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# DERIVING VALUE FROM END-TO-END (E2E) SOLUTIONS IN A DEVELOPING COUNTRY: A STUDY OF LOAN PROCESSING IN BANGLADESH

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## Abstract

*One of the key differences between developed and developing economies is that the 'IT Productivity Paradox' (the relatively slow growth of economic and firm productivity despite advances in IT) is still evident in developing economies. End-to-End (E2E) solutions are seen as a way of improving process and firm productivity by concurrently implementing IT systems and process improvements, and are of particular interest to companies based in developing countries as they have the potential to deliver the necessary improvements in business processes that are hypothesized to drive firm, sectoral and economic performance improvements. This study aims to identify the factors (labeled, 'IT value conversion contingencies') that impede firms in developing countries from realizing value from E2E solutions. The paper begins by developing a conceptual model based on the extant literature on IT value conversion contingencies, E2E solutions and developing countries. This model is tested in the context of E2E loan processing solutions in the banking sector in Bangladesh. Using survey responses from 30 of the 48 banks operating in Bangladesh, the study identifies the IT value conversion factors of E2E solutions and reveals the impact of such factors on how banks derive value from E2E solutions.*

*Keywords: Developing countries, End-to-end (E2E) solutions, IT-enabled business value, IT value conversion contingencies.*

# 1 INTRODUCTION

Known as the 'IT Productivity Paradox' (cf. Brynjolfsson & Hitt, 1996), the once believed apparent contradiction between the huge advances in computing power and the relatively slow growth of economic and firm productivity has been considered refuted (cf. Dedrick et al. 2003; Kohli & Grover, 2008). However, such refutations are based on research in developed economies. In contrast, Dewan and Kraemer (1998), Kraemer and Dedrick (2001), Pohjola (2001), and Heeks (2002) concluded that IT investment does not have any significant correlation with labor productivity in developing countries. The reasons for such results could be that organizations in developing countries face cultural, economic, infrastructure and legal challenges not faced by their counterparts in developed countries (cf. Huang & Palvia 2001; Molla & Licker 2005; Zhu et al. 2004). Despite the challenges facing organizations in developing countries, the potential of IT to aid the productivity of many sectors/industries in developing countries is widely acknowledged (cf. Walsham et al. 2007). In particular, End-to-End (E2E) solutions are of particular interest to domestic and overseas companies based in developing countries as they are seen as a way of improving process and firm productivity by concurrently implementing IT systems and process improvements (cf. Avgerou 2008). E2E solutions are considered to be particularly important for delivering the necessary improvements in business processes that are hypothesized to drive performance improvements at the level of the firm and beyond e.g. sectoral or national economic performance (cf. Bubak et al. 2006).

A business process can be defined as 'a set of subsystems: people, tasks, structure, technology, etc., which interact with each other (internal relationships) and with their environment (external relationships) in order to fulfill some objective(s)' (Melao & Pidd 2000, p.115). An end-to-end business process is 'where customer request trigger the process and fulfillment of customer needs bringing closure to the process' (Davamanirajan et al. 2006, p.69). End-to-End processes require some redesign to facilitate processing across organizational boundaries (Broadbent et al. 1999). Although process redesign frequently includes the introduction of IT (Scheepers & Scheepers 2008), E2E solutions are a reality due to development of commercial software packages. In particular, the implementation of Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems allows businesses to design processes that extend across functional and organizational boundaries. E2E solutions involving ERP can help firms to achieve an end-to-end connectivity (Rajagopal 2002). For example, an end-to-end solution for letter of credit (LC) processing in a bank can use an enterprise system to support LC initiation, integration of LC systems with fund transfer and general ledger (cf. Davamanirajan et al. 2006). A 'heterogeneous' solution (i.e., solutions provided by multiple vendors) is also another possibility. Bubak et al. (2006) provide an example of such heterogeneous E2E solutions where E2E order execution is supported by 'integrated' CRM, ERP and legacy systems. However, the realization of value from E2E solutions is dependent on the actions of the multiple parties (including external parties) involved in the business process (cf. Kohli & Grover 2008). In addition, the realization of value from E2E solutions is not well understood as much of the existing E2E solution literature focuses on implementation and conceptual issues (see for example, Bubak et al. 2006; Jain et al. 2010).

Outside the E2E solution domain, researchers (e.g. Brynjolfsson & Hitt 1996; Weill 1992) have identified that gaps exist between IT expenditure and realized benefits. However, few researchers have tried to uncover the IT value conversion contingencies factors that explain such gaps (Davern & Kauffman 2000; Goh & Kauffman 2009). Such 'conversion contingencies' can be either internal or external to firms (Davern & Kauffman 2000), and have also been referred to as IT value latency (Goh & Kauffman 2009), sources of shocks of IT value (Goh & Kauffman 2005), and sources of risk (Au et al. 2009). IT value conversion contingencies occur at the levels of the business process, the organization as well as in the market (Goh & Kauffman 2005), and can be identified as technological, competitive, organizational, and environmental factors (Goh & Kauffman 2009; Melville et al. 2004). In addition, stakeholders such as consumers and management can be considered conversion contingencies (Au et al. 2009). There is a need for in-depth systematic research on the cause of IT value latency (Goh & Kauffman 2009) as well as methodological guidelines to help practitioners assess IT value latency (Apfel 2008). This is particularly relevant in the context of developing

countries where constraints due to regulatory environment, basic infrastructure, and culture necessitate separate consideration of value conversion contingencies for E2E solutions.

This study aims to identify the factors (e.g., value conversion contingencies) that impede firms from realizing value from E2E solutions in developing countries. The paper begins by developing a conceptual model based on the extant literature on IT value conversion contingencies, E2E solutions and developing countries. This model is tested in the context of E2E loan processing solutions in the banking sector in Bangladesh. Using survey responses from 30 of the 48 banks operating in Bangladesh, the study identifies the IT value conversion contingencies factors of E2E solutions and reveals the impact of such factors on how banks derive value from E2E solutions.

## 2 THEORITICAL GROUNDING AND RESEARCH MODEL

The research model is based on the premise that (i) E2E solutions value conversion contingencies initially occur at the process level, and are of two types; internal and external to the firms (cf. Davern & Kauffman 2000) and (ii) E2E solutions impact the organizational level via process level performance (cf. Melville et al. 2004; Radhakrishnan et al. 2008). This model is consistent with the ERP benefits models proposed by Chen and Chou (2009) and Radhakrishnan et al. (2008). The specific factors under internal organizational context (e.g., support and resources, and alignment and integration), and external environment context (e.g., legal environment, and infrastructure) come from existing literature, especially IS/IT literature on developing countries.

Top management support is the support from key members, especially from CEO (Molla & Licker 2005). Resources may be human, technology and financial. Top management support and resources are interlinked in many ways and together can produce value from E2E solutions. First, IT usage is important not IT spending (Devaraj & Kohli 2003) and top management involvement can ensure the proper usage of IT (Peppard & Ward 2003). Second, IT alone cannot produce value unless complementary resources have been acquired (Davern & Kauffman 2000). Top management support provides the direction for the project (e.g. judicial formation of cross functional team), and ensures continuous funding and procurement of complementary resources (Kalakota & Robinson 2001). E2E solutions require additional resources in comparison with stand-alone systems for proper functioning and fine tuning. In case of E2E solutions, organizational resources (e.g., top management support, people related issues, training, resources allocation) have been reported as critical for implementation success (Jain et al. 2010) as well as business value realization (Zhu et al. 2004). Therefore, lack of support and resources results in non-realization of IT value (Grover et al. 1995). Therefore, we can develop the following hypotheses:

*H1a; H1b: Lack of support and resources will directly and negatively influence the process level performance of E2E solutions, in terms of (a) process performance, and (b) coordination performance.*

Alignment and integration are important as E2E processes typically require a joint production of the service by the customer, the service provider, and, sometimes, other parties. For E2E solutions to succeed alignment and integration are required within processes, as well as across organizational and external process (i.e. connecting an organization with external stakeholders) (Jain et al. 2010). Without such alignment and integration, enterprise systems become 'island of automation' and managers cannot achieve the 'single source of truth' that they are looking for (Bubak et al. 2006). Alignment and integration have been found significant at process level performance of enterprise systems (Wagner 2006). In developing countries, alignment and integration are frequently problematic; a factor that may help explain the non-realization of IT value (Riyadh et al. 2009). Consequently, the following hypotheses are presented:

*H2a; H2b: Lack of alignment and integration will directly and negatively influence the process level performance of E2E solutions, in terms of (a) process performance, and (b) coordination performance.*

External environmental constraints are those that need to be addressed by the government or external agencies (Kapurubandara 2006). External environmental factors play key roles in shaping business value of IT (Goh & Kauffman 2005). External barriers for IT value realization may include the legal environment (Zhu et al. 2004) as well as infrastructure barriers (Molla & Licker 2005). The regulatory environment plays an important role in IT value payoff, especially in developing countries (Zhu et al. 2004; Zhu & Kraemer 2005). While the ‘footprints’ of E2E solutions include paperless transactions, the digitization of services, online contracts, etc., the legal foothold, of computer generated softcopy of documents, digitization of signature, online contract are still questionable in many countries (Larpsiri et al. 2002). We consequently propose the following hypotheses:

*H3a; H3b: Lack of proper legal environment will directly and negatively influence the process level performance of E2E solutions, in terms of (a) process performance, and (b) coordination performance.*

With an E2E solution, the contact with the customer is initiated and completed using a computer system. This 'digitization' of service requires high speed Internet services, state of the art imaging technologies, document management technologies, integration of workflows among E2E value chain (Bruno-Britz 2009). Therefore, organizations need to rely on the public infrastructure at large, as E2E solutions. However, various types of infrastructure (e.g. Internet, hardware and software, telecommunications, electricity, banking, and readiness of customers) have been reported as main impediments of IT/IS implementation success in developing countries (Kapurubandara 2006; Molla & Licker 2005). For example, Kapurubandara (2006) reports that e-commerce implementation in Sri Lanka is greatly hampered by high costs of telecommunications and internet access as well as an unreliable electricity supply. We now propose two more hypotheses:

*H4a; H4b: Lack of infrastructure will directly and negatively influence the process level performance of E2E solutions, in terms of (a) process performance, and (b) coordination performance.*

E2E solutions may create value for the organizations via intermediate business processes (Melville et al. 2004). In line with e-business applications (cf. Zhu et al. 2004) E2E solutions seek to deliver value at a process level by improving internal efficiency/performance and coordination. E2E solutions improve process performance through increasing labor productivity and reducing cycle time, with a ‘knock on’ effect on firm performance (e.g., profit margin) (Davamanirajan et al. 2006). The process redesign that frequently characterizes E2E solutions has an impact on the core processes (e.g. task efficiency) and process coordination as a contribution to overall firm performance improvement (Chen & Chou 2009). We thus present the final two hypotheses and the overall model (Figure 1):

*H5a; H5b: Process level performance of E2E solutions- (a) processing, and (b) coordination will directly and positively associated with aggregate business performance.*

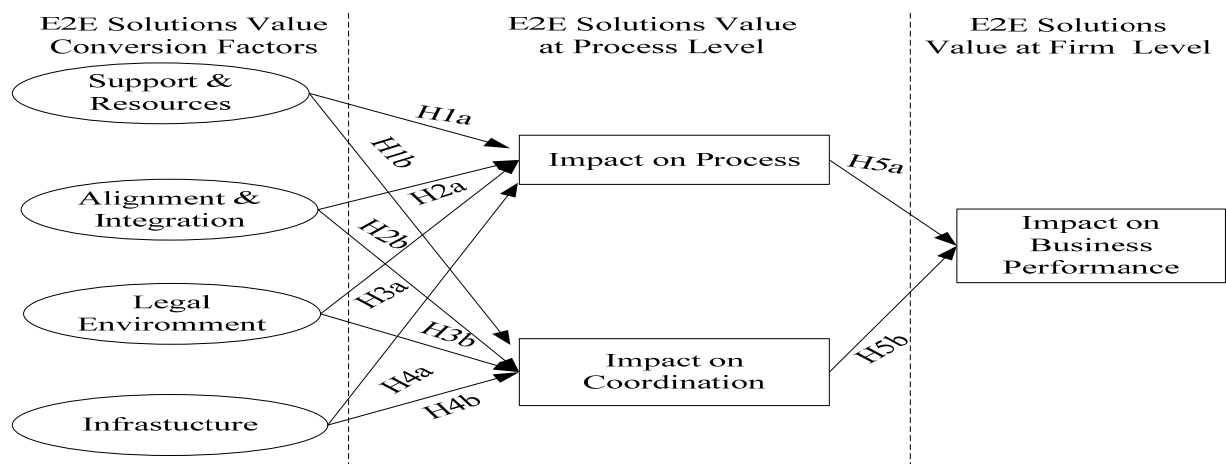


Figure 1. Research Model

### 3 RESEARCH METHOD AND CONTEXT

The study focused on E2E loan application and approval processes in the consumer and business lending sections of commercial banks in Bangladesh. Loan application and approval processes are deemed appropriate for several reasons. First, loan processing is an E2E process, having customers contact and example of joint production, which is separable from the other major processes of a bank (Davamanirajan et al. 2006). Second, loan processing is a good example of E2E solutions where processes flow across organizational and system boundaries (cf. Bubak et al. 2006). Third, bank lending is critical for business, especially for developing countries that lack an efficient stock market and directly linked to national GDP (Valverde et al. 2007). Thus, loan processing is a relevant area of study for E2E solution in developing countries. Bangladesh is considered suitable for the study because it is a representative developing country in regards to GDP, role of banking sector in the economy and socio-economic conditions. However, ICT expenditure as percentage of GDP in 2007 in Bangladesh was 8.0 % in comparison with an average 5.7 % in the rest of south Asia. This is perhaps why Bangladesh is considered one of most promising countries in the group of 'Next Eleven' (Goldman Sachs 2007), with a GDP growth rate of 6.2 % in 2008 as opposed to an average of 2% in rest of the world (World Bank 2009).

A quantitative survey was deemed appropriate because a large number of responses were required to test the model. In May/2009, all of the 48 commercial banks in Bangladesh were contacted, with 30 agreeing to participate. Multiple informants from each bank were chosen as this is the recommended strategy for larger organizations (cf. Cheng & Chiu 2008) and it would help reduce informant bias (cf. Teo TSH et al. 2009). The Head of IT or of loans of each bank was asked to identify appropriate respondents. In total 172 individuals were identified. As the survey was personally administered, the number distributed and collected was identical. The sample size of 172 was deemed adequate for Structural Equation Modelling (SEM), given the recommendation of Hair et al. (1998) of a minimum sample size between 100 and 150. Table 1 shows the profile of the banks studied.

The survey instrument was validated to assess content, adequacy, scope and purpose (cf., Straub 1989). The independent variables are modelled as formative constructs; therefore, as required, a census was made to find out all possible indicators that impact on the IT value realization process (cf. Bollen & Lennox 1991). However, a relatively short questionnaire was designed to increase the response rate (Terziowski et al. 2003). A five point Likert scale was chosen to solicit responses as it is a commonly used scale in IS/IT studies (Zhu et al. 2004). Partial Least Square (PLS) Graph (version 3, build 1126) was used for analyzing measurement and structural models (cf. Chin 1998). PLS was chosen over other LISREL or other co-variance based approaches as it is suited for both formative and reflective indicators (Chin 1998); PLS does not need to have a strong theory and is appropriate when the research model is in an early stage of development (cf. Hsieh, C-T et al. 2006).

|                     | No | %     |                             | No | %    |
|---------------------|----|-------|-----------------------------|----|------|
| Banks Type and Size |    |       | Technological Status        |    |      |
| Banks Type          |    |       | Online Banking              | 25 | 83.3 |
| Government          | 5  | 16.7  | Phone Banking               | 7  | 23.3 |
| Private Domestic    | 23 | 76.7  | SMS Banking                 | 13 | 43.3 |
| Foreign             | 2  | 6.7   | Debit Card                  | 24 | 80   |
| Branch Size         |    |       | Credit Card                 | 18 | 60   |
| 6-30                | 4  | 13.33 | Data Warehousing            | 15 | 50   |
| 31-50               | 13 | 43.34 | Enterprise Solutions        | 29 | 96.7 |
| 51-100              | 6  | 20    | Electronic Data Interchange | 10 | 33.3 |
| 101-1181            | 7  | 23.33 | Intranet                    | 27 | 90   |
| Manpower            |    |       | Internet                    | 29 | 96.7 |
| 200-800             | 6  | 20    | Reuters                     | 30 | 100  |
| 801-1200            | 8  | 26.67 | SWIFT                       | 30 | 100  |
| 1201-3000           | 9  | 30    | Website                     | 30 | 100  |
| 3001-22200          | 7  | 23.33 |                             |    |      |

Table 1. Sample Bank Characteristics (N=30)

## 4 FINDINGS

### 4.1 Assessment of the Measurement Model

The indicators for the E2E solution value conversion factors (i.e. support and resources, alignment and integration, legal environment, and infrastructure) were derived from extant literature on IT value conversion contingencies, E2E solutions and developing countries. These indicators (see Table 2) were used as measures for the value conversion constructs in the model.

| Support and Resources                                | Infrastructure   |
|--|--|
| SR1:Lack of top management support                   | IN1:Lack of robust and stable IT infrastructure        |
| SR2:Limited technological knowledge of employees     | IN2:Lack of reliable credit rating service providers   |
| SR3:Lack of in-house technical team                  | IN3:Lack of reliable Internet infrastructure           |
| SR4:Limited financial resources                      | IN4:Limited power supply                               |
| Alignment and Integration                            | IN5:Absence of unique ID number of borrowers           |
| AI1:E2E solution not aligned with bank's objectives  | IN6:Lack of online integration with credit bureau      |
| AI2: Lack of integration among workflows             | IN7:Absence of online searchable database of borrowers |
| AI3: Lack of online integration with branches        | IN8: Financial statement are less reliable             |
| AI4: Lack of integration with third parties          | IN9: Customers preference of physical interaction      |
| Legal Environment                                    |  |
| LE1:Security problem of virtual banking              |  |
| LE2:Lack of clear legal environment of e-banking     |  |
| LE3:Unrecognizing of unsigned copy as legal document |  |
| LE4: Absence of Digital Signature Act                |  |

Table 2. Indicators for E2E Value Conversion Factors

As is evident from Table 2, the measures are formative. As the correlations among the formative indicators are not explained by the measurement model, the usual procedure used to assess the validity and reliability for reflective construct is not applicable for this study. The Variance Inflation Factor (VIF) using SPSS for formative constructs was computed for a multicollinearity test and the result shows that VIF for all formative indicators are less than the minimum cut-off standard level of 10 (cf. Kleinbaum et al. 1988). The weight is used to measure the relative importance of formative indicators towards Latent Variable (LV) and can be >1 (Sambamurthy & Chin 1994) (see Table 3). As shown in Table 3, not all of the formative indicators weights were found significant at the 1%, 5% and

10% level. This is common in other studies that use formative indicators (see for example, Chwelos et al. 2001). While “reflective indicators are essentially interchangeable and therefore, removal of an item does not change the essential nature of the underlying construct” (Diamantopoulos & Winklhofer 2001, p.271), with formative indicators “omitting an indicator is omitting a part of the construct” (Bollen & Lennox 1991, p.308). Therefore, all formative items were retained for further analysis. In the case of the dependent variables (reflective indicators), all composite reliability indicates a high degree of internal consistency as all values exceed the cut-off threshold of 0.70 (cf. Nunnally & Bernstein 1994). The Average Variance Extracted (AVE) is used to assess discriminant validity of reflective constructs and measures the average variance of measures accounted for by LVs. The AVEs of all LVs were above acceptable AVE of 0.500 (cf. Chin 1998). Factor’s loadings were also above minimum cutoff and all items were found significant at 1% level, demonstrating adequate validity of the instrument.

| Construct (Independent)             | Items | Weight | t stat  | Construct (Independent)           | Items   | Weight      | t stat  |     |
|-------------------------------------|-------|--------|---------|-----------------------------------|---|-------------|---------|-----|
| Alignment & Integration (Formative) | AI1   | 0.56   | 3.17*   | Support & Resources (Formative)   | SR1   | 0.77        | 3.02*   |     |
|                                     | AI2   | 0.06   | 0.44    |                                   | SR2   | 0.05        | 0.18    |     |
|                                     | AI3   | 0.38   | 2.24**  |                                   | SR3   | 0.48        | 1.39*** |     |
|                                     | AI4   | 0.22   | 1.40*** |                                   | SR4   | 0.17        | 0.63    |     |
| Legal Environment (Formative)       | LE1   | 0.37   | 0.81    | Process (Reflective)              | PR1<br>PR2<br>PR3<br>PR4                      | 0.901/0.695 | 0.885   | 52* |
|                                     | LE2   | 0.58   | 1.14    |                                   |   |             | 0.851   | 32* |
|                                     | LE3   | 0.43   | 0.98    |                                   |   |             | 0.801   | 23* |
|                                     | LE4   | 0.41   | 1.01    |                                   |   |             | 0.788   | 23* |
| Infrastructure (Formative)          | IN1   | 0.29   | 1.33*** | Coordination (Reflective)         | CO1<br>CO2<br>CO3                             | 0.916/0.784 | 0.870   | 44* |
|                                     | IN2   | 0.01   | 0.05    |                                   |   |             | 0.916   | 69* |
|                                     | IN3   | 0.08   | 0.36    |                                   |   |             | 0.867   | 28* |
|                                     | IN4   | 0.45   | 2.62*   | Business Performance (Reflective) | BP1<br>BP2<br>BP3<br>BP4<br>BP5<br>BP6<br>BP7 | 0.938/0.684 | 0.819   | 26* |
|                                     | IN5   | 0.10   | 0.47    |                                   |   |             | 0.730   | 15* |
|                                     | IN6   | 0.15   | 0.90    |                                   |   |             | 0.852   | 30* |
|                                     | IN7   | 0.07   | 0.28    |                                   |   |             | 0.846   | 32* |
|                                     | IN8   | 0.76   | 6.55*   |                                   |   |             | 0.886   | 49* |
|                                     | IN9   | 0.16   | 1.14    |                                   |   |             | 0.791   | 25* |
|                                     |       |        | 0.854   |                                   |   |             | 30*     |     |

Note: \*significant at 1% level; \*\*significant at 5% level; \*\*\*significant at 10% level

Table 3. Measurement Model

#### 4.2 Assessment of the Structural Model

A bootstrapping method was used on the basis of 500 sample runs to assess the significance of the path coefficient (cf. White et al. 2003). As indicated in Figure 2, seven (7) out of ten (10) hypotheses were supported. The model explained a substantial amount of variance for value of E2E solutions at the aggregate business level ( $R^2 = 0.65$ ); impact on process ( $R^2 = 0.24$ ), and impact on coordination ( $R^2 = 0.21$ ), which were much greater than the minimum recommended value of 0.10 (cf. Falk & Miller 1992) and other similar studies (see for example, Chen & Chou 2009). The coefficient of the path loadings shows that the influence of support and resources ( $\beta = 0.13$ ) on process was significant and higher than the influence on coordination ( $\beta = 0.05$ ). Whereas, the influence of alignment and integration on process was higher ( $\beta = 0.29$ ) than the influence on coordination ( $\beta = 0.26$ ) and all were found significant at 1% level. The impact of legal environment on process and coordination was found insignificant, however the impact of infrastructure on process ( $\beta = 0.14$ ) and on coordination ( $\beta = 0.19$ ) was found significant at 5% level. Regarding the aggregate level performance, both process performance ( $\beta = 0.42$ ) and coordination performance ( $\beta = 0.44$ ) had a positive impact. Furthermore, effect size ( $f^2$ ) was also computed to judge the strength of the effect of a particular independent



variable on the dependent variable (Chin 1998). As required, the effect size was found to be significant.

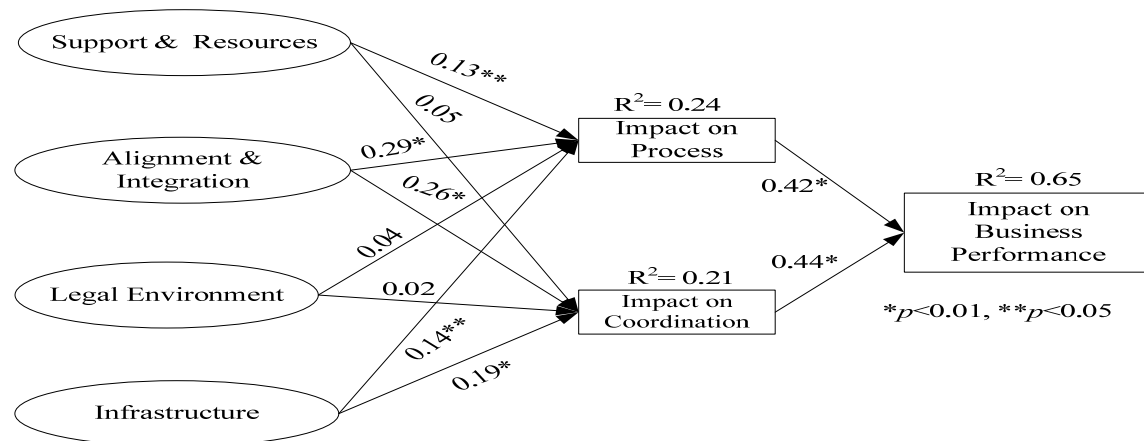


Figure 2. E2E Solution Value Research Model

## 5 DISCUSSION

Based on the above findings, few overall observations can be made. First, E2E solutions value conversion contingencies occur at the process level. This result is consistent with the finding of Davern and Kauffman (2000) who argued that for measuring realized value, measurement below and above the business process level (e.g., aggregate) level is inappropriate as it is at the business process level that the critical conversion contingencies often materialize. There are some infrastructure issues such as customer readiness, the availability of an online database of borrowers, online integration with credit databases, and having the presence of reliable credit rating service providers that are more important for E2E loan processing, but may not have any/little impact on other processes (e.g., marketing, finance) of banks.

Second, this research confirms that in developing countries IT value is embedded at both the internal organizational level and the external environmental level. However, prior research does not include the environmental contextual factors (see for example, Cheng & Chiu 2008; Khong & Richardson 2003). On the other hand, Peppard and Ward (2003) mentioned that only business executives and users can unlock the value from IT. This may be true for developed countries that have the appropriate infrastructure. However, as this research found, there are some factors (e.g. ensuring a 24/7 electricity supply, the absence of a database on borrowers, and the absence of high speed internet), where bank executives and users can do nothing but urge the government to solve the problems.

Third, this research has supports the beliefs of others (e.g. Melville et al. 2004) that IT value research should be studied at the process level as process level performance translate to the aggregate level performance. Specifically, *top management support and resources* have a significant influence on process performance, but not on coordination. This finding can be explained by the concept of 'locus of control'. Core loan process activities are normally done within banks where management controls are in operational. However, management has less control over external process (e.g., coordination) of a loan such as managing the business partners. Further, Lee (2001, p.202) mentioned that in mortgage loan processing "despite managing in-house processes, the most time consuming activities-which determine the total cycle time-are often in the hands of other business partners. One such partner is the appraiser, who needs to physically enter and inspect the property. Often times, this is not controlled for and may delay the whole process". As expected *alignment and integration* was found to be critical. This also supports to the findings of other researchers (e.g. Bubak et al. 2006). The reasons for the strong influence of alignment and integration could be, in loan processing, banks use various types of 'heterogeneous' IT like CRM, Decision Support System (DSS), spreadsheets for ratio

calculations, ERP, and Legacy Systems (Lee 2001) where 'alignment and integration' is the key to support the E2E business process orientation (Bubak et al. 2006). In our research the construct alignment and integration captures both strategic and operational level indicators, however developed countries literature mostly talked about strategic IT-business alignment (e.g., Wagner 2006).

The *legal environment* was found to have insignificant influence on both process performance and coordination performance of E2E solutions. This result contradicts the findings of Zhu et al. (2004) and Zhu and Kraemer (2005) who have mentioned that e-business value in developing countries is influenced by legal environment. While further study is required, some literature (O'Connor 1998) explains that proper implementation of policies and violation of rules and regulation also a problem in some developing countries. The other possibility could be the banks are subject to international trading regulations (cross border). Alternatively, unlike other barriers such as infrastructure, the legal environment is a 'soft barrier' that can be ignored/avoided without having any drastic consequences.

Finally, infrastructure emerges as one of the external environmental barriers to realizing value from E2E solutions. Infrastructure includes generic infrastructure (e.g. hardware, software, internet and electricity) and banking infrastructure (online databases, EDI connection with credit bureau, trustworthy credit rating services, and reliable financial statements). In addition, infrastructure includes customer readiness and acceptances for E2E solutions to deliver value. The significance of infrastructure in value creation is understandable as basic infrastructure such as high bandwidth internet is required for document transfer and management and 24/7 electricity is required for uninterrupted services. Banking infrastructure such as online database of borrowers is required; otherwise bankers need to use a manual search that reduces the value of the E2E solution. Without online connection with credit bureau, whose approval is mandatorily required in Bangladesh, banks usually need to wait in a long queue for manual approval; resulting in the E2E solutions only partially completing the task. Furthermore, true financial statements of borrowers are required; otherwise the Decision Support System (DSS) would produce unreliable ratios, projections and credit scores.

## 6 CONCLUSIONS

This paper articulated the challenges of deriving value from E2E solutions in a developing country. Based on a study of 30 banks in Bangladesh, the study found that lack of top management support and resources, lack of alignment and integration, and poor infrastructure creates barrier to realize value from E2E solutions. Overall, the model of E2E solutions value proposed is well supported by the data, as indicated by high explanatory power of model, with seven out of ten hypotheses supported. Although, the findings are subject to testing in the context of different types of E2E solutions and countries, the following implications can be presented.

By identifying an appropriate set of indicators for constructs (an important aspect of theory building cf. Davamanirajan et al. 2006), this study attempts to fill gaps in the E2E solution's value conversion contingencies literature in developing countries. The results help justify the continuation of separate research streams for developing countries as a number of factors that characterize such countries (e.g. infrastructure) were found to have a significant impact on deriving business value from E2E solutions.

Given increased IT spending and the scarcity of capital in developing countries, this study is relevant to managers as it provides a framework to help managers assess E2E solution value conversion contingencies. In particular, it reveals that managers should pay attention to the levels of support and resources their organization have committed to the proper functioning of E2E solutions. In addition, it identified that proper alignment and integration of various heterogeneous systems is required as stand-alone IT is of limited value where business processes cross organizational boundaries. Finally, as infrastructure emerges as one of the biggest obstacles in deriving value from E2E solutions, organizations need to engage with government agencies to ensure proper infrastructure requirements for E2E solutions at a national level.

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