

**The Electronic Commerce Among Taiwanese
SMEs-- The “Industrial Electronic Database” Project**

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Abstract

The purposes of this paper are twofold: first, to investigate factors influencing Taiwanese Small and Medium Enterprises (“SMEs” henceforward) adopt Electronic Commerce (“EC” hereafter). Second, to evaluate the performance of the “Industrial Electronic Database” project. The very task, coordinated and led by the SMEA (the Small and Medium Enterprise Administration) of Taiwan during the second half of the year 1999 to the end of 2000, was oriented towards the EC promotion among SMEs in Taiwan across different industries.

The study took on a questionnaire-survey conducted by SMEA. The survey gathered information from 2100 firms, which participated in the “Industrial Electronic Database” project. 410 SMEs responded, ranging from electronics, toys, plastics, shoes, to publishing and so on, representing 20 various industries. Several intriguing results are uncovered such as how the sampled firms viewed the impacts of the prevailing EC, and in what way they would react or were responding. The survey also reveals and pinpoints some of the areas that require the assistances from and improvement of the government.

The contribution of this paper is to delineate the status quo of EC development of the Taiwanese SMEs, and hopefully to shed some lights from an area where there is little empirical research so far on the factors influencing Taiwanese SMEs adopting EC to improve and maintain their positions in the new digital era.

PREFACE

It is beneficial to investigate how Taiwanese small and medium-sized enterprises are to embrace electronic commerce in terms of the factors that may influence these SMEs to adopt the new Internet mechanisms. These firms not only represent the plurality of business firms in that country but also were the ignition key in creating the famous economic miracle of Taiwan [11]. How these firms maintain the economic wonders in the new technological epoch plays essential roles in demonstrating to their counterparts of other countries.

This paper has dual purposes: first, through the process of evaluating the performance of the “Industrial Electronic Database” project, this study provides descriptive insight into factors influencing SMEs’ adoption of EC. The second aim of the paper is expectantly to prompt the government and other interest parties to take heed of critical issues when promoting electronic commerce development among Taiwanese SMEs in the future.

LITERATURE REVIEW

A. Electronic Commerce

Before further examination of the Electronic Commerce discussed in this paper, the scope and the nature of the EC among the enterprises need to be more specifically stated.

As far as the scope of Electronic Commerce is concerned, Table 1 provides some brief list from the literature that summaries a wide variety of business applications on the Internet. As can be seen from Table 1, the Internet has been used in area particularly for exchanging information, communicating a firm’s offering, building corporate image, strengthening customer relationship, enhancing inter-firm cooperation and increasing sales. Therefore, many

organizational functions, especially in marketing and sales, can be improved with the use of the Internet technology [3,4,5,9]. In summary, since the Internet has impacted business in many ways, businesses on the **Internet have been suggested repeatedly as something that will affect business operations, marketing, customer relations, and inter-firm relationships.** This paper follows this notion in defining the concept of Electronic Commerce.

The nature of Electronic Commerce, according to the definition used by the Commerce Department of the Ministry of Economic Affairs of R.O.C. (Taiwan), is “any transactions in which both parties undertake transactions using computers over a network”. The participants in e-commerce include enterprises, the government and the consumers. The possible transaction types include those between enterprises(B2B), between enterprises and consumers (B2C), between enterprises and the government (B2G), between consumers and the government (C2G), and other combinations (White paper of SMEs, 2000). **This paper focuses on the B2B transactions.**

Table 1: The Use of the Internet in Business Activities

Research	Business Activities
Kalakota and Winston[15]	Four types of transactions: <ul style="list-style-type: none"> <input type="checkbox"/>between a company and consumers for the purpose of home shopping and home banking; <input type="checkbox"/> between business partners; <input type="checkbox"/> for information gathering such as market research; and <input type="checkbox"/> for information distribution, such as marketing, advertising, and sales.
Hoffman, Novak And Chatterjee[12]	<ul style="list-style-type: none"> <input type="checkbox"/>Providing detailed information on a firm’s offering; <input type="checkbox"/>Creating an image; <input type="checkbox"/>Building an ongoing relationship with the consumers; <input type="checkbox"/>Online storefronts; and <input type="checkbox"/>Content.
Massotto[17]	<ul style="list-style-type: none"> <input type="checkbox"/>Marketing and Sales; <input type="checkbox"/>Public Relations/Corporate Communications; <input type="checkbox"/>Purchasing; and <input type="checkbox"/>Internal communications.
Ainscough and Lockett [3]	<ul style="list-style-type: none"> <input type="checkbox"/>Interactive brochure; <input type="checkbox"/>Customer service tool; <input type="checkbox"/>Virtual storefront; and <input type="checkbox"/>Information clearinghouse.

Frank [9]	<input type="checkbox"/> Electronic exchange of information, goods, services and payment; and <input type="checkbox"/> Creation and maintenance of Web-based relationships.
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Source : Xeuli Huang , Geoffrey N. Soutar , Alan Brown, 2000[24]

B. The measures of Electronic Commerce

The barometer of Electronic Commerce employment by SMEs is the extent or degree of Internet uses suggested by Drennan and Kennedy (2000)[7]. Factors affecting Internet use, as suggested by Iacovou and his colleagues [14] and Drennan and Kennedy (2000)[7] are: perceived benefits, organizational readiness, and external pressures to adopt.

Perceived benefits or value was one of the critical factors for EDI adoption among small businesses [12] and is a key reason why firms adopted and continue to use the Internet [19].

Organizational readiness consists of the level of financial and technological resources of the firm [7]. Constraints of capital and expertise [20], limits of managerial time, poor support, and limited financial resources [6] serve to inhibit IT growth for small firms. We further break down Organizational readiness into adoption cost and IT-competence. Adoption costs are more related to additional investments of capital and personnel when firms decide to adopt EC mechanisms. IT-competence is associated with the degree a firm utilizes new technology and the ability in integrating new technology into its existing IT applications.

External pressures are related to government, competitive and customer demands. Brian, Santos and Peffer [21] reported that new technology adoption by firms in the service and retail sectors was influenced by external agencies such as vendors and professional associations, and also affected by competitors who are using more sophisticated IT.

C. Small and Medium Enterprises

Given that this paper's focal point is on the Taiwanese Small and Medium Enterprises, and different countries employ diverse meanings of SMEs, a vigorous definition of SME is necessary. The definition of the SME, according the SMEA of Taiwan [23], is as follows:

1. Capital requirements:

- a. In the case of manufacturing, construction, mining or quarrying enterprises, its paid-in capital shall not exceed NT\$80 million; or
- b. In the case of agriculture, forestry, fishing, animal raising, plumbing, electrical power, gas and fuel-oil supply, commerce, transportation, warehouse, communications, finance, insurance, real estate, industrial service, commercial service, social service or personal service enterprises, its total operating revenue in the preceding year shall not exceed NT\$100 million.

2. Regular Employees requirement:

The following number of regular employees can serve as standards for identifying medium and small enterprise when the above regulations are not applicable:

- a. In the case of manufacturing, construction, mining or quarrying enterprises, the number of its regular employees shall not exceed 200 persons; or
- b. In the case of agriculture, forestry, fishing, animal raising, plumbing, electrical power, gas and fuel-oil supply, commerce, transportation, warehouse, communications, finance, insurance, real estate, industrial service, commercial

service, social service or personal service enterprises, the number of its regular employees shall not exceed 50 persons.

3. The “small-scaled enterprises” are enterprises that meet the following criteria:

- a. In the case of manufacturing, construction, mining or quarrying enterprises, the number of regular employees shall not exceed 20 persons,
- b. In the case of agriculture, forestry fishing, animal husbandry, plumbing, electrical power, gas and fuel-oil supply, commerce, transportation, warehouse, communications, finance, insurance, real estate, industrial service, commercial service, social service or personal service enterprises, the number of its regular employees shall not exceed 5 persons.

The study presented in this paper adopted these conventions as referring to the definition of SMEs.

D. The “Industrial Electronic Database” project

The “Industrial Electronic Database” project, which started in July 1999 and closed at the end of the year 2000, was coordinated and led by the SMEA (the Small and Medium Enterprise Administration) of Taiwan. The task was oriented towards the Internet promotion among SMEs in Taiwan across different industries. Basically, it attempted to establish a composite internet-based database portal to integrate different industry information within.

The database portal serves several purposes. First, it endeavors to become a horizontal liaison and a portal website in bridging and linking different industries. Second, the database provides a communication channel between government agencies and private sectors. Via this channel, information regarding international businesses and foreign trades gathered by many government institutions may be passed on to those enterprises more directly and

completely. And finally, in view of the fact the two disadvantages that most Taiwanese SMEs possess: slow moving in new technology utilization, and having relatively fewer opportunities in engaging new business opportunities [13], this database portal expectantly may provide an incentive and gateway for SMEs to reach out.

The practice of the project was as follows. Given that the numbers of SMEs in Taiwan exceeds millions (White Book, 1999), it is almost impossible to reconcile and integrate the diverse ideas and views from all the SMEs within one and half a year as the project elapsed. Therefore, 20 industrial associations, which represented 20 different industries, were invited to play an active role in performing the project. In short, these “pilot” associations representing the 20 different industries were gathered to assist in idea, views and industrial knowledge transfers, to communicate with software agencies primarily responsible for implementing the database portal, and to help shape and the composite database portal to fit practical uses.

Some 20 computer-consulting vendors, as mentioned earlier, took the roles of software agencies in actively responding to the requirements fed by the pioneering industrial associations. They further integrated the requirements to a composite cross-industry Internet–platformed database. Therefore the involvement of software agencies in this “Industrial Electronic Database” project cannot be overlooked.

In summary, the database portal was an initial common ground for Taiwanese SMEs to adopting Internet deployment. Also, the implementation route of the project was basically “top-down”, meaning each “pilot” industrial associations assumed to be a driving force in the process of building up the congregation site where hopefully the idea of EC can be further realized **downward** to each SME.

RESEARCH METHOD

Data sources: The source on which this study was based is a questionnaire-survey conducted by the SMEs Management Information System Center of the SMEA from September of year 2000 to late October of the same year. As the “Industrial Electronic Database” project was approaching the end, the “pilot” associations created the sampling frame by selecting 100 prominent firms from the members of its association to evaluate this project. Though no random sampling was performed, this research still took the survey as a useful source for the leading 2100 SME in 20 various industries as the sampling frame provide valuable information.

The questionnaire consists of two main sections. The first section was regarding Taiwanese SMEs’ general perceptions toward Internet utilizations or EC; second, the evaluations of the project by the responding firms. The evaluation portion is further broken down to four areas: the overall views toward the project, the assessments of the liaison industrial association, the appraisals towards the implementing software agencies, and the views to the operations of the government agencies. Most of the survey questions were scored on a five-point Likert scale, ranging from "strongly disagree" to "strongly agree" for each statement.

In addition to the aforementioned survey, this paper also includes other pertinent survey results¹ for two reasons. First, a cross-examination will provide better validity. Furthermore, the perspectives of this research will be broadened as well.

Findings and Analyses

A. Sample profiles

1. Of the 2100 sample firms, a total of 453 questionnaires were received. After eliminating

11 samples for incompleteness, and 32 others with incorrect scale of the firms (should be categorized as large enterprises), 410 SMEs were eligible samples with a response rate of 19.52%.

To further categorize the responded samples from different angles such as scales, sector types, and responding rates, the profiles are in the following:

Table 2: Response Rate – by Scale

Scale of the respondents	No. of responses	Percentage of the total response
Medium Enterprises	266	64.88%
Small Enterprises	144	35.12%

¹. Several similar surveys were conducted by different institutions during almost the same period of time as this survey (see reference 22). A cross-comparison should provide more concrete idea and statement.

Table 3: Response Rate – by Sector

Sector	No. of Responses	Percentage of the total response
Manufacturing	355	86.59%
Services*	55	13.41%

*Service industries including this survey refer to publishing, multimedia, architecture and construction services and travel agencies.

Hence this study would primarily demonstrate the status quo of medium-sized, manufacturing-oriented SMEs in Taiwan.

2. Of the 20 industries, the 5 industries with the highest response rate are as follows (priority from the first highest):

Table 4: Industries with the highest response rate

Industry	No. of Responses	Percentage of the total response
Textiles (including knitting)	46	11.22%
Casting	43	10.49%
Plastics	34	8.29%
Electronics	32	7.80%
Toys	30	7.32%
Total	165	45.12%

- As we compared the above sampling profiles with the statistics of SMEs published by SMEA (White paper, 1999), the sample data provided relatively sound reference regarding to its population. Table 4 illustrates 3 industries with the greatest sales in 1999 and the ratio of each industry sales amount comparing to the total of the whole of 1999. In the table, metal products (including casting), plastics, electronics and textiles (including Filament silk weaving) collectively stood for 46.83% of the total sales of 1999. Therefore, the sampled industries (see Table 4) should be able to illustrate sensible representation of the population in terms of the relative importance of sales.

Table 5: Industries and Sales s In 1999 Unit: of NT dollars (million)

Industry	Sales	Percentage of the total Sales	Percentage of the total response
Metal Products	430040	18.50%	10.49%
Electronics	323221	13.91%	7.80%
Plastics	214232	9.22%	8.29%
Textiles	120841	5.20%	11.22%
Total	1088334	46.83%	37.8%*

*The sales amount of the toys industries was not available in the White paper, 1999. Therefore, toy industry with the fifth high response rate in the survey is not included.

B. Taiwanese SMEs' general perceptions toward Internet utilizations or EC

- Of the respondents, 85.21% agreed that EC is a necessary mechanism for the competition in the 21st century, and 42.64% of the respondents believed EC would bring values/benefits to their businesses and operations. But only 23.41% of the sampled SMEs understood the mechanisms and applications of EC, and only 14.63% of the respondents contended to have successfully adopted EC and integrated Internet into their daily operations².
- From the standpoint of the scale of firms, medium firms illustrate similar degree as small firms in the dimension of familiarity with EC (small firms are 1.15 times of the medium firms)³, but the medium firms believe to some extent more in that EC is a necessary mechanism than the small firms do (1.365:1)³.
- Firms, which were more familiar with the EC mechanism, agreed that EC is a necessary mechanism for the competition ($p < 0.0001$)⁴.
- Firms, which more agreed that EC was a necessary mechanism for the competition in 21 century, have contended that they adopted the mechanism of EC more successfully ($p < 0.0001$)⁴.
- Though the scale of the firms seemed not a significant factor in differentiating whether the sample firms have adopted Internet mechanism (small to medium: 1.064:1), the reverse demonstrated extremely different looks. Those 60 firms which claimed that they

have successfully adopted the Internet mechanism (responding with score of “5” or “4”) are two times more likely to be a medium firm than a small one. Furthermore, among these 60 successful-adoption firms, 45 firms contended that they were familiar with the EC mechanism. In short, the scale of the firms (capital and man powers), and the familiarity with the Internet mechanism played some role in the success of Electronic Commerce.

²We conducted a preliminary analysis by separating the samples into 2 groups by aggregating samples scoring “4” (“agree”) and “5” (“strongly agree”) to group one (group “positive”), and summing up those scoring “1” (“strongly disagree”) and “2” (“disagree”) to another (group “negative”). We then compared these 2 groups to secure the proportions of the sampled SMEs responding to each different statement. Only positive group are reported in the above statement.

³Since the questionnaire items are mostly ordinal-scaled, we adopted Cumulative Logit Models to analyze the survey data. Cumulative Logit Models have simpler interpretations and greater power than ordinary multicategory logit models since logits can directly incorporate the ordering of ordinal response categories[1].

⁴We further analyzed data by modeling ordinal associations. Through testing independent models, ordinal loglinear models or saturated models for two-way tables, we acquired the likely associations of 2 ordinal responses [2].

6. The six most anxious EC business applications SMEs asserted were: exploring trading opportunity, Business Intelligence management, digitalized catalogues, on-line inquiries, on-line quotations and supply chain management. Marketing-oriented motive should be an important reason for SMEs to adopt EC.

Table 6: The EC business Applications SMEs desire to build up

EC business Applications	Samples counts
Exploring trading opportunity	375
Business Intelligence management	359
Digitalized catalogues	285
On-line inquiry	233
On-line quotations	222
Supply chain management	212

C. The evaluations of the project:

1. The responding firms’ overall views of the “Industrial Electronic Database” project

- a. Although 74% of the respondents agreed that the cross-industry information database applications should be implemented, 55% of the respondents were unaware of the project in the first place; and only 23% of the respondents actively participated in the

project during the execution period.

- b. Up to the survey period, only 14.63% of the respondents had successfully integrated the internal applications with the external databases set up by the “Industrial Electronic Database” project.

Generally, this project still has great room for improvement. To pinpoint the problems of the project, we carefully checked the comments left by the sample SMEs. From the sample responses, several main evils need to be addressed: the lack of promotion of this project by the industrial associations, the deficiency of technical support by the software agencies and immature infrastructure provided by the government. More details are stated in the following.

2. The assessments of the liaison industrial associations

- a. Only 28% of the respondents were positive about the service rendered by industrial associations, 36% were negative.
- b. 32% of the respondents were positive about the related industrial association’s specific technical service, 31% were negative.

From the comments left by the responding SMEs, most of the complaints were regarding the industrial associations that were unable to play a good role as a coordinator between SMEs and software agencies, neither were their promotion campaigns for EC adoption for their member SMEs sufficient. Due to these deficiencies, a great portion of the respondents did not really understand the purposes and content of the “Industrial Electronic Database” project.

3. The appraisals of the work in assisting software agencies

- a. 42% of the respondents were unsatisfied with the service and training provided by the assisting agencies (software companies), only 21% was satisfied.
- b. 53% of the respondents were negative about the performance of assisting agencies (software companies) because the agencies were incapable of understanding industrial characteristics and needs.

Another primary criticism about the project was concerning assisting software agencies (vendors): the software vendors were unable to provide a total solution integrating new EC technology with SMEs’ current industrial practices. For this reason, the software agencies or vendors were deemed incapable to provide enough

technical support in helping SMEs setting up EC mechanism.

4. Views of the endeavors of government agencies

- a. Only 19% of the respondents recognized the assistances and services in promoting EC by the government.
- b. 65% of the respondents agreed that the government should devote more to establishing EC infrastructure.

From the comments of sample SMEs, we conclude the following problems concerning the government:

- a. **Policies and procedures:** the government did not provide any long-term comprehensive EC policies, clear procedures or appealing incentives to assisting SMEs, industrial associations or supporting software agencies in adopting EC. Since most of the project participants were unclear about the positions of the government, efforts were nullified.
- b. **Infrastructures:** EC infrastructures have been the major concerns of SMEs when it comes to the EC environment. Overall, the four most concerned issues regarding the EC infrastructures are transaction safety, bandwidth speed, information accuracy and regulations on EC transactions.

Table 7: Most Concerned regarding EC Infrastructure

Issues	Samples counts
Transaction safety	211
Bandwidth speed	195
Information accuracy	186
Regulations on EC transactions	196

Unless doubts on the infrastructures could be further eliminated, high EC adoption extent among SMEs is unlikely to happen.

IMPLICATIONS

A. Long-term perceived value and benefits were recognize, while short-term value was unrecognized.

From the result of the survey, most of the respondents (85%) agreed that EC is a necessary mechanism for the competition in the new era, and approximately 43% of the respondents believed EC would bring values/benefits to their businesses and operations. However, in

another survey titled “The Electronic commerce’s Impact study for SMEs” conducted by SMEA around August 2000[14], the most dissatisfied outcome after adoption of EC mechanism was being unable to secure more customers. In another words, **the Sampled SMEs did believe that if they engaged in EC, they would be more ready to capture and sustain the long-term competitive advantages in the new era. Yet short-term quantifiable values (e.g. numbers of new customers) have not been realized yet.** Unfortunately, these short-term direct values are the main driving force of Taiwanese SMEs to go online (see previous page 12 Table 6 for details). Therefore, the SMEs in Taiwan are experiencing a conflict between long-term ideas and short-term realities. This phenomenon, however, is not exceptional since similar reporting was present in the observations of EC uptakes in Australia and U.S⁵.

⁵ In an exploratory study into why Small business are online, Poon and Swatman [19] investigated 23 Australian small firms and discovered that the perception of long-term benefits and potential business opportunities is what driving Small business hooked online. However, most of the firms contended that the short-term values have been marginal and circumstantial. Another empirical study conducted in the U.S. reported comparable complaints [18].

B. While adoption costs of EC are higher than adoption benefits, fewer SMEs will take up EC.

Despite SMEs’ high recognition of the long-term benefits EC may convey, only 23% admitted that they really understood the mechanisms and applications of EC, and only approximately 15% of the respondents contended to have successfully adopted EC and integrated the Internet into their daily operations. After looking into the comments returned from the SMEs, presumed high adoption costs appeared to be the prime obstruction⁶.

Regarding the adoption cost constraint, the void of extra capital and expertise for IT investment ranked the first reason that inhibits SMEs from taking up EC [22]. The result of the study justifies that presumed high adoption costs was one of the reasons why low adoption extent of EC was prevalent among Taiwanese SMEs, notwithstanding widely accepted beliefs in the long-term benefits of EC.

C. The gap between SMEs’ self IT-competence and new EC mechanism curbs SMEs from adopting EC.

Firms, which were more familiar with the EC mechanism, agreed that EC is a necessary mechanism, and have contended that they adopted the mechanism of EC more successfully ($p < 0.0001$). But up to the survey period, only 15% respondent had successfully integrated the

internal EC applications.

In Poon S. & M.C. Swatman [19] study, little integration between the Internet and the firms' internal systems was observed in Australia. Therefore, even if customer orders were sent in through the Internet, most SMEs still need to process it manually or convert it to the firms' internal systems by hand. This gap greatly eliminated the benefits EC would conceive.

D. External pressures from the government, the vendors (software agencies) and the professional associations were not significant.

If we look into the above unsatisfactory outcomes of evaluations on different parties participating in the project, we may conclude that external influences on SMEs are not significant yet.

Since the external agencies such as vendors (software agencies), professional associations (industrial associations), and also the government seem not yet demonstrating strong influences in EC adoption, it also gives explanation for the low degree of EC adoption.

⁶Since the survey questionnaire did not include items concerning what hinders SMEs in using EC specifically, we looked into the seriatim comments of 350 samples which had confessed not adopting EC successfully. We then compared this result with another survey "EC's Impact study for SMEs" [22] conducted by SMEA.

CONCLUSIONS

Through the questionnaire-survey conducted by SMEA, we first evaluated the overall perceptions of Taiwanese SMES towards EC and concluded the results into two different dimensions: internally, the balance between SMEs' perceived values and organizational readiness in adopting EC; externally, the influencing third parties including industrial associations, technical software agencies and the government.

We discovered that although SMEs perceived EC as a likely long-term benefit initiator, they presumed adopting EC would cost dearly. Also, the gap between current SMEs self IT-competence and new EC technology prohibits SMES to embrace EC. Therefore the fact that the adoption costs overwhelmed the perceived benefits resulted in low adoption extent. These anxieties and concerns need to be further eliminated by the external influencers i.e. the government, the professional associations (industrial associations) and the software vendors. For example, the government should pronounce long-term policies and substantial encouragements in assisting SMEs to get online, e.g. tax deferral or reductions. Moreover, other motivations to other interest groups involving EC adoption can also help. Funding industrial associations and software vendors to provide SMEs with educations in employing EC mechanisms may be a good start. Finally, the recent deregulation of telecommunication

infrastructures appears to be a correct decision in speeding up the maturity of the EC environment.

LIMITATION OF RESEARCH

The survey this paper was based on conducted convenience sampling, which has less controls to ensure precision (Cooper & Schindler, 1998). However, it may still be a useful procedure in exploring factors influencing Taiwanese SMEs to adopt EC.

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