and payment. Of the participants, 13.8% asked for credit card details when their customers make online orders. Combinations of various payment systems have been used by 21.3% of the participants. Finally, the market base for companies that use e-commerce within Australia was 55.8%. This includes those companies that operate in one state and accept customers from that state. Of the respondents, 42.3% have customers from both Australia and overseas. Only 1.9% focus on overseas markets only.

5.2. Measures

The measures used in the study are adapted from past literature. A six-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree’ is used for independent observed variables, ECS1 and ECS2. Meanwhile, a five-point Likert scale is used for ECS3–ECS6.

5.3. Data examination

Before the data were analyzed, it was necessary to assess their properties. The raw data showed some missing values, which was then imputed using an estimated means (EM) method. Next, the data were tested for assumption of multinormality. Although the Kolomogorov–Smirnov
normality test showed the distribution anomalies in all items, the skewness and kurtosis of each item fell within the acceptable range (±2).

In terms of number of cases, some researchers argued that the minimum cases required to run structural equation analysis were about 200 and/or ten times the number of observed variables in the most complex construct. Gefen, Straub, and Boudreau (2000) demonstrate that the required minimal sample size is around 100–150 cases for LISREL. This study, with 129 cases, is considered to be on the lower side of the required sample size to run the LISREL program and is thus a limitation of the research.

6. Results

6.1. Assessment of measurement properties

6.1.1. Assessment of convergent and discriminant validity

The one-factor congeneric measurement model is applied to each construct. The model re-specifications were undertaken to improve the fit of the model. This included the deletion of non-significant estimated parameters and free the parameters that share large error variance. The procedure was undertaken until the satisfactory fit of the model was reached and there was no statistical nor theoretical justification for further modifications. The step-by-step model re-specification for each construct is shown in Table 3.

The results of one-factor congeneric measurement model assessments are shown in Table 4. The five latent variables contain 24 observed items from the original 36 items. The remaining measures are considered to support the convergent validity requirements, because they demonstrated the significant t-values.

In terms of discriminant validity, the data indicated a problem on ID and ED constructs adopting the formula suggested by Holmes-Smith (2000). Holmes-Smith (2000) maintains that the requirement of discriminant validity is that the correlation between constructs should be less than the average variance extracted for two constructs. Table 5 indicates all but one (ID with ED) entry examined, satisfy discriminant validity criteria. However, if discriminant validity was measured following procedures used by Venkatraman (1989) and Sethi and King (1991), the results satisfied the discriminant validity requirement. Table 6 demonstrates that the fit of the unconstrained models were significantly lower (better) than the fit of the constrained models. This meant the tested constructs are different.

The complementary analysis procedure that is performed was predictive validity (Venkatraman, 1989; Sethi & King, 1991). As such, this study examined the validity of the exogenous variables to predict the endogenous variable, e-commerce success. The results shown in Table 7 suggested a support for the predictive validity of two key driver factors, ED and ID, because both factors are significantly associated with the success of e-commerce. Conversely, the remaining impediment factors failed to predict the ECS factor. Although both factors II and EI show negative correlations with ECS, which are supported by the literature, such correlations are not significant. In general, the assessment of four exogenous variables and one endogenous variable provided partial support for the predictive validity of these constructs.
Table 3
Assessment of unidimensionality and convergent validity using the congeneric model

<table>
<thead>
<tr>
<th>Item</th>
<th>Fit indices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electronic commerce success (ECS)</strong></td>
<td></td>
</tr>
<tr>
<td>Hypothesized model</td>
<td>$\chi^2 = 88.3$, df = 9, $p = 0.00$, GFI = 0.81, RMSR = 0.15</td>
</tr>
<tr>
<td>Iteration 1 ECS1, ECS3-ECS6</td>
<td>$\chi^2 = 23.48$, df = 5, $p = 0.00027$, GFI = 0.93, RMSR = 0.061</td>
</tr>
<tr>
<td>In the interest of parsimony, item ECS2 was deleted because ECS2 shared significant error variance with ECS1, but ECS2 has lower loading than ECS1. Theoretically, this attempt can be justified since company’s goals may comprise of achieving the competitive advantage.</td>
<td></td>
</tr>
<tr>
<td>Iteration 2 ECS1, ECS3, ECS4, ECS6</td>
<td>$\chi^2 = 2.98$, df = 2, $p = 0.21$, GFI = 0.99, RMSR = 0.031</td>
</tr>
<tr>
<td>In the interest of parsimony, item ECS5 was dropped since it shared significant standardized residuals with other two items (ECS4 and ECS6). The results show the final model.</td>
<td></td>
</tr>
<tr>
<td><strong>Internal driver (ID)</strong></td>
<td></td>
</tr>
<tr>
<td>Hypothesized model</td>
<td>$\chi^2 = 79.14$, df = 27, $p = 0.00$, GFI = 0.88, RMSR = 0.085</td>
</tr>
<tr>
<td>Iteration 1 &amp; 2 ID1…ID9</td>
<td>$\chi^2 = 68.65$, df = 14, $p = 0.00$, GFI = 0.87, RMSR = 0.098</td>
</tr>
<tr>
<td>Items ID8 and ID9 respectively were dropped because they had practical non-significant loading. Hair et al. (1998) suggest that to be practical significant, the loading factor score should be above $\pm 0.30$.</td>
<td></td>
</tr>
<tr>
<td>Iteration 3 ID1,ID3…ID7</td>
<td>$\chi^2 = 18.91$, df = 9, $p = 0.026$, GFI = 0.95, RMSR = 0.062</td>
</tr>
<tr>
<td>In the interest of parsimony, item ID2 was dropped since it shared significant standardized residual with ID3 and it had lower loading factor.</td>
<td></td>
</tr>
<tr>
<td>Iteration 4 ID1,ID4…ID7</td>
<td>$\chi^2 = 3.86$, df = 5, $p = 0.57$, GFI = 0.99, RMSR = 0.033</td>
</tr>
<tr>
<td>In the interest of parsimony, ID3 was deleted because it shared significant error variance with ID1 and it had lower loading factor. The results show the final model.</td>
<td></td>
</tr>
</tbody>
</table>
### Internal Impediment (II)

<table>
<thead>
<tr>
<th>Hypothesized model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
<th>GFI</th>
<th>RMSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>II1...II6</td>
<td>13.40</td>
<td>9</td>
<td>0.15</td>
<td>0.97</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Iteration 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II2...ID6</td>
<td>3.32</td>
<td>5</td>
<td>0.65</td>
<td>0.99</td>
<td>0.034</td>
</tr>
</tbody>
</table>

Item II1 was deleted since it had non-significant $t$-value. The results show the final model.

### External driver (ED)

<table>
<thead>
<tr>
<th>Hypothesized model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
<th>GFI</th>
<th>RMSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED1...ED9</td>
<td>82.27</td>
<td>27</td>
<td>0.00</td>
<td>0.88</td>
<td>0.091</td>
</tr>
<tr>
<td><strong>Iteration 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ED1,ED3...ED9</td>
<td>43.15</td>
<td>20</td>
<td>0.002</td>
<td>0.92</td>
<td>0.068</td>
</tr>
</tbody>
</table>

Item ED2 shared significant error variance with ED3. In the interest of parsimony, ED2 was deleted because it had lower loading factor.

| **Iteration 2 & 3** |          |     |       |      |      |
| ED1,ED3,ED5...ED8   | 12.73    | 9   | 0.18  | 0.97 | 0.055|

ED9 and ED4 were deleted since they shared significant standardized residual while to correlate them cannot be justified theoretically.

| **Iteration 4**     |          |     |       |      |      |
| ED3,ED5...ED8       | 6.83     | 5   | 0.23  | 0.98 | 0.044|

ED1 was deleted since it had non-significant $t$-value. The results show the final model.

### External impediment (EI)

<table>
<thead>
<tr>
<th>Hypothesized model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
<th>GFI</th>
<th>RMSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>EI1...EI6</td>
<td>77.17</td>
<td>9</td>
<td>0.00</td>
<td>0.83</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Iteration 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EI2...EI6</td>
<td>50.79</td>
<td>5</td>
<td>0.00</td>
<td>0.86</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Item EI1 was dropped because it showed a non-significant $t$-value.

| **Iteration 2**     |          |     |       |      |      |
| EI2...EI6           | 3.92     | 4   | 0.42  | 0.99 | 0.046|

The error terms of item EI4 correlated with item EI5. It was justified since both items tap into the same treat—Transaction Risks. The results show the final model.
Table 4
The results of one-factor congeneric measurement model on each construct

**Internal driver**
- ID1: E-commerce enables cost savings in performing business activities.
- ID4: Marketing costs become lower using e-commerce.
- ID5: Using e-commerce leverages the firm’s reputation.
- ID6: E-commerce enables the firm to expand the base of consumers both nationwide and overseas.
- ID7: E-commerce enables the firm to collect information from consumers and web visitors.

**Internal impediment**
- II2: The organization is concerned about the total cost of e-commerce ownership (e.g., setup cost, connection cost, hardware cost, and maintenance cost).
- II3: E-commerce increases security risks.
- II4: It is difficult to monitor visitor activities in a firm’s website.
- II5: Legal issues are a matter of concern in e-commerce transactions.
- II6: It is difficult to obtain experts in e-commerce.

**External driver**
- ED3: E-commerce allows consumers to find and select products faster.
- ED5: E-commerce allows the firm to offer personalized services for customers.
- ED6: E-commerce allows consumers to pay online.
- ED7: Consumers can perform transactions easily.
- ED8: E-commerce enables the firm to provide customer service 24 hours, 7 days a week.

**External impediment**
- EI2: Delivery cost is a consumer’s concern when conducting transactions online.
- EI3: Delivery time is a consumer’s concern when conducting transactions online.
- EI4: Security is a consumer’s concern when conducting transactions online.
- EI5: Privacy is a consumer’s concern when conducting transactions online.
- EI6: Slow internet access is a barrier for consumers in conducting transactions online.

**Electronic commerce success**
- ECS1: In general, e-commerce contributes significantly to meeting the organization’s goal.
- ECS3: The conversion rate of my company’s e-commerce is:
- ECS4: The number of visitors visiting a site.
- ECS6: The length of time visitors remain on a site.

Table 5
Assessment of discriminant validity *(Holmes-Smith, 2000)*

<table>
<thead>
<tr>
<th>Construct</th>
<th>Average variance extracted</th>
<th>Square of correlation between construct</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID with:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>0.277314</td>
<td>0.0324</td>
</tr>
<tr>
<td>ED</td>
<td>0.301101*</td>
<td>0.7225*</td>
</tr>
<tr>
<td>EI</td>
<td>0.342964</td>
<td>0.0004</td>
</tr>
<tr>
<td>II with:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ED</td>
<td>0.256645</td>
<td>0.0289</td>
</tr>
<tr>
<td>EI</td>
<td>0.298509</td>
<td>0.0361</td>
</tr>
<tr>
<td>ED with:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EI</td>
<td>0.322296</td>
<td>0.0025</td>
</tr>
</tbody>
</table>

*Italics indicate problem of discriminant validity.*
6.1.2. Assessment of reliability

As suggested by Holmes-Smith (2000), in order to obtain the degree to which a set of measures indicates the common latent construct, construct reliability ($\rho$) is examined using the following formula:

$$\rho = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i^2) + \sum \epsilon_i}.$$

The results indicate that all five constructs have satisfactory construct reliability, as all $\rho$ are greater than 50%. The construct reliability scores for all five constructs are shown in Table 8.

6.2. Assessment of the structural model

The constructs that had been assessed for reliability and validity were again examined in terms of the structural model. Four latent independent variables (Ksi) with 20 measures and a latent
dependent variable (Eta) with four measures were included into the structural model. The initial structural model is then re-specified to improve the model fit. In doing so the error measurements of EI4 and EI5 are correlated. It is possible to do so as both EI4 and EI5 represent an individual consumer’s internal (personal) concerns (see Table 4). The hypothesized (initial) model depicted in Fig. 2 produced the goodness-of-fit indices and loading scores from ECS to ID, II, ED and EI as shown in Fig. 2 and Table 9. Although chi-square ($\chi^2$) value is high, the ratio of $\chi^2$ to df is less than 3, and considered acceptable in the literature (Gefen et al. 2000).

The initial structural model supported hypotheses H1 and H3, although the model fit showed only marginal satisfactory goodness-of-fit indices. Model re-specification is then undertaken because the results indicated some factors—individually and/or sharing with other factors—have high residuals, and the presence of non-significant loadings. Therefore, in the revised structural model, loadings EI–ECS and II–ECS were fixed to zero in the first iteration (Holmes-Smith, 2000). Then, to further improve the model fit, item ECS6 is correlated with ECS3 since the first iteration results show that it shares a high residual with ECS3. The correlation between ECS6 and ECS3 in the second iteration is plausible, since the longer the consumers remain on-site the more likely is conversion. This attempt has slightly improved the normed chi-square ($\chi^2$/df) from 2.06 to 2.02 as well as the RMSEA from 0.091 to 0.089. Finally, the revised structural model results, as seen in Table 10, supported hypotheses H1 and H3. Both internal driver ($\gamma = 0.68$, $t = 3.94$) and external driver ($\gamma = 0.54$, $t = 2.42$) factors have a positive direct effect on the success of e-commerce. The final model is shown in Fig. 3.

7. Discussion

The research procedures in terms of reliability, validity, one-factor measurement model, and structural model assessment have been undertaken to attain a robust and parsimonious model of the success of e-commerce. The one-factor congeneric model assessment screened the items on each construct. Items with low squared multiple correlation, which suggested problematic item reliability, were then dropped. As a result, only reliable items were used in the structural assessment. This was followed by construct reliability evaluation that resulted in satisfactory scores on each construct. In terms of discriminant validity assessment, although there are somewhat different results from the tests, in general the results satisfy discriminant validity
Fig. 2. The electronic commerce success—initial model.
requirements. The predictive validity test, which is an optional procedure, provided a lack of support for factors II and EI to predict ECS.

7.1. Measurement phase

In the congeneric measurement model phase, the number of observed variables decreased from 36 in the initial model to 24 in the final model. In terms of the ECS factor, two items ECS2 and ECS5 were dropped from the measurement model. Item ECS2 that measures the competitive advantage achieved from the use of e-commerce, correlates highly with item ECS1 that measures the contribution of e-commerce in meeting the organization’s goals. In the interest of parsimony, item ECS2 was dropped for the following reasons.

Statistically, item ECS2 had a lower loading than item ECS1, and theoretically, item ECS2 overlapped item ECS1. In addition, the deletion of item ECS5 that measures the page view is reasonable since it shows a complex pattern of relationships and is similar to page hit.

The one-factor measurement model for the construct internal driver lost 4 items. Item ID8 that assesses the quality of Internet customers compared to retail shop customers received weak
Further, weak support is received for item ID9. In addition, in the interest of parsimony, both items ID2 and ID3 were deleted.

In terms of the internal impediment factor, the data do not support item II1. Moreover, the data also indicate low support for external impediment item EI1, which assesses the higher costs incurred by customers in performing online transactions rather than in retail shopping. Another
interesting finding is that item EI4 (security concern) covaries with EI5 (privacy concern) in the model re-specification processes. This is consistent with the common view that both issues are intertwined—that security breach can harm privacy and vice versa. As suggested by the literature, both transaction risks are seen as major hindrances to the performance of online transactions (Auger & Gallaugher, 1997; Furnell & Karweni, 1999; Nath et al., 1998; Rose et al., 1999).

Items ED1, ED2, ED4 and ED9 of external drivers were dropped during the one-factor measurement model procedures. Item ED2 is not regarded as a robust measure of external driver since it shared significant residuals with item ED3 and had a lower loading factor than ED3. Thus, the notion of less time spent shopping online could be more appropriately represented by how fast customers can find and select products online. In the interest of parsimony, items ED9 and ED4 were dropped since they shared significant residuals, while to link them could not be justified theoretically. Finally, item ED1 was deleted because of a non-significant \( t \)-value.

7.2. Hypotheses H1 and H3

Concerning the structural model, the findings show that hypothesis H1 is supported. This is consistent with the literature in which internal driver factors predict the perceived success of e-commerce. In addition, hypothesis H3 that suggests the association between external driver and ECS is also confirmed. Arguably, organizations seek to attain superior values for external parties by utilizing the capabilities of e-commerce. Hence, these results provided support for e-commerce implementation by both organization adopters as well as customers and validated the important role of perceived usefulness in IT adoption and diffusion. While prior studies mainly focused on the internal benefits obtained by individual users and organization adopters to represent the notion of usefulness, this study contributed to the IT research domain by suggesting the importance of the benefit to the external organization, such as customers. Hence, Internet technology has enabled organizations to widen their IT orientation from internal support, like automation of clerical tasks and data processing using traditional IT, towards a more external orientation that incorporates and improves stakeholders’ benefits.

7.3. Hypotheses H2 and H4

The negative and non-significant relationships between the impediment and ECS factors (H2 and H4) indicate a lack of support for both relationships. The negative relationships of the impediment factors and ECS indicated that the higher presence of these impediment factors leads to lower perceptions of e-commerce success. Although both relationships showed the right direction, unfortunately the data did not support the significant association of these factors and the success of e-commerce. This meant that amongst Internet adopter organizations, the impediment factors were not regarded as important issues. Thereby, organizations perceived e-commerce success in terms of the potential benefit obtained, (which might be more apparent) rather than the reduction of impediment factors. As a consequence, it is understandable that many ‘dot.com’ companies cannot sustain their business since they primarily view internal and external drivers as the preconditions of e-commerce success.
7.4. Non-effects of the impediment factors

The reason for non-effects of the impediment factors on e-commerce success are examined next. It is noted that all the constructs have gone through extensive validity and reliability tests. The impediment factors did not reveal any problems with the convergent and discriminant validity and construct reliability tests. This implies that the impediment constructs are well conceptualized and operationalized. However, the impediment factors failed the predicted validity test, where they were scheduled to predict the e-commerce success (see Table 7). It must be highlighted that while the direction of tests was right (i.e., negative association), the data did not support the significance of the relationship with the predicted construct e-commerce success (see Table 7). It is surmised that the failure of the predictive validity test is perhaps the primary reason of non-effects of the impediment factors in final structural analysis. The authors performed some post-event analyses to delve into the matter further. Means for the five constructs are compared to see if the respondents favored some constructs. However, nothing unusual is observed. A range of regression models were then run starting with ECS as a function of ID, II, ED and EI. It was observed that ID and ED significantly impact ECS, while II and EI do not, confirming the earlier findings. A stepwise regression is also run with only ID and ED in the model.

All these reveal that either the inhibitors are not as serious as theorized or there are problems with the measurement of the constructs. As the inhibitors fail the predictive validity test (see Table 7) bivariate correlations of the items are calculated. This revealed that one of the items of e-commerce success, ECS3 (conversion rate), is highly correlated with most of items of ID, ED, II and EI. As reported earlier, Agrawal et al. (2001) considered conversion rate to be one of the most important success measures of e-commerce. Therefore, ECS3 is used as the single measure of e-commerce success and bivariate correlations are calculated. ID, ED, II and EI are significantly correlated with ECS3. This suggests that the measurement of II and EI should be reconsidered. However, the measurement of e-commerce success could also be reviewed. Further research is therefore needed to answer these questions.

7.5. Limitations of and prospects for the study

This research has a number of limitations and prospective research directions. The first limitation lies with the method of data collection. The data were collected using a broad definition of e-commerce from a single informant within a company operating a web page and performing some e-commerce activity. The informant is an IT manager or CEO. No separate analysis is performed for the IT manager and CEO due to a lack of sufficient data. Also, no distinction between B2C and B2B is made. The perspective is of a company engaged in some form of e-commerce activity. Further research needs to be carried out along the lines of these limitations. For example, the model can be fine-tuned for B2B e-commerce and data can be collected to test the model in a B2B environment. The instruments for the constructs are conceptualized and operationalized using a rigorous approach; however, the failure of predicted validity tests of the inhibiting factors raises questions as to the measurement of these and e-commerce success factors. Further research is also needed to fine-tune the instruments of the model using different data sets. Research is also needed to replicate the model with larger sample size.
Despite these limitations, the research is topical and it unearths findings that are useful to companies undertaking or planning to undertake e-commerce activity. There is a growing body of literature where the concepts advocated in the model can be useful. For example, Harrison-Walker (2002) discusses problems associated with international e-marketing concentrating on external barriers. The model developed here advocates consideration of both external and internal barriers as well as drivers. Cotter (2002) discusses the measures of e-marketing success and proposes some KPIs for e-marketing. Some of the KPIs observed are click-through rate, new versus repeat ratio, conversion rate and cost per conversion. It is noted that all these KPIs can be cast into a modeling framework to perform an empirical test of the model. In a recent editorial Thompson (2003) discusses the need and use of strategy in e-marketing. This special issue of the Journal of Business Research included articles dealing with aspects of strategy in e-marketing, risks and patronage of Internet shops, and adoption of the Internet. Ultimately the issue is consumer acceptance of e-commerce and appropriate strategies. The modeling framework adopted here can be adapted to one of these e-marketing strategy issues in order to empirically test key factors.

8. Concluding remarks

Evaluation of the success of e-commerce businesses requires appropriate metrics. Past studies demonstrate the extensive use of operational measures such as page hits, views, stickiness and, more recently, the conversion rate. The e-commerce success framework reported in this study incorporates both operational and strategic measures. The measures capture the impact of e-commerce on business goal attainment and competitive advantage. The literature also suggests key factors that affect the performance of e-commerce. Based on the direction of impact, the framework differentiates driving and impeding factors. These factors are then differentiated according to their contribution to the success of e-commerce and by the locus of impact. As an attempt to confirm the proposed framework, the current study proposes an analytical tool using a structural equation model.

The results of structural equation modeling indicate that the promised benefits of e-commerce for both the internal organization as well as customers are still the dominant factors that shape the perception of e-commerce success. Another interpretation is that the main purpose of e-commerce use by organizations is to attain e-commerce advantages such as cost savings and personalized service for customers. Further, the findings also suggest that organizations may not see the impeding factors, for instance security and privacy risks, as the important factors that can undermine the success of their e-commerce. Overall, while the literature maintains that the success story of e-commerce usage is built on an ability to gain the promised benefits and to mitigate against the impeding factors, this study concludes that organizations often experience ‘IT myopia’, only considering the potential advantages of IT use, but ignoring the factors that may impede its attainment.

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