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**Implementation Success of Internet-based
Electronic Commerce for Small- and Medium-sized
Enterprises in Australia**

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Abstract

This study surveys the perceptions and experience of Australian small- and medium-sized enterprises (SMEs) in the adoption and implementation of Internet-based Electronic Commerce. Employing Rogers (1995) model of innovation diffusion as the framework and considering Electronic Commerce (EC) as a form of new innovation, we analyse factors affecting EC implementation success. With a sample of 71 small businesses in Australia, preliminary results show that respondents' perception of the attributes of Internet-based EC are pre-dominantly positive. However, a further analysis was carried out regressing overall satisfaction of EC implementation on the five attributes of innovation. It was found that only 3 characteristics - perceived relative advantage, compatibility and complexity to make a significant contribution to the implementation success of Internet-based EC adoption.

1. Introduction

The commercialization of the Internet and World Wide Web (WWW) has driven Electronic Commerce (EC) to become one of the most important media for facilitating the sharing of business information within organisations and between business partners. According to Forrester Research (2000), it was estimated that the value of worldwide Electronic Commerce would reach US\$

6.8 trillion by the year 2004 while the Asia Pacific region would have Electronic Commerce revenue of US\$992 billion (Gartner Group, 2000). In Australia it was reported that 1.4 billion electronic transactions took place by the end of 1997 and there will be more than 8 million Internet users at the end of year 2000 (eTForecast, 2000). While the numerous prognoses of Electronic Commerce growth differ greatly, they serve as a clear indication of the importance for and impact on the business world.

According to the 2000 report of the Australian National Office of the Information Economy (NOIE), Australia is well positioned to benefit from the emerging information economy. On a number of metrics, Australia is among the leading nations in terms of measures of Internet infrastructure, penetration and activity. However, in comparison with other countries and other larger Australian businesses, small- and medium-sized enterprises (SMEs) have been relatively slow in adopting EC (NOIE, 2000; Small Business Index, 2000). Most SMEs perceive the challenge of integrating EC into their business operations as risky, complex, time-consuming, and an expensive initiative (NOIE, 2000). If the EC implementation is successful, potential benefits to small businesses can include increased sales, improved profitability, increased productivity, reduced costs associated with inventories, procurement and distribution, improved quality of service, and secured competitive positions (see Campbell, 1998; Puro and Campbell, 1998; Smith, 1998; Whiteley, 2000). On the other hand, if EC implementation is unsuccessful, it will have severe repercussions on small businesses with their limited resources. This paper aims to identify which factors are important in the successful implementation of EC for SMEs. While these results may be generalisable to other countries, the data set is Australian and conclusions are restricted to that environment at this stage.

2. Significance & Objectives of the Research

The significance of the research stems from addressing several needs – as outlined below:

- As mentioned in Australian government reports by Foreign Affairs and Trade (1995) and the Department for Communications, Trade and the Arts (1999), SMEs play a crucial role in the Australian economy as they account for about half of total employment, contribute more to employment growth than large companies and represent an entrepreneurial engine of growth. However, barriers which Australian SMEs face are discouraging them from moving online and integrating EC in their business operations and systems. In the long run, there may be wide-ranging adverse national, community and business impacts, particularly on small businesses and their communities in regional and rural Australia. This may also have a critical effect on how Australian SMEs engage in competitive and global commerce in the future. Thus, a comprehensive research study of EC adoption and implementation,

specifically for SMEs, is needed to encourage widespread use of EC in Australia.

- Despite the growth of EC, many organisations lack business strategies or models to support their EC implementation and thus fail to enhance their competitive advantage (Yoffie, 1996). This lack of business framework causes inadequate planning of IT investment and ultimately leads to adoption failure (Keen, 1991). Particularly for SMEs, this requires the (re-)development and application of new concepts and models to allow them to take advantage of the many benefits of EC. In a globalised economy, with less and less opportunities for regional and niche market positions, the adoption and successful deployment of Internet technology into an integrated EC business approach thus becomes a strategic necessity.
- Adoption and implementation factors of EC have generally been identified through studies of large organisations, and their applicability to small business is questionable and doubtful. Smaller organisations have been shown to have different technology adoption patterns than large ones (for examples, see Rogers, 1983; Massey, 1986; Cragg and King, 1993; Benbasat, *et al.*, 1993). There is therefore a need to study the adoption patterns and behaviour of small organisations.
- It has been observed and verified in many studies that SMEs have been actively looking for suitable solutions and methods of adopting and integrating EC into their business process (Benbasat, Bergeron and Dexter, 1993; Cragg and King, 1993; Dos Santos and Peffers, 1998; Massey, 1986; Purao and Campbell, 1998). Although there is a growing body of literature dedicated to the analysis of the technical and operational aspects of EC, there is little empirical research on topics relating to the factors that would lead to the successful adoption and implementation of this emerging technological innovation and business practice. Moreover, there is little empirical research to date that examines the success of EC deployment in organisations once the technology has been adopted.
- Based on case studies and surveys, a number of potential factors have been identified in the literature of IS and IT, as critical to implementation success in small business (Cragg and King, 1993; Delone, 1988; Gable, 1991; Gunasekaran and Cecille, 1998; Lees, 1987; Montazemi, 1988; Raymond, 1985; Sohal, 1999; Yap, *et al.*, 1992). However, little of the prior IS and IT literature, and none from EC literature, has investigated the relative importance of the identified factors of implementation success. Without knowing the relative importance of these factors, SMEs may be expending their limited resources and energy on less important factors which have limited contribution to EC implementation success. Thus, there is a need to identify the more important factors so that implications and guidelines can be drawn for effective EC implementation in SMEs.

- In the model of innovation diffusion, Rogers (1995) hypothesized that perceptions of the *attributes of an innovation* exert a strong influence in favour of the adoption of that innovation. He highlighted that the five innovation attributes are the main determinants in explaining more than 50 to 80 percent of the variance in the rate of adoption (Rogers, 1995:206). The *rate of adoption* may be translated into the speed of the firms' indication, intention and/or implementation that the firm has to engage in the adoption of an innovation. The above questions have been widely explored, however, not with the innovation attributes and measure it against an outcome of implementation, such as 'satisfaction'. Therefore, in this study we are keen to explore whether the attributes suggested by Rogers can be applicable to EC implementation success.

3. Scope of the Research

In this research, the scope of EC applications is limited to the utilisation of Internet as the technology infrastructure to communicate, distribute and conduct information exchange and business transactions with business partners. The overwhelming growth rate of the Internet since the commercialisation in the early 1990's makes it the most utilised Wide Area Network platform even for business-to-business communications and makes the further substitution of previous platforms highly likely throughout the next decade.

This study has also purposely focused on organisations that use EC to carry out transactions and interactions that affect existing business relationships or pre-existing contractual relations between trading partners, i.e. Business-to-business EC. For more justification see Chong and Bauer (2000).

Although it is acknowledged that adoption and diffusion processes vary from industry to industry, it is anticipated that the findings of this study should be more broadly applicable to most companies. It is therefore the intention of this research to develop models and conclusions that are generalisable to most industries. It is anticipated that this study will provide valuable insights into the current perceptions of EC in enterprises that are engaged in business-to-business transactions with their counterparts. Answers to the research questions should prove of interest and value to SME owners, practising managers and those seeking to adopt and implement EC strategies.

In spirit, it is the interest of the study to discover factors affecting SMEs' perceived level of EC implementation success as well as in quantifying their relative importance. Specifically, through surveying SMEs and using an adaptation of Rogers (1995) model of innovation diffusion, this study looks forward to test the applicability of the model in the context of implementation success.

Focus of this Paper

Although there are studies that give information about the presence and use of EC (Abell and Lim, 1997; Barker, *et. al.*, 1997; Fink, *et al.*, 1997; Poon and Swatman, 1998, 1999), there is a lack of insight into the factors that affect the adoption of EC in SMEs and the factors that determine the success of EC once it has been implemented. Currently, a full-scale research study has been undertaken to identify a comprehensive set of potential determinants that are important in both the adoption and subsequent implementation of EC. A detailed explanation of the proposed model can be found in Chong (2000). Specifically, in this paper, we are looking at the factors that affect SMEs' satisfaction with the (technical and organisational) **implementation** of Internet-based EC.

4. Conceptual Framework

On top of the theoretical foundations mentioned previously, a comprehensive review of the literature has been covered to develop a proposed model of EC adoption and implementation for SMEs. This study examines 5 types of factors that are considered to be relevant to the adoption and implementation of EC. These factors are illustrated in Figure 1 and further elaborated in the following sections. Some of these factors may be more important at the time the organisation is deciding whether to adopt EC than in influencing the extent to which EC is implemented in the organisation or vice versa. On the other hand, some factors may be important both in the adoption decision and in the subsequent implementation or the extent to which EC is implemented. It is the purpose of this paper to direct discussion towards the identification of factors that only exert influence on the perceived implementation success of EC using the findings of the first-wave survey.

Adoption & Implementation of Electronic Commerce

It is argued that diffusion of innovation theory is relevant to the study of EC, and that EC has unique features suggesting that EC needs its own specific study. EC has technical component similar to other IT innovations, but EC also has interorganisational elements which distinguish it from other types of innovations.

According to Rogers (1983), diffusion is the process during which an innovation is communicated through certain channels over time among members of a social system. However, prior to that, the decision has to be made on whether or not the organisation should adopt a new innovation or practice for the business. Rogers distinguishes diffusion from adoption by stating that

adoption is a decision to make full use of an innovation as the best course of action, whereas rejection is a decision not to adopt an available innovation (Rogers, 1983:21). In this study, *EC adoption* is therefore defined as the decision to make use of EC to conduct business or transaction with its trading partners and *EC implementation* is taking the necessary actions to facilitate and execute EC into the business practice or process.

Rogers's Theory of Innovation Diffusion

This study extends Rogers innovation diffusion theory, which has been cited widely in innovation diffusion research, as a framework to assess which factors are important to the implementation success of EC. The reference to Rogers's theory provides us with more explanatory power, as EC will be treated as a new innovation in this study.

Based on Rogers (1995) theory, technology diffusion follows the three broad stages of initiation, decision to adopt, and implementation. After extensive gathering of information and determining the utility of the innovation, if the decision is in favour of adoption, an implementation phase follows. Implementation is a critical period in the diffusion process since it requires overt action on the part of adopters to put the new idea into practice. As noted by Rogers (1995), "it is often one thing for an individual to decide to adopt a new idea, but quite a different thing to put the innovation into use". At this stage, the innovation may become incorporated into the culture of the user population, undergo changes (re-invention), or be discontinued (Hahn and Schoch, 1997).

Innovation Characteristics

In the same vein, Rogers (1995) innovation diffusion theory provides a general explanation for the manner in which new ideas disseminate through social systems over time. Amongst variables which Rogers (1995) highlighted to determine the rate of adoption (i.e. type of innovation decision, type of communication channels used, nature of the social system and extent of change agent), *innovation characteristics* have been considered to be the most significant of all and studied more frequently.

By viewing the adoption of EC by SMEs as an innovation, a conceptual framework was developed using the five attributes of innovations highlighted by Rogers (1995), namely - *perceived relative advantage*, *compatibility*, *complexity*, *trialability* and *observability*, to assess EC implementation success. A fuller explanation for each other five attributes as used in this study is given in a later section.

EC Implementation Success Factor

From the many variables that might be considered as indicators for success of an Internet-based EC, *satisfaction* has been chosen in this study. In the IS literature, satisfaction is one of the variables most often used as a success indicator (Crum, *et al.*, 1996; Delone and McLean, 1992; Alavi and Joachimsthaler, 1992; Seddon and Kiew, 1994; Thong and Yap, 1996; Wierenga and Ophuis, 1997). Being one of the popular constructs of IS implementation success, satisfaction has been found to correlate with usage (Baroudi, *et al.*, 1996; Gelderman, 1995; Wierenga and Ophuis, 1997; Zinkhan *et al.*, 1987). Other scholars have even suggested that low satisfaction causes discontinuity in the usage of information technology (Evans, 1976; Thong and Yap, 1996). Hence, satisfaction is employed as a construct of EC implementation success in this study.

The Proposed Model of EC Implementation Success

Using theoretical foundations from established information systems implementation research, innovation diffusion, EC and small business literature, this study seeks to explain EC implementation success by examining factors that have the attributes of an innovation. The relationships of these factors with implementation success are shown in Figure 1.

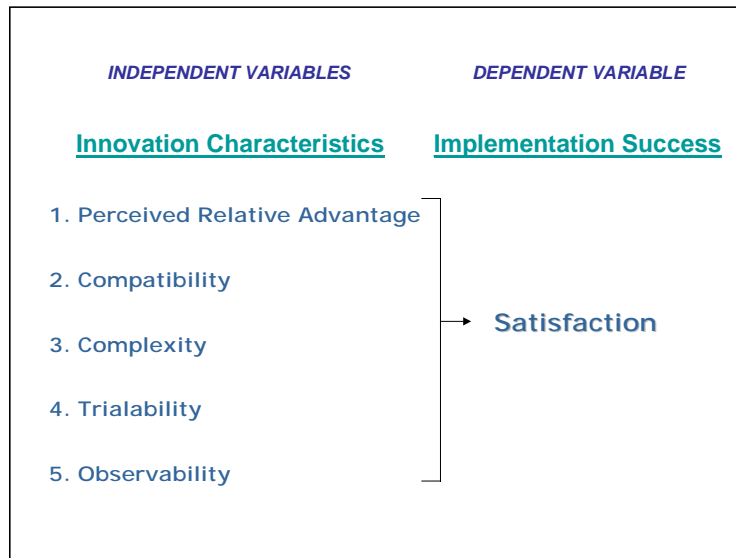


Figure 1: Conceptual framework of innovation factors that influence Implementation Success of EC

5. Methodology

Preliminary interviews with five Australian SMEs¹ were conducted in April and September of 1999. These provided direction to what adoption and implementation factors are imperative to SMEs and was supported by an extensive literature review, this contributed to the design of the proposed research model (Chong, 1999). This exploratory study intuitively implied that the factors proposed in the research model would make a key contribution to the adoption and implementation success of EC for small businesses.

A survey instrument was developed and pilot-tested to capture the information reflecting the perceptions and practice of those adopting EC, specifically what internal or external environment factors affect the adoption of EC and the degree of influence. In order to focus on SMEs, assistance was sought from the Small Business Unit (SBU) in Western Australia to develop a database of SMEs and contact details of target respondents.

Data Collection

As the survey was intended to apply over a wide geographical area, the chosen method of delivery was a combination of email, web and mail survey. 300 survey questionnaires were disseminated between September and November of 2000 by email and mail with a cover letter stating the objective of the study and the web address of the online survey. The surveys sent out were personally addressed to the director or owner of the firms. At the time of writing, 71 SMEs had responded via Web, mail and fax. In order to improve the response rate, reminders were sent out four weeks after the first mail-out. A second-wave of the survey mail-out has commenced. This data will be added later.

The data collected from the survey provided us with information about the problems and issues faced by Australian SMEs, and their perceptions of the Internet-based EC in terms of a number of characteristics.

Measurement of Variables

The measures used in this study were developed through an extensive literature review followed by iterative reviews by both practitioners and experienced academics in IS and EC fields. Further, the measures had been used in prior studies and were found to demonstrate adequate reliability and validity. The

¹ Definition of Small- and Medium-sized Enterprises (SMEs) in Australia is any business employing less than 20 people; and 20 or more but less than 200 people for medium business. For further definitions of SMEs, please refer to <http://sbdc.gov.au>.

questionnaires containing the measures were also pilot-tested before the main survey.

Innovation Attributes	<i>Explanatory Notes</i>
Perc'd Relative Advantage	The degree to which EC is perceived as advantageous to existing or current practice or system. This is measured by the belief that SMEs are able to 'derive satisfaction from the use of EC' in the business ² , 'enhance the corporate image', 'establish stronger links with clients or business partners', 'develop new business opportunities', 'reduce costs of info. marketing & advertising, customer service, info. gathering & telecommuting', 'increase sales' and 'enlarge market share'.
Compatibility	The degree to which EC is perceived as fitting well into their existing business processes. There is a higher degree of compatibility when the adoption of EC is regarded as 'consistent with the values, beliefs, & business needs of the company', when there is 'sufficient support from the top management', and when there is 'no or minimal resistance to change from their staff'.
Complexity ³	The degree to which EC is perceived as relatively difficult to comprehend or use. SMEs tend to think EC to be complex when they face 'problems in locating information in relation to EC', 'rapid changes & technological advances', 'technical constraints', and 'problems relating to the complexity of EC applications, the skills & training required' in adopting EC.
Trialability	The degree to which EC is perceived to be trialable without incurring high start-up costs. SMEs are more likely to engage in EC when they see 'no fear of time slippage when experimenting with Internet-based EC', 'face no financial constraints', and think that they are able to experiment with EC 'before committing more resources to it'.
Observability	The degree to which EC's advantages are perceived to be visible to companies. Beneficial results are considered to be observable when SMEs believe that 'the use of EC will be highly valued', that 'most firms will adopt the use of EC', when company 'does not face limitation to the use of EC for business', when they could 'see the success of similar initiatives by other companies', and when they find 'the use of EC will become essential'.

Table 1: Factors Influencing the Adoption & Implementation of EC by SMEs

All variables covered in this paper were measured as perceptual items on five-point Likert scales. In order to secure their assistance in completing the survey

2 For the purpose of predicting 'Satisfaction', the first questionnaire item of the 'Perceived Relative Advantage' was deleted for this analysis. This is because it was extremely similar to our dependent variable and may have extremely biased the analysis.

3 It should be noted that perception of increased complexity is negatively related to level of satisfaction with the EC implementation. This finding runs parallel to Rogers's (1995) negative association between complexity and rate of adoption.

questionnaire, perceptual rather than objective measures were used. According to Dess and Robinson (1984), subjective measures can be appropriate surrogates for organisational performance.

A list of questionnaire items have been developed from Rogers' (1995) five attributes of innovation. The questionnaire items that were derived from the definition of each attribute as applied to the business use of Internet-based EC are summarized in Table 1.

The indices of innovative attributes were generally arrived at by combining the responses of the items conceptually associated with the variable being measured. This usually involved simple summation except with those items whose contributions were logically opposite to the set of the scale.

As for 'Satisfaction', respondents were asked to indicate their perception of the overall satisfaction with EC from the perspective of the organisation. The five-point Likert scale ranges from 'very satisfied' to 'very dissatisfied'.

6. Results

Table 2 presents results of the regression analysis to determine whether a (linear) relationship exists between SMEs' level of satisfaction and the five characteristics identified by Rogers.

Innovation Characteristics	Standardized Coefficient (beta)	t-value	Significance
(Constant)		2.951	0.004
Perceived Relative Advantage	0.284	2.438	0.018*
Compatibility	0.265	2.076	0.042*
Complexity	-0.312	-2.691	0.009**
Trialability	-0.022	-0.192	0.849
Observability	0.067	0.551	0.584

$R^2 = 0.378$ $Adjusted R^2 = 0.327$ $F\text{-statistics} = 7.522$ $Observations = 71$

* Significant at the 0.05 level

** Significant at the 0.01 level

Table 2: Regression Analysis of Innovation Characteristics & Overall Satisfaction

As seen from Table 2, *Perceived Relative Advantage* and *Compatibility* were both significant at the 0.05 level of significance, while *Complexity* was significant at the 0.01 level of significance. In other words, only three factors appear to make a significant contribution to the satisfaction of EC implementation for SMEs. On the other hand, *Trialability* and *Observability*

were not found to make a significant contribution to explaining *Overall Satisfaction*.

The relationship between *Overall Satisfaction* and the detailed components of *Trialability* and *Observability* were explored. Two of the sub-components⁴ were found individually to have significant correlations with *Overall Satisfaction*, but in the overall model, they did not make any additional contribution beyond what is already explained by *Perceived Relative Advantage*, *Compatibility* and *Complexity*.

The fact that many of the other sub-components of these two variables (*Trialability* and *Observability*) were found to be unconnected to *Overall Satisfaction* suggests that the manner in which these two variables were measured in Rogers's theory is not transferable to the context of implementation success in EC.

Since *Trialability* and *Observability* were found not to be the contributing factors to *Overall Satisfaction*, they were excluded in the later model estimation. When both of the variables were removed from the regression model, the significance of the remaining variables improved. (i.e. *Perceived Relative Advantage* = 0.010, *Compatibility* = 0.012 and *Complexity* = 0.005).

Finally, the regression model is considered to have less explanatory power than previous work in other areas in which the five characteristics of innovation used in the regression model would explain 49 to 87 percent of the adoption of an innovation. In our analysis, only three out of the five characteristics emerged to be of significance to the implementation success. In total, the regression model showed that the five characteristics explained only 37.8 percent of the overall satisfaction that SMEs perceived in the implementation of EC. Conjectures as to why this happened are discussed in the following section.

7. Discussion

Complexity emerged as the most important factor affecting SMEs' overall satisfaction in implementing EC. This fear of complexity combined with pressures from competition and trading partners can sometimes be one of the most antagonizing experiences for many SME owners. The lack of appropriate technical and management knowledge or skills of what is required to conduct business on the Internet is the primary barrier to successful EC implementation and is consistent with Attewell's (1984) notion of "knowledge barriers" to successful IS implementation. The implication for SMEs is that to achieve a high level of EC implementation success, they may need to engage experienced EC consultants to undertake the implementation. Other alternatives could include increasing the level of EC or IT knowledge by sending employees for training and courses.

⁴ Item 3 of *Trialability* – 'company perceived Internet-based EC to be trialable before committing more resources to it'; and Item 1 of *Observability* – 'company believes that the use of Internet-based EC will be highly valued'.

Perceived Relative Advantage appears to be significantly important to the implementation success of EC. This can be logically explained as it is akin to the benefits and costs of adopting an innovation. Rogers mentions that diffusion scholars have found perceived relative advantage to be one of the best predictors of an innovation's rate of adoption (1995:216). Although *Perceived Relative Advantage* is significant in this study, in regards to implementation success, it was not found to be the most significant variable compared to *Complexity*. On the other hand, this study contradicts the results of a study by Premkumar *et al.* (1994) where they found perceived relative advantage only to influence adoption decision and not implementation success of EDI.

In this study, the high relative importance of this variable indicates that the benefits of EC perceived by SMEs have led to high implementation success. It can be seen that SMEs are most motivated by the prospects of gaining a relative advantage over competitors. They generally believe that EC can open up markets for them, as well as lowering their business costs. This perception influenced the satisfaction level of EC implementation. On the other hand, it could be suggested that if companies do not believe EC can provide them with relative advantage after they have adopted EC, it is likely that the implementation would be discontinued. Perhaps government and industry associations alike can play a more active role raising the awareness, pointing SMEs to the opportunities and benefits of EC, giving support and working with them to overcome their doubts regarding implementing EC.

Compatibility is also nearly as important in explaining EC implementation success. According to Rogers's description of 'compatibility with needs' (Rogers, 1995:228). This means that when a new idea such as EC is perceived by SMEs to be in accordance with the organisation's beliefs and values, they understand its consequences, and thus a higher level of success usually occurs. Importantly, this finding confirms another study by Small Business Index (2000) that 50 percent of SMEs do not see EC as having particular relevance to their businesses because "they don't know what they don't know". The implication for SMEs is that to attain higher implementation success, much effort must be invested in exploring how EC can meet the business needs of the SMEs. After gaining the right objective, SMEs should acquire involvement and support from top management, employees and even business partners (e.g. suppliers or customers). By ensuring their suggestions and requirements are incorporated, this lowers their resistance to adapt to new work and business process.

The insignificance of *Trialability* may be explained by the fact that 'time slippage' and 'financial constraints' are inevitable issues faced by a majority of small business owners. It may also be the case, that small businesses are performing EC adoption decisions for primarily strategic reasons, making the operational *Trialability* a less important factor. For example, a small business owner might want to pursue EC activities for fear of "being left behind", "missing out on opportunities" or induced by government initiatives.

In contrast to a preliminary report based on a much smaller sample, the *Observability* variable is not significant. It appears that in the preliminary analysis,

the relationship may have been accidental as may occur in a small sample. In addition, the validity of the *Observability* items when transferred into the context of *Overall Satisfaction* of EC implementation may be questionable. The components of the *Observability* variable, which is in fact a combination of confidence, optimism, observed outside success and inevitability (i.e. the inevitable progress of EC in the future). Therefore, the explanation for the existence of this relationship requires a psychological approach. For future reference, this variable has to be dealt / treated with much caution, as the benefits of EC or any kinds of technological adoption have to be observable to be satisfying. Therefore it is doubtful whether we would learn anything new from the significance of the variable.

8. Conclusions, Limitation & Further Research

This paper has developed and tested a proposed model of EC implementation success in SMEs. Based on Rogers's (1995) framework of innovation diffusion and attributes of innovation, a model of EC implementation success has been conceptualised. Key factors of EC implementation success were identified: complexity, perceived relative advantage, and compatibility. The relative importance of these key factors of EC implementation success was examined using multivariate analysis. The regression analysis showed significant support for the EC implementation model with the complexity factor being the most important followed by the perceived relative advantage and compatibility factors.

The overall results are considered to be consistent with what previous scholars have found in other areas of adoption studies. After testing the transferability of the Rogers's model, it should be noted that some aspects of the model have found to be relevant, while others require modifications. Future work would need to consider how to create sets of questions that match more closely with perceived attributes. This also applies to our measure of implementation success of EC. The existence of two factors suggests more needs to be done to focus on questions relevant to SMEs.

A total of 300 surveys were sent to SMEs owners and directors in Australia. Whilst a response rate of 23.6% (71 of 300) was acceptable, reminders were sent out, at the time of writing this paper, to achieve a better representation of the target sample. Further research is currently undertaken to extend the proposed model by examining other key factors that may lead to successful EC implementation in SMEs. In addition, contextual or environmental factors that may lead to the success of EC implementation will also be incorporated into the model if found to be important.

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