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Factors affecting the Adoption of B2B E-commerce – An Empirical Study

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Abstract

By the use of B2B E-commerce, leading companies are transforming inter-organizational transaction processing, trading, and collaboration into a competitive advantage. This research empirically examines B2B E-commerce adoption and overall use as the dependent variable and innovation characteristics, context, channel factors, benefits, critical success factors and organizational characteristics, compatibility with existing systems, cooperative norms with customers, lateral integration within a firm, technocratic specialization, and decentralization of information technology etc as the predictor variables. Objective of this study is to understand the key factors associated with the adoption of B2B E-commerce in Indian companies.

Keywords: Adoption, B2B Electronic Commerce, Adoption Factors, E-commerce, E-markets, Electronic Markets,

Introduction

Electronic commerce refers to the conducting of business transactions over electronic/computer networks, including the internet, (Barnes and Hunt, 2001) and therefore encompasses processes related to the buying, selling and trading of products, services and information, (Gunasekaran et al. 2002).

There has been considerable promotion given to the use of E-commerce in B2C markets, where transactions involving such activities as personal banking, ordering goods, and share trading are becoming increasingly common. However, the use of E-commerce for B2B transactions has been widely identified as an area with significant potential for future revenue generation and cost savings (Barnes and Hunt, 2001). For businesses, B2B can mean electronic interaction with the members of supply base, i.e. for inbound procurement, and with customers for transactions pertaining to their procurement activity.

As the internet became more and more commercialized and users started to participate in the World Wide Web in the early 1990s, the term Electronic Commerce was coined and E-commerce applications expanded rapidly (Turban et al. 2002). The Internet and E-commerce especially have much more to offer in the way of increasing the

efficiencies and competitive advantage of procurement (; Teo et al. 2009). B2B E-commerce is a fundamental shift in the manner by which firms are interacting with buyers and suppliers ().

Table 1.Summary of factors affecting Adoption of E-commerce Source: (Puri and Bansal, 2013)

Adoption Factors	Literatures
Increasing market efficiency	Detourn et al. (2000), Skjott-Larsen et al. (2003), Hsiao (2003), Heikkila (2002) and Mclvor and Humphrevs (2004)
Attracting new buyers	Min and Galle (1999), Skjott-Larsen et al. (2003), Prasad and Babbar (2000) and Bendoly and Schoenherr (2005)
Increasing price competitiveness	Skjott-Larsen et al. (2003)
Strengthening customer relations and marketing activities	Noekkenved (2000), Mclvor and Humphreys (2004), Boyer and Hult (2005), Gimenez and Ventura (2005)
Lowering transaction cost	Detourn et al. (2000), Skjott-Larsen et al. (2003), Dewar and Dutton (1986), Bendoly and Schoenherr (2005), Mclvor and Humphreys (2004) and Min and Galle (1999), Gottschalk and Abrahamsen (2002), Barnes et al. (2004), Pucihar and Gricar (2005), Rahman (2004)
Lowering inventory level	Detourn et al. (2000) and Mclvor and Humphrevs (2004)
Strengthening customer service and interaction	Skjott-Larsen et al. (2003), Kumar and Crook (1999), Noekkenved (2000), Gimenez and Ventura (2005), Heikkila (2002) and Boyer and Hult (2005)
Strengthening integration and collaboration of marketing activities with other industries	Hsiao (2003), Noekkenved (2000), AMR (1998), Gural et al. (2001) and Gimenez and Ventura (2005)
High competition	Trouong (2002), Heck and Ribbers (2002), Zhu et al. (2008), Akkeren and Cavaye (1999), Rashid and Qirim (2001), Wang and Tasi (2002), Ling (2001), and Heck and Ribbers (2002)
Increasing product visibility	Detourn et al. (2000) and Premkumar et al. (1994)
Cost of adopting new technologies and equipment	Hsiao (2003), Kendall et al. (2001), Premkumar and Ramamurthy (1995), Premkumar et al. (1994) and Thong and Yap (1995)
Complexity of new technologies	Thong and Yap (1995), Thong (1999) and Tornatzky and Klein (1982)
Compatibility of new technologies	Hsiao (2003), Premkumar et al. (1994), Tornatzky and Klein (1982), Thong and Yap (1995), Premkumar and Ramamurthy (1995), Rogers (1983) and Truman (2000)
Pressure from Customers to adopt E-commerce	Rashid and Qirim (2001), Ling (2001), Wang and Tasi (2002), Son and Benbasat (2007), Heck and Ribbers (2002), and Daniel and Grimshaw (2002), Joo and Kim (2004), Yu (2007), Teo et al. (2009)

Speed of Internet network	Flynn (2000), Taylor et al. (2012)
Transaction security and trust	Hsiao (2003), Kumar and Crook (1999), Truman (2000), Hart and Saunders (1997) and Knights et al.(2001), Turban et al. (2002), Pucihar and Gricar (2005), Jianyuan et al. (2009), Taylor et al. (2012)
Organizational scope	Premkumar and Ramamurthy (1995) and Markus and Soh (2003)
Compatibility of E-commerce with Other Systems	Rashid and Qirim (2001), Ling (2001), Trouong (2002), Heck and Ribbers (1999), and Lee and Kim (2007)
Pressure from Suppliers to adopt E-commerce	Heck and Ribbers (1999), Wang and Tasi (2002), Ling (2001), and Rashid and Qirim (2001), Yu (2007), Teo et al. (2009)
Issue of Internet security	APEC E-commerce (1999), Wang and Tasi (2002), Mukti (2000), Jun (2003), and Turban et al. (2002), Taylor et al. (2012)
Organizational empowerment	Dewar and Dutton (1986)
Government regulations and pressures	Bailey and Capozzoli (2001), Yu (2007)
Organizational innovative ability	Premkumar and Ramamurthy (1995) and Thong (1999)
Depth of management decisions	Hsiao (2003), Premkumar and Ramamurthy (1995), Thong (1999), Grover et al (1995) and Thong and Yap (1995), Teo et al. (2009)
Infrastructure available for the adoption of E-commerce	APEC E-commerce (2000), Kirkman et al. (2002), CSPP (1998), Molla and Licker (2005)
Government promotion and investment for E-commerce	Gibbs et al (2003), Kirkman et al. (2002), Molla and Licker (2005), Thatcher et al. (2006)
Customers readiness to adopt E-commerce	Doherty et al. (2000), Zhu et al. (2002), Sung (2006), Hoffman and Chatterjee (1995), and Turban et al. (2008), Taylor et al. (2012)
Ability of a business to support E-commerce in terms of information-technology hardware and infrastructure	Hsiao (2003), Tan and Wu (2002), Kraemer et al (2002), Farhoomand et al (2000), Markus and Soh (2003), Gural et al (2001) and Grieger (2003), Taylor et al. (2012)
Trustworthy and secure online payment options	Thatcher et al. (2006), AlGhamdi et al. (2012), Taylor et al. (2012)
Government support and assistance for E-commerce	Hart and Saunders (1997), Thatcher et al. (2006), AlGhamdi et al. (2012), Taylor et al. (2012)
Development of strong ICT Infrastructure	Tan and Wu (2002), Thatcher et al. (2006), AlGhamdi et al. (2012), Taylor et al. (2012)
Educational programs for people and building the awareness of E-commerce in the country	Budhiraha (2004), Thatcher et al. (2006), AlGhamdi et al. (2012), Taylor et al. (2012)

Research Methodology

B2B E-commerce has, in recent years, been used as a means to significantly reduce costs, as it enables volume purchases, allows wider choice of buyers and suppliers, brings about better quality, improves delivery, reduces paperwork, and lowers administrative costs (Hsiao et al. 2005). Objective of this study is to understand the key factors associated with the adoption of B2B E-commerce in Indian companies.

The sample size was taken as 300. To ensure required sample size and to allow for the possibility of spoiled questionnaires, trained research assistants targeted top management executives and middle management executives of 300 Indian companies. The research assistants explained the voluntary nature of the survey to the respondents of the companies, assured them of the anonymity of their responses, and told them to feel free to opt out at any time. They provided each respondent with a copy of the questionnaire and an envelope, explained how the questionnaire was to be filled out and collected the completed questionnaires.

Table 2.Survey Response Rate

Total Sample Size	300
Declined participation	37
Response received	263
Usable response received	221
Response rate (%)	73.66

Analysis of Factors Affecting the Adoption of B2B E-commerce

The internet has remarkably lowered barriers to entry in several industries, lowered switching costs of suppliers and buyers and paved the room for many new entrants, decreased market transaction and coordination costs, enhanced market reach and compounded intra-industry competition. For modern-day organizations, presence on the web has become more of a necessity than an extra tool to gain an edge over the competition. Organizations are increasingly attempting to incorporate Web technologies in their business processes and systems, and build Web-based applications for transacting their business with suppliers and consumers. Firms are more and more using the Web to conduct their inter-organizational business transactions. Despite the speedy growth in B2B activity in the virtual marketplace, there is very little knowledge on the dynamics underlying the B2B initiatives. There is no absolute idea on how firms are managing these initiatives and what troubles they face in deploying B2B E-commerce systems. Given the distinct quality of the internet as compared to any of the earlier information technologies, there is considerable ambiguity about the applicability of our current knowledge on conventional inter-organizational systems to the area of Web-based inter-organizational applications.

The Factor Analysis is a premier data reduction technique and its procedure has several extraction methods for constructing a solution. The principal components method of extraction starts by finding a linear combination of variables (a component) that accounts for as much variation in the original variables as possible. It then finds another component that accounts for as much of the remaining variation as possible and is uncorrelated with the previous component, continuing in this way until there are as many components as original variables. Usually, a few components will account for most of the variation, and these components can be used to replace the original variables. This method is most often used to reduce the number of variables in the data file.

Researcher has applied factor analysis on the responses provided by respondents. Factor analysis is a good way of identifying latent or underlying factors from an array of seemingly important variables. In a more general way, factor analysis is a set of techniques, which, by analyzing correlations between variables, reduces their number into fewer factors, which explain much of the original data, more economically (Nargundkar, 2002).

In factor analysis, a rotation procedure is commonly applied which maximizes the correlations of item on a factor (Comrey and Lee, 1992). Principal Component analysis was used for extracting factors and seven factors were retained depending on eigenvalues and variance explained. Eigenvalue represents the total variance explained by each factor.

The standard practice normally used is that all the factors with an Eigen value of one or more should be extracted. There are seven factors having Eigen values more than 1 (in other words, a factor must explain at least as much of the variance if not more, than a single original variable). Thus seven factors have been extracted. The solution of factor analysis gave seven factors, which explained 77.88% of the total variance. Total variance explained (77.88 percent) by these components exceeds the 60 percent threshold commonly used in social sciences to establish satisfaction with the solution (Hair et al. 1995).The results were obtained through orthogonal rotations with Varimax method and all the factor loadings greater than 0.50 were retained. The name of the factors, variable labels and factor loadings are summarized in following Table 3.

Table 3 clearly depicts that Factor 1 is linear combination of variable number AF4, AF5, AF6, AF32 and AF31 (α=0.91). Factor 2 is linear combination of variable number AF24, AF22, AF23, AF8 and AF1 (α=0.83). Factor 3 is linear combination of variable number AF20, AF21, AF2, AF16, and AF15 (α=0.87). Factor 4 is linear combination of variable number AF14, AF26, AF25, and AF7 (α=0.84). Factor 5 is linear combination of variable number AF3, AF19, and AF27 (α=0.91). Factor 6 is linear combination of variable number AF11, AF13, AF18 and AF12 (α=0.83). Factor 7 is linear combination of variable number AF29, AF28 and AF9 (α=0.76). (α denotes the degree of internal consistency). Only three statements AF17 (Increasing product visibility), AF30 (Strengthening integration and collaboration of marketing activities with other industries), and AF10 (Educational programs for people and building the awareness of E-commerce in the country) was found low on all factors, hence rejected.

The Cronbach's alpha estimate also tells us how highly the items in our questionnaire are interrelated. Unlike the split-half reliability method, however, this estimate does not have to be corrected for length. Calculation of Cronbach's estimate is usually done with the help of a statistical package designed to calculate this reliability estimate. Statistical packages are usually used if questionnaires have many items. Cronbach's (1951) estimate of reliability is calculated using the variance of individual items and co-variances between the items. This estimate, however, also can be calculated using the correlations between the items. Given that items within a questionnaire use the same scale, both approaches give similar estimates. The latter approach is easier to understand and is presented here.

Using SPSS version 17.0, an internal consistency analysis was performed to assess the reliability aspect of the instrument. Reliability refers to the instrument's ability to provide consistent results in repeated uses (Gatewood and Field, 1990). Coefficient (Cronbach's) alpha is the basic measure for reliability (Green et al. 2000). Nunnally (1975) suggested that an alpha value of 0.7 is acceptable.

After the number of extracted factors is decided, the next task of the Researcher is to interpret and name the factors. This is done by the process of identifying the factors that are associated with which of the original variables. The factor matrix is used for this purpose. The factor matrix gives us the loading of each variable on each of the extracted factors. This is similar to correlation matrix, with loadings having values between 0 and 1. Values close to 1 represent high loadings and those close to 0, low loadings. The objective is to find variable which have high loading on one factor, but low loading on other factors.

TABLE 3. Factor Analysis

n=221

Factors	Factors Loads	Eigen Value	Percentage of Variance Explained	CronbachAlpha α
Factor 1		3.85	14.63	0.91
Capital Factor				
AF4. Compatibility of new technologies	0.841			
AF5. Complexity of new technologies	0.956			
AF6. Cost of adopting new technologies and equipment	0.891			
AF32.Trustworthy and secure online payment options	0.916			
AF31. Transaction security and trust				
Factor 2				
Organizational Factor				
AF24. Organizational scope		3.65	13.67	0.83
AF22. Organizational empowerment				
AF23. Organizational innovative ability	0.736			
AF8. Depth of management decisions	0.871			
AF1. Ability of a business to support B2B E-commerce	0.891			
in terms of information-technology hardware and	0.716			
infrastructure	0.707			
Factor 3				
Securing Market Competitiveness				
AF20. Lowering inventory level		3.52	12.11	0.87
AF21. Lowering transaction cost				
AF2. Attracting new buyers	0.861			
AF16. Increasing price competitiveness	0.761			
AF15. Increasing market efficiency	0.814			
	0.810			
Factor 4	0.746			
Inter Organizational Factor				
AF14. High competition		3.16	11.40	0.84
AF26. Pressure from Suppliers to adopt B2B E-commerce	0.827			
AF25. Pressure from Customers to adopt B2B E-commerce	0.836			
AF7. Customers readiness to adopt B2B E-commerce	0.863			
Factor 5	0.743			
Technical Factor				
AF3. Compatibility of B2B E-commerce with Other Systems		2.68	10.36	0.91
AF19. Issue of Internet security				
AF27. Speed of Internet network	0.869			

Factor 6	0.861	2.31	9.06	0.83
Government Factor	0.817			
AF11. Government promotion and investment for B2B E-commerce				
AF13. Government support and assistance for E-commerce	0.809			
AF18. Infrastructure available for the adoption of B2B E-commerce	0.816			
AF12. Government regulations and pressures				
	0.809	1.68	6.65	0.76
Factor 7				
Obtaining External Resources	0.795			
AF29. Strengthening customer service and interaction				
AF28. Strengthening customer relations and marketing activities	0.801			
AF9. Development of strong ICT Infrastructure				
	0.809			
	0.712			

Naming of Factors

All the factors have been given appropriate names according to the variables that have been loaded on each factor. The seven factors depicted in table are discussed below:

FACTOR-1 : Capital Factor

The rotated matrix has revealed that respondents have perceived this factor to be the most important factor with the highest explained variance of 14.63%. Five out of thirty two adoption variables load on significantly to this factor. Researcher have named this factor as Capital Factor as it includes Compatibility of new technologies, Complexity of new technologies, Cost of adopting new technologies and equipment, Transaction security and trust and Trustworthy and secure online payment options.

FACTOR-2: Organizational Factor

It has been revealed to be the second most important factor with explained variance of 13.67%. Five types of adoption variables were loaded on to this factor. Organizational scope, Organizational empowerment, Organizational innovative ability, Depth of management decisions, Ability of a business to support B2B E-commerce in terms of information-technology hardware and infrastructure loaded on this factor and thus researchers have named this factor as Organization Factor. This factor represents changes in organizational structure, culture, and business processes that are necessary for successfully deploying B2B applications. This also includes the extent of cross-functional cooperation required across different business functions in order to deploy B2B E-commerce applications.

FACTOR-3: Securing Market Competitiveness

This is the next important factor, which accounts for 12.11% of the variance. Five types of adoption variables were loaded on to this factor. Lowering inventory level Lowering transaction cost, Attracting new buyers, Increasing price competitiveness, Increasing market efficiency. Firms require an active E-commerce strategy, detailed plan and operational tactics for realizing its E-commerce objectives. This factor represents the extent to which a firm has a strategic vision for utilizing Internet technologies and use of appropriate business models for B2B E-commerce.

FACTOR-4: Inter Organizational Factor

Four types of variables load on this factor and together account for 11.40% of the variance. This factor includes High competition, Pressure from Suppliers to adopt B2B E-commerce, Pressure from Customers to adopt B2B E-commerce, Customers readiness to adopt B2B E-commerce. For successfully deploying a B2B application, a firm needs active support from its suppliers, consumers, and other external agents with whom it interacts.

FACTOR-5: Technical Factor

Three variables loads on this factor and together account for 10.36% of the variance. This factor includes Compatibility of B2B E-commerce with other systems,

Issue of internet security and Speed of internet network. Factors relating to the IT infrastructure, database infrastructure, application integration across E-commerce and other IS applications, integration of organizational applications with those of other business partners and existence of IT expertise for successful deployment of E-commerce applications fall under this category.

FACTOR-6: Government Factor

Four variables load on this factor and together account for 9.06% of the variance. This factor includes Government promotion and investment for B2B E-commerce, Infrastructure available for the adoption of B2B E-commerce, Government regulations and pressures and Government support and assistance for E-commerce. Thus researchers have named this factor as Government Factors. This category includes the taxation issues concerning online payments and sales, legal issues in electronic document transfer across organizations, and international trade barriers for conducting global E-commerce.

FACTOR-7: Obtaining External Resources

This is the easiness to relate to. Three variables load on this factor and together account for 6.65% of the variance. This factor includes Strengthening customer service and interaction, strengthening customer relations, marketing activities and Development of strong ICT Infrastructure thus the name Obtaining External Resources has been assigned.

Conclusion

A developing country can become modernized and industrialized if it can extensively apply IT to enhance productivity and international competitiveness, develop E-commerce and e-governance applications. An information-based society or knowledge based society is composed of IT products, IT applications in society and economy as a whole. Many nations in Asia are taking advantage of E-commerce through opening of economies, which is essential for encouraging competition and diffusion of Internet technologies. The results indicated that the key factors of importance are capital factors, organization factors, securing market competitiveness; inter organizational factors, technical factors, government factors, and obtaining external resources. Interestingly, the level of IT investments instead annual revenue was strongly related with B2B E-commerce adoption. This implied that B2B E-commerce adoption often required the organization to devote a certain level of resources to its deployment.

As the main objective of the present research was to study the business application aspect of B2B E-commerce in the Indian context, technical aspect of B2B E-commerce technologies was not covered properly. The result of the present study was based on the opinions and experiences of the respondents. In opinions survey there would always be possibilities of individual biasness in opinions, and results look unreliable. This biasness could not be eliminated.

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