

December 2006

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Sherry Thatcher  
*The University of Arizona*

Ling Zhu  
*The University of Arizona*

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## Recommended Citation

Thatcher, Sherry and Zhu, Ling, "Institutional Environments for B2B E-commerce Adoption: A Quantitative Study of Electronics and Textiles Firms in Greater China and the U.S." (2006). *AMCIS 2006 Proceedings*. 424.  
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# Institutional Environments for B2B E-commerce Adoption: A Quantitative Study of Electronics and Textiles Firms in Greater China and the U.S.

**Sherry M. B. Thatcher**

Department of Management Information Systems  
Eller College of Management  
The University of Arizona  
sherryt@eller.arizona.edu

**Ling Zhu**

Department of Management Information Systems  
Eller College of Management  
The University of Arizona  
lingz@email.arizona.edu

## ABSTRACT

Grounded in institutional theory and IT adoption literature, we conducted a quantitative analysis assessing the effects of industrial, governmental, regulatory, and cultural factors on the initial stages of B2B e-commerce adoption. Our analysis is based on survey data collected from electronics and textiles firms in China, Taiwan, Hong Kong and the U.S., reflecting business perceptions of institutional environments in emerging and traditional industries and in developing, newly industrialized, and developed economies. The results of our analysis indicate that industrial and governmental encouragements are the most powerful facilitators at the beginning of B2B e-commerce adoption. There are also significant culture and country effects. The study confirms that institutional environments exert an important influence on organizations' decisions on whether or not to adopt e-commerce. It is one of the first cross-country and industry-level empirical studies on institutional environments and the research results have policy implications for global e-commerce development.

## Keywords

Institutional environments, B2B e-commerce, adoption, electronics, textiles, China, Hong Kong, Taiwan.

## INTRODUCTION

Business-to-business electronic commerce (B2B e-commerce) has been both a strategic initiative of private sectors and a key policy issue of public institutions. From a business perspective, when undergoing globalization and economic integration, companies rely on B2B e-commerce systems for cross-border flows of products and services within the entire inter-organizational value chain. From a governance perspective, the economic contributions of e-commerce have attracted the attention of policy-makers and encouraged numerous governmental actions. These institutional activities, in turn, create and shape the environments for firms' e-commerce adoption. In 1997 the U.S. government released the *Framework for Global Electronic Commerce*, suggesting a set of principles to help the growth of e-commerce. Among those principles are that (1) the private sector should lead; (2) governments should avoid undue restrictions on e-commerce; and (3) the aim of governmental involvement should be to support and enforce a predictable, minimalist, consistent and simple legal environment for e-commerce (Clinton and Gore, 1997). The *Framework* recognizes that governments can have a profound effect on e-commerce, either facilitating or inhibiting it. Knowing when and how the government should act is crucial to the development of e-commerce.

The U.S. is indubitably the world's earliest and largest adopter of e-commerce (UNCTAD, 2001). However, e-commerce is not just an American phenomenon, but has the attention of the entire world (Kauffman and Walden, 2001). Some research has begun to address the issues of B2B e-commerce adoption in non-U.S. countries (e.g., Brazil (Tigre and Dedrick, 2004), India (Dasgupta, Agarwal, Ioannidis and Gopalakrishnan, 1999), Mexico (Garcia-Murillo, 2004), and Singapore (Teo and Ranganathan, 2004)). Although most of these studies emphasize the physical infrastructure that explains the variation in basic IT uses, some theoretical arguments suggest that e-commerce adoption also depends on supportive environments, such as industrial initiative, governmental sponsorship, and cultural compatibility (Gibbs, Kraemer and Dedrick, 2003). Little empirical research has looked at the extent to which this is true (Ein-Dor, Segev and Orgad, 1993; Shore, 2001). Very little research has yet investigated the magnitudes of the external factors across different economies. Contrary to these theoretical arguments, a study of Taiwanese small and medium size enterprises (SMEs) concludes that, regardless of whether

government support is available, the central issue of adoption is the organization's internal factors (i.e. whether or not the objectives of e-commerce are consistent with companies' business strategies; (Tsao, Lin and Lin, 2004).

Given the scant and contradictory findings in the previous literature, this paper examines the following research questions: (1) do environmental factors matter in B2B e-commerce adoption? And if so, (2) which factors play significant roles in B2B e-commerce adoption? The study provides empirical evidence to answer these questions, using a survey dataset collected from electronics and textiles firms in the U.S. and Greater China (i.e., China, Taiwan and Hong Kong). China, Taiwan and Hong Kong are all undergoing economic and political transformations in the global information society, while the U.S. has relatively mature markets. The governmental, legal, business and cultural variances may have unique implications for e-commerce adoption in each location. Since e-commerce adoption is an uneven process among countries as well as firms (Gibbs and Kraemer, 2004), this research focuses on the environmental contexts of companies in Greater China, using the U.S. as a benchmark.

This paper is one of the first cross-country and industry-level analyses of institutional environments for B2B e-commerce adoption. This study contributes to the literature on e-commerce adoption from an institutional perspective and helps researchers better understand the environmental factors influencing e-commerce adoption. This study also has policy implications for developing and emerging economies, suggesting ways to create the enabling environment for e-commerce adoption. Furthermore, since business entities always "seek guidance from the experience of others in comparable situations" when facing choices (DiMaggio and Powell, 1991a), those business perceptions at the starting point of e-commerce in Greater China and the U.S. can still be used by companies today for reference on making their own IT adoption decisions.

## **THEORETICAL FOUNDATION FOR THE INSTITUTIONAL APPROACH**

Theoretic tradition views institutions as a framework "of rules, procedures, and arrangements" (Shepsle, 1986). Contemporary institutional theories attempt to answer how social choices are shaped, mediated, and channeled by institutional arrangements (DiMaggio and Powell, 1991a). The institutionalists believe that institutions can reduce organizational uncertainty by providing dependable and efficient frameworks for economic exchange (North, 1986). Applied to B2B e-commerce adoption, the new institutionalism provides an important theoretical approach for conducting analysis on external environments for organizations' decisions.

IS researchers have defined institutions as "any standing social entity that exerts influence and regulation over other social entities" (King, Gurbaxani, Kraemer, McFarlan, Raman and Yap, 1994), and suggest that the relationship between environmental factors and e-commerce adoption (which is decided by business entities operating in those environments) can be explained by institutional theory. For example, the industrial, governmental and cultural factors can be analyzed as institutional environments promoting e-commerce (Oxley and Yeung, 2001). In that context, the institutional environment is the "set of fundamental political, social and legal ground rules that establishes the basis for production, exchange and distribution" (Oxley and Yeung, 2001), and consists of stakeholders such as suppliers, customers, competitors, trading partners, government and society (Gibbs and Kraemer, 2004).

The institutional approach has been used in studies of organizations' adoption of technological innovation. According to their findings, adoption decisions are not purely driven by internal factors, such as the organizational perception of technology, but also influenced as much or even more by the institutional environment in which the organization conducts business (Gibbs and Kraemer, 2004).

## **CONCEPTUAL FRAMEWORK AND HYPOTHESES**

### **Conceptual Framework**

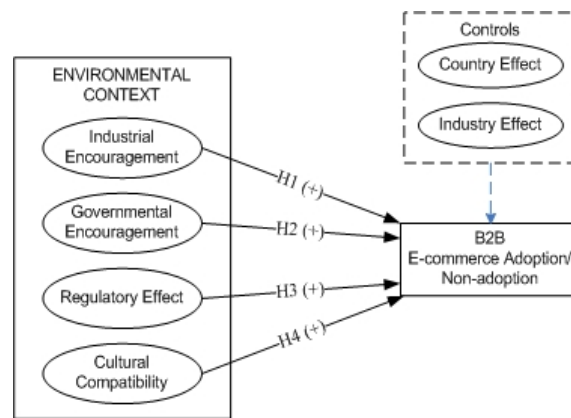
The institutional approach guides our conceptual framework. This framework, as shown in Figure 1, posits four predictors expected to contribute to B2B e-commerce adoption—industrial encouragement, governmental encouragement, regulatory effect and cultural compatibility, controlling for country and industry effects.

The conceptual framework visualizes the variables included in the institutional theory and the logic underlying the theory. First, environmental contexts, rather than internal factors, are treated as independent variables for e-commerce adoption (DiMaggio and Powell, 1991a). Second, the observation and analysis are focused on industrial, governmental, regulatory and cultural factors as a major source of "institutional environments" (Shore, 2001). Third, institutional contexts are particularly important when IT systems bridge both organizational and national boundaries (DiMaggio and Powell, 1991a). Four hypotheses were theoretically derived, each corresponding to one predictor in the conceptual framework.

## Hypotheses

### Industrial Encouragement

The industry within which an organization operates may be instrumental in determining the degree to which an organization participates in B2B e-commerce (Shore, 2001). Trend-setting companies (defined as powerful domestic companies leading the technological innovations) and multinational corporations (defined as cross-national companies that influence the movement of technology) both influence IT innovations (King et al., 1994). In the personal computer (PC) industry in Asia for instance, firms are motivated by international brand marketers to adopt e-commerce systems thereby increasing the speed of orders, production and shipping cycles (Chen, 2003). For the same reasons, industries driving e-commerce tend to be in sectors that are internationally competitive and in which productivity and service are critical (Gibbs et al., 2003). Beginning in the second half of the 1990s, the IT industry in Taiwan faced a challenge in preserving their position in the global production network while relocating their manufacturing activities to China (Chen, 2003). E-commerce systems played an important role in this restructuring process by helping Taiwanese firms not only connect to their international buyers, but also coordinate with their upstream suppliers in China efficiently and quickly (Trappey and Trappey, 2001). Industry associations have been another strong promoter of e-commerce, especially to SMEs, by providing them with technical support, training and funding (Gibbs et al., 2003). The global electronic industry, under an initiative called Rosettanet, is collectively developing standards to facilitate inter-organizational electronic communications (Thatcher, Foster and Zhu, in press).



**Figure 1. Conceptual Framework of Environmental Predictors for B2B E-commerce Adoption**

Most findings from previous literature agree that industry is a leading influence in affecting B2B e-commerce adoption decisions. We thus hypothesize that encouragement from the industry in which the firm operates, that is, the e-commerce promotion from industry associations, movement and advocate from industry leaders and multinational companies, and the needs of automating the processes with customers and suppliers, has a positive influence on firm's e-commerce adoption, summarized as follows:

*H1. Firms perceiving greater industrial encouragement will be more likely to adopt e-commerce.*

### Governmental Encouragement

Governments may play a critical role in creating the institutional environment that fosters private investment (Oxley and Yeung, 2001) such as when B2B e-commerce adoption is considered as one way a company invests in IT. Governmental IT support can be provided through national policies for training and maintaining an adequate IT workforce (Shore, 2001). Building national IT infrastructure is also a helpful policy choice for supporting IT adoption in newly industrialized economies (Wang, 1999). Government promotions, government incentives and national policies such as trade and telecommunication liberalization are also likely to have a big impact on e-commerce (Gibbs et al., 2003). Thus, governmental encouragement, such as government support, initiatives and strategies, subsidies and tax deductions, and procurement requirements, is expected to have a positive impact on e-commerce adoption.

*H2. Firms perceiving more governmental encouragement will be more likely to adopt e-commerce.*

### Regulatory Effect

Since the first Model Law on Electronic Commerce drafted by the United Nations Commission on International Trade Law (UNCITRAL) in 1996, there have been at least fifty countries and regions (including Greater China and the U.S.) with various legislations, regulations and policies regarding e-commerce (BakerandMcKenzie, 2004). There are international and regional organizations, including the World Trade Organization (WTO) and Asian-Pacific Economic Cooperation (APEC),

involved actively in global policymaking on e-commerce development. Institutions have focused on different issues, but the key areas are digital signatures, privacy, intellectual property and taxation (Gibbs et al., 2003). Several studies have developed theories as to the best practices for regulating e-commerce, ranging from policy frameworks to legislating efforts (Bond and Whiteley, 1998; Mitchell, 2001; Zekos, 2003). It remains unknown, however, whether the adoption of e-commerce is influenced by those regulatory actions. The theoretical assertion that organizations conform to perceptions of regulatory changes and institutional pressure (DiMaggio and Powell, 1991b; North, 1986) leads to the following hypothesis:

*H3. Firms perceiving more regulation changes will be more likely to adopt e-commerce.*

#### *Cultural Compatibility*

Institutionalists question whether organizational choices and preferences can be properly understood outside of the cultural framework in which they are embedded (DiMaggio and Powell, 1991a). One aspect of institutional theory posits that preferences arising from cultural biases shape positions and preferences in social processes (Douglas, 1986). It is thus important to understand the role of culture in IT adoption (Harris and Davison, 1999; Thatcher et al., in press).

B2B e-commerce automates business processes that are traditionally done either face-to-face or between individuals who have an established relationship. It is generally believed that e-commerce is not compatible with Chinese culture, whereby individuals prefer that commercial transactions be “personalized”. B2B e-commerce also requires a willingness of companies to freely share information with others. Culture may thus be a factor which encourages or inhibits this sharing of information (Shore, 2001). Culture is one of the main explanations for the lack of IT diffusion in the Middle East because the Western belief in the free movement of information violates the cultural environments of many Arabian countries (Goodman and Green, 1992).

With an increasing emphasis on IT diffusion in the context of globalization, there is a need to discuss national cultural impacts as well as to empirically check for their significance (Maitland and Bauer, 2001). Therefore we investigate the role that culture compatibility has on e-commerce adoption.

*H4. Firms perceiving more compatibility of the local culture will be more likely to adopt e-commerce.*

## **RESEARCH METHODOLOGY**

### **Data and Sample**

Both theoretical insights and practical experiences indicate that, just like for most other technological innovations, a supportive environment is particularly important for adoption decisions at the infant stage of e-commerce development. This paper intentionally uses a dataset obtained from a study in the U.S. and Greater China in 2001, revealing the status of B2B e-commerce at the beginning stage across developed, emerging, and developing economies. The year of 2001 is a milestone in e-commerce development. In that year, the United Nations Conference on Trade and Development (UNCTAD) published its inaugural *E-commerce and Development Report* in response to the emergence of e-commerce. The report claimed that “the ICT age has dawned, but not yet for all.” (UNCTAD, 2001) Although the share of e-commerce in total B2B transactions was modest in the U.S. (below 16%) and much less in Greater China, B2B e-commerce was growing quickly on both sides of the Pacific, showing a sign of a massive shift of business operations towards the electronic setting (UNCTAD, 2002).

The major part of the study included a mail survey of 257 U.S. companies and 346 Greater Chinese companies. The sampling frame of the U.S. companies was obtained from a member list of the National Association of Purchasing Management (NAPM), whereby these companies were either engaging in B2B e-commerce or doing business with companies in Greater China. The sampling frame of the Chinese companies was obtained from company directories provided by local industry associations and government agencies. Companies in all locations were mostly selected from two manufacturing categories—electronics and relatively traditional textiles.

Respondents in the survey were primarily purchasing executives, MIS managers, CIOs, or CEOs who were responsible for and/or knowledgeable about the companies’ B2B-related operations and decisions. The overall response rate was 30%. Given a normal 10% response rate for mail surveys and the cross-country nature of data collection, the response rate in this study was considered even better than the ones in similar studies (Gibbs and Kraemer, 2004; Zhu and Kraemer, 2005). The final dataset consisted of 179 valid cases, containing 37 U.S. firms, 58 Chinese firms, 29 Taiwanese firms and 55 Hong Kong firms. Among them, 118 cases belonged to the electronics industry and 46 cases belonged to the textiles industry. A normal distribution of firm sizes measured by employee numbers indicated a balance between large and small businesses.

## Constructs and Measures

### Independent Variables

All items from the original survey questionnaire were respondents' perceptions on institutional environments for e-commerce adoption. They were measured on 5-point Likert scales, ranging from 1 = "strongly disagree" to 5 = "strongly agree". Exploratory factor analysis (EFA) on all items was run first for assistance in deciding whether to exclude any items from the constructs. Based on the assessment of the results of EFA, items with low communalities (0.5 or lower) and substantial cross-loading on multiple factors were dropped from the analysis. The measurement model was further refined and factor analysis was run again. A total of eight items remained. Another factor analysis was then performed specifying a 4-factor solution. The result confirmed the four factors as the theoretical constructs and showed that most item loadings were higher than 0.7. Therefore, the four independent variables in the research model were *industrial encouragement*, *regulatory effect*, *governmental encouragement*, and *cultural compatibility*.

### Control Variables

Industry was controlled by using a dummy variable for textiles firms; thus electronics firms made up the reference group. Country was controlled by including dummy variables for China, Taiwan and Hong Kong; the U.S. was the reference group.

### Dependent Variable

The dependent variable in this analysis was simply a dichotomy of adopter (=1) /non-adopter (=0) of B2B e-commerce. The exploratory nature of this study lends itself to a simple measure of e-commerce adoption.

### Validity and Reliability

The external validity of the study came from the fact that samples were obtained randomly from two typical industries covering various company sizes, and four geographic locations covering different levels of institutional infrastructure and e-commerce development. In addition, Greater China and the U.S. have close business relations with each other; the highest levels of exports/imports among these four economies consist of electronics and textiles products (USBOC, 2001). Statistical results of confidence intervals further upheld the external validity.

Due to the lack of relevant research on the institutional environments for B2B e-commerce, semi-structured interviews were conducted first to gain general understanding of the issues. Based on the results of the interviews and examination of existing literature, measures in the survey were generated and pre-tested. To ensure construct equivalence in the Chinese version of the survey, translation and back-translation procedures were applied.

As for statistical validity, since this study is exploratory by nature, significance in later regression analysis was said to exist if  $p \leq 0.1$ . Construct validity was assessed through Cronbach's alpha. The factor analysis with varimax rotation established discriminant validity.

## ANALYSIS AND RESULTS

A binary logistic regression was used for testing the four hypotheses in the conceptual model. Table 1 presents the estimated logistic model based on the results.

Variable	Logistic Coefficient	Std. Error	Wald Statistic	p-value	Odds Ratio
Industrial encouragement	1.030***	0.337	9.351	0.002	2.802
Governmental encouragement	1.140***	0.399	8.168	0.004	3.128
Cultural compatibility	0.542*	0.293	3.425	0.064	1.719
Regulatory effect	0.313	0.301	1.084	0.298	1.368
Country dummies			15.620	0.001	
China vs. US	-3.520****	0.987	12.712	0.000	0.030
Taiwan vs. US	-1.763	1.112	2.515	0.113	0.171
Hong Kong vs. US	-0.889	0.997	0.795	0.373	0.411
Industry dummies			4.359	0.113	
Textiles vs. Electronics	-1.312**	0.633	4.294	0.038	0.269

\*\*\*\* $p < 0.001$ ; \*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

**Table 1. Logistic Model for B2B E-commerce Adoption**

The results showed that the most significant predictors of B2B e-commerce adoption in this model were *industrial encouragement* and *governmental encouragement* (both  $p < 0.01$ ). The positive coefficients of these two variables confirmed their roles as adoption facilitators. Whenever encouragement from industry or government increases one unit, the odds of adopting e-commerce increase by a factor of 2.8 and 3.1 respectively, controlling for other variables in the model. Furthermore, the confidence interval statistics indicated that the positive relationships found in this sample between industrial/governmental encouragement and e-commerce adoption could be held for the whole population (both lower and upper values of 95% confidence intervals for odds ratios were greater than 1).

The effect of *cultural compatibility* on B2B e-commerce adoption was marginally significant ( $p < 0.1$ ) and positive, roughly consistent with prior literature that culture would play a role in e-commerce adoption decisions. As firms perceive more cultural compatibility with e-commerce, chances for firms to adopt e-commerce also increase.

The last independent variable of *regulatory effect* had a positive but non-significant effect on B2B e-commerce adoption. Of the control variables, country was significant ( $p < 0.001$ ), as firms in China were found to have very significantly lower probabilities of adopting e-commerce than the U.S. firms while the differences between Taiwan/Hong Kong and the U.S. firms were non-significant. Meanwhile, textiles firms had a significantly ( $p < 0.05$ ) lower chance of adoption than electronics firms.

Goodness-of-fit of the model was assessed successfully with all measures available in SPSS output, suggesting that the model was well-suited to the data. The predictive accuracy of the logistic model was also assessed—the logistic model in use had a high predictive power.

## DISCUSSION

### Discussion of Findings

The empirical analysis confirms three hypotheses and hence three key environmental factors in B2B e-commerce adoption (See Figure 2). Specifically, the statistical results show that both industrial and governmental encouragements do exert powerful direct effects on B2B e-commerce adoption. Companies that perceive more encouragements, such as support, promotions and incentives, from industry associations, customers, suppliers and governments are more likely to adopt e-commerce. These findings support the institutional perspective about the critical roles industries and governments play in fostering companies' investments in IT.

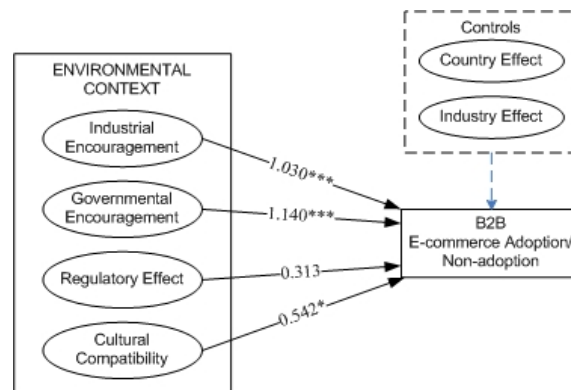


Figure 2. Results of Regression Model (\*\* $p < 0.01$ , \* $p < 0.1$ )

The findings also suggest that culture is an important institutional factor for B2B e-commerce adoption. If the national culture in which the firm conducts business is compatible with e-commerce, it can be supportive of the firm's e-commerce initiatives; otherwise culture may be a barrier when making e-commerce adoption decisions. However, the effect of culture found in this study is marginal and should not be generalized to the whole population. When B2B e-commerce was still at its nascent stage in most countries, e-commerce adoption was mostly business-driven and sensitive to governmental intervention. Effects of culture compatibility may be negligible until e-commerce technology is more integrated into daily organizations' operations.

The good model fit and satisfactory predictive power demonstrates the appropriateness and usefulness of the conceptual framework for examining environmental factors in B2B e-commerce adoption. In addition, the country and industry differences in the analysis prove that there are more U.S. firms than Chinese firms adopting B2B e-commerce, and that the electronics industry is more advanced in using IT for business than the traditional textiles industry. It confirms prior theoretical assertions that e-commerce diffusion was an uneven process—certain countries and industries drove the process while others lagged behind (Gibbs et al., 2003).

Regulatory change is commonly believed to have a lagging effect on private sectors. The first governmental initiative on e-commerce was issued by the U.S. in 1997. Most substantial legislation actions on e-commerce were taken by countries after 2000 or even later. The impact of e-commerce regulations remains to be seen. For example, despite the implementation of legislation in the U.S. recognizing electronic signatures in 2000, e-signatures are still not yet widely used today (Gibbs et al., 2003). Therefore, as in a snapshot of e-commerce in 2001, the lack of significance in regulatory effect seems reasonable in our results. It also implies that more direct and clear factors, such as regulatory pressures or legal barriers, should replace the original, more general, regulatory predictor variable in our conceptual framework.

### Limitation and Future Research

Designing and conducting such an empirical study on global B2B e-commerce adoption and institutional environments is difficult, mostly because any kind of influence of environmental factors is hard to measure quantitatively. All measures in this study are subjective in the sense that they reflect the perceptions of respondents on a Likert-scale. Therefore the measurements still need refinement and could be more objective. Second, this study reveals a general idea of “yes/no” adoption decision from two manufacturing industries in four different economies. Future research should expand the numbers of countries and industries. It should also investigate the *level* of e-commerce adoption as a dependent variable. Third, we were unable to run the regression model separately with each location due to data limitations, and thus unable to identify the differences of institutional effects in different economies. Fourth, a more comprehensive research model should include external, internal and relational factors. Finally, after four years of development, a follow-up survey in Greater China is strongly suggested, so that the regulatory and cultural factors could be re-investigated and a longitudinal comparison could be conducted.

### Policy Implications

A concern that uneven diffusion of e-commerce would create a “digital divide” between developed and developing countries and unfair competitive advantages for multinational oligarchs against local SMEs has led to uninterrupted efforts by international organizations and national governments. Governments and industry associations, especially in developing and emerging economies, should keep working and exerting their influence on promoting e-commerce. With immature institutional structures, governmental and industrial encouragement tend to play an even greater role in developing countries (Xu, Zhu and Gibbs, 2004). Promotional efforts could be more noteworthy if they were carried out by government in partnership with the private sectors (Gibbs et al., 2003). Finally, just as what Kofi Annan, the Secretary-General of UN, suggested, “if all countries are to be benefit, ... more needs to be done to ... create an enabling environment, nationally and internationally.” (UNCTAD, 2004).

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