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# A Comparative Analysis between SMEs and Large Companies in Relation to Integration Technologies Adoption

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**Abstract:** Integration technologies like Enterprise Application Integration (EAI) and Web Services allow organisations to collaborate with their partners, increase flexibility and gain competitive advantages. Despite the benefits that the integration of Information Systems (IS) can offer to enterprises, little attention has paid on the adoption of integration software by Small to Medium Sized Enterprises (SMEs). The body of literature suggests that the findings that derive from the study of large enterprises can not be generalised and applied in SMEs due to the nature and characteristics of SMEs. In an attempt to study this area, research questions were raised. These research questions are investigated in this paper and supported the authors to propose a research model. The proposed model might be used to explain why SMEs and large organisations take decisions for the adoption of integration technologies focusing on different factors. The results of an empirical study carried out on a sample of 102 companies of any size in Taiwan are presented, aiming at highlighting any significant difference in the way SMEs and large companies approach integration technologies.

**Keywords:** SMEs, Integration technologies, EAI, Web Services, Integration technologies adoption.

## I. Introduction

Despite the advantages that IS integration can offer to organisations as mentioned in the literature, little attention has been paid to the adoption of integration technologies by SMEs [22][43]. Iacovou *et al.* [23] reported that SMEs differ from large companies in many ways that affect the adoption of integration technologies. These differences include: the lower levels of resources available for this [23] [28], the substantially less sophisticated IS management [25][43], the needs for integration and their characteristics, and the quantity and quality of the available environmental information [33]. For these reasons, Kuan and Chau [28], among others suggested that the general applicability of the studies in large organisations may be questionable if applied to small businesses. Thong [46] 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 in the normative literature as being different between large and small companies, the literature on the adoption of integration technologies by SMEs remains limited [28]. Nevertheless, among the existing works, their focus mostly emphasises on either the adoption decision or the successful implementation factors [9][28][38]. To the best of the authors' knowledge, there are no studies on the reasons why SMEs and large companies take the decision to adopt integration technologies, which focus specifically on the different factors. Thus, this presents a research issue which needs further investigation. This paper attempts to address this issue by studying the factors affecting the adoption of integration technologies by comparatively analysing the adoption factors between SMEs and large companies. The proposed research model is tested through a survey study in Taiwan IT industry (with 68 usable responses and 87% of the responding firms' integration technology users).

Therefore, this paper aims to identify the significant differences in the way that SMEs and large companies approach integration technologies. In doing so, the parameters are identified that can be used to explain the adoption of integration technologies between SMEs and large firms, which are the nature, company size, integration needs, adoption factors for SMEs and large organisations and time. It is argued that this paper is of value in highlighting the specific parameters in SMEs and large organisations in relation to integration technologies adoption.

## II. Research Issues Analysis

### II.1 Nature of Organisations

Globalisation forces many enterprises to change the way they do business. To compete in global markets, SMEs need to develop new business strategies and deploy new technologies. For example, Web Services and EAI are relatively new technologies. However, Storey [41] argued that the size of small businesses creates a special condition, which can be referred to as resource poverty, that distinguishes them from their larger counterparts and requires some different management approaches. Thus, it is

vital to identify the nature of SMEs to assess what makes them distinct from other types of organisation (e.g. large organisations), as the nature of SMEs might be a real obstacle to their adoption of integration technologies.

SMEs consist of a significant part of the economy and are characterised by high firm failure rates [42]. Storey and Cressy [41] reported that about 11% of small businesses fail to survive in any given year. This failure rate is six times higher for smaller than it is for larger businesses. This is due to SMEs usually:

- Having little ability to influence market price by altering their output [27].
- Having small market shares, so are unable to erect barriers to enter their industry [15].
- Can not easily raise prices and tend to be heavily dependent on a small number of customers [42].

Small businesses can not usually afford to pay for the kind of accounting and book keeping services they need, nor can their new employees be adequately tested and trained in advance [49]. Small businesses are also under increasing pressure to employ IS to maintain their competitive positions. At the same time, there are more barriers to IS implementation in small businesses than there are for large businesses, due to the high capital investment and skilled manpower involved in implementing and operating IS [47]. Welsh and White [49] also pointed out that resource constraints (time, finance and expertise) in small businesses are based on the concept of the resource-based theory. The resource-based theory is often used to explain the adoption and use of information systems and technology in SMEs. According to it, firms are characterised as being collectors of resources or capabilities. A firm's resources may include both tangible and intangible assets, including capabilities, organisational processes, information, and knowledge, that are all controlled by a firm to enable them to conceive and implement strategies that improve its efficiency and effectiveness [2]. The resource-based theory emphasises an understanding of the internal capabilities that enable organisations to secure competitive positions and the importance of internal resources in a company [2] [4]. In this research, the resources-based theory is applied to explain the importance of the natural resources of a company, in terms of the integration of their technologies adoption decision (e.g. time, finance and expertise constraints).

Time constraints refer to the limited amount of time available for activities beyond the normal job responsibilities of individuals in small businesses. Financial constraints refer to the limited amount of finance available for activities beyond the normal operations of the small businesses. Expertise constraints refer to the limited amount of expertise within the small businesses to carry out activities beyond their designated job responsibilities. Based on these, Welsh and White [49] reported that: (a) SMEs have to control their cash flows carefully, as they do not have unlimited funds for their IS project; (b) SMEs tend to choose the cheapest system, which may be inadequate for

their purposes; (c) SMEs usually underestimate the amount of time and effort required for adopting integration technologies; and (d) SMEs normally engage consultants and IT vendors to develop and support their information systems [47]. For example, SMEs might prefer to outsource most of their activities, whereas large companies might only prefer to outsource those activities which are not directly related to their business strategies, or even to manage these activities totally on their own.

Resources such as time, finance, and expertise that are all necessary for planning, represent the most critical difficulties for small businesses [10]. Due to this reason, Kagan *et al.*, [25] and Tagliavini *et al.*, [43] claimed that SMEs usually have substantially less management over their sophisticated information systems and that this might affect the way that they approach integration technologies. In addition, according to Attewell's [1] technology diffusion theory, it emphasises the role of external entities (e.g. consultants and IT vendors) as knowledge providers in lowering the knowledge barrier or knowledge deficiency on the parts of potential IS adopters. Small businesses tend to delay in-house IS implementation because they have insufficient knowledge to implement IS successfully [47].

Thus, based on the discussion in this section, it appears that the nature of SMEs, in terms of external and internal resources (e.g. time, finance and expertise), impacts on the way that they approach integration technologies. To this end, the following research question is raised for further investigation.

**RQ1:** *Is the nature of SMEs a real obstacle to integration technologies adoption.*

## II. 2 Company Sizes

Apart from organisational or strategic remarks, various literature emphasises size as one of the issues that is increasing the need for the co-ordination and control of organisational activities [21][32][50]. Tagliavini *et al.* [43] proposed that company size is an important factor affecting ERP adoption. DeLone [16] also suggested that computer usage characteristics are different in organisations of different sizes. Other research works, like IDC's [24], suggest a direct relationship between the size of organisations and the percentage of those organisations in which ERP has been implemented. All these studies indicated that the size of the organisations have many different impacts on the ways that the organisations do things.

As reported in the literature, SMEs can be categorised as micro sized companies if they have up to 20 employees. SMEs can also be defined as small sized companies if they have up to 100 employees, whereas SMEs can be classified as being medium sized companies if they have up to 500 employees. Companies that have more than 500 employees can be seen as large organisations [11]. Company size is important, as a company with 20 employees and a company with 500 employees have different ways of managing their

IS. For example, the same system might be managed by 200 employees from the IT department in large companies, but only managed by 20 or less employees in small companies. In accordance with the views discussed here, the authors suggest that there is a possibility that companies of different sizes follow different approaches towards the adoption of integration technologies. Thus, company size is included here as a factor that affects the adoption of integration technologies.

In accordance with the views discussed in this section, the researcher suggests that it is possible that companies of different sizes may follow different approaches for their adoption of integration technologies. Thus, a research question is proposed for further investigation:

**RQ2:** *What is the relationship between integration technologies and their adoption in companies of different sizes?*

### II. 3 Need for Integration

It was found that organisations adopt a new technology only if it provides significantly better benefits than their existing ones [39]. A new technology has to provide solutions for existing problems or open up new opportunities to motivate an organisation to take a proactive decision to adopt it with a trading partner. Although the organisational structure of larger organisations could be very different from SMEs, companies of any size show a critical need for the coordination and control of business activities [43]. Thus, it is important to understand organisations' motivations/needs for adopting a new technology.

According to the literature, the reasons that push large companies to turn to enterprise application integration, include among other things: (a) their Enterprise Resources Planning (ERP) systems cannot fully automate and integrate organisations since ERP coexists alongside other applications, (b) technical reasons, (c) financial reasons, (d) managerial reasons and (e) strategic reasons [45]. However, the authors found that the motivations mentioned by Themistocleous [45] are not appropriate to explain SMEs' need for integration. For example, some small firms might not even have ERP systems. Therefore, by reviewing the existing literature on the adoption of integration technologies by SMEs, a number of reasons that push SMEs to turn to integration technologies to support their IS have been identified. These reasons are explained as follows:

- **External Pressures:** External forces tend to have more impact on small businesses than they do on large businesses [23] [49]. 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 found to be an important factor in the adoption of integration technologies [20] [28] [35]. Since SMEs are usually the weaker partners in inter-organisational relationships, small businesses are susceptible to impositions by their larger partners [40]. Therefore, SMEs

are under pressure to adopt integration technologies if its business partners request or recommend it to do so.

- **Internal Pressures:** Internal pressures include both the financial and technological resources of the firm. Financial resources are related to the financial resources 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 IT usage and IT management in an organisation. As mentioned before, 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 [47]. In addition, Thong [47] also reported 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 all indicate that SMEs' need for integration technologies might be based on their internal resources/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 than their larger counterparts [28].

- **Competition:** The main reason SMEs adopt IT is to enhance their competitiveness [23][34]. 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's.[23], the most significant reason that pushes SMEs to adopt integration technology is to gain a competitive advantage.

Based on the discussion above, the authors found that firstly, due to SMEs' resource poverty, SMEs' motivations to turn to adopting integration technologies mostly comes from external forces. This is different from large organisations, as their motivations mostly arise from their technical, financial, strategic and managerial needs [45]. Secondly, the different integration needs between SMEs and large organisations might be caused by their different business complexity [43]. The interpretation of business complexity here means whether the condition of being a complex organisation is related to their adoption of integration technologies. After years of different technological purchases, enterprises have ended up with disparate systems spread throughout different units. However, the number of systems to be managed (i.e. disparate systems) is different between SMEs and large companies. For example, SMEs may only have a few systems, whereas large organisations may have many. Therefore, some SMEs (with only 10 employees or less) may find it ineffective to adopt integration technologies since there are not many disparate systems within the organisations. In this case, adopting integration technologies

to support SMEs' IS integration will only increase their capital or maintenance costs and add complexity to their existing operations, unless there are some irresistible reasons. For example, an SME's trading partners might require them to do so, or pressure from the government may make them act. As for larger organisations, since they are relatively complex organisations compared to SMEs (e.g. with many disparate systems within the organisation), adopting integration technologies can help them solve their integration problems, increase effectiveness, and speed up transactions, etc.

Thus, the discussion in this section demonstrates that different sized companies might have different needs and ways of managing their adoption of integration technologies. Hence, the researcher suggests that SMEs' integration needs might be different from those of large companies, and this might affect their adoption decisions. Therefore, the following research question is formed:

**RQ3:** *In what ways does SMEs' integration needs differ from large companies?*

## II. 4 Integration Technologies Adoption by SMEs and Large Organisations

Due to SMEs' inadequate resources, limited knowledge, lack of 'know-how' about IS, and several other constraints, some researchers have found that small businesses generally face greater risks in IS implementation and the use of information technology than large businesses [12][13][23]. Thus, managers in SMEs have been characterised as having reservations about the adoption and use of information systems [6][46]. However, these reservations have not always obviated the benefits and successes such organisations can achieve from IS. In the early days, SMEs tended to use IS as tools to automate their standard administrative functions, e.g. accounting, budgeting and inventory control, etc. Until recently, there has been growing literature addressing the issue of using IS for a competitive advantage amongst SMEs [34]. According to Lin *et al.*, [30], the increasing interest in the strategic use of IS by SMEs is based on three factors: (a) the increased adoption of IS and its effective use by competitors, (b) a decrease in the cost of IS so that it is accessible to SMEs, and (c) the ability for IS to allow SMEs to mask their size from their external partners. Due to these reasons some SMEs have turned to the adoption of integration technologies as a new strategy to improve their competitiveness.

The review of the literature has shown that some SMEs adopt ERP and EDI to automate their business processes, as well as showing that there are only a few prior studies that have focused on EDI and ERP in small businesses. These studies include those by Iacovou *et al.* [23], [23], Daniel [14], Hughes *et al.*, [22], Kuan and Chau [28], Waarts *et al.*, [48], Ravarini *et al.*, [36] and Tagliavini *et al.*, [43]. Among these studies on adoption, the model proposed by Iacovou *et al.*, [23] presents the most comprehensive research that focuses on the adoption of integration technologies (EDI) in small

businesses [28]. Most of the literature on this subject that has been reviewed mainly focuses on the adoption of EDI and ERP, with 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 it is in the early stages of adoption [19]. 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.

Opposite 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 terms of supporting IS integration in large organisations. To better understand these factors reported in the literature, the authors analyse them and this is shown in Table 1. Factors like competitive pressure, Dependency on Partners/ Trading Partners Readiness/Pressure, External Pressure, Perceived Financial Cost/ Financial Resources and Perceived Governmental Pressure that particularly focus on SMEs are highlighted.

Factors derived from the literature	EAI	EDI	ERP	Web Services
Adopter Characteristics			✓	
Availability of Standards		✓		✓
Barriers	✓			
Business Complexity			✓	
<b>Competitive Pressures</b>	✓	✓		
Customer Power		✓		
<b>Dependency on Partners/ Trading Partners Readiness/pressure</b>	✓	✓		
Environmental Characteristics			✓	
Evaluation Framework for the Integration Technology and Packages	✓			
<b>External Pressure</b>	✓	✓		
Extent of Organisational Change			✓	
External Environment Characteristics			✓	
IS Innovation Type				✓
IT Sophistication	✓	✓		✓
IT Infrastructure	✓			✓
Internal Environment Characteristics			✓	
Internal Pressure	✓			

Innovation Characteristics/ Perceived Innovation Characteristics			✓	
Organisational Characteristics			✓	
Organisational Readiness		✓		
<b>Perceived Financial Cost/ Resources</b>	✓	✓		✓
Perceived Benefits (Direct and Indirect benefits)	✓	✓		✓
Perceived Technical Competence/ Technological Skills Readiness	✓	✓		✓
Perceived Industry Pressure	✓	✓		
<b>Perceived Governmental Pressure</b>		✓		
<b>Prior EDI experience</b>		✓		
Security		✓		✓
Support/ Organisational Support	✓	✓		✓
Stakeholders				✓
Supplier Trust		✓		
Supplier Commitment		✓		
Technical Factors	✓			✓
The desire for faster and better communication		✓		

Table1. Summary of Factors that Influence Organisations' Integration Technologies Adoption Decision

From Tables 1, the authors found that firstly, similar factors are sometimes used to explain different adoptions of integration technologies (i.e. common factors). For example, IT sophistication, perceived benefits, technical competence, support and financial resources (i.e. cost) factors were applied to explain EAI, EDI and Web Services adoptions in many studies. Therefore, these factors can be considered as the most important factors for explaining the adoption of integration technologies.

Secondly, the authors found that only a few factors were used to explain both the adoption of integration technologies by SMEs and large organisations. For instance, factors like perceived benefits, perceived financial costs and external pressures were used to explain the adoption of integration technologies by SMEs as well as large organisations. However, among these research papers, there was only one of the papers in which the authors referred to this research concerning the EAI and Web Services adoption in SMEs. This indicates that (a) there is a lack of literature on EAI and Web Services adoption in SMEs; and (b) most of the factors identified from the normative literature can not be equally applied to both SMEs and large companies to interpret their

decision whether to adopt integration technologies because having one piece of evidence is not enough to represent every example.

Thirdly, similar factors were highlighted in many research papers to explain the adoption of integration technologies by SMEs. For example, *competitive pressures, dependency on partners, external pressure, perceived financial cost, prior EDI experience* and *perceived governmental pressure* were used in many studies to explain the adoption of integration technologies by SMEs. This indicates that the aforementioned factors here are the main/important factors for the adoption of integration technologies by SMEs. However, these factors can also be used to explain the adoption decision by large organisation, even though it may not necessarily be a good one. For example, the perceived governmental pressure might not be a factor that assists the studying of adoption decisions in large organisations, as this factor is particularly used to explain the adoption decision by SMEs. The reason for this is that large organisations like SMEs often find it hard to adopt integration technologies without any kind of support (e.g. not only support from vendors and consultants but also from the government and their suppliers, etc) due to their natural resource constraints. Moreover, as mentioned in the literature review, SMEs might be forced to adopt integration technologies as their business partners or governments require them to do so [8]. This situation might not be appropriate for their larger counterparts as they are usually the stronger partners in inter-organisational relationships, when compared to the SMEs [40][42]. Another explanation is that most of the research papers that focused on the adoption of integration technologies in large companies did not include *perceived governmental pressure* as a factor that might explain or influence their adoption decision.

In accordance with the above considerations, the researcher proposes that there is a high possibility that SMEs and large companies take their decision for the adoption of integration technologies by mostly focusing on different factors (as shown in Tables 3.1, 3.2 and 3.3). This will be illustrated in more detail in Sections 3.3 and 3.4. This assumption matches with the literature, where it is reported that the adoption of integration technologies is different for both large and small companies [23][28]. Thus, the following research question is raised for further investigation:

**RQ4:** *Do SMEs and large companies consider different factors when taking decisions for the adoption of integration technologies?*

**II. 5 Time**

In addition, according to the literature, the authors found that most of the factors that focused on the adoption of integration technologies by SMEs are mostly 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 do so [23][28]. Thus, to remain competitive, SMEs have no choice but to adopt integration technologies. Due to these reasons, when referring to the adoption life cycles, some literature suggest that SMEs tend to be the late adopters (late majority/laggards) in the adoption of new technology/innovation, rather than the early adopters [23] [28] [31].

Laggards can be summarised as those who only adopt a technology 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 [39]. 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 [27] and Storey [42] are among those others who claim that SMEs can not afford to fail due to their limited resources. Therefore, most SMEs can be categorised as laggards.

The adopters in the late majority group not only want to be certain that the new technology works, they also want to wait until it's been widely adopted and standardised. They do not consider that the technology offers them any competitive advantage, even though they recognise that they can not 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 do so (e.g. external pressure). Thus, SMEs can also be categorised in the late majority group.

However, there might be an exceptional case where SMEs might be considered as innovators, such as when SMEs are Hi-technology firms. Hi-technology SMEs might use more advanced or sophisticated information technologies for their production or information systems management than those SMEs from other sectors.

Nevertheless, most large companies tend to be in the early adopters/early majority group, with even some of them being classified as innovators. Early adopters are more interested in the business and competitive advantages of a new technology rather 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 [39]. They do not want 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 [26].

Thus, based on the above discussion, it suggests that time plays an important role in terms of integration technologies adoption, as late adopters may find that they have a competitive disadvantage [26]. Kaye [26] suggested that by extending the middle of the early-adopter phase into

the start of the late-majority phase, this period may offer a competitive advantage to the adoption of integration technologies. However, at some time early in the late majority phase, having implemented integration technologies ceases to offer any competitive advantage, and not having implemented anything begins to be a problem. To this end, the following research question is raised:

**RQ5:** *Can early adoption of integration technologies by the organisations gain competitive advantages?*

### III. Conceptual Framework

Based on the discussion and identified research questions in Sections 2.1, 2.2, 2.3, 2.4, and 2.5, 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*, *integration needs*, *adoption factors for large companies* and *adoption factors for SMEs*, which are then illustrated in a cube diagram in Figure 1, which shows the dimensions for the integration technologies adoption between SMEs and large organisations.

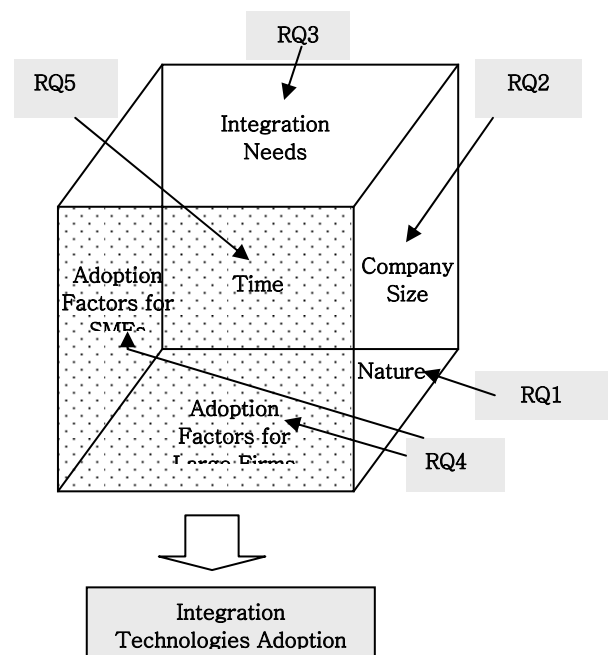


Figure1. Dimensions for Adoption of Integration Technologies between SMEs and Large Organisations

### IV. Methodology

The questionnaire contained two sections regarding: (1) general company information, and (2) integration technologies adoption. The questions in this section were categorised into 5 parts according to the parameters identified in Chapter 3, Figure 3.2: *nature*, *integration needs*, *company size*, *adoption factors* and *time*. The questionnaire was validated by two MIS managers from an IT

manufacturing company in Taiwan. They were asked to identify questions, and any for which answers may not be easily available. The questionnaire was then mailed to computer professionals of 500 firms of any size and industry in Taiwan. Enterprises were categorised as SMEs in Taiwan if their paid-in capital was less than NT\$60 million (US\$1.8 million), or the number of regular employees did not exceed 200. The firms were chosen randomly from the database provided by the Industrial Bureau of Ministry of Economics (MOE) in Taiwan. The respondents were asked: (1) to complete if they are using integration technologies, (2) to complete it if they had evaluated integration technologies in the past and had chosen not to use them, and (3) to ignore the questionnaire if the firm does not belong to either category, but to explain their reasons.

A total of 101 responses were received and 68 of them were useable. 40 (58%) responses were from large organisations and 28 (42%) were from SMEs. 59 (87%) of the responding firms were integration technology users (this includes ERP, EAI, EDI and Web Services), and 53 of these were IT manufacturing/high-technology firms. The remaining 9 of the responding firms were non-users, and 4 of these were IT manufacturing/high-technology firms. The responding firms represented diverse industries, such as manufacturing, IT industry, high-technology industry, services sectors and merchandising. The survey results were then analysed by descriptive statistical method and are analysed in the following sections.

## V. Survey Results Analysis

### V.1 Nature of Organisations

Integration technologies implementation requires capital investment and may involve other expenditure in upgrading the computer and integrating some systems. It seems that large firms should be able to afford such investments more easily than smaller ones, and therefore integration technologies users' firms are expected to be the larger ones. According to the data, among the 9 non-users, 8 are SMEs, (see Table2). The reasons for not adopting integration technologies are shown in Table 3. In addition to those reasons, further reasons for not adopting integration technologies were found to be: (1) that most SMEs do not fully understand what integration technologies (EDI, ERP, EAI and Web Services) are, and (2) that some SMEs find it unnecessary to adopt integration technologies as they are satisfied with the current technologies they are using (e.g. the Internet is good enough for their daily operations). In this research, the author is particularly interested in the integration technologies adopters (in total, 59 adopters).

Moreover, Table 4 shows that EAI has not been popular among SMEs compared to other integration technologies. The possible explanation for this is that the high investment cost and complexity associated with EAI might cause concern to many organisations, especially SMEs. According to Charlesworth and Jones [7], integration technologies need to be "dumbed-down" to effectively communicate the

benefits and issues at the most appropriate level within the organisation.

	Responses	User Firms	Nonuser Firms
SMEs	28	(20) 71.4%	(8) 28.6%
Large	40	(39) 97.5%	(1) 2.5%
<b>Total</b>	<b>68</b>	<b>(59) 86.7%</b>	<b>(9)13.2%</b>

Table 2. User and Nonuser Percentage

Reasons	Responses
Costs	33.3%
Security	11.1%
Uncertainty	11.1%
Financial resources	11.1%
Skills	11.1%
Others	22.3%

Table3. SMEs' Reasons for not Adopting Integration Technologies

	EAI	EDI	ERP	Web Services
SMEs	0	35%	50%	15%
Large	5.1%	51.3%	90%	38.5%

Table4. Integration Technologies Adoption Percentage

Therefore, based on the survey results, the researcher suggests that the nature of SMEs might be an obstacle to their adoption of integration technologies. The reasons for this are: (1) the results indicate that cost is still an obstacle to SMEs, as they cannot really afford to spend extra money on R&D investment; (2) some SMEs still find it unnecessary to implement integration technologies, as there are not that many employees within the organisation; and (3) most SMEs still lack knowledge regarding integration technologies compared to large counterparts.

### V.2 Company Size

The survey results reported in Table 5 suggest that SMEs and large organisations manage their IS in different ways. The majority of the integration technologies users in large organisations (71.4%) reported that the MIS department is in charge of the companies' information systems. As for SMEs, there were only around 40% that reported this. The remaining 60% indicated that their IS are often managed under managers or are outsourced. The possible explanations are that, firstly, the culture of a small enterprise is tied in with the needs, desires and abilities of its owner [3]. The owners of SMEs often like controlling their own destiny and doing things differently. Thus, the managers like to manage the IS on their own. Secondly, according to Carter and Evan [5], due to the lack of financial resources and expertise in IT, SMEs usually do not develop IS on their own. Instead, they rely more on standardised and *off-the-shelf* software packages, and normally seek external support for their IT problems, such as friends, vendors or consultants. Thus, many SMEs like to outsource their systems. This shows that companies of different sizes manage their IS and integration technologies differently.



	MIS Dept	Managers	Outsourcing	Others
SMEs	40%	33.3%	20%	6.7%
Large	71.4%	14.3%	9.5%	4.8%

Table 5. Information System Management in Organisations

### V. 3 Integration Needs

Table 6 shows that the reasons that push SMEs and large firms to turn to integration technologies are different. The majority of large organisations reported that integration technologies can provide real-time data which can help them to eliminate: (1) systems heterogeneity, (2) data redundancy, and (3) low data quality. For example, multiple applications store data for the same entity (e.g. orders), but there is often an inability to combine data and take decisions, since there is: (1) data incompatibility, (2) confusion regarding data latency, or (3) communication problems. As for SMEs, the majority reported that external pressure and competition are the main reasons that push them to adopt integration technologies. There are only 2.6% and 7.7% of large organisations which reported this. Thus, it clearly shows that integration needs are different between SMEs and large organisations, and this can influence the ways they approach integration technologies.

Additionally, Table 4 shows that the newer the technologies, the less likelihood that SMEs will adopt them. For instance, the adoption rate for EAI and Web Services among SMEs is relatively low compared to their large counterparts. This suggests that the more complex and expensive the integration technologies are, the less likelihood that SMEs will adopt them. For large organisations, they will use the integration technologies in a circumstance it will help them to increase their competitiveness or solve a particular problem. This also shows the different motivations towards integration technologies adoption between SMEs and large organisations.

Integration Needs	SMEs	Large Firms
External pressure	45%	2.6%
Competition	40%	7.7%
Technical reasons	10%	2.6%
Financial reasons	10%	5.1%
Provide solution to the existing problem	20%	12.8%
Managerial reasons	35%	43.6%
Strategic reasons	20%	7.7%
ERP can not fully automate and integrate business process	10%	2.6%
Others	0	2.6%

Table 6. Integration Needs Related Factors

### V. 4 Time

Table 7 demonstrates that the timing of integration technologies adoption is different between SMEs and large organisations. For instance, the majority of large

organisations reported that they have adopted integration technologies for more than 10 years. As for SMEs, this only applies to around 15% of them. The majority of SMEs lie between 5 to 10 years. This indicates that SMEs tend to be later adopters compared to large organisations.

	Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
SMEs Adopted	6.848	67	.000	.412	.29	.53
Competitive advantages	16.836	67	.000	.809	.71	.90
Don't know	1.000	2	.423	.333	-1.10	1.77
	2.000	2	.184	.667	-.77	2.10

Table 7. Timing and Competitive Advantages

Table 8 shows that the early adoption of integration technologies can help organisations to gain some minor competitive advantages. However, many of the respondents claimed that it is hard to tell whether adopting integration technologies gives them a major competitive advantage or not. Nevertheless, they were sure that not having implemented any of these integration technologies may become a problem for their companies.

	< 10 Years	5-10 Years	> 5 Years	Very Recently	-	Planning
SMEs	15%	35%	25%	15%		10%
Large	35.9%	23.1%	10.3%	5.1%		2.6%

Table 8. Timing for Integration Technologies Adoption

### V. 5 Adoption Factors for SMEs and Large Organisation

Table 9 shows that SMEs and large organisations face different problems when integrating their IS. The majority of SMEs reported that due to their lack of technical skills they have encountered many technical problems. As for large firms, they reported that they have encountered many strategic problems when integrating their information systems (around 33.3%).

Problems Faced When Adopting Technologies	SMEs	Large Firms
Financial problems due to the limited resources	35%	10.3%
Technical problems due to the lack of expertise's support and technical skills	60%	12.8%
Organisational change	20%	17.9%
Managerial problems	25%	25.6%
Strategic problems	15%	33.3%

No problem at all	0	10.3%
Others	5%	2.6%

Table 9. Problems Faced When Adopting Integration Technologies

Adoption Factors	SMEs	Large Firms
Availability of standards	70%	56.4%
Barriers	20%	7.7%
Perceived industry pressure	15%	2.6%
Business complexity	5%	7.7%
Customer power	35%	5.1%
Internal pressure	10%	2.6%
IT infrastructure	20%	12.8%
Technology characteristics	15%	5.1%
Organisational readiness	20%	10.2%
Extent of organisational change	30%	12.8%
IT infrastructure	10%	12.8%
Security Technical factors	5%	10.3%
Competitive pressures	20%	12.8%
Dependency on partners	25%	7.7%
External pressure	5%	5.1%
IT sophistication	25%	7.7%
Support	20%	17.9%
Perceived financial cost	20%	12.8%
Perceived benefits	40%	35.9%
Perceived technical competence	30%	5.1%
Perceived government pressure	15%	2.6%
Others	0	2.6%

Table 10. Integration Technologies Adoption Factors

Table 10 indicates that SMEs and large organisations take decisions for the adoption of integration technologies, mostly focusing on the different factors. For example, around 35% of SME respondents reported that customer power influences their adoption decisions, but only 5.1% of large organisations reported this. Another example is that 25% of SMEs claimed that dependency on partners is a factor that influences their adoption decisions, but only 7.7% of large organisations reported this.

## VI. Conclusion

This research has attempted to study the factors affecting the integration technologies adoption in SMEs based on comparative analysis between SMEs and large companies. In doing so, the authors critically analyse the normative literature regarding the integration technologies adoption in both SMEs and large organisations with number of research questions raised. These research questions are: (1) In what ways does SMEs' integration needs differ from large companies, (2) Is the nature of SMEs a real obstacle to the adoption of integration technologies, (3) What is the relationship between integration technologies and their adoption in companies of different sizes, (4) can early adoption of integration technologies by organisations gain

competitive advantages, (5) Do SMEs and large companies consider different factors when taking decisions for adoption of integration technologies, and (6) if the adoption factors for SMEs and large organisations are thought to be different, to what extent do: (1) integration needs, (2) nature of organisations, (3) company size, and (4) time, influence the different adoption factors.

Based on these research questions and the analysis of the literature, the authors found that the differences between SMEs and large companies on their *nature of organisations, integration need, company size, adoption factors and their timing of adoption* are important parameters affecting integration technologies adoption.

The data for the current study were collected using a postal questionnaire, which limited the ability to include important variables or information regarding the adoption of integration technologies. Therefore, it would be useful to collect in-depth data by conducting interviews that examine more information regarding the differences between SMEs and large organisations in relation to their integration technologies adoption. This will provide a clearer and more complete picture of different integration technologies adoption between SMEs and large organisations.

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