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Investigating Factors Affecting Integration Technologies Adoption in Organizations

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ABSTRACT

The existing works point out that smaller organisations have been shown to have different technology adoption patterns than large ones. However, it is unclear whether Small to Medium Sized Enterprises (SMEs) and large organisations take decisions for the adoption of integration technologies by focusing on different factors. Moreover, the literature also shows that there is an absence of theoretical models that explain the adoption of Enterprise Application Integration (EAI) and Web Services in SMEs. These research issues, derived from the literature review, are taken into consideration and addressed in this paper, aiming at highlighting any significant difference in the way SMEs and large companies adopt integration technologies. In doing so, the parameters that can be used to explain the adoption of integration technologies in organizations are identified, as nature of organisations, company size, integration needs and time. These are tested through four case studies: a large organization and three SMEs.

Keywords:

Enterprise Application Integration (EAI), Small to Medium Sized Enterprises (SMEs), Integration Technologies, Adoption, Factors.

INTRODUCTION

Despite the advantages that Information Systems (IS) integration and practices can offer to organisations, little attention has been paid to the adoption of integration technologies by small to medium sized enterprises (Hughes et al., 2003; Tagliavini et al., 2002). A review of the literature on integration technologies adoption indicates that many studies have mainly focused on large businesses (Premkumar et al., 1994; Themistocleous, 2001). Iacovou et al. (1995) report that SMEs differ from large companies in many ways that affect the adoption of integration technologies. These differences include: (a) the lower levels of resources available for adopting integration technologies (Iacovou et al., 1995; Kuan & Chau, 2001); (b) the substantially less sophisticated information systems management (Kagan, 1990; Tagliavini et al., 2002); (c) the needs for integration and their characteristics; and (d) the quantity and quality of the available environmental information (Pearc et al., 1982). Due to these reasons, certain literature has suggested that the general applicability of the integration technologies adoption studies (researched in relation to large organisations) may be questionable if applied to small businesses (DeLone, 1988; Iacovou et al., 1995; Kuan & Chau, 2001; Raymond, 1985). Thong (1999) also argued that because of the unique characteristics of small businesses, there is a need to examine whether those models for IS adoption, developed for the large-business context, can be equally applied to small businesses.

Although the adoption of integration technologies is recognised as being different between large and small companies in the normative literature, the literature on the adoption of integration technologies by SMEs remains limited (Kuan & Chau, 2001). In this paper, the authors focus on the analysis of the factors and issues affecting the integration technologies adoption between SMEs and large organisations, as these have not been yet perceived as anticipated. This paper attempts to address this research issue through four case studies: a large organisation and three SMEs (adopter, non-adopter, and planning to adopt). In doing so, potential parameters are identified, which (1) clarifies much confusion surrounding the integration technologies adoption between SMEs and large organisations, and (2) can be used as a tool for decision-making to support organisations, and allow researchers to apprehend and analyse integration technologies. In addressing this void, the paper initially introduces the area of integration technologies adoption in SMEs and large organisations (Section 2). Thereafter, the research methodology used is then reported. In Section 4 and 5, the empirical findings are discussed, with key lessons learnt extrapolated and presented as implications to practice before offering conclusions.

LITERATURE REVIEW

The review of the literature has shown that a few prior studies have focused on integration technologies in small businesses, as reported by Daniel (2003), Hughes et al. (2003), Themistocleous and Chen (2004), Iacovou et al. (1995), Kuan and Chau (2001), Ravarini et al. (2000) Tagliavini et al. (2002), and Waarts et al. (2002). Among these studies on adoption, the model proposed by Iacovou et al. (1995) presents the most comprehensive research that focuses on the adoption of EDI in small businesses (Kuan and Chau, 2001). However, most of the literature on this subject that has been reviewed mainly focuses on the adoption of EDI and ERP, its studies related to EAI and Web Services adoption in SMEs proving to be largely lacking. This might be due to the fact that EAI and Web Services are only beginning to emerge and are in the early stages of adoption (Hailstone and Perry, 2002). Another reason might be that SMEs feel it unnecessary to adopt EAI or Web Services due to the extra costs and expertise required to implement these integrative technologies. In contrast to studies on SMEs, EAI and Web Services adoption models and studies for larger organisations are available. Many studies have focused on different aspects of adopting EDI, EAI and Web Services in supporting IS integration in large organisations. According to Themistocleous (2002), the reasons that push large companies to turn to EAI include, among others: (1) Enterprise Resources Planning (ERP) systems limitations to systems integration, (2) technical reasons, (3) financial reasons, (4) managerial reasons, and (5) strategic reasons. However, the researcher suggests that not all of the motivations mentioned by Themistocleous (2002) are appropriate to explain SMEs' needs for integration. For instance, some small firms might not even have ERP systems. Thus, apart from the reasons reported by Themistocleous (2002), additional reasons that push SMEs to turn to integration technologies to support their IS have been identified by the researcher from the existing literature. These reasons are explained as follows:

External Pressures: External forces tend to have more impact on small businesses than on large businesses (Iacovou et al., 1995; Welsh & White, 1981). In many cases, a company may adopt a technology due to the influences exerted by its business partners and/or its competitors, having no relation to the technology and organisation itself. For example, pressures from business partners or competitors have been suggested by many researchers to be an important factor in the adoption of integration technologies (Kuan & Chau, 2001; Premkumar et al., 1994). Since SMEs are usually the weaker partners in inter-organisational relationships, small businesses are susceptible to impositions by their larger partners (Saunders & Hart, 1993). Therefore, SMEs are under pressure to adopt integration technologies if their business partners request or recommend doing so.

Internal Pressures: Internal pressures include both the financial and technological resources of the firm. Financial resources are related to those available to pay for the integration technologies' installation costs and for the implementation of any subsequent enhancements, as well as for ongoing expenses during usage. Technological resources refer to the level of sophistication of Information Technology (IT) usage and IT management in an organisation. As mentioned in the literature, SMEs need to control their cash flows carefully, as they do not have unlimited funds for their IS projects. Thus, smaller firms tend to choose the cheapest system which may be adequate for their purposes (Thong, 2001). Furthermore, Levy et al. (2001) report that large firms use IS/IT to add value rather than simply to reduce costs. SMEs' exploitation of IS tends to mimic the early use in large firms – cost reduction. However, SMEs may use IS to co-ordinate internal activities, to add value through collaboration, particularly with customers, and occasionally to innovate (Levy et al. 2001). In addition, Thong (2001) also reports that small businesses tend to have insufficient knowledge to implement IS successfully, thus SMEs might need to seek external expertise (e.g. IT vendors, etc.). These indicate that SMEs' need for integration technologies might be based on their internal pressures. Since SMEs are normally lacking in internal resources, when compared to large companies, it was thus argued that SMEs might make different adoption decisions from their larger counterparts (Kuan & Chau, 2001).

Competition: The main reason why SMEs adopt IT is to enhance their competitiveness (Iacovou et al., 1995; Pollard & Hayne, 1998). Therefore, SMEs may feel the pressure when they see more and more companies in the industry adopting the integration technologies to solve the technical difficulties caused by the incompatibility of systems, especially if it is their business partners, competitors or larger trading partners. Thus, SMEs will feel under pressure and the need to adapt to the IS integrated environment to remain competitive. According to various literature, like Iacovou et al. (1995), the most significant reason that pushes SMEs to adopt integration technology is to gain a competitive advantage.

Moreover, as reported in the literature, most of the factors that focused on the adoption of integration technologies by SMEs are mostly from the external forces, e.g. governmental support, external pressures, pressure from trading partners, etc. This indicates that in many situations, SMEs are forced to adopt integration technologies as their partners require them to (Iacovou et al., 1995; Kuan & Chau, 2001). Thus, to remain competitive, SMEs have no choice but to adopt integration technologies. For these reasons, when referring to the adoption life cycles, some literature suggests that SMEs tend to be late adopters (late majority/laggards) in the adoption of new technology/innovation, rather than early adopters (Kuan & Chau, 2001; Ling, 2001). Laggards can be summarised as those who adopt a technology only when they have no choice. In fact, many laggards do not explicitly adopt technologies at all, but rather acquire them accidentally when a particular technology is a component of a packaged solution (Rogers, 1995). Laggards' innovation-decision process is relatively lengthy, with adoption and use lagging far behind the awareness-knowledge of a new idea. Resistance to new technologies on the part of laggards may be entirely rational from the laggards' viewpoint, as their resources are limited,

and they must be certain that a new idea will not fail before they adopt it. Kirby (2003) and Storey (1994) are among those others who claim that SMEs cannot afford to fail, due to their limited resources. Therefore, most SMEs might be categorised as laggards. The adopters in the late majority group not only like to be certain that the new technology works, they also like to wait until it has been widely adopted and standardised. They do not consider that the technology offers them any competitive advantage, even though they recognise that they cannot live without it once their partners or competitors have adopted it. The pressure of peers is necessary to motivate adoption. In accordance with this point, as mentioned before, sometimes SMEs are forced to adopt integration technologies as their partners require them to (i.e. external pressure). Thus, SMEs might also be categorised in the late majority group. However, some literature like Buccolini (2004) reports that SMEs are able to innovate. Buccolini (2004) claims that European SMEs have at disposal a lot of instruments for innovation especially in the healthcare sector and the web and ICT services. Therefore, SMEs might be also considered as innovators, but this point needs to be further investigated.

Nevertheless, most large companies tend to be in the early adopters/early majority group, with some of them might even being classified as innovators. Early adopters are more interested in the business and competitive advantages that a new technology brings about rather than the technology itself, but they are still risk-takers, since they are willing to adopt a new technology before it has been proven or widely accepted. Those in the early majority group are the pragmatists (Rogers, 1995). They do not intend to take the risk of adopting a technology too early, even though they also recognise that waiting too long can put them at a substantial disadvantage. They want to make sure the technology works for others before they invest (Kaye, 2003).

The above discussion demonstrates that different sized companies might have different needs and ways of managing their adoption of integration technologies. Hence, the authors identified the potential parameters that can be used to explain the adoption of integration technologies by SMEs and large companies. These adoption parameters are *company size*, *time*, *nature of resources*, and *integration needs*. There will be tested through the empirical data in Section 4 and 5.

RESEARCH METHODOLOGY

Considering the depth, sensitivity, and aim of this paper, the multiple case study strategy suggested by Yin (1994) was adopted. Such an approach can be used to: (1) investigate little-known phenomena as if understanding and analysing factors affecting integration technologies in SMEs, (2) examine in depth complex processes (integration technologies decision-making), (3) examine the phenomenon in its natural setting, and (4) learn from practice. Multiple case study strategy was employed to explore and understand the factors associated with integration technologies adoption in SMEs and large organisations. In doing so, various data collection methods such as interviews, and observation were used. The bias that is considered a danger in using qualitative research approach was overcome in this research through data triangulation. The use of multiple data collection methods makes the triangulation possible, which provides stronger substantiation of theory. For the purpose of this paper, four types of triangulation were used, namely: (1) data, (2) theory, (3) methodological, and (4) interdisciplinary triangulation (Denzin 1978; Janesick 2000).

The authors interviewed two different types of organisations: SMEs and large organisation. Face-to-face, structured, semi-structured, and unstructured interviews were conducted to different interviewee (i.e. managers, Management Information Systems (MIS) managers, employees etc.), and lasted one and a half hour each. In this research, the structured interviews were based on the interview agenda. By the interview agenda, the interviewees replied to specific questions regarding integration technologies adoption. Semi-structured interviews also took place, using a semi-structured interview agenda. This is a focused interview, in which respondents are interviewed for a short time, e.g. an hour. In such cases, the interviews still remain open-ended and take on a conversational style. Subsequently, unstructured interviews were used. In the majority of cases, all interviews took place in the interviewee's office. Since qualitative data are collected through three types of interviews, bias of such data can be overcome. Technically speaking, data collected from the same interviewee by structured, semi-structured, and unstructured interviews are put together for analysing purposes.

SMEs in some countries are classified as micro, small, or medium enterprises (European Commission, 2003). The definition may vary among countries or institutions, based on the differences in economic levels or the wealth of the countries (Gibson, 2001; Storey, 1994). Since the case studies were conducted in Taiwan, thus, SMEs definition given by Taiwan Economy Affairs Commission is adopted, where organisations are classified as SMEs when their sales turnovers are less than US\$5 millions. In this research, four case organisation companies from IT industry have been studied to explore the identified research question. Due to confidentiality reasons, the companies' names cannot be revealed in this paper. Therefore, we use Companies A, B, C and D to represent the case companies. Company A is a large company, whilst companies B, C and D are SMEs (adopter, non-adopter and planning to adopt).

CASE STUDY

The authors studied four companies, including one large organisation and three SMEs (adopter and non-adopter). Table 1 presents the profile of the case companies, the interviewees, the number of interviews conducted, and brief description about the organizations.

Company	Description	Profile Details		Type		Interviewees' Position in Organisation					Type of Interview		
		No of Employees	Turnover (billions)	Large	SME	MIS Manager	Manager	Project Manager	Deputy Director	Technical Personnel	Structured	Semi structured	Unstructured
Company A	The Company is a leading provider of strategic solutions of mobile and Small Office/Home Office (SOHO) data communications. It also has a branch office in the USA. Since its inception, the company has been positioning itself as the partner of choice for telecommuters in mobile computing. Its Network Data Communication Division has distributed a full range of network data communication devices, including Personal Computer (PC) Cards, Universal Serial Bus (USB) adapters, modems, and most recently, gateway devices.	651	1.4	✓		✓		✓	✓		✓		✓
Company B (Adopter)	The company designs and manufactures the Hi-Ti brand of digital photo printers, using dye-sublimation technology to offer both consumer and commercial print solutions. The company has branches in the UK, USA, Netherlands, Middle East, India, Russia and China, trading across the globe.	250	0.14		✓	✓	✓			✓	✓		✓
Company C (Non-Adopter)	The company had been dedicating itself to be a Computer Integration Manufacturing (CIM) leading company in IC and the TFT-LCD fabrication-related field. Company C's mission is to provide the customers with total CIM solution, with solid teamwork implementation, professional domain know-how, and on-time delivery, to create the value and profit together. The main business areas include software development, computer integration manufacturing, and manufacturing executions systems.	70	0.03		✓		✓	✓			✓		✓
Company D (Going to Adopt)	The trade company, founded in the 1980s. The company is an equipment supplier specializing in high technology components and devices for most manufacturers in the Taiwan semiconductor industry, such as Delta and Inventec. Its main products include electronic semiconductor devices and heat-treatment, and most of this equipment is imported from European companies such as ABB, Naberthern, IXYS, and SMSC Corporations. The company has been growing rapidly in the Asia market, and is planning to set up branches in Thailand, China, Vietnam, and Indonesia in the near future.	15	-		✓		✓			✓	✓		✓

Table 1. Profile of Case Companies

Company A (Adopter)	
Technical Problem	<ul style="list-style-type: none"> • The existing IT infrastructure is heterogeneous and consists of hundreds of incompatible systems. As a result, company faces significant integration problems when attempting to migrate its existing custom-built applications and update the day-to-day software. • Each business unit or subsidiary has its own IT infrastructure. This caused redundancy of data and functionality, as many applications store similar data or run systems that overlap in functionality. • In each subsidiary, applications were customized in a unique way. This results in data redundancy as applications cannot share common data or objects due to integration problems. • The non-integrated infrastructure could not achieve supply chain and e-Procurement integration. Thus, company could not take advantage of IT and support closer collaboration with its suppliers and customers.
Managerial Problem	<ul style="list-style-type: none"> • Its suppliers, vendors and customers all have different needs, thus, company could not avoid or neglect changing its whole systems according to these needs. Thus, its hard to manage its supply chain. • Since multiple applications store data for the same entity, management could not retrieve the most updated data for this entity, and thus faced problems in decision –making. • The existing IT infrastructures cannot efficiently support core business processes, and this is therefore becoming an obstacle for achieving business goals.
Financial Problem	<ul style="list-style-type: none"> • The insufficient IT infrastructure could not accomplish a tighter collaboration at both intra-organisational and inter-organisational level. This situation resulted in a loss of sales, since company could not efficiently support its customers or coordinate its activities with its suppliers. • The high operational and maintenance costs of the existing IT infrastructure, which included numerous systems with overlapping functionality.
Company B (Adopter)	
Technical Problem	<ul style="list-style-type: none"> • Since the company prefers to buy off-the-shelf software, and to further develop these software to suit their needs. Thus, the organisation consists of many application and obtain data from custom system is difficult, as the majority of them have incompatible and heterogeneous data structures and formats. • The company has 5 subsidiaries around the world, and they all have different IT infrastructure and install different applications and systems. Thus, they found it hard to manage these systems without an integrated solution.
Managerial Problem	<ul style="list-style-type: none"> • The diversity of IS causes delays in giving information, as applications are not integrated, and much work has to be carried out manually. For instance, data from one system have to be printed out and then re-entered in a different format to a target system. • The delays in delivering information cause problems in decision-making and management. • Data redundancy. Applications cannot share common data or objects due to integration problems. • The non-integrated infrastructure leads managers to inefficient decisions, important information is often missing, and/or data cannot be retrieved from applications. • There is often delay in confirming order information and sending information dealing with product availability. Therefore, in many cases, the management cannot take accurate decisions regarding the replacement of products. This inability thus leads to loss of sales and low customer satisfaction.
Financial Problem	<ul style="list-style-type: none"> • The non-integrated nature of systems cost the organisation money and time. This is attributed to the organisation having to spend high amounts of money to support and maintain all these systems. • The inability of company to serve customers efficiently has an extra cost, as it leads to loss of sales, and thus customers often turn to competitors.
Company C (Non-Adopter)	
Technical Problem	The business processes are rather simple in company c, and hence the manager from the company suggested that there is no need to invest in integration technologies at the moment. The company has once introduced on ERP system, but the result was unsuccessful. Due to the limited resources within the company, it is not yet able to adopt an ERP system again, as it does not wish to fail, and cannot afford to fail again. This limitation also restricts the company from taking decisions to adopt any other types of integration technologies to support its IS or data integration. In addition, the purchasing process is simple since there is no a variety of products. Thus, the company finds it unnecessary to standardise its purchasing process.
Managerial Problem	The company is still in the early stage of development, thus, the manager from the company reported that at this stage, the company is trying to survive. Since the employees' turnover is high at the moment and after its prior failure on ERP adoption, it is hard to resume ERP adoption, as it does not have suitable engineers with appropriate skills to manage the ERP system, and most of the existing engineers are pretty much occupied with other jobs. The company will not invest in any integration technologies if the immediate benefits cannot be realized or a quick return on investment is not guaranteed.
Financial Problem	The company does not wish to invest in further development, as the company does not have sufficient budget for it. Additionally, the prior failure experience in adopting ERP systems which resulted in time-wasting and money lost has delayed company's decisions in further adopting integration technologies to support its IS.
Company D (Planning to Adopt)	
Technical Problem	The company consists of many applications and systems from different customers, and their non-integration has caused problems and inconvenience, as reported by the MIS manager that most of company's key customers asked it to set-up a platform that is compatible to its systems. Therefore, it needs to develop different systems to meet different customers' requirements. This is time-consuming as it needs to employ someone with technical background to maintain each of its customers' system.
Managerial Problem	The company realized the need to integrate its IT infrastructure as a way to gain a better control over its subsidiaries, customers and suppliers. However, it is hard to perform such a task, due to its lack of finance, and expertise, and because many companies develop their own systems e.g. Web Services, RosettaNet, and ebSML.

Table 2. Integration Problems

Those companies faced many problems related to their existing IT infrastructure and to better understand case companies' existing IT infrastructure, the authors have categorised their existing integration problems into three sections: (1) technical problem; (2) managerial problem; and financial problem, and these are summarized in Table 2.

These limitations led the Case Companies A, B and D to significantly advance their IT infrastructure by integrating the existing IS. Companies A, B, and C seek new ways to gain competitive advantage and believe that integration will support this strategy, as integration enables the sharing of data and business functions across applications.

The MIS manager from company A reported that in order to compete, efficiency is very important. Thus, adapting to an integrated IT infrastructure is a way to increase the efficiency, so company A can provide its customers with better services. The MIS manager of company A said that: "Adopting integration technologies does not guarantee that our company will gain competitive advantages, but not having it will become a problem". Company A's traditional enterprise applications were custom-built to address specific business needs. As enterprises have grown, the need to share information across departments and business areas becomes more critical. Thus, company A is turning to integration to provide a method for interconnecting these distributed and often proprietary systems. In doing so, ERP, EAI, Electronic Data Interchange (EDI) and Web Services technologies are adopted by company A to support its inter- and intra-organizational integration.

Although Company B has the vision that it needs to automate its business process and integrate the heterogeneous data structures and formats, it has only managed to adopt EDI partially to communicate with its partners, suppliers and customers (mainly for purchasing, i.e. orders), as well as the ERP system from DATA SYSTEM (ERP vendor) to manage its internal business processes. The main reason for this is due to the high costs associated with the adoption of integration technologies, e.g. EAI is expensive. Company B reported that even though it has adopted EDI to solve its integration problem, it still requires altering target and source applications all the time, when there are any changes. Additionally, EDI has a high cost, and the nature of EDI standards in use (UN/EDIFACT) is complicated, which adds complexity. This is why company B is slowly moving to EDI over Internet technology, but this part has not been implemented completely. Company B has also adopted ERP systems to support its intra-organisational integration. However, it claimed that ERP systems have failed to fully support Company B's intra and inter-organisational integration, since they co-exist alongside other applications, and the version of ERP systems used is the simplified version. Company B's ERP systems do not support real-time capabilities, and there are many compatibility problems among ERP systems, and as they do not support all these systems under an e-business architecture that requires real-time data, this is an obstacle. Therefore, the organisation believes that the way forward is to develop an integrated IT infrastructure by redesigning its existing infrastructure, and phasing out all redundant systems and data. However, this is not an easy task for a company with limited resources like Company B.

Company B states that it does not have enough budget to implement integration technologies at the moment, although it knows it is essential, as the non-integrated IT infrastructure has caused company B many problems: (1) high cost of maintenance, (2) not manageable, (3) not flexible, (4) results in insufficient decision-making, and (5) leads to low customer and partner satisfaction. EDI is as far as it goes so far, but company B hopes to fully automate its IS in the future to increase its efficiency. Therefore, there is a need for rapid transformation from closed internal processes to open externalised processes. However, this target can be achieved through the development of an integrated, adaptive and consistent IT infrastructure across company B Technologies Ltd. Also, it was found that the technical person and the product manager do not have a clear picture for the company workflow.

Semiconductor was a fast growing industry in Taiwan in the 1980s, with many business opportunities. However, these have decreased dramatically in the past few years due to the semiconductor industrial migration, with many of the manufacturers moving their factories to other Asian countries like China, Vietnam, Malaysia and Thailand. In this case, Company D has lost many of its customers (i.e. loss of competitive advantages), and has begun to realise that there is an urgent need to seek business opportunities outside Taiwan, as well as to build up a closer relationship with its existing customers (i.e. to provide a better service to them). To do this, the manager in Company D recognised the importance of adopting integration technologies to support its intra and inter-organisational IS. Thus, Company D set up an internationalised business plan three years ago regarding the adoption of integration technologies to support its intra and inter-organisational business processes. The plan was first to integrate its internal systems, then its external systems. However, this plan did not succeed due to cost concerns over the integration solutions available in the market at that time, e.g. mySAP and Oracle ERP were too expensive. Until recently, Company D has been introduced to a new software package from SAP, Business One (B1). SAP B1 is a simple, 'off-the-shelf' integration software based on a Web Services platform (i.e. Web Services technology), which provides a cheaper, easier, and quicker adoption process for SMEs. SAP B1 provides the integration abilities that cover finance, sales, purchase, warehouse, distribution, production, invoice management, customer relations management, and human resources management, thus resulting in a quicker decision-making process and increased efficiency. Company D's MIS manager reported the reasons for planning to adopt such software: (1) SAP is a well-known integration technology provider, (2) many IT companies adopt software from SAP, (3) reasonable and affordable price for small businesses, and (4) SAP B1 provides a platform which supports EAI and Web Services technologies.

EMPIRICAL FINDINGS AND DISCUSSION

A synopsis of the main findings elicited from Section 4 is given in this section, allowing others to relate their experiences to those reported in that Section 2. A number of interesting issues have been extrapolated from the empirical data, and an additional factor was discovered that was taken into account during the adoption of integration technologies by the case organisations reported. The key issues derived from empirical data are summarised and further analysed in the following sub-sections.

Nature of Resources of Organisations

All types of companies today seek to become more agile and responsive, and to maximise their existing IT investments. To do this, they need to share information and functionality in individual applications and turn them into an enterprise-wide resource. Thus, integration of enterprise applications and data to simplify and automate business processes has become an important focus for many organisations. Nonetheless, as stated in Section 2, the unique characteristics of small businesses are exemplified in the condition known as resource poverty, where small businesses operate under severe time constraints, financial constraints, and expertise constraints. Whipp and Rosenfeld (1989) and Caldeira and Ward (2003) also emphasise the internal and external resources to analyse the IS/IT implementation in SMEs. They state that the internal resources include: (1) financial resources, (2) human resources, (3) management perspectives and attitudes, (4) IS/IT competences, (5) organisational structure, (6) power relationships, and (7) user attitudes. The external resources cover: (1) external expertise (e.g. vendors' support or consultant effectiveness), (2) technology available, and (3) business environment (e.g. clients, and suppliers, pressure to adopt IS/IT).

The empirical data complement the viewpoint reported in the literature and indicate that different types of organisations (micro, small, medium and large organisations) approach integration technologies' adoption differently, due to their internal and external resources constraints. Companies B, C, and D reported that the limited finance, time and expertise resources have inhibited their integration technologies' adoption. For this reason, Company D has not yet adopted any type of integration technology to support there is, and it is only able to integrate its internal IS. Although Company B has adopted EDI technology, EDI, it has many drawbacks, and cannot fully support organisations to integrate their intra and inter-organisational systems. Thus, Company B has not managed to overcome all of its integration problems. Furthermore, the empirical data also demonstrate that the financial constraint seems to be the biggest concern to Companies B, C, and D, and this tends to delay their integration technologies' adoption. Company A also reported that its SMEs suppliers' abilities for integration are low, and this has caused a problem to Company A, as many transactions still need to be handed manually by telephone or fax. Nonetheless, the empirical evidence also illustrates that the lack of sufficient integrated technologies' knowledge of most SME managers (e.g. suppliers, Companies B and C) has caused delay in their integration technologies' adoption decision-making, since they are the major decision makers as well as the key persons in the survival of the business (Rizzoni, 1991; Thong and Yap, 1994). In contrast to Companies B and C, the manager in Company D is intended to integrate their intra and inter-organisational systems. In order to meet this goal, Company D is currently working on integrating its intra-organisational systems, and is preparing to integrate its inter-organisational systems by considering EAI and Web Services technologies in the near future. Therefore, this indicates that the decision on whether to adopt an integration technology is heavily dependent on SMEs managers' perceptions, knowledge and intentions (i.e. highly dependent on adopter or organisational characteristics).

Company Size

The empirical data suggest that companies of different sizes have different perceptions in relation to their integration technologies' adoption. For instance, a small-sized company like Company C reported that its business activity is simple, and adopting integration technologies will only add complexity and extra costs for the company. A micro-sized company like Company D reported that although the integration technologies' adoption is important, it cannot manage to adopt any of them at the moment, due to the resources concerns like finance, know-how, etc. A medium-sized company like Company B claimed that it realised the importance of adopting integration technologies to support its IS integration. However, at the moment, it has only managed to adopt ERP and EDI technologies, but it is seriously considering adopting EAI or Web Services in the future to fully integrate its intra and inter-organisational systems. For companies like Company A, its business activities are complex, and integration technologies enable its IT infrastructure and applications to respond rapidly to business changes by providing a dynamic way to streamline, integrate, and manage previously independent business processes. These suggest that there is a relationship between business complexity and company size. The larger size the company is, the more complex the business activities can get. Moreover, when the business activities are more complex in an organisation, the more the likelihood that such an organisation will adopt integration technologies. When the business activities are less complex in an organisation, the more the likelihood that such an organisation will not adopt integration technologies (see Figure 1).

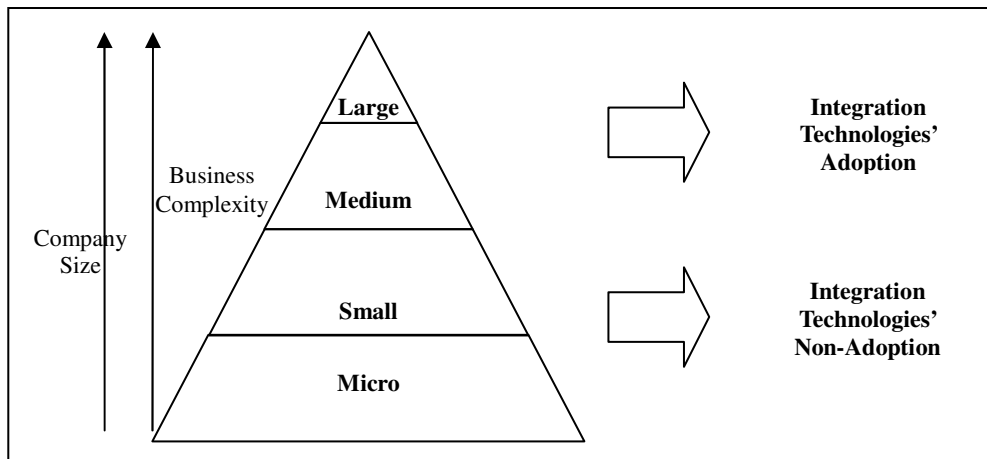


Figure 1. Relationship between Company Size and Integration Technologies Adoption

Need for Integration

Company A adopts integration technologies to assist its supply chains: (1) to support their own manufacturing processes, (2) to retain their competitiveness, (3) to support their future needs for any possible type of supply chain integration, and (4) to fulfil the transparency that would facilitate the enhanced levels of customer service required in order to stay competitive in the IT industry. Company B described that despite whether there is a need to adapt to an integrated IT infrastructure, cost is always the concern. Company C also revealed that failure is not allowed, as the main goal for them is to survive, thus they cannot afford to fail. In this kind of situation, SMEs' integration need is most likely lead to an integration technologies' non-adoption.

The empirical evidence here suggests that the integration needs for SMEs and large organisations can be classified into: (1) passive mode, and (2) active mode. When organisations' integration needs are more towards active mode (e.g. needs come from their technical, managerial needs, etc.), they are more likely to adopt them, and less likely not adopt integration technologies. When organisations' integration needs are more towards passive mode (e.g. being forced), they have equal chances to either adopt or not to adopt integration technologies, and this decision is highly dependent on the perception of SMEs' managers. The relationship between integration needs and integration technologies adoption is shown in Figure 2. For large organisations, it appears that they are more towards active mode, as they often take initiative to adopt integration technologies to improve business efficiency and to meet customer satisfaction. As reported by Company A not having implemented integration technologies will become a problem for the company in the future, thus, to stay in the competition, it is essential that it adopts integration technologies. As for SMEs like Companies B, C and D, their needs for integration can be seen as passive mode, since they reported that they will not adopt integration technologies unless the benefits of adopting such technologies are made obvious.

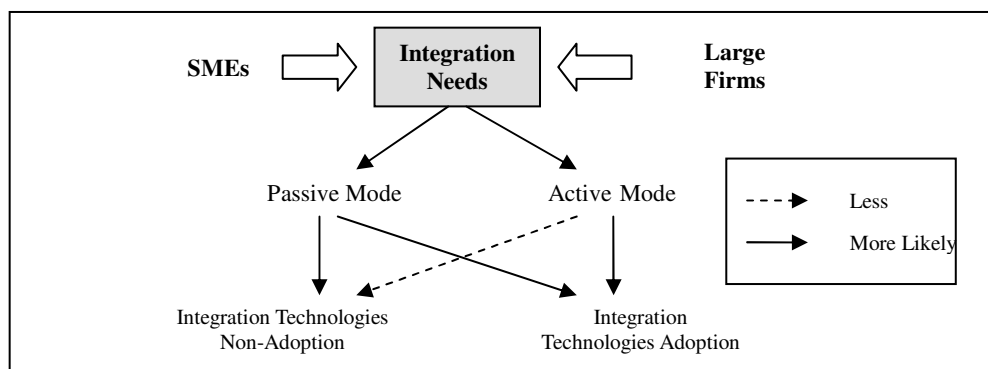


Figure 2. Relationships between Integration Needs and Integration Technologies Adoption

Time

Company B indicates that its IT abilities are relatively low, and having less financial support compared to those large organisations, they thus tend to go for off-the-shelf software packages. Company B reported that it does feel the pressure from the external environment; however, its financial status is still its biggest concern in relation to its integration technologies adoption. Thus, it tends to delay adoption. In the analysis of the case data, timing was identified to have influence on adoption decision-making. Consequently, such differences led to divergent adoption policies and practices. To further illustrate the integration technologies' adoptions between SMEs and large organisations in a comprehensive manner, a single-dimension typology to distinguish each integration technologies adopter is considered through the themes of *Initiator*, *Facilitator* and *Consumer*.

Initiator. Integration technologies initiator refers to organisations that have recognised the need for adopting integration technologies, have less constraint for financial support, have higher level of IT sophistication, and do not experience excessive pressure through external factors. These firms normally adopt integration technologies internally to strengthen their core business competitiveness. This type of adoption later transforms into increased interaction with their business partners. As it stands, adopters of this type can also be categorised as innovators or early adopters, as early adopters are more interested in the business and competitive advantages that a new technology brings about, rather than in the technology itself. In this case, Company A can be representative of such an initiator and innovators/early adopter.

Facilitator. Integration technologies' facilitator refers to organisations that have recognised the potential growth of the market, are financially and technically capable to develop integration technologies products, and make it their core business at strategic level. These firms may adopt integration technologies internally to support their business objectives and operation. The adopters classified in this group can also be categorised as the early majority, as early majority adopters intend to make sure the technology works for others before they invest. In this case, Company A can be representative of such a facilitator and early majority.

Consumer. Integration technologies' consumer refers to adopters which have already received or recognised the pressure from the business environment, have less IT capability and financial support, and use integration technologies to support their core business. As it stands, the adopters classified in this group can also be categorised as the late majority or laggards, since these tend to adopt a technology only when they have no choice. Many laggards do not explicitly adopt technologies at all, but rather acquire them accidentally when a particular technology is a component of a packaged solution (Rogers, 1995). In this case, SMEs like Companies B and D are representative of such a consumer and late majority/laggards. Table 3 summarises the discussion above.

Adopter Typology	Adopter Categories	Case Company	Adoption Decision	Adoption Results
Initiator	<ul style="list-style-type: none"> • Innovators • Early adopters 	<ul style="list-style-type: none"> • Company A 	Adopt primarily for internal IS integration and external supply chain integration	<ul style="list-style-type: none"> • Competitiveness strengthened • Dictating position with business partners
Facilitator	<ul style="list-style-type: none"> • Early majority 	<ul style="list-style-type: none"> • Company A 	Adopt in new products and services creation	<ul style="list-style-type: none"> • Critical to success of business • New services created
Consumer	<ul style="list-style-type: none"> • Late majority • Laggards 	<ul style="list-style-type: none"> • Company B • Company C • Company D 	Adopt commercial packages for internal use	<ul style="list-style-type: none"> • End-user of innovative IS products

Table 3. Summary of Integration Technologies Adopter Categories

CONCLUSIONS AND LIMITATIONS

The literature reports that the findings that derive from the study of large enterprises cannot be generalised and applied in SMEs due to the nature and characteristics of SMEs, thus it is expected that both might approach integration technologies adoption differently. However, the existing literature does not specify whether they focus on different factors when taking adoption decisions. Therefore, this forms research gap which needs further investigation. In doing so, the following parameters were identified by the authors from the literature that influence the different adoption factors focused on by SMEs and large firms when taking decisions for their integration technologies adoption: (1) nature resources, (2) time, (3) integration needs, and (4) company size. In doing so, this clarifies much confusion surrounding the integration technologies adoption between SMEs and large organisations, and allows researchers to apprehend and analyse integration technologies.

One of the limitations of this research is that the outcomes presented herein are based on real life case study. Thus, the data and the observations derived from these cases might not be generalised. Nonetheless, it is not the intention of this paper to offer prescriptive guidelines for integration technologies' adoption but rather to describe case study perspectives that allow others to relate their experiences to those reported. Hence, this paper offers a broader understanding of the phenomenon of integration technologies' adoption, taking into consideration the differences between SMEs' and large organisations' nature, company size, integration needs and adoption timing, and makes use of resource-based and innovation diffusion theories to analyse and interpret such differences. However, this research does not intend to compare the adoption of integration technologies between SMEs and large organisations, as it is inappropriate to compare two very different types of companies, as the result ought to be different. Rather, this research aims to apply the diffusion of innovation theories to interpret and analyse the different adoption factors that SMEs and large organisations focused on when taking decisions for their integration technologies' adoption. This results in a richer picture of this adoption.

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