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AN EMPIRICAL INVESTIGATION INTO THE CRITICAL SUCCESS FACTORS USED BY IT COMPANIES OF VARIOUS SIZES TO ADOPT INTERNET TECHNOLOGY

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ABSTRACT

Internet technology is transforming the way in which business strategies are formulated in the corporate world. Indeed, it is proving to be the most effective and influential strategic tool of the century by connecting thousands of companies and millions of people every minute. This paper highlights the salient factors used by IT companies of various sizes in the adoption of internet technology. Five organisational and two marketplace factors were used in this study. The final analysis confirm that larger IT companies were more influenced by the following factors — perceived direct benefits, organisational compatibility, trading partner pressure, organisational support, and perceived in-direct benefits than smaller IT companies. On the other hand, smaller IT companies were affected by technical complexity than larger IT companies. However, competitive pressure is not an influential factor.

Keywords: Electronic commerce; Internet technology; World Wide Web

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INTRODUCTION

In Malaysia, the internet is increasingly becoming popular among local and multinational companies as a medium to advertise their business and enhance corporate performance on the electronic superhighway. internet technology, which has been used extensively by larger companies to further enhance their business strategies, can now play a similar role in the small and medium enterprises (SME). Many SMEs are becoming aware of the need to integrate internet technology into their business processes to boost their efficiency, productivity, and return of investment. This internet technology solutions will assist the SMEs in ensuring that they are well–equipped to thrive in the market, which is increasingly becoming competitive, with the entry of more players that are just as prepared. Thus, SME should not lag behind, but instead make sure that they also use and manipulate the internet to their advantage.

However, limited research had been done to identify the critical success factors (CSFs) used in adopting new innovations. In particular, information on salient factors that influence organisations' perception towards internet technology adoption and its affect on both large and small companies.

This paper is organised as follows. The next section presents the objective for this study. Then a brief review of the literatures is highlighted. Subsequently, the hypotheses, methodology and results are presented. This is followed by an analysis of the hypotheses and discussion that relates the findings back to the original theory.

OBJECTIVE OF STUDY

One of the most difficult challenges facing senior information systems (I/S) managers is establishing a flexible I/S infrastructure that will allow their organisations to successfully compete (Brancheau and Wetherbe, 1996; Neiderman et al., 1991). Senior I/S managers must work closely with functional business managers to establish an I/S infrastructure that effectively supports existing systems, while remaining responsive to the constantly changing I/S needs of the organisation (Stephens, 1992). Establishing a stable I/S infrastructure is not an easy task, numerous factors, both internal and external to the firm, influence their decisions.

In recent years, the problem of establishing a stable I/S environment is affected by a rapidly changing technical environment. The I/S manager must decide whether to adopt emerging technologies based on both internal and external factor and on the firm's business objectives. Internal factors include top management support (Gordon and Gordon, 1992), perceived benefits (Banerjee and Golhar, 1994), technical compatibility (Iacovou, Benbasat, and Dexter, 1995), complexity (Rogers, 1983), and organisational compatibility (Grover and Teng, 1992). Several factors that are external to the organisation also impact the adoption decision. These include market competitiveness (Kunnathur et al., 1996) and pressure from other trading partners (Grover, 1993).

Previous research (Kimberly and Evanisko, 1981) indicates that larger organisations

tend to adopt new technology more quickly than smaller organisations because they have the in-house expertise and financial resources available to readily evaluate a technology for possible future adoption. Larger organisations have been found to have a positive relationship with technology adoption because larger firms have the slack resources, economic of scale and competitive pressure needed to best utilise the technology. However, other research has found that smaller organisations are more able to adopt new technologies since they are generally able to be more flexible in their decision-making processes (Utterback, 1971). To address this issue, both the large organisations and SMEs are compared with several salient factors to determine which factors influence them the most when deciding to adopt Internet technology. Thus, the objective of the study is to find answers to the following research questions.

RQ1: Larger companies that perceive greater benefits from adopting internet will more likely to adopt internet technology than smaller companies

RQ2: Larger companies that perceive that internet technology is compatible with their existing beliefs and work practices will more likely to adopt internet technology than smalle companies.

RQ3: Larger companies that perceive that internet technology is compatible with their existing information systems environment will more likely to adopt internet technology than smaller companies

RQ4: Larger companies perceive the adoption of internet technology as a less complex process will more likely to adopt internet technology than smaller companies.

RQ5: Larger companies that receive pressure from their key trading partners to adopt internet technology will more likely to adopt internet technology than smaller com panies.

RQ6: Larger companies with top management support for the adoption of internet technology will more likely to adopt internet technology than smaller companies.

RQ7: Larger companies that are in a highly competitive environment will more likely to adopt internet technology than smaller companies.

LITERATURE REVIEW

The internet is not just for SMEs. That is the gist of findings in a report compiled by the London School of Economics and E-Audits, a UK-based internet research company entitled "The Web 2000 Top 100 G: ·th Report". The study aims to explore links between corporate growth and business practice on the Web. The report mentions that large, traditional brick-and-mortar companies are learning how to expand and evolve successfully by embracing

new media technologies and electronic business. One of the key findings is that many of the world's largest and best-established enterprises are also among the most successful proponents of e-business. This phenomenon reflects the superior resources of big companies as well as the perennial winners' knack for staying abreast of changing markets and technologies but it also runs against the grain of popular perceptions that the biggest companies, too big and slow on their feet to react to the lightning fast pace of hi-tech trends, are laggardly in their approach to e-business." The indication here is that a lot of the brick and mortar companies are behind," said Pamela Mahoney, a spokeswoman at Novell. In fact, they have been doing a fair amount of work"

The report complements a Forrester Research report (Computimes, 2000) that small businesses hoping to maintain their lead in e-business lead will have to recognise that the big companies are not going to remain content to sit on the sidelines. The survey notes that the world e-commerce market growth is projected to reach US$1.65 trillion by 2004, up from US$180 billion this year. And within that framework, large companies with sales over US$10 billion annually tend to be the ones with the most sophisticated and innovative e-business capabilities. However large companies are perceived to be moving slowly in reaction to the internet's growth, perhaps many of the big companies are waiting for smaller, higher-risk companies to spend their money, and make the important mistakes first. "There is an adoption curve, and the early adopters are the ones who are willing to take the greatest risks but now that the internet has proven itself, there will be a lot more companies both large and small who are comfortable in making the kinds of investments to extend their business. And obviously the Net's is not going away" said Mahoney.

Furthermore, business start-ups with limited access to funding should consider findings a partner with "dot.com" capabilities rather than experiment on e-commerce on their own. Andersen Consulting partner Jeffrey R. Smith said "small companies always wanted to be ahead of the big companies, but their web-enabled strategy always face constraints in capital and assets, as well as limited management team and attention". More often, SMEs forgotten to attach value proposition on their Web sites, so much that 90 percent of e-commerce ventures ended up as failures (Computimes, 2000).

Many companies believe that the internet is going to change how companies do business in the next five years. And looking at today's happenings, especially through reports in the media, the big picture shows that the Malaysian business community is already moving towards conducting their business electronically. Traditionally, smaller companies have been less likely to invest in a network infrastructure like the internet. The five major problems that small and medium enterprises (SME) faces are; financial support, computer literacy, lack of proper marketing strategies, human resource and environmental issues. Currently, only 40 percent of the total 110,000 SMEs in the country are using the internet while 70 percent use e-mail facilities," said Deputy Energy, Communication and Multimedia Minister Datuk Tan Chai Ho. However the internet and e-mail is levelling the playing field. In the old days, small firms had no chance, when only big companies had computers. Today, even the smallest firm can sit at the grown-ups table when it comes to technology (IDC, 1999). A

small company's average Web purchase will total only a fraction of a larger company's average purchase, but what small businesses lack in size they will make up for in quantity (IDC, 1999).

Electronic commerce (e-commerce) is another aspect of internet technology that is having tremendous impact on the SME community. Through e-commerce, the SMEs are able to reach a wider audience for their products without having to establish a physical presence. According to Abdul Rahim Daud (CEO, Telekom Malaysia), "e-commerce network is emerging as the largest, richest, most diverse, borderless, and sleepless market of goods services, and ideas that the world has ever seen. It is inherently global and SMEs will discover that by adopting this electronic medium, they are half way to securing a position in the global market place" (Computimes, 2000).

Hitechniaga Sdn. Bhd.'s chief communication officer Terrence Ooi says e-commerce will lower cost and open up new markets that traditionally would require a lot of investment and resources. "The benefits include low start-up cost by lower specialised information technology (IT) investment, low risk, access to new market and reduced delivery cost. It also increase the efficiency of procuring and selling and opens up new opportunity for niche marketing, thereby lowering marketing and promotion costs and improving market intelligence," he says (Computimes, 1999).

Currently, Malaysia have 586 local SMEs engaged in the information technology and multimedia operating in the country last year compared to only 297 in 1998, said Dr. Mohamed Arif Nun, senior vice president (operations) of Multimedia Development Corporation (MDC). So far, a total of 158 Malaysian SMEs had MSC (Multimedia Super Corridor) status out of the total number of 302 companies granted MSC status including 57 SMEs operating in the MSC Central Incubator (MCI). By the end of Phase One of MSC's development plan in 2003, he said MDC expected to reach its target of having 1,500 IT and multimedia SMEs (Computimes, 2000). However, despite the commendable growth of SMEs, Arif said Malaysia is still behind major hubs around the world in terms of the number of SMEs. "Taiwan for example has 4,000 IT SMEs out of a total of one million SMEs, Singapore has less than 1,000 IT SMEs while there are 7,000 IT SMEs in the Silicon Valley with 500 to 600 new IT start-ups a year," he said (Computimes, 2000).

Recently, the campaign by the 21-member Asia Pacific Economic Co-operation (Apec) to push for commerce via the internet in developing economies was held in Brunei. This is to rally millions of SME in the Asia-Pacific region to embrace e-commerce to prevent a digital divide as it opens up trade. The benefits of liberalisation, Apec's key agenda, would be achieved sooner if more SMEs adopted e-commerce, said Lim Jock Hoi, chairman of Apec's policy level group on SMEs ("Apec: Embrace Net commerce", 2000). There are an estimated 40 million SMEs throughout Apec member economies accounting for over 90 percent of all enterprises. They employ anywhere from 32 to 84 percent of the workforce, contribute from 30 to 60 percent of gross domestic product and account for 35 percent of exports in the region. Apec has acknowledged that its members, who were struck down by the regional financial crisis, which erupted in mid-1997, could have mitigated economic

damage if their SMEs had been well developed. For instance, Taiwan's strong SME sector helped the island economy overcome the crisis. Hence, a well-developed competitive SME sector was not only the engine of growth but also contributed to the resilience of an economy exposed to downside risks ("Apec: Embrace Net commerce", 2000).

Therefore, with the internet explosion, there is now a huge business opportunity for both large and small companies. Nonetheless, a research is needed to determine the salient factors that influence organisations of various sizes to adopt internet technology.

HYPOTHESES

In this section, various hypotheses are translated for business study, based on their respective observation. Innovation adoption research indicates that an organisation will only choose to adopt an innovation if it perceives that doing so will provide significantly greater benefits than existing technologies and processes (Rogers, 1983). The organisation must perceive that the adoption of the innovation will either resolve existing operational problems or provide the firm with new business opportunities.

H1: The means for perceived benefits are greater for larger companies than smaller companies

H2: The means for organisational compatibility are greater for larger companies than smaller companies

H3: The means for technical compatibility are less for larger companies than smaller companies

H4: The means for complexity are less for larger companies than smaller companies

H5: The means for trading partner pressure are greater for larger companies than smaller companies

H6: The means for top management support for the adoption of internet technology are greater for larger companies than smaller companies

H7: The means for competitive pressure are greater for larger companies than smaller companies

METHODOLOGY

The research design for the study is exploratory in nature. Exploratory research was designed to provide a summary of some aspects of the environment when the hypotheses were tentative and speculative in nature (Aaker and Day, 1998).

Data Collection Method

The data was secured by means of questionnaires, distributed to both MSC and Non-MSC companies that were planning to adopt, currently adopting and those that had already adopted internet technology. Specifically, eligible respondents consisted of top IT executives who are responsible for managing the assessment and adoption of innovative information systems technologies

According to the "*Computer Era*" directory, the population number of public and private IT organisations in Malaysia is about 1,976. The target population for this study was the organisations in Malaysia IT industry. Selangor and Kuala Lumpur, being the popular places among IT companies (73.5%) was selected as the location of study. The final sample size consisted of 306 respondents selected from records listed in the directory via simple random sampling process. A set of self-administered questionnaire was handed to a potential respondent that satisfies the survey criteria which were later collected once the respondent finish answering it. For this purpose the questionnaires were kept as simple, short and self-explanatory as possible.

Out of the total number of 306 questionnaires distributed, 250 usable questionnaires were returned for analysis. The remaining number was rejected because of incomplete data (6), non-respondents (25), and those that did not adopt the technology (25). Non-response bias was also tested using chi-square test and the result show there were no significant difference, at $\alpha = 0.05$.

Data Analysis Techniques

Data were analysed using descriptive statistics, factor analysis, Cronbach' coefficient alpha, and MANOVA. To analyse the respondent's background, descriptive analysis and common measures such as total, mean, frequencies and percentage were utilised. The demographic information included: 1) job title, 2) the respondent's level of experience, 3) MSC status, 4) total number of employees, 5) total number of I/S employees, 6) percent of firm's budget dedicated to I/S, and 7) organisation years in operation. Next, factor analysis was used to assess unidimensionality and Cronbach's coefficient alpha was used to assess internal consistency. The researcher then interpreted the output and related the findings to the hypotheses. (The study consists of seven research hypotheses that were tested using MANOVA technique to determine whether the research hypotheses were supported by the collected data.)

RESPONDENT AND ORGANISATIONAL PROFILE

A series of seven questions were used to obtain demographics information on both the respondent and the respondent's organisation

Table 1: Respondent and Organisational Profile

	Category	Frequency (N) Valid Percentage (%)
Job title		
IT managers	51	20.4
Chief Information Officers	47	18.8
Vice-Presidents	29	11.6
Director of I/S	22	8.8
Others	101	40.4
Experience level		
Very experience	47	18.8
Somewhat experience	72	28.8
Experience	63	25.2
Limited experience	58	23.2
Not experience	10	4.0
MSC status		
Non-MSC companies	126	50.4
MSC companies	124	49.6
Total employees		
Less Than 10 (Micro)	68	27.2
More Than 10 Up To 100 (Small)	97	38.8
More Than 100 Up To 500 (Medium)	46	18.4
More Than 500 (Large)	39	15.6
Total I/S employees		
Less than 3	73	29.4
More than 3 up to 10	91	36.7
More than 10 up to 50	29	11.7
More than 50	55	22.2
Missing	2	
Annual I/S budget		
Less than 1%	82	36.4
More than 1 % up to 5%	113	50.2
More than 5% up to 10%	20	9.0
More than 10%	10	4.4
Missing	25	
Years company in operation		
Less than 1	38	15.2
1 to less than 5	136	54.4

5 to less than 10	55	22.0
10 years to less than 20	17	6.8
More than 20	4	1.6

FINDINGS

An exploratory factor analysis was used to help assess the unidimensionality of the multi-item scales. The unidimensionality of a set of items used to measure a given construct is necessary, but not sufficient, condition for construct validity. Construct validity was also assessed by examining the internal consistency, and convergent and discriminant validity of each construct.

A principle components factor analysis using a Varimax rotation was performed using the twenty-nine items proposed to measure the following seven constructs: *top management support, organisational compatibility, technical compatibility, complexity, competitive pressure, trading partner pressure*, and *perceived benefits*. The criteria used to determine the number of factors to extract was an eigenvalue that was greater than equal to one (Zeller and Carmines, 1980). The results indicated that seven factors had eigenvalues exceeding 1.00 (see Table 2). Thus, seven factors were extracted during this analysis.

Dimensionality of each of the factors was assessed by examining the factor loadings. Items with factor loadings of greater that 0.5 on the factor with which they are hypothesized to load were considered adequate indicators of that factor (Hair et al., 1998). However, items with factor loadings of at least 0.3 on other factors were examined to see it they measured an additional factor.

Based on the rotated results, a new construct called *organizational support* was developed which encompassed both the 3 items in the hypothesized construct *top management support* and 2 items from *organisational compatibility*. Another new construct called *technical complexity* was developed which encompassed both the items in the hypothesized construct *technical compatibility* and *complexity*. As for the 8 items hypothesized to measure the construct *perceived benefits* were loaded on 2 factors *perceived direct benefits* and *perceived in-direct benefits*.

Reliability has been defined as the "degree to which measures are free from error and therefore yield consistent results" (Peter, 1981). One aspect of reliability is internal consistency, which is an indicator of the level of homogeneity of a measuring scale (Cronbach, 2000). One criterion that has been widely used to assess the reliability of a multi-item measurement scale is Cronbach's (2000) coefficient alpha. Based on the reliability analysis result, six of the seven constructs had coefficient alpha values exceeding 0.7 (see Table 2). Only the construct *competitive pressure* had coefficient alpha of 0.54. Nunnally (1994) suggested that a set of items with a coefficient alpha greater than 0.7 is considered internally consistent. Because this construct had a coefficient alpha less then the recommended level of 0.7, its internal consistency was weak. Therefore, it was not used in subsequent analysis.

Table 2: Confirmation of The 7 Factors

Measurement Variable and Dimension	**Factor Loading**
Factor 1: Organisational Support (Reliability α = 0.8900)	
Organisation Values and Beliefs	0.838
Top Management Communicate	0.799
Top Management Interest	0.797
Favourable Attitude	0.797
Top Management Importance	0.788
Factor 2: Trading Partner Pressure (Reliability α = 0.9123)	
Trading Partner Business Needs	0.890
Adversely Impart Trading Partner Relations	0.849
Trading Partner Strategies	0.826
Trading Partner Recommendation	0.815
Factor 3: Perceived Direct Benefits (Reliability α = 0.8877)	
Reduce Transaction Costs	0.899
Improve Overall Productivity	0.865
Improve Cash Flow	0.822
Improve Operational Efficiency	0.759
Factor 4: Technical Complexity (Reliability α = 0.7953)	
Decrease Productivity-Time To Learn	0.818
Complex To Use	0.805
Disrupt Work Environment	0.783
Complex To Develop	0.680
Factor 5: Perceived In-Direct Benefits (Reliability α = 0.9173)	
Improve Existing Customer Relations	0.865
Reach New Customers	0.858
Increase Ability To Compete	0.837
Factor 6: Organisational Compatibility (Reliability α = 0.8444)	
Computerised Data Resources	0.856
Organisational Experience	0.820
Communications Infrastructure	0.772
Factor 7: Competitive Pressure (Reliability α = 0.5438)	
Customers Can Switch Easily	0.751
Intense Competitive Rivalry	0.726
Monitor Competitors Action	0.636

Test Of Hypotheses

MANOVA was used to examine the relationship between four organisation sizes and the final six constructs hypothesized to impact internet technology within organisations. Based on the findings, it can be seen that there is significant relationship between the company sizes and factors for adopting internet technology. The Wilk's Lambda, (F-value = 8.88) and the level of significance, (p-value = 0.0001 < 0.05), indicates that the means for the four different company sizes contained significant differences at the $\alpha = 0.05$ level (see Table 3).

Table 3: MANOVA Statistic Results

Statistics	F-value	D.F.	p-value
Wilks' Lambda	8.881	21	0.0001
Pillai's Trace	7.508	21	0.0001
Hotelling's Trace	10.382	21	0.0001
Roy's Largest Root	28.583	7	0.0001

Tukey's Studentised Range (HSD) Test shows that there were significant differences between the means of six of the seven proposed internet technology adoption constructs and the four company sizes established for this study (see Table 4).

Table 4: Summary of Mean Values by Construct for Different Company Sizes

Constructs	Large (More Than 500 Employees)	Medium (100 Up To 500 Employees)	Small (10 Up To 100 Employees)	Minor (Less Than 10 Employees)
Perceived Direct Benefits	3.44	3.36	3.12	2.93
Organisational Compatibility	3.86	3.61	3.35	3.13
Technical Complexity	2.10	2.17	2.31	2.57
Trading Partners Pressure	3.73	3.33	2.83	2.69
Organisational Support	4.47	4.28	3.75	3.36
Perceived In-Direct Benefits	4.39	3.72	3.39	2.92

NOTE: The scale used for all constructs ranged from 1 (strongly disagree) to 5 (strongly agree)

Table 5 shows a comparison of adoption factors between larger organisations and smaller organisations by using their respective mean values. The adoption factors ranking identified for larger organisations are difference to those for smaller organisations, with exception of *organisational support* and *technical complexity*. The differences were *perceived in-direct benefits, organisational compatibility, trading partner pressure*, and *perceived direct benefits*. *Perceived in-direct benefits* factor was second in importance for larger organisations and was fourth in importance for smaller organisations. *Organisational compatibility* was second in importance for smaller organisations and was third in importance for larger organisations. *Trading partner pressure* was fourth in importance for larger organisations and was fifth in importance for smaller organisations. The *perceived direct benefits* factor was third in importance for smaller organisations and was fifth in importance for larger organisations.

Table 5: Comparison Between Larger and Smaller Organisation

Larger Organisation	**Smaller Organisation**
1. Organisational Support	1. Organisational Support
2. Perceived In-Direct Benefits	2. Organisational Compatibility
3. Organisational Compatibility	3. Perceived Direct Benefits
4. Trading Partners Pressure	4. Perceived In-Direct Benefits
5. Perceived Direct Benefits	5. Trading Partners Pressure
6. Technical Complexity	6. Technical Complexity

This result is further supported by an analysis on each of the adoption factors, the F-values obtained from the univariate analysis of variance for each construct were significant between the different company sizes for hypotheses, H1 (*perceived direct benefits*), H2 (*organisational compatibility*), H3 (*technical complexity*), H4 (*trading partner pressure*), H5 (*organisational support*), and H6 (*perceived in-direct benefits*) (see Table 6). In short, the level of significance, p, rejects the null hypothesis (H_0) and accepts the alternative hypothesis (H_1).

Table 6: Summary of Research Findings By Company Sizes

Constructs	**F-value**	**P-value**	**Expected Results**	**Actual Results**
Perceived Direct Benefits	4.792	0.0020	Greater Means for Larger Companies than Smaller Companies	Supported
Organisational Compatibility	8.367	0.0001	Greater Means for Larger Companies than Smaller Companies	Supported
Technical Complexity	4.801	0.0030	Lower Means for Larger Companies than Smaller Companies	Supported

Trading Partner Pressure	19.877	0.0001	Greater Means for Larger Companies than Smaller Companies	Supported
Organisational Support	34.126	0.0001	Greater Means for Larger Companies than Smaller Companies	Supported
Perceived In-Direct Benefits	35.574	0.0001	Greater Means for Larger Companies than Smaller Companies	Supported
Competitive Pressure (*)			Greater Means for Larger Companies than Smaller Companies	Not Supported

NOTE: * not included in MANOVA because the factor was not internally consistent

CONCLUSION

The main objective of this study was to determine the CSFs that influences large and small companies to adopt internet technology. This study was carried out using a questionnaire survey on 306 randomly selected IT organisations located around Selangor and KL. Appropriate measure of control and precautions were taken during each section to produce more reliable and meaningful views and opinions. Through a pilot test, the reliability and consistent of the survey instrument were examined. Factor analysis was used to group and minimise 29 variables into 7 constructs for easier management. The correlation of the constructs was also investigated. As a result, the *competitive pressure* construct was found to be not reliable; thus, dropped from further analysis.

The overall result shows that there was significant difference between large and small companies and six of the seven constructs (i.e. *organisational compatibility, trading partner pressure, organisational support, perceived direct benefits, perceived in-direct benefits*). In short, these factors influences larger companies more than smaller companies when it comes to deciding internet technology adoption. With exception of the *technical complexity* construct, which show larger companies were less concern about technical issues than smaller companies before adopting a new technology.

According to theory, larger companies are more likely to adopt internet technology if it is compatible with their existing beliefs and work cultures than smaller companies because most of the smaller companies are still fairly new, thus, should face lesser problems to incorporate new technologies into their corporate cultures. As for the technical complexity issue, larger companies were less concern about it than smaller companies as they have more financial resources to spend on hi-tech equipments or/and hire external consultants to solve any problems they might face. In addition, larger companies have more I/S staffs per total company employees than smaller companies. Larger companies also have to

communicate their intention to more internal and external parties (i.e. employees, trading partners, and customers) to gain support from them, otherwise none of them would know about it and use it. Since larger organisations have to deal with more trading partners, they tend to receive more pressure from them than smaller organisations. Finally, larger companies are more particular about the direct and indirect benefits from adopting internet technology because any decision they make will affect their operations, productivity, competitiveness, customer relations, cash flow, and etc.

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