BUSINESS PROCESS COMPLEXITY AND IS AUDIT SERVICE QUALITY: AN ENTERPRISE SYSTEM PERSPECTIVE

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ABSTRACT

The central theme of this paper is to examine the impact of Business process complexity on IS audit quality using the construct of SERVQUAL. From the IS auditors perception of an organizations ability to deploy appropriate compliance measures in an enterprise system, this paper contends that as business process complexity increases in an enterprise system environment the IS audit service quality will witness a corresponding decrease as IS auditors will grapple with understanding the business process hence lowering their expectations on audit reliability, assurance, empathy, and responsiveness.
Keywords: Business Process Complexity, Enterprise System, IS Audit, SERVQUAL

INTRODUCTION

In the last century, the global business environment has witnessed the arrival of new sophisticated technological infrastructure aimed at alleviating risk, streamlining business processes and enhancing operational efficiency. Firms on their part have embraced these technologies in such a manner that they more than ever before rely on large-scale systems to coordinate complex business processes and sustain competitive advantages. Most renowned among them are enterprise systems, which are industry specific customizable software packages that integrate information and business processes in an organization (Rosemann & Waston 2002; Devadoss & Pan 2007). The use of technology has evolved from a data centric era to a process driven initiative where technologies are embedded with "best practice" process considerations. For example, enterprise systems have heralded an era where processes embedded in these

technologies are increasingly becoming the panacea for efficiency as vendors surged to develop 'best practice' solutions for company's information processing needs. Nowadays, the search for optimal business processes ends up with enterprise systems in the form of packaged implementation, modular implementation or some degree of customization with existing in-house systems.

The consequences of these evolutions are seen in the role of information system auditors, which have subsequently evolved from complementary to mandatory service in an audit engagement. IS auditors are now critical members of the audit team and their expertise and knowledge are required more than ever before. Hence as organizations continue to deploy robust and complex IT infrastructure, it becomes inevitable that 21st century auditors need to have the sufficient grasp of business processes to be able to make informed judgments and decisions critical to audit quality. Such thorough understanding of client's business processes help auditors assess potential business and financial risk and help evaluate control adequacy (Carnahan 2006).

Information system auditors' audit reports often serves as a proxy for an organization effective use of enterprise systems and its alignment with its business processes. Enterprise systems aim to mitigate risks by reducing complexity; complexity reduction is mainly at the system level rather than capturing evolving complexities at process and workflow levels. David (2007) compares enterprise systems to monolithic templates that are more self-serving to the system instead of being agile to changing process and governance complexities. Simply put, due to time or cost considerations, companies often fail to incorporate and align actual business process complexities with their enterprise systems. Over time, these complexities devolve as a result of changes in processes and software configuration resulting to a declining state of complexity where the result of the system may no longer be reliable. Therein lies the problem as often, enterprise systems fail to capture the realities of process complexities, creating a disconnect and therefore, an issue of concern for IS auditors. With the overwhelming need for collaboration across distributed workflow and with tightly coupled complex linkages, complexity is increasingly becoming a natural part of business growth. By encapsulating myriad process complexities, enterprise systems offer IS auditors a constant challenge of assuring quality IS audit. Unless organizations can either control business process complexities or periodically customize their enterprise system software, IS audits will become onerous engagements for IS auditors who will find it more difficult in providing objective assessments and service quality. This issue begs the following research question: In auditing enterprise systems, how do IS auditors perceive the downstream effects of business process complexities on IS audit service quality?

This paper attempts to use SERVQUAL matrix to investigate IS audit quality. We seek to find out how business process complexity will influence IS audit service quality. Therefore, it must be noted that IS audit SERVQUAL is not the organization's (client) perception of the IS audit but the IS auditor's perception of the capability of the organization in deploying appropriate measures for maintaining compliance with its Enterprise Systems. Our paper extends the IS audit

quality literature by examining a critical determinant of audit quality which has been largely ignored. Finally, we offer propositions regarding the consequence of business process complexity on each service quality construct and how it affects IS audit quality.

We begin this paper with a discussion of process complexity literature followed by a review of the enterprise system literature, including a brief review of IS audit service quality. We then introduce the IS audit service quality constructs and a theoretical framework, on which we propose propositions and a research agenda. The paper concludes with a discussion of its contributions to IS research.

THEORETICAL BACKGROUND AND CONCEPTUAL DEVELOPMENT

Process Complexity

Process complexity is defined as the degree to which a process is difficult to examine, understand or explain (McDonnell 2007). Although there remains an ongoing debate on definitional aspects of process complexity (e.g. Gell-Mann and Lloyd 1996, Arteta & Giachetti 2004), certain commonalities are traceable. Fathee et al (1998) observed that a business process may be complex in two ways either 'by having a large number of steps, or by having a complex set of percentage routings and feedback loops'. Fathee et al (1998) further argued that complex processes tend to be hierarchical, cross-functional and usually associated with random changes thus creating very dynamic systems. This was consistent with

Simon (1982) that complex systems are composed of interrelated sub-processes that are often associated with large corporations with complex and cross functional business processes. Sutherland and van den Heuval (2000) went further to argue that complexity emerged from the size of the system, the interrelationship of the system components and unpredictable behavior of individual system components. Typically, the degree of process complexity is dynamic as it changes over time as organizations continue to align with changing business environment. Fathee et al (1998) concluded that the greater the likelihood for vertical decomposition of a process the higher the level of process complexity. Cardoso (2008) went further to examine the complexity in business process from the control-flow perspective. The paper identified four main complexity perspectives, which are activity complexity, control-flow complexity, data-flow complexity and resource complexity. According to Cardoso (2008) activity complexity viewed complexity based on the number of activities within a process while control-flow complexity looks at the constructs such as loops, splits and joins. Data-flow complexity measures the number of formal parameters of activities and the mapping between activities of data and finally resource complexity, which measures the amount of resources used up in a process. The paper concluded that complexity increases over time as more processes are been added to accommodate changes in the business environment.

Building on definitions offered by existing literature, this paper defines business process complexity as a state of business comprising of multiple loosely and tightly-coupled functions

and processes within and outside the business organization exhibiting dynamic and random interdependencies and cross-functional activities. The interdependencies and cross-functional activities are such that uncoupling them will lead to unforeseeable random outcomes.

While increasing business processes are growing realities in firms as they strive to adjust to unpredictable business challenges such increases in processes came with baggage of problems such as error detection. Hence, complexities not only create barriers to analyzing process effectiveness but could also obscure positive organizational reforms. (Arteta & Giachetti, 2004). Process complexity could propagate tremendous bottleneck resulting to limited understanding, leading to more errors and defects (Cardoso 2008). Moreover, Fathee et al (1998) argued that process complexity tends to reduce the possibility of identifying risks associated with reengineering. As processes get more complex they tend to obscure the overall business process conversely making effective coordination difficult.

Enterprise Systems

Enterprise system refers to industry specific customizable software packages that integrate information and business processes in an organization (Rosemann & Waston 2002; Devadoss & Pan, 2007). Firms implement enterprise systems to support business processes such as customer relationship management, supply chain management and to integrate disparate business processes within the functional areas of an organization (McAfee 2006). Organizations view enterprise systems as a solution for fragmented information, incompatible legacy systems and inefficient processes. However, these systems are fundamentally different from other information systems due to high complexities, risks, scope and the investment requirement (Devadoss & Pan 2007). Enterprise systems as associated with huge changes in the organization existing business processes as the "best practice" embedded in them are often inconsistent with an organization existing practices (Mudimigh et al 2001) hence creating the need for some customization.

Enterprise system supports the process-oriented view of an enterprise because of its ability to streamline information flow across traditional business functions using a common database. Hence, as business processes of hitherto disparate functional areas become more interrelated and integrated, the systems and processes that support the organization grow correspondingly more complex. Enveloping complex business processes, enterprise systems are examples of complex systems. The complexity of enterprise systems can be found on the lines of codes consisting of conditional branching and hierarchical interaction of objects used to manipulate information into logical steps (Rettig 2007). Enterprise system vendors calm that complexity is removed with the integration capability of the enterprise system. However, Rettig (2007) argues that, in reality, replacing legacy systems with sets of interconnected modules to run the organizational functions creates its own complexities.

As today's organizations continue to grapple with the task of adapting to the dynamic changes in the environment in order to retain the competitive advantage, it becomes imperative that firms

need to constantly align and readjust business processes across multiple chains within the value chain. Processes are constantly redesigned and readjusted in response to customers changing demand for better products and services (Hammer and Champy 1993). Many organizations that have implemented enterprise systems in a bid to achieve the so called 'best practice' business processes and services as in constant touch with enterprise vendors for continuous reengineering-engaging in an unending cycle of process reengineering in tandem with growing process complexities. Hence a post implementation evaluation of an enterprise system will show a system that has devolved into a 'black box' over time.

THEORETICAL FRAMEWORK

IS Audit Quality

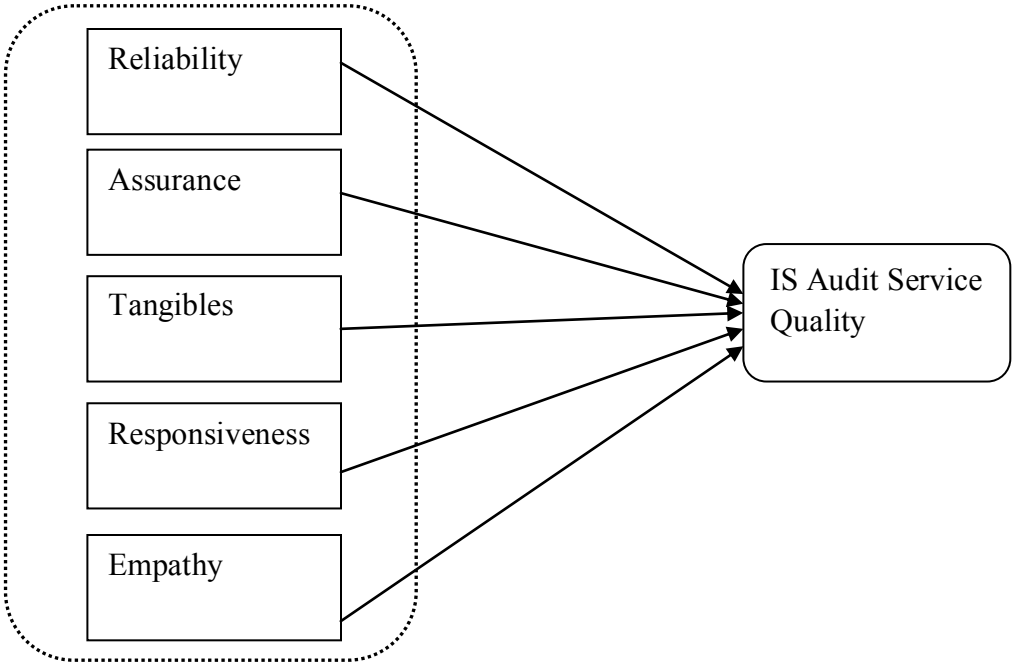
Audit quality has always been a source of concern to various end-user of financial information as users seek assurance that audited information is free of material mismatch and error. DeAngelo (1981) defined audit quality as the probability that an audit will discover and report material mismatch or breach in a financial statement. Several studies have tried to identify key determinants of audit quality such as auditor's independence, auditors reputation, client size, and audit fee. However, the results have been mixed and at best inconclusive. For example, while some researchers argue that large audit fees paid to auditors may increase the effort by auditors, hence improving audit quality (Hoitash el al 2007), on the other hand the opposing school argues that large fees paid to auditors could make auditors more economically dependent on these clients leading to scenarios where auditors are reluctant to make appropriate investigation for the fear of losing clients (Becker et al 1998). Moreover, such economic bonding could lead to "Same As Last Year" audit approach: a situation where auditors are merely repeating what they did last rather examining for potential new issues and concerns. In a bid to ensure audit quality, the Sarbanes-Oxley Act 2002 included the mandatory rotation of lead and reviewing audit partners after five consecutive years on an engagement while regulations are formulated to ensure independence. However, with the current trend toward process integration and technology adoption, the auditing landscape has inevitably shifted to IS auditors in determining the overall audit quality.

IS audit is a subset of the overall audit process which is aimed at determining the state of affairs of an organization and at facilitating good corporate governance (Sanaya 2002). According to Ron Weber, IS audit refers to the process of collection and evaluating evidence to make a determination as to whether the information system safeguards assets maintains data integrity and achieve organizations goals and objectives. Sanaya (2002) identified the major elements of IS audit as physical review, system administrator review, application software review, network security review, business continuity review and data integrity review. However, in order for IS auditors to improve service to clients, they need to understand the business process and unveil any potential complexity. The question becomes how can we ensure that the quality of IS audits

in not compromised or obscured by processes that have metamorphosed into black boxes in organizations.

SERVQUAL

SERVQUAL refers to a five dimensional construct used by customers to measure service quality (Parasuraman el al 1985). The dimensions include reliability, assurance, tangibles, empathy and responsiveness. While SERVQUAL has generally been used to capture consumer perceptions of service, SERVQUAL is equally appropriate for gauging IS audits. Organizations implementing enterprise systems use enterprise systems to provide a portfolio of services including information control and compliance based on certain accepted standards (e.g. EU 8th Directive, COSO internal controls). The role of the IS auditor is to review, verify, and assure controls, compliance, and risk management. Because the IS audit is a third party engagement, the quality of the IS audit, therefore, rests on how well the IS auditor feels that the organization has capably managed its enterprise systems. Therefore, it must be noted that IS audit SERVQUAL is not the organization's (client) perception of the IS audit but the IS auditor's perception of the capability of the organization in deploying appropriate measures for maintaining compliance with its Enterprise Systems. The assumption is that IS audit service quality is an implied function of the preparedness of the organization implementing enterprise systems to produce and provide information services. Thus drawing from the SERVQUAL dimensions, this study provides a research framework underlying our investigation in figure 1.



Research Framework (Figure 1)

Reliability

Reliability in the context of IS audit refers to the ability of IS audit report to be dependable and accurate. This means that IS audit report should conform to standards and regulations while reflecting the true state of the system. According (ISACA 2008, SAS 94) conforming to standards with regards to enterprise systems means that IS auditors need to examine the business processes and procedures, system functionality, application security and data conversion and integrity. IS audit should indicate to what degree the system is able to safeguard organizations assets and prevent fraud. Hence audit reliability is closely associated with the evidence gathered by auditors. The quality of audit evidence is very important in audit as auditors are less likely to make error in judgment with high quality evidence. Typically auditors gather evidence through test of control, test of detail, analytical procedures etc.

However, it is the task of IS auditors to understand of the system and business processes in order to indentify and extract high quality evidence hence improving the overall audit quality. For example an audit examines a business process from origin to its disposition and what to know how assess control and object allocation are treated. The challenge is to identify whether proper segregation of duties are contained in these processes. The problem is that as business processes become more integrated and complex, auditor's ability to isolate evidence becomes even more blurred. According to Daigle et al (2005) IS auditors would spend less time to complete reliability evaluation of system control with a well documented and designed system. Yet many organization have documentation that do not reflect the current status of the system while some organizations have business processes so tailored and customized to meet their needs that it becomes very difficult for an outside expert to comprehend.

Moreover, as the degree of process complexity increases, the time and the number of expertise required will inevitably increase. With limited time on audit engagement and pressures from audit team and client, IS auditors are faced with situations where assessments are made with limited information and time. In addition, while IS auditors are expected understand the business process level controls designed to address business risks and risk of misstatement, however, these controls are not generic rather are based on management policies. As the complexity of a system increases due to interrelated sub-processes and third party integration, the effective allocation of internal control become very difficult to identify and assess by IS auditors. Consequently the result will affect the reliability of the IS audit report as the IS auditor will require more time, expertise and other resources if they are to understand the control mechanisms and business processes to make an inform judgment. With these increased process complexity the level of understanding of the potential business and control risks becomes more obscured and complicated. IS auditors are now faced with the dilemma of trying decomposing the system to an acceptable level of abstraction to gain adequate insight. Such process complexity would inhibit IS auditors information processing and system understanding hence limiting the level of reliance the IS auditor will place on the system. Hence we propose:

Proposition 1: An IS auditor will perceive a lower sense of reliability when auditing Enterprise Systems in firms with high business complexity than for firms with low business complexity.

Assurance

Assurance refers to the ability of the IS auditor to inspire confidence and trust among users of the audit information. This assurance will be accomplished if users of the audit information believe that the IS audit can potential detect errors, mismatch, recognize system flaws and unmask complexities that could potentially jeopardize audit results. The IS auditor's expertise and knowledge is typically assumed and expected to be at a very high level capable of seeing beyond the system and process complexities. Typically, when auditing an enterprise system, the IS auditor needs to provide assurance on process integrity, infrastructure integrity, application security and assurance that controls within the system are appropriate and effective. Yet the degree to which IS audit are able to perform these examination are increasingly becoming difficult as the level of complexity increases.

While section 404 of SOX requires management of SEC registered companies to annually make assertion of the effectiveness of internal control however, auditors still need to provide assurance on these assertions. Assurance can only come from an IS audit if IS auditors are able to decompose the system and understand the underlying business processes. As organizations implement enterprise systems with its inherent complex processes, auditors ability to inspire confidence and trust will diminishes as IS auditors cannot give complete assurance without first gaining comprehensive understanding of how the system processes information. Therefore as process complexity increases due to process integration and enterprise system implementation, IS auditors will need more verification and evaluation of information reliability to give assurance on the IS audit report. Assessing the strength of system controls is a necessary condition for assurance. Therefore as process complexity increases the level of assurance will reduce as IS auditors will be unable to obtain a sufficient understanding of how an entity use of systems may affect controls. Thus we propose:

Proposition 2: IS auditor will perceive a lower sense of assurance when auditing enterprise systems in firms with high business process complexity.

Tangibles

This refers to the underlying IT infrastructure, security facilities personnel and in-house IT department within the organization. In today's auditing landscape where the auditor rely heavily upon client documentation, control structure and business process these tangibles become so essential to IS audit service quality. For example a well documented modularity driven system with clearly identified business processes may require fewer assessment hour and IS audit effort while on the other hand a system with incomplete documentation and multiple layers of integrated IT artifact may require more time, effort and resource to understand. Moreover, the facilities and personnel will have significant impact on the IS audit. For instance, IS auditors can

work through and interview personnel in an in-house IT department compared to an organization whose IT service are out sourced to an outside party. Hence, the role of tangibles becomes very important as business process get more complex as these tangibles act as necessary tools and instruments that enables IS auditors obtain understanding of systems reliability and assurance. Hence we propose:

Proposition 3: An IS auditor will require the support of more IS tangibles when auditing Enterprise Systems in firms with high business complexity than for firms with low business complexity.

Empathy

This refers to the extent of improved value-added services, individualized services and care that accompany IS audit. This means that the service provider (IS auditor) understands the needs of the clients and is able to show care and personalized service in alleviating those needs (Parasuraman et al 1988). There is need to ensure that IS audit is tailored to suit the specific business processes and Information system deployed by the organization. Individualized service is essential since business processes typically differ across organizations and even with organizations using similar enterprise systems, the level of integration and customization may differ among them. Moreover, empathy can be viewed from the lens of value added service derived from IS audit. Typically companies pay less attention to security implications of enterprise systems configuration during the deployment and implementation phase as such attention only increases implementation time and budget (Hendrawirawan et al (2007). The challenge therefore for IS auditors is to recommending ways to improve weak controls and in setting up prevention mechanism to mitigate fraud rather than playing the role of detecting control flaws and vulnerabilities in the system. However as complexity increases IS auditors ability to provide these value added services will inevitably reduce. This is because as the IS auditor grapples with understanding and these process complexities, the audit focus will be directed toward assurance and information reliability rather than empathy. Empathy can be accomplished if IS auditors have sufficient understanding of the system as to be able to make recommendation for improvements. For example if IS auditors are struggling to understand the business processes within a client system then providing the client with recommendations for improvement become very unlikely as such service are conditional on having clear understanding of the system.

Proposition 4: An IS auditor is more to demonstrate a less degree of empathy when auditing Enterprise Systems in firms with high business complexity than for firms with low business complexity.

Responsiveness

Responsiveness refers to the auditor's perception of her ability to capture the changes in client environment. As business climate continue to evolve the role of IS audit will inevitably be

increased. However, the question is to what degree are the processes and techniques evolving to capture these changing business conditions and these responsibilities. As IS audit consideration continue to increase as indicated in SAS94 what input are introduced to ensure the changing conditions are incorporated in the procedures, techniques, skills and conduct of IS auditors. For example there need to find out to what degree IS auditors are equipped to provide prompt services to clients with high business process complexity compared to clients with simple business process.

Proposition 5: An IS auditor is likely to feel less responsive when auditing Enterprise Systems in firms with high business complexity than for firms with low business complexity.

DISCUSSION AND IMPLICATION

Using SERVQUAL construct this paper offers a new perspective on how business process complexity created by companies could have significant effect on IS audit service quality. As business process complexity increases in an enterprise system environment the audit service quality will witness as corresponding decrease as IS auditors wrestle with understanding the business processes hence lowering their expectations on audit reliability, assurance, empathy and responsiveness. The implication of this is that companies need to consider ways to mitigate unnecessary process complexity as such levels of complexity can become draw backs to audit service quality. In addition, such complexity will inevitability increase audit fee as IS auditors will spend more time than necessary gathering evidence in a bid to comprehend the process flow. Furthermore, as complexity increases the need for more expertise within the audit team will arise leading to a corresponding implication with the audit fee.

One way to alleviate this concern could be through modular implementation of an enterprise system so that processes can be matched with a module hence making understanding of the process framework much easier. In addition, there is the need for organizations to have comprehensive documentation of existing business process. These documentations should be detailed and truly depict the functionality of the business processes. There should be a clear distinction between how business processes are expected to function and how such processes are actually functioning. The impact of integration of multiple business activities and effective allocation of internal control should be examined more carefully. Prior to re-engineering of business processes organization may need to consider how control mechanisms are allocated and whether such allocations are consistent with management policies. This new trend of business process re-engineering where every business activity that can be accommodated is added to the existing process without any consideration on the control mechanism, and process framework is a potential recipe for an incomprehensible process complexity and such additions end up creating business process monsters, which are neither helpful to companies nor to IS auditors. “A complex system that works is invariably found to have evolved from a simple system that works”- John Gaule

DIRECTION FOR FUTURE RESEARCH

This study examined the impact of business process complexity on IS audit process solely from the IS auditors perspective. Hence, the further studies examining more dimensions such as multiple stakeholders, using balance score card will be interesting. For example it would be interesting to examine whether process complexity has an impact in audit fee and audit completion time. In addition, there is also a concern of collinearlity among the variables used in the paper. We acknowledge that there may be correlations among these variables however we believe that each variable had its own merit. Therefore, future empirical research could be done by developing measurement scales to validate this proposed model of audit service quality.

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