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Wilson, H.; Daniel, E. and Davies, I. (2008). The diffusion of e-commerce in UK SMEs. *Journal of Marketing Management*, 24(5-6) pp. 489–516.

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Version: Accepted Manuscript

Link(s) to article on publisher's website:
<http://dx.doi.org/doi:10.1362/026725708X325968>

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The diffusion of e-commerce in UK SMEs

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**Keywords: e-commerce, small and medium enterprises,
adoption, barriers, success factors, Internet, survey, stage model**

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Abstract

The concept of the Internet as a cluster of related innovations, along with the staged approach to organisational learning exhibited by SMEs in other domains, suggest that e-commerce is likely to be adopted in a sequence of stages. This exploratory survey, carried out by means of a postal questionnaire with 678 respondents, uses cluster analysis to derive a grouped classification of e-commerce adoption. Four groups of organisations emerge, which we term developers, communicators, promoters and customer lifecycle managers. Through inductive analysis of these groups we are able to suggest that they represent four stages in the adoption of e-commerce. Five factors found to influence this adoption are top management support, management understanding of business benefits, presence of IT skills, availability of consultancy, and prioritisation of e-commerce. In addition to these factors, several other factors influence the value of e-commerce to the enterprise for any given adoption level, notably perceived risk and customer demand. Further research is encouraged to validate and extend the stage model: further stages are hypothesised, for example, termed supply chain managers and virtual value deliverers. Implications for practitioners include the need to include customer demand information and a risk assessment in decisions on adoption, and the importance of building in-house skills as part of the adoption plan.

Introduction

The emergence of e-commerce in the 1990s promised organisations of all types many advantages. In the six or more years that have passed since the height of the dot-com boom, however, many failed initiatives have shown that achieving the promised advantages has not always been straightforward. As Internet usage and trading statistics nevertheless show the Internet's increasing commercial importance, the argument has perhaps moved beyond the early somewhat evangelical tone towards a more mature desire to discriminate the factors influencing success.

Small and medium-sized enterprises (SMEs), in particular, have continued to show an interest in the use of e-commerce but, perhaps due to their limited resources, seem to be cautious about thorough adoption. Ensuring that SMEs can effectively harness e-commerce has been recognised as playing a key part in regional and national economic performance (OECD 2004). Recent surveys underline the continuing interest SMEs have in e-commerce adoption. The Small Enterprise Research Report (SERTeam 2006) finds that 87% of small firms use email and over 66% use the Internet as either a source of information or for advertising and promoting their own products and services. Not all aspects of e-commerce are as widely adopted, however: for example, a survey in 2005 from the same source (SERTeam 2005) found that only 11% of SMEs accept online payments, with a further 14% intending to accept payments within a year. Similar predictions had, furthermore, been made in previous years which had not been borne out, leading the authors to suggest that SMEs were facing difficulties in developing their online activities beyond the most basic services.

This exploratory study seeks to help both practising managers in SMEs and scholars in this domain, by considering how such organisations can develop both simple and more advanced e-commerce services, based on the experience of other SMEs. In particular, the study examines three aspects of e-commerce adoption: adoption patterns, factors affecting adoption and factors affecting benefits realisation.

Adoption patterns

Rogers's (1995) work on the diffusion of innovation provides a key conceptual framework for studying innovation adoption. However, White et al. (1998), Prescott and Conger (1995) and Van Slyke (1996) have argued that the ability to use the Internet for such a wide range of business activities suggests that it is better regarded not as a single innovation, but as a cluster of related innovations. In order to fully understand adoption in this domain, it would therefore appear necessary to bring these two perspectives together and consider the diffusion according to clusters of business activities carried out via the Internet.

The notion of clusters of adoption relates to the theory of organisational learning. Frank (1988), Dosi (1988) and Reid and Smith (2000) regard the SME as an organisation that gains knowledge in a sequence of steps or stages in order to dissipate the uncertainty of the unknown. Achievement of the first stage of an initiative allows the organisation to gain vital experience for successfully moving on to the second stage, and so on. An example is Cavusgil's (1980) five-stage model for the process of internationalisation, which has been empirically tested by Bell (1995), Reuber and Fischer (1997) and Gankema et al. (2000) amongst others. Another is Drazin and Kazanjian's (1990, 1993) stage model for the growth of technology based new ventures.

If e-commerce can be considered as clusters of activities, and if SMEs tend to evolve through a staged approach to organisational learning, then it might be expected that e-commerce is adopted by SMEs according to a stage model, where each stage introduces new activities. There is no shortage of hypothesised stage models (White et al 1998; McDonald and Wilson 2002; Piercy 2002) which are reviewed by Mendo and Fitzgerald (2005). However, many of these models were formulated soon after the emergence of e-commerce and are not based on actual experience. Perhaps the most relevant studies are those by Ching and Ellis (2004) and Lefebvre et al. (2005). The former use White et al.'s (1998) stage model to classify their empirical data of the adoption of e-commerce by a sample of SMEs in Hong Kong. Similarly Lefebvre et al (2005) determine stages from a focus group, which they then use to classify their substantive data which are from a sample of 192 manufacturing SMEs. In contrast to both of these, our study, rather than pre-classifying stages and the activities within them, aims to derive these inductively from empirical data of actual e-commerce adoption by a sample of SMEs.

Factors affecting adoption rates

If SMEs do indeed progress through a set of stages in adopting e-commerce, a natural question is what factors influence the rate at which they progress.

Again, Rogers (1995) provides a starting-point. Summarising previous research across a wide range of innovations, he summarises five factors as influencing the rate of diffusion of an innovation: its relative advantage over existing ways of meeting the need; its compatibility with current practices; its communicability (how readily its features and benefits can be communicated); its complexity; and its divisibility (whether it can be tried out on a small scale before commitment). Innovation research quickly added to this the additional factor of the perceived risk associated with adoption.

However, it has been argued by Dickerson and Gentry (1983) and others that adoption research needs to be conducted on an innovation by innovation basis, as factors appear to vary in practice. Indeed in more recent work, Rogers himself warns scholars not to adopt measures developed for other innovations (Rogers 2003).

Factors affecting benefit realisation

Adoption does not, however, of itself guarantee that the intended business benefits will be achieved. We therefore wished to examine factors influencing e-commerce success, as measured by perceived benefits realisation, as well as those influencing adoption. Much of the relevant literature does not distinguish clearly between adoption factors and success factors, with the use of terms such as facilitators (Keeling et al 2000), enablers (Levy et al 2005) and best practice (Jeffcoate et al 2002) adding to this lack of discrimination. Indeed, adoption is sometimes used as a measure of IT system success (Snitkin and King 1986). We therefore developed in Table 1 a single synthesised list of hypothesised factors, which were tested separately for their impact on adoption and benefits realisation.

Insert Table 1 about here

We should note that in this study we have, in the main, concentrated on issues under the broad heading of successful implementation. The efficacy of the business strategy case for the adoption of e-commerce is clearly likely to be another strong determinant of success. The literature on how to allow for e-commerce within strategy processes has been enriched by Porter (2001) and Tjan (2001), amongst others. Testing the efficacy of strategic decision-making processes is, however, famously difficult, and presents considerable difficulties for survey methods. We decided to leave these important issues outside the scope of this study.

Previous Literature and Conceptual Framework

Early work in e-commerce, such as that Kalakota and Whinston (1998), defined e-commerce rather narrowly as "the buying and selling of information, products and services via computer networks", the computer networks primarily being the Internet. Others (Cabinet Office 1999; Chaffey 2002) used the term more broadly to encompass not only the buying and selling described above but also the use of Internet technologies, such as email and intranets, to exchange or share information either within the firm itself or with external stakeholders. This broad interpretation of the term e-commerce has continued, with Ching and Ellis (2004) describing e-commerce as "technologically mediated exchanges", and it is this broad use of the term e-commerce that is used in this study. A definition of e-commerce was stated clearly on the survey instrument to ensure common understanding amongst respondents.

The conceptual framework for the study is shown in Figure 1 and is similar to that of Wierenga and Ophuis (1997) and Wu et al. (2003). The framework postulates that certain drivers result in an enterprise considering the adoption of e-commerce. Drivers or objectives identified by Levy et al (2005) include: to find new customers, to lower transaction costs, to improve customer service and to obtain better purchasing terms. The enterprise may then proceed to develop and launch e-commerce services, but the rate of adoption will be influenced by various organisational and contextual factors. Early studies of the adoption of e-commerce by SMEs, such as that by Hamill and Gregory (1997), suggested the factors affecting adoption would include the availability of finance, the IT skills of staff and the perceived risks. These factors are consistent with studies of the adoption of other forms of IT by SMEs, for example the study by Caldeira and Ward (2003), which also identified factors such as staff training, support from vendors and the availability of consultants. More recent empirically based studies of e-commerce adoption by SMEs, such as those by Ching and Ellis (2004) and Grandon and Pearson (2004), support the factors identified in earlier studies and also add additional factors such as compatibility and customer and supplier pressure. The factors affecting adoption explored in this study are shown in Table 1.

The critical success factors for e-commerce use by SMEs were studied by Jeffcoate et al (2002). Drawing on studies of other forms of IT adoption, most notably EDI, they found that success and the realisation of benefits was reliant upon factors including customer and supplier demand, top management support and understanding, and the ability of organisations to automate their processes. In another study, Wu et al. (2003) discuss the performance outcomes of e-commerce adoption in terms of four general categories: efficiency; sales performance; customer satisfaction; and relationship development. They consider these performance outcomes in relation to the level of e-commerce adoption, which they in turn relate to various factors including organisational learning ability, customer power and normative pressure from other organisations. Whilst these success factors need to be treated with care, since they have been derived via the intermediate step of the level of e-commerce adoption, they do form a useful starting point for more detailed studies such as this.

Due to the considerable overlap between adoption and success factors in previous studies, this study seeks to combine these as shown in Table 1, and allow the data analysis to indicate the role of each in adoption and the successful realisation of benefits.

The adoption itself can be subdivided according to the use of e-commerce for one or more business activities. Early studies such as those by Hamill and Gregory (1997) and Webb and Sayer (1998) identified a range of business activities for which e-commerce could be used. Such studies were used to derive the activities shown on the left of Table 2. More recent studies such as those by Wu et al. (2003) and Lefebvre et al (2005) confirm that these activities are those that are still being considered and adopted by SMEs. While this study has focused on business activities, an approximate correspondence with technologies is plausible. For example providing information on the company and on goods and services is most likely to be achieved via a Web site, while communications with specific customers might be achieved primarily by email.

Insert Figure 1: Conceptual Framework about here.

It has been suggested (Levy et al 2005; Lynn et al 1999) that e-commerce can offer smaller companies considerable benefit. In particular, these authors suggest that it offers such companies an opportunity to compete more effectively with their competitors, both large and small. The use of e-commerce to compete more effectively with large players has been termed 'levelling the playing field' (Clayton 2000). The notion of an 'overall value' measure follows examples such as Shih and Venkatesh (2004), who developed a measure of "perceived impact" for their consumer innovation study. Given our specific interest in defining an appropriate dependent variable for the analysis of adoption and success factors, we focused on three generic success variables drawn from the foregoing:

- Perceived overall value to the organisation.
- Impact on competitiveness with large organisations
- Impact on competitiveness with other SMEs.

This follows the example of Bradford and Florin (2003), who used a set of five success measures drawn from the benefits of the innovation – in their case, ERP systems – hypothesised in previous literature. While some studies of innovation success find an objective success measure, such as Verhees and Meulenberg's (2004) measure of relative product price, many use such perceptual measures.

Research Propositions

The study's aims are summarised in the following research propositions:

P₁: SMEs tend to adopt e-commerce in a set of sequential steps or stages, each of which consists of a cluster of e-commerce activities which are implemented at that stage, in addition to continuing use of those activities implemented at previous stages.

This proposition is explored inductively through two methods:

- a) A cluster analysis of e-commerce activities, as described in the method section below, will provide clusters of organisations according to the business activities they are currently undertaking or intend to undertake via e-commerce.
- b) Further analysis of the cluster formations, especially in relation to e-commerce activities that are operational and those that are under development, will be used to explore whether

these groups indicate a significant trend in adoption, which in turn could be identified as stages.

P₂: The level of adoption is influenced by a set of adoption factors.

This proposition leads to the hypotheses H1 to H15 that the variables listed in Table 1 are related to e-commerce adoption. The relationship is hypothesised to be positive except in the case of perceived risk (H13), where a higher perceived risk is hypothesised to be associated with lower adoption.

P₃: E-commerce success is influenced by a set of success factors.

This proposition leads to hypotheses H16 to H30 that the variables listed in Table 1 are related to e-commerce success – again positively except in the case of perceived risk (H28).

Method

Sampling procedure

The population of interest was defined as UK SMEs who are using, developing or considering e-commerce services. SMEs were defined in accordance with other studies in this domain (see for example Jeffcoate et al. 2002, Levy et al. 2005) as firms with 250 employees or less. Whilst it is recognised that there may be differences in approaches and experiences between firms in this range, such a definition is well accepted in research in the SME domain (Gankema et al 2000; Webb and Sayer 1998; Storey 1994).

No other constraints were placed on the population, such as industry sector or geographic location. Indeed it was preferred that that a wide spread in other variables could be achieved in order to ensure the greatest generalisability of the findings.

Two samples of SMEs were used: a database of 1,500 directors and managers held by a business school, which contains companies that have attended, or made enquiries about, an executive education programme for SMEs; and a list of 5,000 directors and managers which was bought from a commercial database company, with the criterion that companies should have 250 employees or less.

The two lists were first de-duplicated. Responses from the two samples were analysed separately and the results compared. No significant differences were found between the two samples on adoption levels or presence of adoption/success factors, so this paper presents results based upon the combination of these two samples. The combined sample was also checked for representativeness of UK industry sectors and geographic locations.

Companies which were neither using e-commerce nor considering its use were asked to de-select themselves from the sample, by indicating this on the first question and not filling in the survey further. Also, it is likely that many of those not yet considering e-commerce deselected themselves by not completing the questionnaire.

766 responses were received, representing a response rate of 11.8%. Of these, 46 were rejected as representing companies with more than 250 employees and a further 42 were excluded since the respondents reported that their organisations were not considering e-commerce. Hence 678 useable responses (effective response rate 10.4%) were received. Appendix 2 shows a breakdown of these responses according to the size of the organisation.

To minimise non-response bias, a covering letter to the questionnaire emphasised that “We are interested in hearing from organisations with varying degrees of experience with e-commerce, so whatever your experience, please complete the questionnaire.” To check for non-response bias, the usable responses were split into two equal sets of earlier and later responses according to the dates on which they were received. No significant differences were found for a selection of key items between these two groups.

Survey instrument

The questionnaire was piloted with 21 SMEs.

Adoption levels were assessed by means of the business activities shown in Table 2. Respondents were asked to indicate for each whether their company currently used e-commerce for this activity, were developing an e-commerce solution for the activity, or had no plans to use e-commerce for the activity.

The adoption/success factors shown in Table 1 were each measured by a single item, due to restrictions on questionnaire length. Where possible the items, which are listed in Table A1 in Appendix 1, were derived from wording from previous empirical research. Respondents were asked to indicate their level of agreement with each statement on a four point scale, a fifth point being used to indicate that the statement was not relevant to their company. As with other questionnaire designs several of the statements were worded negatively, and reversed during data analysis (Hague 1993, Brace 2004). We acknowledge, however, that this approach is not universally supported. The three perceptual success measures were each measured by a single item, shown in Table A2 in Appendix 1.

Data analysis procedures: Adoption patterns

Cluster analysis was carried out on the responses to the business activities listed in Table 2 according to the K-Means method using Euclidean distance (MacQueen 1967, SPSS 1999). Cluster analysis is a technique for grouping cases (in this case firms) into groups that are similar according to the attributes of interest (here, the activities being supported by e-commerce), while differing from others on these attributes. K-means is the most popular method of clustering in marketing and is especially useful when dealing with large data sets (Dillon 1994, Wendel and Kamakura 2000). As such K-means was selected over hierarchical methods due to its applicability and the sample size in this research.

In contrast to hierarchical cluster analysis, K-means requires predetermination of the number of clusters. As this research is exploratory and inductive, the number and characteristics of the groups were not known prior to the analysis. As such a method of identifying the number of clusters was required. Sarle (1983) used extensive simulations to develop the cubic clustering criterion, which can be used for crude hypothesis testing and estimating the number of population clusters. In tests of thirty methods for identifying the number of clusters in a population, Milligan and Cooper (1985) identified three methods that proved significantly more robust than the others, one of which was the cubic clustering criterion. The cubic clustering criterion has also proved very effective in large samples (Sarle 1983) and was deemed appropriate for the size of sample in this research. Clustering was therefore carried out with three, four and five clusters and the cubic cluster criteria generated for each. A large increase in this measure at the four cluster level suggested the suitability of a four cluster solution. This solution also met a secondary criterion that there were sufficient numbers of cases in each cluster to allow statistical analysis.

Two steps were used to explore whether the four resulting clusters represent a set of sequential stages through which SMEs pass when adopting e-commerce. Firstly, the e-commerce activities were tabulated by cluster (see Table 2). This was used to expose the nature of each cluster for further analysis and thereby hypothesise the order in which firms progress through the clusters.

Secondly, the activities were plotted on a proportional adoption basis (Figure 2). Following Smith (1999), the percentage of total activities operational and under development were represented and central cluster means plotted, where the scale was based on an unweighted sum of the sixteen adoption activities. This draws the data back out of the weighted clusters to demonstrate the movement between the clusters from activities that are under development in early clusters to being operational in later clusters.

Factors affecting adoption

A Pearson linear correlation analysis was initially undertaken between each of the factors and the adoption stage, coded as a variable with a value between 1 and 4. However, tabulation of factor means against stages suggested that the assumption of linearity of the relationship between some factors and the stage was not satisfied. Hence, a one-way analysis of variance was used to assess whether each factor varied significantly by cluster (Table 3), and the correlation analysis is not further reported.

Factors affecting benefit realisation

The assumption could not be made that success factors were independent of the adoption stage. A separate Pearson correlation analysis was therefore performed for each stage, between the hypothesised success factors and each of the three perceptual success measures (Table 4).

Findings

Adoption patterns

A cross tabulation of e-commerce activities by cluster is presented in Table 2.

Insert Table 2: E-commerce Activities by Cluster about here

Table 2 shows that the clusters developed in this analysis are significantly different in their e-commerce activities. We now summarise the characteristics of the clusters, along with some suggested descriptors for each.

Cluster 1 (Developers): These companies had the lowest levels of operational e-commerce services, compared to the other three clusters, but the highest percentages of services under development. This cluster appears, therefore, to represent companies at the very start of their e-commerce adoption, or companies with some intention to develop e-commerce but who to date have done very little in this regard. The most common areas of development activity were: communication with customers and suppliers (87%); providing information about the company's products and services (85%) and the company itself (77%); and advertising and brand building (77%).

Cluster 2 (Communicators): The companies in cluster 2 were making extensive use of electronic media for communication with customers and suppliers (90%) and for finding business information (78%), presumably in the main using Internet access and email. Just

over half of these companies were also using electronic channels for employee communication (57%) and to exchange documents with customers and suppliers (56%). In this group the most common development activity was focused on the classic 'brochureware' Web site basics of providing company or product and service information (73% and 59% respectively).

Cluster 3 (Promoters): Companies in cluster 3 were undertaking electronically all of the activities which characterise cluster 2, such as communicating with customers and suppliers (95%) and finding external information (81%). They were also operating the services that cluster 2 companies were developing, with 98% providing information about their company and 89% about its products and services through electronic media.

The most common areas of development in cluster 3 companies were taking orders (31%) and receiving payment (24%). It would therefore seem that cluster 3 contains companies that are operating an information-only web site and are looking to develop transactional capabilities.

Cluster 4 (Customer lifecycle managers): Companies in cluster 4 were undertaking all of the activities from cluster 3, and in addition were far more likely to be taking orders electronically (62%) and providing after sales service (62%). Along with advertising (80%, versus 55% in stage 3), then, these companies were using electronic support for most aspects of the customer lifecycle. Receiving payment was a partial exception at 27%, though one of the most common areas of development (7%). Another activity which a number of cluster members were developing (6%) was digital delivery of goods or services, which 27% were already performing. One of the key characteristics of cluster 4 is that they are generally no longer developing or intending to develop any of the e-commerce activities covered in this survey and therefore appear to be reaching a halting point in these e-commerce activities. However, these companies may move on to develop new e-commerce capabilities which have not been discussed in this study.

Relationships with other stakeholders were also more preponderant in this group, though less common than the customer-focused tasks, with 44% using electronic media for recruitment and 42% for non-inventory purchasing. Inventory purchasing was rather lower, at 16%, though a further 7% were developing this activity. A similar number (16%) were using electronic communication with shareholders and investors.

Regarding the proposition that the four clusters represent a set of sequential stages, the activities appear to be cumulative, in that each cluster maintains or grows the percentage performing the tasks which characterised the previous cluster (see Table 2), as well as performing the tasks that characterise the new cluster. So, it can be seen that cluster 2 companies are performing many of the activities cluster 1 companies were intending to develop; and companies in cluster 3 were performing the cluster 2 activities of communication and document exchange, as well as the additional activities of providing information about their companies' products and services on-line. Finally cluster 4 companies have developed, to at least the same extent as cluster 3 companies, all the activities in cluster 3, and have developed many to a greater extent than cluster 3 companies were intending. It can be seen, then, that the dominant areas of development for each cluster are the additional activities characterising the subsequent cluster. This does at least suggest that the clusters may well form sequential stages.

To identify movement from an intention to develop a capability to the operational creation of an activity, it is necessary to look at the whole data set in relation to the clusters. Figure 2 provides a graphical representation of the extent to which e-commerce activities are moving from under-development to operational. For this analysis we use un-weighted average adoption to identify the cumulative extent to which intention to adopt leads to adoption. An analysis of variance of the adoption scale across the adoption stages is summarised as the cluster centres in the diagram. These clearly show a progression through the identified clusters from activities being under development to being operational. This shows that mean values are significantly different between the stages. It can be seen that organisations in each consecutive cluster have a progressively higher level of e-commerce adoption, lending further support to the stage model of adoption. The graph also shows that clusters overlap when the values used are un-weighted (not given the associated weightings used in the cluster analysis) demonstrating that it is the development of certain levels of key activities (such as the provision of product and service information – movement from cluster 2 to 3) which would be required for organisations to move from one cluster to another. This suggests that development of certain key activities over time causes an organisation to progress to another cluster. This is an indicator of these clusters also representing stages of e-commerce development.

Insert Figure 2: Adoption of Activities by Cluster about here.

In summary of Proposition P₁, there is support for the notion that these four clusters do indeed represent a set of stages through which SMEs could pass sequentially. However, this tentative conclusion requires confirmation by other methods such as longitudinal studies.

Factors affecting adoption

Table 3 tabulates the factor means against stages. The factors are sorted according to the mean factor score, so the factors at the top of the table such as top management support were relatively strongly present in the sample.

Insert Table 3 about here

The one-way analysis of variance found that only five of the fifteen hypothesised variables showed a significant difference across the four stages of adoption. In decreasing order of mean factor score across the sample, these were:

- H11 Top management support
- H1 Management understanding
- H7 Presence of IT skills
- H4 Availability of consultancy
- H12 Prioritisation of e-commerce compared with other projects.

In each case, these factors show a partial linear relationship with adoption stage, as might be expected. However, there is a dip from stage 1 to stage 2 in presence of the factor, and a subsequent increase in factor score for stages 3 and 4, where the factor score is highest. We will discuss this ‘acculturation effect’ below.

As such proposition 2 partially fails in that only a few of the factors hypothesised to effect adoption had a significant linear relationship to the stage of adoption.

Factors affecting benefit realisation

Table 4 summarises the results of the correlation analysis which was performed for each stage.

Insert Table 4 about here

A correlation matrix was not examined for stage 1, as at this stage benefits would not be expected to be gained, as adoption has not yet occurred. In addition, the 39 respondents at stage 1 are insufficiently numerous for the analysis to be carried out with any statistical power. This is, in part, related to the suggested lack of response from organisations with little interest in e-commerce as discussed in the method section.

The following factors are significantly correlated at the 1% level with system success for at least one stage and at least one success measure:

- H16 Management understanding
- H18 Training
- H22 IT skills
- H25 Customer/supplier demand
- H26 Top management support
- H27 Prioritisation
- H28 Perceived risk
- H29 Divisibility.

Discussion

Adoption patterns

The four clusters, which we have termed developers, communicators, promoters and customer lifecycle managers, are in many ways unsurprising, but provide an empirical basis for the subsequent research propositions and future research.

We have based the cluster analysis on business activities rather than technologies, but in accordance with previous, hypothetical stage models, the activities which characterise each stage strongly suggest a technological core to the adoption process. Companies appear to start with the most simple technologies, for example, the use of email and Web browsing, and then proceed via a 'brochure-ware' website to a transactional one. The order of adoption of e-commerce's components is perhaps, then, driven more by a technological rationale than by conscious choice of where the greatest benefits would lie.

On closer inspection, though, there is some indication that the clusters also have a meaning which is related to areas of business focus, hence our suggested cluster labels. The launch of an informational website also represents a move towards one-to-many communication, from the predominantly one-to-one communication of early adopters of e-mail. This communication suits the task of promotion, where the members of the target market may not yet be known individually and hence not be targetable through e-mail. But this cluster also represents a large increase in the percentage using electronic advertising (to 55% from 14%), which is more suggestive of banner advertisements, e-mail campaigns, links with third-party sites and so on than static company websites. It seems that stage 3 companies, along with their website development, are viewing promotion and how it can best be enabled online in a holistic manner.

Similarly, cluster 4 seems to represent not just a technological move towards transactional capabilities, but also a broadening of business focus from promotion and lead generation towards the support of communications throughout the relationship with the customer, including not just order handling but also after-sales service and, for some, digital delivery.

Some within cluster 4 are broadening their focus further to relationships with other stakeholders, particularly suppliers and the recruitment market. Again, these are not obviously predicated on the development of transactional websites: for SMEs, non-inventory purchasing, for example, may well rely on the supplier's website, email or use of a third party service such as an e-marketplace.

Further support for our contention that the stage model is as much about diffusion of business process innovation as it is about diffusion of technology is provided by the positive relationship between management understanding of business benefits and perceived success.

As SMEs mature in their use of the Internet, the stage model may need supplementing with additional stages, which were insufficiently represented in this sample to emerge in the cluster analysis. We can speculate from our discussion of the data of Table 2 that a further stage of 'supply chain managers' is possible, as the use of the Internet for purchasing develops.

Future studies could not presume, though, that further clusters will necessarily continue to be sequential, as our clusters appear to be on our tentative evidence. For example, the significant minority of cluster 4 delivering products or services online suggests that a further cluster of 'virtual value deliverers' could emerge representing those companies for whom digital delivery of products/services is a major focus.

These are, however, speculations, and we would encourage further research to test the proposed stage model and identify further clusters as new technologies or business applications become available.

Further research could also usefully look in more detail at the trajectories of individual firms. While we have found some evidence that the stages are broadly sequential in the sample as a whole, this does not preclude the possibility that individual firms may stop, retrench or indeed skip a stage, as has been observed in stage models in the internationalisation literature (Gankema et al 2000; Kalantaridis 2004).

Factors affecting adoption

Of the factors significantly associated with adoption stage, the one with the highest mean factor score is top management support. As top management support is generally found to be a strong influence both on adoption of technologies and on their success, this is not a surprising finding. Its relatively high mean score suggests, though, that its absence is not actually dominant as a barrier to adoption in this population.

But is this top management commitment backed up by sufficient top management insight? We have distinguished management support from management understanding, which relates to Rogers's (2003) "communicability" factor – the ease of communicating the innovation to the adopters. Management understanding, operationalised as "We understand how e-commerce can help our business", was a significant determinant of adoption stage – unlike the related "Keeping pace with IT". It seems that conceptualising how to apply e-commerce

to the business is more of a barrier than understanding the technology itself. Other lists of IT adoption or success factors do not include such an element (see for example Caldeira and Ward 2003) - perhaps because the business impact is more obvious in such areas of automation as accountancy or payroll – so this represents a factor which is, at least, more pertinent to the e-commerce sphere.

The significance of the “IT skills” and “Consultancy availability” factors suggests that of the various resources required, human resources (both internal and external) are more important than software availability or, indeed, finance availability in determining adoption levels. These factors seem to relate to Rogers’s (2003) complexity criterion: if e-commerce is perceived as complex, then that complexity needs to be managed by appropriately skilled people. It is, then, surprising that the “Training” factor does not vary significantly by stage. Perhaps this is because the increasing skills required in more advanced clusters are met by a combination of the prior experience that staff have in earlier clusters and the increased use of consultancy suggested by the “Consultancy availability” factor.

The final significant factor, and the one with the lowest mean factor score, is prioritisation of e-commerce against other projects. The low mean score as compared with top management support suggests that despite perceiving e-commerce as important, many SMEs find other priorities slow its rate of adoption. This may represent entirely rational behaviour, in tune with Rogers’s “relative advantage” criterion. The notion that e-commerce is a good in itself across the board has no obvious empirical justification, and the dominant need for investment in any given business at any given moment may indeed lie elsewhere.

However, in this context the absence of “Customer/supplier demand” from the significant adoption factors is worrying, particularly given that, as one would expect, it is present as a success factor. This suggests that whatever the prioritisation criteria SMEs are applying to decisions on e-commerce adoption, they are not entirely market-focused – leaving open the danger of those who push forwards finding themselves out of tune with their market, or equally in other markets with more latent e-commerce demand, of too slow a pace of adoption.

With the exception of top management support, then, the adoption factors relate closely to some of Rogers’s criteria. It is relevant to note the three of Rogers’s criteria which were not reflected in the adoption factors:

- Compatibility with existing business processes. This may have been absent because many early applications of e-commerce have been kept distinct from existing business processes (Poon and Swatman 1999).
- Perceived risk does not relate to adoption, though it does to success. Again, this may represent less than optimal decision-making about adoption by SMEs: if business and technical risks are indeed a factor in the achievement of benefits, then it would be appropriate for this to be taken into account when deciding on e-commerce adoption. Perhaps the significance of the management understanding factor represents an acknowledgement by respondents that business risk, like business benefits, could be better understood.
- Finally, divisibility, or the ease of trying out the innovation in stages, was not present. Given that e-commerce does indeed appear to be generally adopted in stages, it makes sense that this factor would not be likely to distinguish earlier from later adopters. This interpretation is reinforced by the relatively high mean factor score for divisibility, and its

low standard deviation, suggesting that the factor varies relatively little amongst the sample.

Overall, then, Rogers still encapsulates in a broad sense many of the drivers of adoption, and indeed still has important lessons in the perception of risk and how relative advantage is assessed.

These variables do not, though, increase in a linear fashion with adoption stage. We have drawn attention to the dip that occurs in the value of each of the significant adoption factor variables in stage 2, followed by an increase in stages 3 and 4. We suggest that this may be explicable as follows. Firms at stage 1, having little experience of e-commerce, show over-optimism about the presence of the various necessary adoption factors – top management support, management understanding and so on. Once work begins, though, problems begin to be encountered, and the extent of the presence of these factors becomes seriously tested. This leads to a more realistic assessment. This more accurate assessment is maintained through the later stages, so the reported differences reflect genuine differences in the relevant personal, organisational and environmental variables.

This interpretation provides support for the “trough of disillusionment” arising from e-commerce adoption, which Guyatt et al. (1999) hypothesised would follow after heady early expectations were not immediately fulfilled. It seems that this effect applies not just to the business community as a whole, but also to individual enterprises. It is also consistent with what has been described, in other areas of SME activity, as an “acculturation effect” (Frank 1988). As Frank put it: “The difficulty facing the entrepreneur is that he does not know his own talent for running the firm” – until tested against the realities of the marketplace.

Whether or not this interpretation is correct, the lack of linearity has important methodological implications for other studies of e-commerce adoption. The most common method of assessing technology adoption is to construct a single adoption variable, such as Snitkin and King’s (1986) use of the number of hours’ usage per week, as a basis for correlation and/or regression with a number of independent variables. But an assumption of linearity lies behind these parametric tests (Kerlinger 1973 p287-8), though it is rarely checked for. A stage model approach therefore seems an appropriate alternative.

A stage model also allows success factors, which we will turn to now, to be discriminated by stage, rather than assuming that they remain constant throughout, as they are frequently reported.

Factors affecting benefit realisation

The success factors, like the adoption factors, show a predominant emphasis on issues related to the business case rather than technology. Where technology-related factors are significant, they tend to relate to skills availability rather than finance or availability of appropriate software.

Along with top management support, management understanding is strongly associated with success across all stages, just as they both influence adoption. For a given adoption stage, it seems that clarity of management vision can enable e-commerce to deliver greater benefits from the same broad technology. This makes sense, given the complexity of the business issues raised by e-commerce, such as industry restructuring, multi-channel integration, dynamic pricing, tailored products and services and so on.

Prioritisation, the presence of a high priority for e-commerce, is a closely related factor which influences success as well as adoption, though this does not appear as a success factor at stage 3, for reasons which are not obvious and require further investigation.

We have mentioned the surprising absence of perceived risk from the adoption factors. It does, though, appear as a success factor at each stage (though only at the 5% significance level in stage 3), with a positive correlation after the relevant item was reversed, so the higher the perceived risk, the lower the benefits. There are two rather different possible explanations:

1. For some companies, the risk associated with e-commerce is higher than for others. Some of these higher-risk companies will not see the intended level of benefits due to the technical or business risks involved.
2. Some risk-averse managers perceive there to be a higher risk, as a result of which they invest less effort or resources in e-commerce and hence achieve lower benefits.

A combination of these is also possible. Further research would be needed to explore the impact of risk in more detail.

The final factor which appears across all stages is customer/supplier demand. Given its strong correlation with success, it would seem well worthwhile including it as a factor in decision-making on adoption, as we have already mentioned – particularly for the more expensive developments involved in stage 4. Its correlation is lower (and only significant at the 5% level) for stage 3: this is another unexplained difference at stage 3 which needs further investigation. One would expect that having built a website, the customer demand to use it would have a strong bearing on the benefits achieved.

Several other factors relating to implementation rather than the business case do not appear until stage 3. The availability of the relevant skills in the business environment, whether from employees (staff availability) or from consultants (consulting availability), becomes relevant at stage 3. By stage 4, the emphasis seems to switch to the IT skills of those in-house, in the IT skills and training factors. While outsourcing of static and even transactional websites is not uncommon, a transactional website is likely to affect business processes and IT systems for the whole business, hence presumably the growing importance of IT skills and training at this stage. It may also be that by stage 4, many companies have attempted to ensure a skills handover from any outside help they receive, so that they can continue to develop their e-commerce facilities in-house.

The final factor, divisibility, appears only at stage 2, those companies that believe they can more readily divide e-commerce into stages reporting greater overall value from e-commerce. As larger projects tend to have greater failure rates (McDonald and Wilson 2002), the relevance of this factor is not surprising, although why it is not present in subsequent stages is not clear.

Summary and conclusions

We summarise the study's findings and implications for practitioners and researchers in Table 6.

Insert Table 6 about here

We have used cluster analysis to identify organisational clusters in relation to e-commerce adoption. From analysis of these clusters we have derived a possible four-stage model of the adoption of e-commerce by UK SMEs. Although broadly in line with stage models hypothesised in previous literature, we advocate this empirical approach as a sounder basis for research on adoption and benefits achievement than the use of an unvalidated stage model such as White et al's (1998) 'Traditionalists', 'Straddlers' and 'Innovators' which was used by Ching and Ellis (2004). We have also identified methodological difficulties with the use of a continuous adoption scale, due to the lack of linearity between it and variables influencing adoption rates, an important point for future research, and one that casts a question-mark over the results of recent studies such as Wu et al (2003). Future studies may well find additional stages as SMEs gain in e-commerce maturity: we have hypothesised the further stages of 'Supply chain managers' and 'Virtual value deliverers', for example.

The rate of adoption appears to be influenced by several factors:

- Top management support: though a significant factor in this study as in most IT-related initiatives, its high mean score across all the stages suggests that SME management in general is favourable to e-commerce activities and therefore that this adoption factor is mostly present.
- Management understanding: conceptualising how e-commerce can help the business seems more of an issue than understanding the technology itself.
- IT skills within the organisation, and ready access to help outside it: these factors suggest that of the various resources required, human resources are more important than the availability of finance or software in determining adoption levels.
- Prioritisation: the presence of other pressing projects can act as a brake on adoption. This can be reasonable enough, but there are worrying signs that customer demand is under-represented in the decision-making process.

These factors suggest how those endeavouring to influence adoption rates - both suppliers and government agencies - could best help SMEs. Notably, the importance of management understanding, combined with the already high levels of top management support, suggests that SMEs need practical help with e-commerce strategy formulation more than emotional lobbying on its importance. This is consistent with Ching and Ellis' (2004) interview-based observation that:

“few of the informants interviewed had designed a coherent strategy to capitalise on the full potential of e-commerce. Rather, online activities often appeared to be ad hoc, circumspect, and tangential to the corporate strategy of the firm.”

In this respect, our research has echoes in research into other innovations in SMEs. Morrell and Ezingard (2002), in a study of the adoption of inter-organisational information systems such as EDI, concluded that:

“a culturally-rooted lack of vision and awareness are restricting adoption and the realisation of benefits associated with such systems”.

In similar vein, Mole et al (2004)'s exploration of the adoption of process innovations such as Total Quality Management concluded that formal planning was a prerequisite for small firms to adopt many such “soft process technologies”, and indeed a more significant adoption factor than the competitive environment.

We have distinguished factors influencing adoption from factors influencing success. Within any given stage of adoption, these factors analyse what seems to cause variation in benefits achieved. Those identified are:

- Top management support, management understanding and prioritisation: these appear to influence not just the rate of adoption, but also the extent of benefits for any given level of adoption.
- Consultancy availability and staff availability: for the stage 3 promoters, the degree of benefit is influenced by the availability of appropriately skilled staff in the jobs market, as well as the availability of outside help.
- IT skills and training: by stage 4, organisations who are gaining benefits from e-commerce seem to have achieved greater skills transfer, with better in-house IT skills and staff training than their less successful peers. As with adoption factors, these human resource issues seem more influential than the availability of financial and software resources.
- Customer/supplier demand: the many dot-com ventures who have failed due to an over-enthusiastic prediction of the speed at which customers would adopt new buying habits should mean that this factor does not come as a surprise – and yet as we have pointed out, it seems strangely absent as a factor influencing adoption.
- Perceived risk: those perceiving a higher risk tend to achieve lower benefits
- Divisibility: there is some suggestion that those who can divide their projects into stages more readily achieve greater benefits.

A stage model approach to the examination of e-commerce adoption, then, seems to hold promise, and we hope that it will be taken up in future research, to validate and extend the current model, and to determine the extent to which it can be generalised to other populations or indeed other related innovations. In addition to survey approaches, a longitudinal study of a panel of businesses, similar to Gankema et al's (2000) study of internationalisation, would help to establish how companies move from one stage to the next, and indeed whether some companies stop, retrench or jump, and help to verify causality in the various adoption and success factors we have identified.

Further research would benefit from the development of multi-item scales for variable measurement, concentrating on the variables we have identified as most promising, to replace the single item measures used in this exploratory study. Other weaknesses of this study include its convenience sample, the limited range of benefits measured and the lack of a previous empirical model from which we could have gauged respondents' movement from previous stages. Further adoption/success factors specific to e-commerce may also, of course, be identified through qualitative research. Promising sources including Moss-Kanter (2001) and McDonald and Wilson (2002). Another area for further research is to check for any differences in adoption and success factors by industry, by the nature of the product or service and by geographical location.

Implications for Practitioners and Influencers

We have noted that the stages cluster around marketing processes and not just technology. This suggests that practitioners need to review each customer-focused marketing process holistically before introducing Internet technology. But serious questions are raised as to how well this is being done by the absence of adoption factors relating to business risk and, alarmingly, customer demand. The need to raise the level of SME marketing strategy skills is

also suggested by the importance of management understanding rather than simply top management support which is mainly present.

The help currently being offered to practitioners, however, tends to focus on specific Internet technologies, such as the UK government's push of broadband, as if they were an end in themselves. While such technological infrastructure is doubtless invaluable, business schools and government agencies have a vital role in providing complementary advice on marketing process design in the channel-neutral way that is essential if e-commerce success rather than sheer adoption is the aim. While stage 3 promoters are relatively well supported by research and practitioner-oriented books on integrated marketing communications, there is a contrasting paucity of help for stage 4 lifecycle managers on multi-channel strategy and the place of the Internet within it - notable exceptions including Friedman and Furey (1999) and Daniel et al (2002). We would also draw the attention of practitioners to tools for assessing customer demand for new channels proposed by Kim and Mauborgne (1999), Tjan (2001) and Chaffey (2002 p193-5 and p408-9).

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Table 1: Adoption/success factors

Factor	Illustrative Sources
H1,H16 Management understanding	Wu et al. (2003); Ching and Ellis (2004)
H2,H17 Keeping pace with IT	Wu et al. (2003)
H3,H18 Training	Caldeira and Ward (2003)
H4,H19 Consultancy availability	Hamill & Gregory (1997);
H5,H20 Vendor support	Caldeira and Ward (2003)
H6,H21 Finance availability	Hamill and Gregory (1997)
H7,H22 IT skills: skills of in-house staff	Hamill and Gregory (1997)
H8,H23 Staff availability: ease of recruiting appropriate staff	Hamill and Gregory (1997)
H9,H24 Software availability	Caldeira and Ward (2003)
H10,H25 Customer/supplier demand	Ching and Ellis (2004); Jeffcoate et al. (2002)
H11,H26 Top management support	Jeffcoate et al. (2002)
H12,H27 Prioritisation: extent to which e-commerce is prioritised over other projects	Wu et al. (2003)
H13,H28 Perceived risk	Hamill and Gregory (1997)
H14,H29 Divisibility: ease of dividing into stages	Caldeira and Ward (2003)
H15,H30 Compatibility: extent of change to business processes	Jeffcoate et al. (2002); Ching and Ellis (2004)

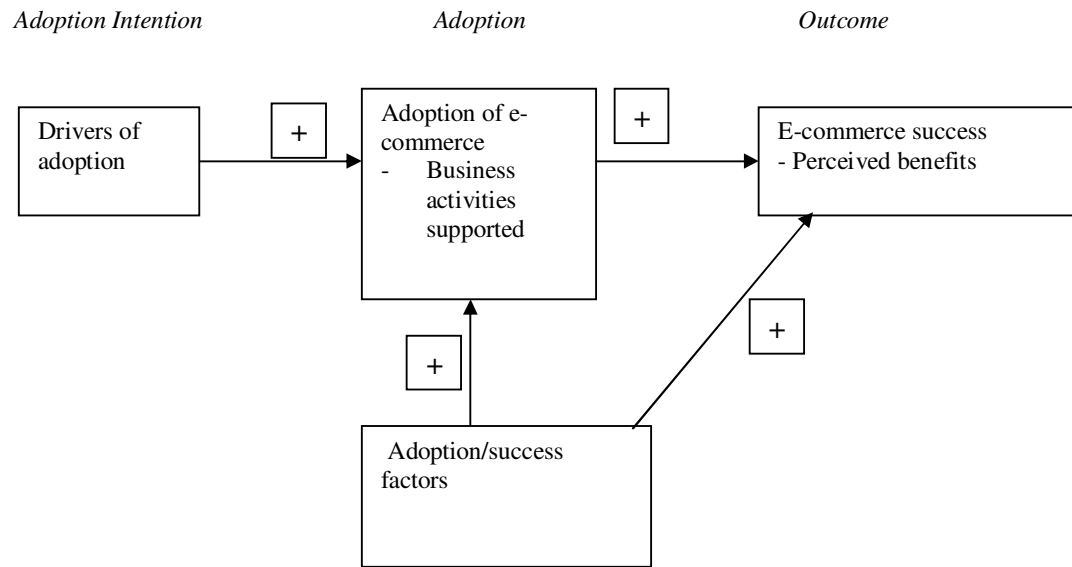


Figure 1: Conceptual Framework

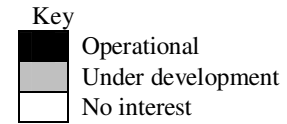


Table 2: Activities by cluster

Activities	Cluster 1 (N=39)		Cluster 2 (N=135)		Cluster 3 (N=203)		Cluster 4 (N=208)		Asymp Sig (2 tailed)
	Operational	Under development	Operational	Under development	Operational	Under development	Operational	Under development	
Internal communication between employees	12.8%	53.8%	57.0%	5.9%	63.1%	4.9%	81.3%	1.0%	0.000
Providing information on company	10.3%	76.9%	2.2%	73.3%	97.5%	0.0%	95.7%	1.4%	0.000
Communications with customers or suppliers	7.7%	87.2%	89.6%	0.0%	95.1%	3.4%	99.5%	0.0%	0.000
External information search	7.7%	74.4%	77.8%	3.0%	80.8%	2.0%	90.4%	0.5%	0.000
Providing information on goods or services	5.1%	84.6%	5.9%	59.3%	89.2%	3.4%	96.6%	1.4%	0.000
Advertising	5.1%	76.9%	14.1%	31.1%	55.7%	7.4%	80.3%	1.9%	0.000
Document exchange with customers or suppliers	2.6%	59.0%	56.3%	11.1%	56.2%	5.9%	78.8%	1.9%	0.000
Recruitment	2.6%	33.3%	13.3%	5.9%	13.8%	12.8%	44.2%	1.0%	0.000
Receiving payment	2.6%	30.8%	8.3%	10.4%	4.4%	24.1%	27.4%	6.7%	0.000
Communications with shareholders and investors	2.6%	28.2%	8.3%	3.0%	9.3%	3.9%	15.3%	2.4%	0.000
After sales service or contact	0.0%	51.3%	20.0%	17.0%	14.3%	16.3%	61.5%	0.5%	0.000
Taking orders	0.0%	51.3%	11.9%	21.5%	7.9%	30.5%	61.5%	1.9%	0.000
Identifying new inventory suppliers	0.0%	33.3%	20.0%	4.4%	15.2%	4.4%	29.3%	3.4%	0.000
Ordering and payment of inventory purchasing	0.0%	30.8%	14.1%	3.7%	6.4%	7.4%	16.3%	6.7%	0.000
Non inventory purchasing	0.0%	28.2%	37.0%	7.4%	18.7%	8.4%	41.8%	1.9%	0.000
Delivery (of digital goods or services)	0.0%	28.2%	9.6%	6.7%	5.4%	12.3%	26.9%	0.3%	0.000

Figure 2: Adoption of activities by cluster

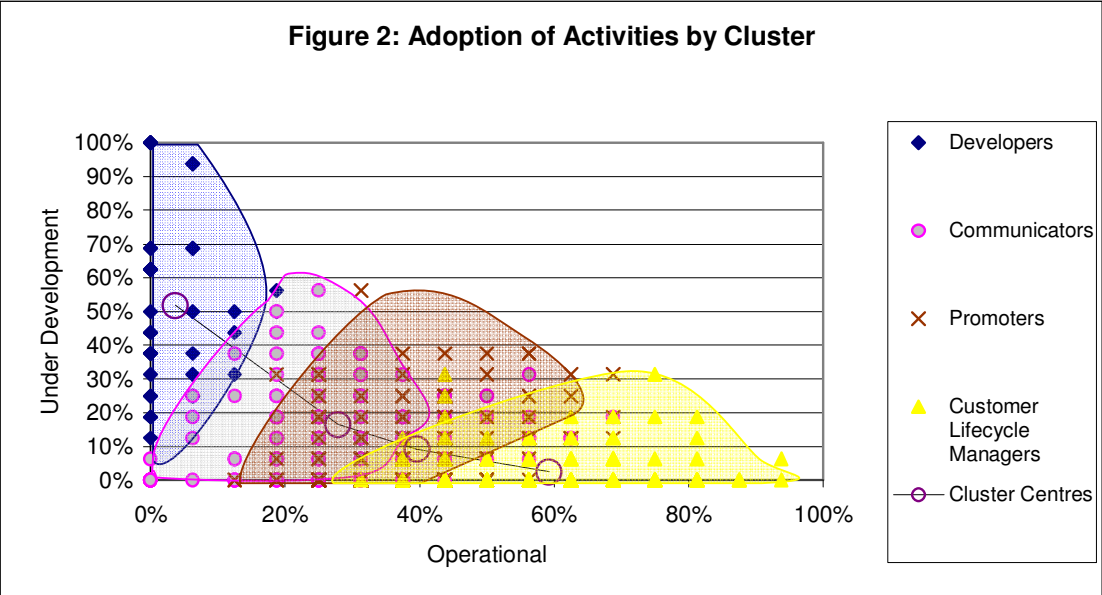


Table 3: Adoption factors by stage of adoption

Hypothesised adoption factor	Stage 1		Stage 2		Stage 3		Stage 4		Degrees of Freedom		F	Sig. (p-value)	Pearson's Correlation
	mean	std dev	mean	std dev	mean	std dev	mean	std dev	Between Groups	Within Groups			
H11 Top management support	3.10	0.47	3.15	0.54	3.20	0.55	3.40	0.61	3	535	7.33	**	0.933
H1 Management understanding	3.06	0.34	2.89	0.67	3.01	0.57	3.21	0.63	3	559	7.85	**	0.555
H2 Keeping pace with IT	2.97	0.57	2.98	0.64	3.05	0.68	3.00	0.63	3	565	0.38		0.580
H14 Divisibility	3.09	0.28	3.05	0.47	3.04	0.50	3.00	0.44	3	546	0.55		-0.978
H3 Training	2.77	0.49	2.65	0.63	2.69	0.59	2.78	0.63	3	543	1.38		0.144
H7 IT skills	2.50	0.56	2.45	0.66	2.56	0.61	2.72	0.60	3	561	5.85	**	0.847
H10 Customer/supplier demand	2.52	0.66	2.53	0.67	2.53	0.70	2.65	0.68	3	538	1.34		0.814
H4 Consultancy availability	2.70	0.59	2.48	0.71	2.41	0.68	2.63	0.68	3	526	4.23	**	-0.271
H5 Vendor support	2.70	0.55	2.54	0.69	2.60	0.73	2.53	0.61	3	501	0.60		-0.744
H6 Finance availability	2.52	0.61	2.55	0.81	2.45	0.80	2.34	0.72	3	546	2.13		-0.886
H9 Software availability	2.50	0.56	2.39	0.65	2.33	0.69	2.31	0.65	3	507	0.93		-0.952
H15 Compatibility	2.44	0.60	2.34	0.68	2.33	0.72	2.31	0.71	3	550	0.35		-0.890
H12 Prioritisation	2.39	0.66	2.37	0.68	2.50	0.73	2.66	0.68	3	527	5.03	**	0.913
H8 Staff availability	2.29	0.61	2.19	0.64	2.11	0.62	2.25	0.64	3	474	1.76		-0.330
H13 Perceived risk	2.07	0.36	1.98	0.49	1.97	0.60	1.93	0.54	3	520	0.67		-0.939

** : correlation is significant at 0.01 level

Table 4: Factors influencing success – simplified correlation matrix

Hypothesised success factor	Compete with SMEs			Compete with large cos			Overall value		
	Stage 2	Stage 3	Stage 4	Stage 2	Stage 3	Stage 4	Stage 2	Stage 3	Stage 4
H16 Understanding	.37 **	.30 **	.25 **	.35 **	.30 **	.33 **	.38 **	.41 **	.36 **
H17 Keeping pace with IT									
H18 Training			.21 **			.30 **			.22 **
H19 Consultancy availability							.17 *		.16 *
H20 Vendor support									
H21 Finance availability									
H22 IT skills			.18 *			.25 **			.22 *
H23 Staff availability		.17 *			.21 *				
H24 Software availability									
H25 Customer/supplier demand			.20 *	.33 **		.19 *	.31 **	.16 *	.36 **
H26 Top management support	.27 *	.25 **	.28 **		.19 *	.33 **	.33 **	.37 **	.37 **
H27 Prioritisation	.29 *		.22 **			.23 **	.27 **		.35 **
H28 Perceived risk	.30 **		.20 *			.17 *		.16 *	.31 **
H29 Divisibility							.29 **		
H30 Compatibility									

Key: Each cell contains Pearson correlation coefficient followed by indication of significance (*: $p \leq .05$ **: $p \leq .01$). Insignificant correlations at 5% omitted.

Table 5: Summary of findings and implications

	Confirming previous research	Extending previous research	Implications: practitioners and advisors	Implications: researchers
P₁ SMEs adopt e-commerce in stages	Four empirically derived clusters, with tentative ordering into stages, broadly consistent with those hypothesised by O'Connor & Galvin (1998) etc <ul style="list-style-type: none"> - Developers - Communicators - Promoters - Lifecycle managers 	Detail of stages, particularly their clustering around marketing processes not just technology <ul style="list-style-type: none"> - Promoters, not just static web sites - Lifecycle managers, not just transactional sites Hypothesised further stages: supply chain managers, virtual value deliverers	Review each marketing process holistically including both Internet subchannels and other channels before introducing Internet technology	Provides an empirically derived stage model that can be confirmed and built on by other researchers Demonstrates a cluster analysis method which allows stage models to be empirically derived rather than assumed
P₂ Factors influencing adoption	Confirmed factors: <ul style="list-style-type: none"> - Top management support - Management understanding - Presence of IT skills - Consultancy availability - Prioritisation of e-commerce 	Top management insight is more of a problem than top management support Factors absent include keeping pace with IT, and customer/supplier demand	Government and other influencing agencies should focus on business understanding more than technology understanding Practitioners should monitor customer demand as an input into adoption decisions	E-commerce adoption research needs to explore nature & influence of management understanding Adoption research should beware non-linear relationships due to acculturation effect
P₃ Factors influencing success	Confirmed factors: <ul style="list-style-type: none"> -Top management support - Management understanding - Presence of IT skills - Customer/supplier demand - Training - Prioritisation of e-commerce - Perceived risk - Divisibility. 	Business risk, while influencing success as expected, is not currently influencing adoption significantly Required skillsets vary across stages: promoters can use outsourced skills, but customer lifecycle managers need internal skills developed through training	Practitioners should take into account business risk when making adoption decisions Influencers should develop supportive environment (with skilled staff and consultancy availability) if mature Internet use is desired and not just sheer Internet connectivity Practitioners should plan on skills transfer by stage 4	Need to explore practitioners' prioritisation of e-commerce and whether it is currently optimal Need for richer exploration of the concept of management understanding, given its importance to success

Appendix 1. Variable operationalisation

The items used to operationalise the adoption/success factors are shown in Table A1.

Table A1: Adoption/success factor items

Factor	Questionnaire item
Management understanding	We understand how e-commerce can help our business
Keeping pace with IT	It is difficult to keep pace with the rate of change in IT
Training	We train staff to use systems effectively
Consultancy availability	We can find quality and affordable outside expert help
Vendor support	SMEs have little support from IT/IS vendors
Finance availability	We have insufficient financial resources available for the development of e-commerce services
IT skills	Our staff have the relevant IT skills
Staff availability	We can heasily hire necessary IS/IT staff
Software availability	There is little affordable e-commerce software suitable for my business
Customer/supplier demand	Our customers and/or suppliers are encouraging us to adopt e-commerce
Top management support	Senior management backs our e-commerce activities
Prioritisation	We have other more pressing projects
Perceived risk	E-commerce is highly risky for us and our customers
Divisibility	We can adopt e-commerce in stages
Compatibility	It requires a complete change to how we currently work

Table A2 shows the items used to operationalise the success measures.

Table A2: E-commerce success items

Factor	Questionnaire item
Competitiveness with SMEs	It has helped us to compete with other SMEs in our field
Competitiveness with large organisations	It has helped us to compete with large companies in our field
Perceived overall value	Overall, e-commerce has proved valuable to our company

Appendix 2. Number of employees in companies included in study

The number of employees in the organisations participating in the survey is shown in Figure A2. Micro-businesses, typically defined as organisations with 5 employees or less (Smith 1999), represented 6% of the sample. Small businesses, that is organisations with between 6 and 50 employees, represent a slight majority in the responses, accounting for 51%. Medium sized businesses, that is those with between 51 and 250 employees accounted for 43% of the responses.

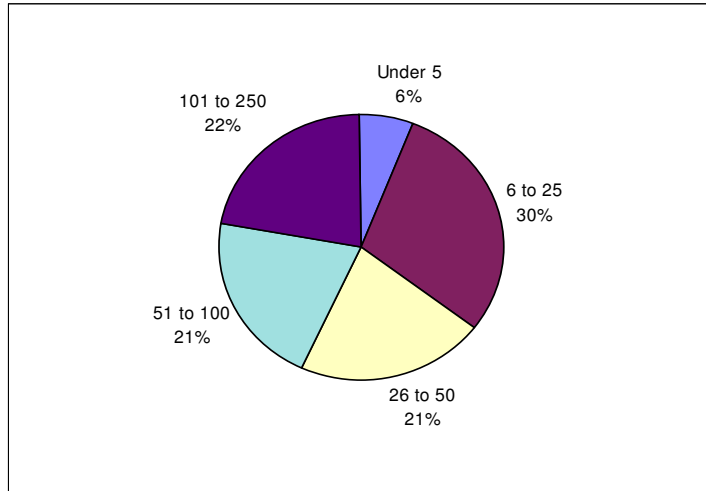


Figure A2: Number of Employees in Respondents' Organisations