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Toward a Quality Model for Enterprise Information Systems in Developing Countries: A Jamaican Case Study

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ABSTRACT

Several companies have made substantial investments in enterprise information systems (EIS) and some have reaped the expected benefits; however, EIS implementation failure rate is high and even those that are successfully deployed may produce a variety of post-implementation problems. Many studies have modeled quality attributes for information systems and some have particularized these to EIS. However, the contextual bases for these models are corporations in developed countries and therefore need revision to make them applicable to enterprises in developing countries like Jamaica that are less equipped to manage such complex implementations. In this paper, we examine quality attributes that pertain specifically to EIS success in developing countries and develop a model that we believe captures the parameters that influence the quality and success of such implementations. We then match the implementation experiences of five Jamaican companies to these parameters.

INTRODUCTION

Information technology (IT) innovations have allowed organizations to expand their global reach, causing small and large companies alike to compete beyond their national borders. As a competitive necessity, many small organizations in developing countries like Jamaica are forced to acquire advanced information systems (IS) such as enterprise information systems (EIS), described by Lee and Myers (2004) as large, complex, software packages that integrate several of an organization's core IS around a common database. Once considered expensive giants, EIS are now used routinely in major corporations (first generation adopters) for transaction processing (Kumar & Hillegersberg, 2000). However, despite their increasing penetration in small and medium enterprises and in developing countries (Gable & Stewart, 1999) these systems provide considerable implementation challenges for these second generation adopters.

There has been a marked increase in EIS implementations over the past several years in corporate, government, and educational institutions (Esteves & Pastor, 2001). Over 30,000 firms worldwide (Lee & Lee, 2004) and more than 60 per cent of Fortune 500 companies in the US (Bernroider & Koch, 2000) have invested in them. Some organizations – 10 to 15 percent according to James and Wolf (2000) – experience popularly cited benefits such as improved competitiveness, organizational transformation, and greater customer responsiveness as a result of increased coordination of information flows, and greater business integration (Brown & Vessey, 2003; Markus & Tannis, 2000). However, others have experienced severe implementation failures resulting in abandonment before deployment and a variety of post-implementation problems (Lee & Lee, 2004). While notable failures have occurred in large corporations such as FoxMeyer Corporation (Scott, 1999) and Hershey (Scott & Vessey, 2002) and others, developing countries, because of less preparation for such systems, are more likely to encounter failure factors.

Scholars (Bertoa & Vallecillo, 2000; Carvallo et al., 2003; Esteves & Pastor, 2001; Murray & Coffin, 2001; Nah et al., 2001; Parr & Shanks, 2000; Sarker & Lee, 2000;) have proposed many modifications to existing IS quality and success models to account for EIS dissimilarities. However, most of these revisions reflect EIS implementation experiences in developed environments and may be inadequate to assess the quality requisites of smaller organizations in developing countries like Jamaica. These organizations have mostly transitioned to EIS from standalone applications without the preparation for integrated systems that MRP and MRP II systems afforded larger organizations. They are therefore severely challenged by the size and other scale-related complexities of EIS, the range of affected business processes, the number and diversity of stakeholders, and organizational readiness to absorb the impact of the changes these systems cause.

There is a glaring need to revisit these models from the distinct perspectives of developing countries. Our objective therefore is to make a contribution to research and practice in this area by offering a quality model specifically for EIS implementation in small economies such as Jamaica's, which may be representative of economies in many developing countries. We then match the EIS implementation experience of five Jamaican companies to the parameters we propose in this model.

RISK-BEARING CHARACTERISTICS OF EIS

EIS are known by several names, such as enterprise resource planning (ERP) systems, enterprise systems (Davenport, 2000), total enterprise integration (Langenwalter, 2000), collaborative business solutions, Internet enterprise platforms, on-line interactive systems (Brown & Vessey, 1999), and ERP II systems (Bond et al., 2000). These names denote the all-encompassing, integrative nature of such systems - a feature which represents a significant deviation from traditional IS.

Many of the salient features of EIS are widely discussed in the literature and will not be further elaborated here. For our purposes, the interesting characteristics are those that are likely to elevate the risks of implementation failure for organizations in developing countries. For example, EIS span the boundaries of traditional functional organizational units (Parr & Shanks, 2000), exploiting cross-functional dependencies among business processes to manage value chain operations. This is both a blessing and a curse for organizations; they desire the benefit but must incur significant implementation risks to obtain it.

Although EIS are examples of commercial off the shelf (COTS) software, they have several distinguishing features that contribute to additional implementation risks not associated with traditional COTS applications. Many companies invest in these systems to effect organizational transformation that may require changes to business

Table 1. Typical EIS features

Feature	Explanation	Implications
Integration.	Multiple systems that together encompass the information-needs of an entire organization	Most small organizations have not previously encountered systems of this size and scope
Configuration	Organizations implement business logic by setting software switches This is a form of customization without "programming"	Requires knowledgeable domain experts to partner with a variety of technocrats. Success, even competitive advantage, may be at stake; unfamiliar approach for developing countries
Industry Settings	ERP systems have many configuration tables thus vendors developed templates of typical settings - "best practices" - for different processes and industries, that ERP purchasers can use with or without modification	Best practices typically reflect the industry practices of organizations in developed countries and are not as valuable for implementers in developing countries
Client-server architecture.	ERP systems typically use client-server architecture – where the workload of information systems is distributed among a network of client computers and servers that provide specialized services.	Many developing countries are more experienced with centralized architectures. EIS Implementation forces acquisition of other technical competencies, thereby increasing failure factors
Common central database.	The ERP system has a common central database that can be accessed and kept up-to-date by all implemented modules	Data analytic competencies must be acquired and data conversion increases implementation risk
Stakeholder community	cross-functional business processes and modules for the enterprise means larger than normal user community, and external consultants	Collaboration and communication difficulties have caused many software failures; small corporations have no experience with such large, diverse implementation groups
User Involvement	Transfer of pivotal user involvement from requirement determination (pre-acquisition) to configuration stage (post-acquisition)	Entirely new concept and experience for most developing countries

process operations, relationships, or organizational power structures (Wood & Valdas, 2001). Table 1 identifies several other distinct EIS features and summarizes their implications for the successful management of EIS implementations in developing countries.

These and other EIS characteristics elevate change management to critical-success-factor proportions (Bhattacherjee, 2000; Esteves & Pastor, 2001). This is more so in developing countries where the adoption of massive, alien systems that replace more comfortable individual systems may help to generate significant resistance (Stewart et al., 2000). Consequently, high-level orchestration is required to modify cultural paradigms and realize business transformation objectives (Curry & Ferguson, 2000; Davenport, 2000; Wood & Caldas, 2001).

The high price-tag of EIS typically provides expectation management problems, particularly in developing countries, where hype is sometimes a strategy for winning scarce investment dollars. Elevated expectations and unidentified hidden costs later contribute to post-implementation disappointments and even lost productivity due to organizational depression. Pyun (2002) refers to this as the "valley of despair."

From the authors' combined experience of information development practices in Jamaica, many organizations are not as attuned to the benefits of user involvement and its connection to user satisfaction, which Rushineck and Rushineck (1986) claim is a popular measure IS success. For EIS projects, user involvement is critical for effectively navigating business process interdependence and several software components for successful configuration (Bingi et al., 1999; Majed, 2003). EIS also require the collaboration of several stakeholders; cross-functional systems implementation needs cross-functional teams of domain experts and external consultants (Volkoff et al., 2002).

AN EIS QUALITY MODEL FOR DEVELOPING COUNTRIES

Despite several reports of low-quality IS (Brynjolfssen, 1993; CIO, 2001; Gibbs, 1994; KPMG, 1994; Mousinho, 1990; Niederman et al., 1991), there is no consensus on what constitutes software quality. Prescriptions for improving quality are often moderated by the perspectives of the heterogeneous IS stakeholder community (Newman & Robey, 1992) . Yet there is a universal search for high-quality software.

Duggan (2004) distilled the contributions of several authors to the definition of IS quality (Erikkson & McFadden, 1993; Grady, 1993; Hanna, 1995; Hough, 1993; Lyytinen, 1988; Markus & Keil, 1994; Newman & Robey, 1992; Palvia et al., 2001) into the following statement that embraces various perspectives: IS quality is reflected in the provision of system features that satisfy the expected system and business benefits and perceived user needs at an economically viable life cycle cost and within the required time frame. High-quality systems are reliable and provide correct and consistent responses with acceptable response times. Sources of errors are easily identifiable and correctable with normal effort. Such systems should be scalable to incorporate unforeseen functionality and accommodate growth in user base.

This definition of IS quality, however, embraces the typical producer-oriented view where quality features can be explicitly built in or accommodated by reducing variability in the software production and implementation process (Humphrey, 2002). This notion of quality originated in the quality literature in manufacturing (e.g., Deming, 1986) and pervades software process improvement thrusts (Rae et al., 1995). However, COTS systems, and therefore EIS, have triggered a demand-oriented shift in IS delivery quality perspectives (Sawyer, 2001).

Typically, generic IS quality models highlight the importance of people, IS delivery processes, and software production methods and practices to the software product. While these influential factors are still valid for COTS quality models, the weight of their impact has shifted. IS success and the quality of delivered systems do not rely at all on production methods and very little on the delivery process for EIS implementations in organizations in developing countries. To a large extent, successful implementations in this environment are impacted by organizational readiness, stakeholder involvement and collaboration, and the effectiveness of change management (Huang & Palvia, 2001). Table 2

Table 2. Salience of IS quality requisites

Quality Attributes	Producer-oriented Software	COTS	EIS	EIS in Developing Countries
Software Process	E	E	D	D
Software Production Methods	E	N	N	N
Product Characteristics	E	E	E	E
Vendor Characteristics	N	E	E	E
Evaluations of Product Fit with Requirements	E	P	N	N
Acquisition Specification	N	P	N	N
Change Management	E	E	E	P
Organizational Readiness	D	D	E	P
Systems Integration	E	E	N	N
Risk Mitigation	D	E	E	P
Stakeholder Collaboration	E	E	E	P
User Involvement	E	E	E	E
Project Governance	E	E	E	P

Figure 1. Quality model for EIS in developing countries

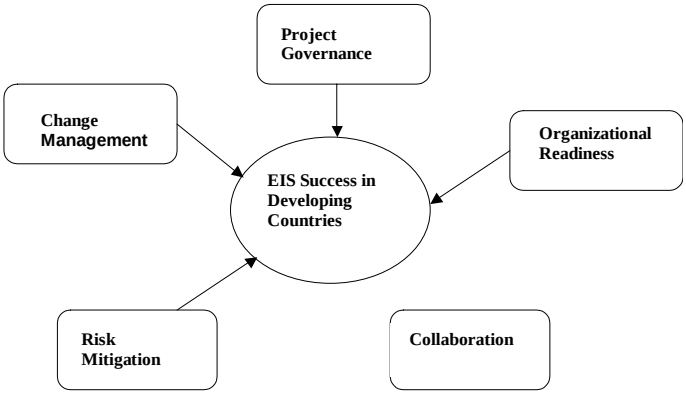

Table 3. Implementation problems

Problems Encountered	Company
Change Management	A, C, E
Organizational Readiness	A, B, C, D, E
Unmanaged Risks	A, B, C, E
Lack of Collaboration	B, D, E
Project Governance	A, C, E,

provides a listing of typical quality requisites that are considered in various IS delivery contexts and indicates the importance of each to implementation success, using the notations: E – essential; D – desirable; N – not significant, and P – pivotal.

Figure 1 further distills the information in Table 2 to denote the quality attributes that are pivotal to the delivery of successful EIS in developing countries.

IMPLEMENTATION EXPERIENCE OF FIVE JAMAICAN COMPANIES

In this limited research, we obtained information from five private and public sector organizations in Jamaica. These organizations had implemented EIS and were willing to provide the requested information. Several graduate students in a computer-based information systems course conducted face-to-face interviews with various employees including CIO's and other executives, functional managers responsible for the implementation of the various EIS modules, project managers, and IT staff and perused project documents to acquire information related to the variables we highlighted in our EIS quality model.

While we did not attempt to obtain data for statistical analysis, we examined pre- and post- implementation as well as deployment issues that affected these organizations. The information we obtained from these five companies, allowed us to compare actual experiences with the theoretical propositions of the model as a precursor to more rigorous data collection and analysis in follow-up research. Our gleanings from these studies are condensed in Table 3, in which the companies are referred to as company A, B, C, D and E, in order to protect their identity.

CONCLUSIONS

Since their introduction, EIS have received a great deal of attention. However, most of the literature addresses implementations in developed countries. We have initiated some redress to this situation by analyzing the challenges faced by organizations in developing countries. We explored this issue by progressively filtering generic IS quality requisites for COTS-related and EIS-specific concerns and finally incorporated considerations that are peculiar to Jamaica and other developing countries.

EIS implementations present significant risk management challenges for most organizations; however the stakes are much higher for organizations in developing countries. They must contend with the large financial outlay, EIS size and complexity, simultaneous adoption of a variety of supporting IT, the scope of the business processes affected, changes to business process operations, the size and diversity of the stakeholder community, and the degree of collaboration required. Each parameter individually is unlike anything most of these organizations have ever experienced in software projects; their confluence in the same project magnifies the difficulty greatly.

The prerequisites for successful EIS implementations in developing countries therefore render the general models of IS quality and success inadequate, necessitating extensive revision to reflect the truly influential parameters in this context - organizational readiness for such ventures, and the high-level orchestration needed to effectively manage and enable modifications to cultural paradigms for organizational transformation, mitigate risks, foster collaboration, and provide the required governance. We have supplied such a model, which we intend to use, and offer to others, to guide further examination of this understudied phenomenon in future research.

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