FACTORS AFFECTING THE UPTAKE OF E-BUSINESS BY SMALL BUILDING ENTERPRISES

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The adoption of e-business by Small and Medium Enterprises (SMEs) in construction lags other service and product businesses within the building sector. Twenty SMEs were studied to establish the drivers and barriers to e-business adoption within construction. Empirical techniques included interviews and repertory grids for business web site assessment. Data was transcribed and analysed using cluster analyses. Preliminary results reveal that current models for e-business adoption are not effective for the small businesses as they tend to target large enterprises or from other sectors such as retail and tourism. These generic models have largely ignored the nature of the construction industry, and some modifications appear to be required. This paper proposes adoption guidelines sensitive to the nature of the industry – particularly for e-business uptake in building SME's.

Keywords: e-business adoption, ICT maturity levels, technology uptake, innovation diffusion, small and medium enterprise.

INTRODUCTION

According to the National Office for The Information Economy (2005) small and medium enterprises (SME) have yet to experienced the full value of e-business. The dominance of SMEs in the Australian construction industry effectively means the industry is largely unaware of, or not gaining benefit from, e-business. An understanding of the reasons behind e-business adoption by SME business owners will allow an effective awareness scheme to be developed for the industry. This paper presents the preliminary results from a broader project that seeks to understand the factors influencing e-business adoption in construction SMEs. Specifically, it identifies a range of real and perceived barriers by business owners and business technology users, and proposes a *technology adoption framework* for the industry.

The term *"e-business"* is commonly used to describe Internet-enabled systems that provide information, facilitate transactions or provide shared business processes (Bloor Research, 2005). The Department of Commerce (2002) argues that e-business technology typically supersedes either paper-based systems or Electronic Data Interchange (EDI) to provide an improved communication channel between business partners. Definitions of e-business from other industry sectors include: the undertaking of business related transactions and information exchanges utilising an electronic format and environment (e-MORI 2001); the creation of networks that act as electronic supply chains (NOIE 2001a); and the creation of commercial efficiency with subsequent benefits for all stakeholders (Ribeiro 2001).

Aranda-Mena, G, Blismas, N and Wakefield, R (2005) Factors affecting the uptake of e-business by small building enterprises. *In:* Khosrowshahi, F (Ed.), *21st Annual ARCOM Conference*, 7-9 September 2005, SOAS, University of London. Association of Researchers in Construction Management, Vol. 2, 685-95.

Clearly a variety of perceptions exist in the industry, and NOIE (2001b) confirms that misconceptions of e-business terms are still an issue. It is argued that by integrating business processes, consultants, builders, contractors and the wider supply chain can perform more efficiently and reliably. Supply chains can be consolidated and the long term relationships between participants in the construction process can be enhanced. For the purposes of this research the NOIE (2001c) definition for e-business namely *'the facilitation and integration of business processes'*, has been adopted.

An approach to accelerate uptake is that of innovation diffusion (Rogers 1995), which refers to the spread of ideas and concepts, technical information, and actual practices within a social system. In diffusion theory it is assumed that the spread of ideas moves from a source to an adopter through a process of communication and influence at various levels. Weknert (2002) offers a simple, yet comprehensive framework to analyse the implementation and diffusion of innovation from various angles. This conceptual framework is derived by grouping diffusion variables into three major components (table 1). This study aims identify factors influencing the diffusion or uptake of e-business and Internet use for business purposes by small construction enterprises.

Table 1 Framework for analysing implementation and diffusion of innovation (Weknert 2002).

Public vs private consequences	Social entity variable	Environmental context
- benefits vs. costs - collective actors / countries - diffusion processes that differ in nature	- familiarity with the innovation - status characteristics - socioeconomic characteristics - position in social networks - personal characteristics	- geographical settings - societal culture - political conditions - global uniformity

Small collective actors, such as SME networks, organizations, or groups of friends, adopt innovations mainly in a personal capacity for activities such as e-banking or book shopping. The greater the density of adopters, the less the perceived risk of adopting by non-adopters and the greater the chance of uptake by small building businesses (Rogers, 1995). Success stories and testimonials by SMEs are seen as vehicles for encouraging uptake within the sector. A series of interviews were conducted to collect these anecdotes of e-business success among SMEs.

STUDY DESIGN

A comparative case study design was used to capture reasons behind the adoption of e-business by small metropolitan and regional building businesses. The case study approach aims to gain insights into builders' personal decision-making when adopting the Internet for their business purposes. Qualitative data analysis was used to assess participants' responses to e-business adoption, including aspects such as on-line banking, on-line transacting, on-line tendering and all areas of e-procurement. Four groups were identified from which five SMEs were selected for interview.

1. Regional non-adopter [RN] (n=5)
2. Regional [R] (n=5)
3. Metropolitan non-adopter [MN] (n=5)
4. Metropolitan [M] (n=5)

The approach underpinning the study is that of Qualitative Data Analysis (QDA) (Seidel, 1998). QDA provides insights into theoretical and applied studies of knowledge, attitude measurement and cognition. Attitudes were discerned qualitatively and these were measured and presented using cluster grids and a summary grid (Denicolo and Pope, 2001). Grid Suite™ software was used to analyse responses as it offers the ability to arrange qualitative and quantitative content into cluster grids and cluster diagrams (Fromm, 2004). In this case it was used to plot attitude ratings and to synthesise the interview data. An interview agenda was developed, with responses transcribed and analyzed using *repertory and cluster grids.*

Procedure

Cases were randomly selected from a database of Master Builders Association of Victoria (MBAV) members. All the interviews were conducted by telephone and lasted approximately 45 minutes. The interview agenda was designed with 14 questions, each containing multiple-choice and tick-box prompts. Respondents were also asked to elaborate on their responses to these structured questions.

RESULTS

The results of the interviews are presented under nine categories. The categorised responses are presented in figures 1 to 5, which are relational summaries of the 20 organisations. Each grid contains four categories (RN, R, MN and M) listed in the left column, with numbers and pattern matching plotted across the grids. A value of 1 was given to attributes perceived as important and a value of 3 to those perceived as not important. Three-level shading was used to identify pattern clusters. A selection of quotations has been used to provide depth to the responses.

ICT Attributes

The first theme or category refers to the use of Information and Communication Technologies (ICT) across five categories (figure 1). Before discussion started, interviewees rated all prompts by level of importance. Results show that fax and telephone are still the most used communication technologies. For the two adopter groups (rural and metropolitan) e-mail and web sites are almost as equally important as fax and phone. Although mobile short message systems (SMS) are not highly rated, several respondents thought they provided a useful method for sending quick specific directions without the need for dialogue. SMS systems can also send a message to multiple users from a single source.

Results indicate that the two adopter group (R and M) rightly correlated with the strongest use of ICT in their businesses. For the rural adopter group Internet use was equally important (including web site and e-mail). However, SMS rated the lowest across all respondents. An explanation may be the lack of awareness of possibilities available for integrating SMS mobile technology into everyday business processes.

Figure 1 Cluster Grid: ICT Attributes

Rate the importance of communication technologies	RN1	RN2	RN3	RN4	RN5	R1	R2	R3	R4	R5	MN1	MN2	MN3	MN4	MN5	M1	M2	M3	M4	M5
fax	1	1	1	1	1	1	1	1	1	2	1	1	2	1	1	1	1	2	1	1
phone	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
web site	2	2	3	3	3	2	2	1	1	1	1	3	3	3	3	1	2	2	1	2
e-mai	1	3	3	2	2	1	1	1	1	1	1	3	3	2	3	1	2	1	1	1
SMS messaging	3	3	3	2	3	2	3	2	3	2	2	1	3	3	2	3	3	3	3	3

The following quotations elaborate some of the findings of the cluster grid for ICT attributes.

[E-mail] *The e mail has become a key component in our communication strategies. We use it to transfer large drawings and because it is instantaneous it really helps in getting things to clients or potential clients. I also find searching facility for in/out boxes extremely useful* [R2]

[E-mail] *Three main key benefits include instant communication, ability to receive, archive and retrieve information and improvement in business relations within other businesses and with clients* [R2]

[E-mail] *The tree main key benefits of using the e mail are: speed, precision, and easy exchange of documentation. It is today's tool, the best way to send information – especially to accountants – I also use e mail with attachments and quotes for clients. It certainly saves time; I sometimes ask for quotes by phone and request an answer by e mail* [R3]

[Web-site] *Nowadays having a dedicated web site is very important. Perhaps number one in our priorities as, we get heaps of enquiries over the internet. The web site domain name (as company name) is a very important factor to be found and contacted by occasional clients* [M1]

[SMS] *I'm finding the SMS mobile more useful, for example: if I can not get through to talk with my husband then I leave an SMS, it really helps to manage home issues and save business time. Its very convenient in the house, no doubt it will be in our business as well – it means access to anyone without intrusion* [RN1]

ICT Usage Behaviour

The ICT user behaviour category sought to ascertain user adoption of the Internet for business purposes. Contrasting opinions emerged, such as MN2 who sees that having a web site attracts unwanted clients, he also commented on his frustration with viruses and the time required for learning, particularly for SMEs.

Figure 2 indicates that out of 20 only two respondents do not use the Internet at all. RN and MN groups have used the Internet for personal rather than business requirements. Rural adopters have been using the Internet for some years, R4 having adopted ICT 12 years ago primarily through e-mail. R1, the latest adopter, had been using e-mail for 3 years.

Figure 2 Cluster Grid: ICT usage behaviour

For how long has your business been using the Internet? [years]	RN1	RN2	RN3	RN4	RN5	R1	R2	R3	R4	R5	MN1	MN2	MN3	MN4	MN5	M1	M2	M3	M4	M5
e-mail	2	1		2	5	3	6	5	12	5	2	8		3		8	2	4	5	5
Web browsing	1	1		1	5	3	6	5	15	5	1.5	2		3		8	3	5	5	5
Deidicatied Web site	0.5			0.5		1	4	4	15	1						7	3	5	5	1
Orders / purchase						2														5

Participant MN3 prefers to call his clients and deal with people over the phone. For him the mobile phone provides more value than the Internet. *"As I am a phone user, I first try to call" [MN3]*. However, some adopters such as R3 also use the phone to contact and request information. He would then ask to receive it by e mail – as spreadsheet tables if possible where he can then compare prices and update files.

Respondent RA5 strongly believes that the integrated functions of the Internet are becoming important for any business type and size.

> *"We had a dedicated business web site and e mail for some 5 years now. It is very useful for dealing with finance and banking, I feel efficient and very pro-active. In terms of the benefit of using the e mail, there is no time wasted on waiting for phone calls to return. E mail is pretty much our receptionist." [R5]*

Importance of having a web site

Out of a list of 12 prompts to ascertain the reasons why business owners do not have a dedicated website, three groups [R1, M1 and MN1] responded that *'they did not feel the need for it'*. Rural adopters such as R1 and R2 just *'did not know where to go'* or *'where to get it'*. Respondent R3 *'could not afford the initial cost for design and content development'*. Respondent R5 felt that the main barrier is the *'overall cost of*

maintenance, hard and software' although aware that hardware prices are constantly dropping.

Figure 3 Cluster Grid: Importance of having a web site

How important do you think it is to have a business web site?	RN1	RN2	RN3	RN4	RN5	R1	R2	R3	R4	R5	MN1	MN2	MN3	MN4	MN5	M1	M2	M3	M4	M5
Very important: in order to remain in business							1	1	1							1	1	1	1	
Important: it creates new business opportunities	1									1					1					1
Not so important: just another way to advertise		1	1	1	1	1							1							

Figure 3 also indicates the relevance of having a business website. As with the importance of using e mail, respondents have polarised views. Metropolitan non-adopters (MN) were sceptical, with rural non-adopters (RN) showing some willingness to adopt e-business.

> *"In my opinion having a web site has some great benefits but we are still reluctant to put financial functions such as taking credit payments. What we most like is that it is easy for people to access information and to have the ability to link to enquiries. It also saves us the need to send brochures. This suits our type of business. Our business web site is also important because it allows us to put photos of our projects and products – we like directing people to our web site." [R3]*

> *"Our business has been some 6 years on the internet and 4 years for a dedicated web site. Nowadays it is very important to develop web presence as it is expected in order to remain in business. Some of the main values includes that it improves our service to the client, it allows clients to find more about us and we improve communication with them. It also allows us to promote the work that has been done." [R2]*

Drive for uptake

Drivers for the uptake of website facilities, the rural adopter group (RA) shows strong interest on sharing projects or product catalogues.

> *"In our opinion, some of the main reasons to adopt e-business was made in order to have a professional presence in today's business environment." [R2]*

From the non-adopter groups contrasting views emerged, especially amongst RN1, MN1 and MN5. The use of search engines rated as one of the strongest incentives to adopt the Internet for business purposes (figure 4). This is indicated by the shift by various respondents from using printed *yellow pages* to the Internet for finding service providers and suppliers.

> *"We would like to have our inventories on-line and being able to access availability of stock and to know if we can get things, for example by checking the timber files. It has fast tracking of stock and time saving for us and our clients." [RN1]*

Figure 4 Cluster Grid: Drive for uptake

What would make you have a web site?	RN1	RN2	RN3	RN4	RN5	R1	R2	R3	R4	R5	MN1	MN2	MN3	MN4	MN5	M1	M2	M3	M4	M5
Promote my business (on-line presence)	1	1		1	1	2	1	2	1	2	1		3	3	1	1	2	2	1	2
Improve business service - ie.contact us enquiry form		1				3	2	1	1	1	1		3	3	1		1	2	1	2
Product catalogue		1				1	1	1	1	1	1		3	3	1		1	2	2	2
Ability to upload documents		1				3	3	1	3	1	1		3	3	1		3	3	3	3
Number of e-mail addresses supplied with my site		1				3	2	2	2	2	1		3	3	1		2	3	2	2
Have a business name as domain		1	1			2	1	2	2	2	1		3	1	1	1	1	2	1	2
To take credit payment						3	3	3	3	2	1		3	3	1		3	3	3	3

Drivers for uptake varied between cases. Some of these include a junior employee driving through technology; peer recommendation; self-motivation to engage the technology; the need to improve service; a fear of being left behind and influences by family members.

Counteracting these drivers a number of attitudes playing against uptake were identified, including a natural resistance to change and perceived inefficiencies.

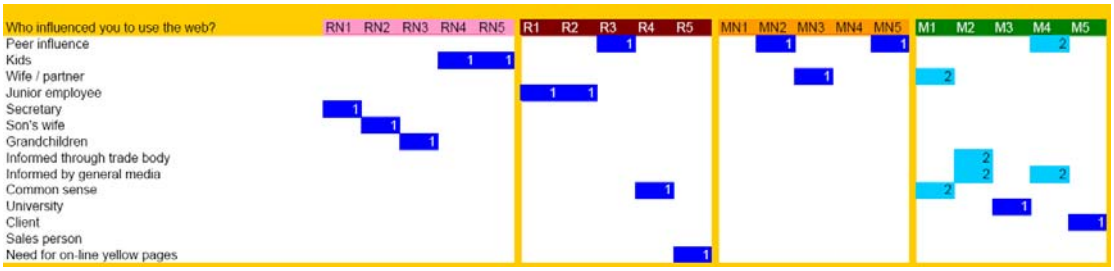
> *"I do not need a dedicated business web site because I work by reputation and I want to stay small. My best marketing is word of mouth. I would use It to find suppliers and to compare prices." [MN3]*

Skills development

Figure 5 shows that informal approaches to learning ICT skills were the most common across the four groups. Learning through family members is a common scenario for SMEs'. A concurrent scenario is where a spouse or children explain aspects of ICT during nonworking hours.

> *"I learned a lot of this through my children - Wife director 1 of 2, husband and children are good in introducing Internet and related technologies." [M2]*

Figure 5 Cluster Grid: Skills development



Respondents nevertheless called for more formal guidance on how to set-up and maintain their own websites, suggesting that reliance on informal familial-type diffusion is not sufficient.

> *"It would be good to sometimes get information of what needs to be done. How to design and what type of web site, what photos etc. Finding guidance on how to update and maintain sites for small businesses like ours would be very helpful." [MN1]*

> *The type of support that a business like ours need when setting up and maintaining a business web site includes the easy updating and maintaining. We would like to know how to upload new images to our site instead of paying someone else to do it. [R1]*

Summary Cluster Grid

Figure 6 is a cluster grid indicating areas of similarity and differences amongst individuals and groups of respondents. Data is analysed by calculating the mean result across individual grids. With the tree diagrams it is possible to identify commonalities between respondents (top row) or between attributes (right and left columns). The cluster (or pattern) grid indicates commonalities across respondents and attributes. Figure 6 indicates four clusters, numbered 1 to 4. These are summarised in table 2.

Figure 6 Summary Cluster Grid

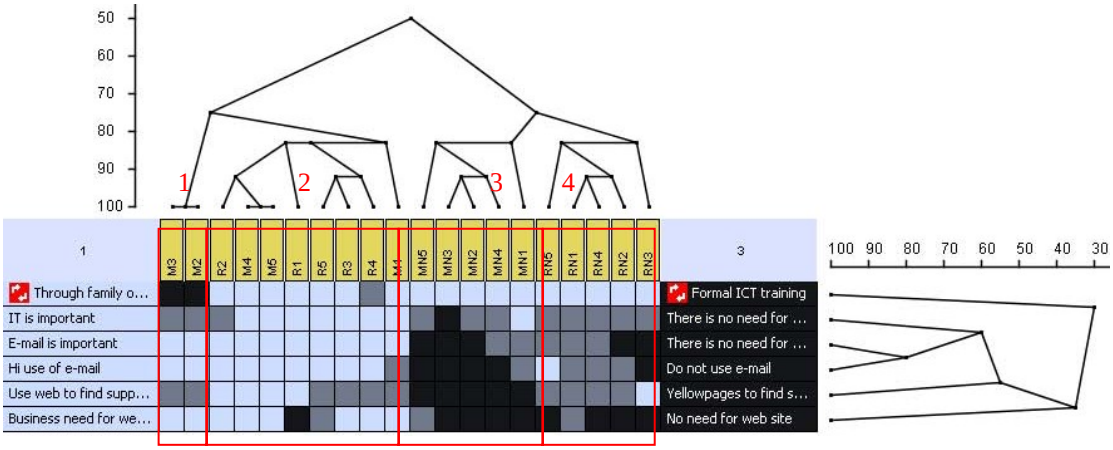


Table 2 Cluster grid summary

Cluster	Groups	Comments
1	M2, M3	These have strong ICT values including, formal training, high use of e mail and high use of web searching
2	R1, R2, R3, R5, M1, M4 & M5	Similar values to cluster 1, however, the main difference with this group is that they have no formal ICT training and have learned in their own spare time – mainly through a partner or family member. This group has identified the *lack of time* as the mayor barrier to learn.
3	MN1, MN2, MN3, MN4, MN5	The metropolitan non-adopter group has shown the highest level of scepticism. This group has an attitude of *'there is no need for Internet to run a small business'*. Indicating the most challenging group to push towards adoption.
4	RN1, RN2, RN3, RN4, RN5	Attitude results between metropolitan non adopters and rural non adopters (MN and RN) were similar. The only difference is that metropolitan non-adopters have shown a common non-interest in using the Internet. Conversely the rural non-adopter group (RN) tended to use the Internet (including the web and e-mail) for private purposes and results indicate that they are familiar and more confident ICT users. Results show that they will be e-business adopters in the near future. Having the right attitude of *'let's give it a go'* is perhaps the single most important aspect towards SMEs e-business adoption – where someone driving de uptake of e-business is not necessarily a user of the technology. This is illustrated in the following, *"I am a junior consultant for this business, I am the main user of technology. Greg is the owner, he spends money but doesn't really use it although he is looking on ways improve our business" [R3]*

E-BUSINESS ADOPTION

Because e-business is a relatively new innovation in business and because many Small and Medium Enterprises have not implemented these systems a number of misconceptions can easily develop. A previous study identified the main barriers that apply to various organisation types within the construction sector (Aranda-Mena and Stewart, 2005). In this paper an empirical study has been carried out with 20 small businesses, concluding that a series of myths are currently affecting e-business adoption by SMEs.

Drive for uptake

Uptake of e-business in SMEs is usually gradual. In most cases owners have been influenced by a colleague, a family member or a junior employee. Although there is

the need for the business owner to approve time and money spent on any e-business initiatives, they are often not the main users

Learning commonly happens informally. These incremental steps happen in a non-threatening situation for the business owner or operator, for example, by having one of their junior assistants spending time searching for suppliers on line, this same junior employee typically will also update the web site and organise e-mail communications. Only one respondent received formal e-business training, in this case the roles of *owner* and *user* aligned.

None of the respondents transact money through their web sites. There is a common feeling that most businesses are not using e-business systems, and that it would be unlikely to find SME's receiving credit payment or bidding for work on-line. None of the respondents was ready to adopt these aspects of e-business.

Business reservations about difficulties faced when introducing these systems can be eased when business owners become more familiar, thus confident, with the use of Internet technologies. Rural non-adopters (RN) are generally confident with search engines and Internet banking for personal use and it is therefore predicted that SMEs with these characteristics will gradually adopt e-business into their operations. A case with non adopters includes firstly swapping book keeping for electronic systems and increasingly using the Internet to search for suppliers, and organise e-mail. Following these steps SMEs can improve service with clients (B2C), improve collaboration with other businesses (B2B), experience cost reductions and minimise risk.

Various respondents asked for some introductory e-business programs through government or their professional bodies. It is especially important to demystify the expected high investments and difficulty of installing and implementing these systems into SME's, both of which affect uptake. According to most adopters this is not the case as the cost of IT systems (hardware, software and training) have reduced substantially in the past decade. Most of these systems require standard office computers and they will work with dialup or broadband connections to the internet.

Web usage behaviour [Risky-taking attitudes]

Although fully integrated e business implementation, including the facility to receive credit payments, can offer substantial competitive advantage, none of the adopters has implemented such a system. These businesses are naturally risk-averse, and are rarely leaders of integrated e-business systems within the sector. The risk is reduced for businesses that simply implement existing proven systems with known benefits in the industry. To further reduce risk, businesses most often consider using service providers who manage their systems, provide secure transactions and maintain the integrity of data stored in the system.

Skills development

Time is the single most important factor needed for learning. It was found that in most instances learning happens informally within users' spare time. Learning also happens through junior staff or even trainees. It is good policy for the business owner, or whoever drives the use of ICT to allow some spare time for junior staff or trainees to spend some time learning some tasks. Formal training and learning activities programmes can also be arranged. Various respondents wanted their professional bodies to provide more guidance on this issue.

ADOPTION FRAMEWORK

It is important for SMEs to step back and look at the major value adding business processes rather than focussing purely on the introduction of new technologies. A business process can be defined as *"A series of business functions within defined boundaries (e.g. sales process, invoicing process, marketing process, etc)"*. Building businesses typically have processes for tendering, procurement, cost control and document management, while design consultants might have processes for briefing, feasibility, sketch design, detailed documentation and tender evaluation. In many cases these business processes will require the sharing and transfer of information with other groups and businesses including the client. Theses business process characteristics will define the type of web site developed.

Internet banking, online shopping and electronic flight ticketing are examples of e-business applications, used by all adopters and some non-adopters, illustrating a familiarity with the Internet that may favourably lead to e-business uptake. More testimonials are needed to make the added value and benefits of e-business obvious to small businesses.

It is also important to have the need or ambition for business growth as driver for adoption. This clearly does not happen amongst most of the non-adopters. They have not or would not adopt e business on the basis that they are pleased with their current business size and *word of mouth* marketing strategy.

It is important for SMEs to identified business processes which could be re-designed to achieve the best improvements and added value. Several major improvements were identified including the increased value for customers and partners from reduced processing times; fewer errors with improved quality, ease of access and exchange of information. further they help to better understand and meet customers' needs; and this might appear to be a barrier for businesses that are unable to acquire the people and financial resources to successfully develop and introduce e-business – as time and money are the main barriers for SMEs. Some of the more widely used e business applications in the construction industry are tendering, procurement, document control, project collaboration, correspondence management, project management, contract management, workflows and reporting.

If e business is to deliver value to SME daily operations, taking the following steps is recommended (table 3).

Table 3 Steps to deliver value to SMEs through e-business.

Identify whether a business is an innovator, early adopter or a follower. Businesses in the first two categories are rare, and those in the last group tend to reduce the perceived level of risk by adopting only proven or mainstream processes.
Review how customer needs are changing and what operational benefits can be achieved by new business process designs.
List all of major business processes, and rank them in order of importance to your customers, business and contribution to the bottom line. In doing this identify which of the existing business processes require collaboration and information exchange. For these you will have to consider common information exchange formats and how collaboration will be maintained.
Review the e-business case studies and best practice examples when deciding on which processes will be re-designed.
Scan emerging technologies, as they affect customer needs and customer needs then influence business designs. Eventually these business designs will affect processes which in turn will influence the next

generation of technologies.
Examine the applications existing service providers offer, and the range of existing generic applications, then measure their fit with your specific needs. You probably should do this with your working associates so that collaboration on projects can be improved.
Develop your e-business plan and justification. Ensure that it has a focus on the customer, that it seeks creation of value, it transforms business processes into digital form, and it has a forward looking application architecture (to enable integration with other systems while reducing costs and increasing customer satisfaction).
Examine your internal skills and abilities to deliver the e-business plan and aim to acquire any skills that cannot be readily found within your business. Of course senior management support and involvement and adequate training of staff are also going to be essential for success of your activities. So make allowances for this within the plan.
Ensure that you have a narrow focus for each e-business design, and that there is an overall strategy in place to move from task orientated to functional then to integrated systems.

Drivers and barriers to e-business uptake in construction SMEs was determined through a series of case studies of both adopters and non-adopters of technology. Aversion to uptake is usually grounded in the perception that e-business has no benefit to offer an SME. While those that did take-up e-business, even though rudimentary forms, often did so in an informal and indirect manner. A series of steps have been suggested to ensure that SMEs wishing to engage in e-business derive value from such an undertaking.

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