The Association Between Confidentiality and Integrity of Information Assets in ICT Outsourcing

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Abstract. Information security risk is a major concern for organisations, particularly when implementing Information Communication Technology (ICT) outsourcing. Despite the benefits of ICT outsourcing, it places information assets at risk and thus the viability of the strategy owes much of its success to the security measures taken to minimise such risks. The overall objective of this paper is to conduct an empirical study on the association between information assets confidentiality and availability in ICT outsourcing phases. Through purposive sampling, questionnaires were distributed to 300 respondents in various private and government agencies in Malaysia with a return rate of 36%. Findings reveal that the higher the confidentiality level, the higher the integrity level of the information assets. Results through Bivariate Pearson Product-Moment Correlation analysis reveal that all Correlation Coefficient values, $r > 0.7$. Hence, it is illustrated that there exists strong, positive associations between confidentiality and integrity of the information assets, in all phases of ICT outsourcing. The upshot is, organisations must concentrate on confidentiality and integrity principles to manage their information assets well, which would then urgently address information security risks so that the business value of ICT outsourcing is not lost.

Keywords: Information Asset, Confidentiality, Integrity, ICT Outsourcing, Information Security Risk

1. Introduction

Information Communication Technology (ICT) outsourcing is a key supply and cost management strategy of most organisations today. Although effective, it presents significant risks that must be identified and managed [1]. Potential risks could emerge [2]. Previous studies emphasise that information security risks are amongst the critical risks in ICT outsourcing [3, 4]. Furthermore, while the importance of information asset as a key asset continues to grow, following a period where its production, complexity, volume and demand have accelerated, fulfilling the real information needs of the organisation has been limited due to obstacles [5] which include information security risks. Thus, it is crucial to manage the confidentiality and integrity of these information assets efficiently for without it, much damage could be caused. This study aims to present empirical findings on the significant associations between confidentiality and integrity of the Information Assets in the ICT outsourcing cycle of Malaysian private and government agencies.

2. Literature Review

The study was conducted based on a review of several literatures focusing on theories and concepts as well as previous research in ICT outsourcing, information assets, and information security principles.

2.1. Information Communication Technology (ICT) Outsourcing

ICT outsourcing involves transferring some or all of the IT related decision making rights, business process, internal activities and services to external providers who develop and administer these activities in accordance with the deliverables, performance standard and outputs, as agreed in a contractual agreement [6]. ICT services commonly outsource ISP services, web hosting, ICT application maintenance and support, ICT infrastructure, programming, e-business solutions, application analysis, application services provision, support end user, staff/user training, ICT security audit and security policy or standards development [7, 8]. The different phases of ICT outsourcing cycles are, however, similar. The generic conceptual phases of ICT outsourcing cycles are; the analysis of decision to outsource; selection of Service Providers; contract management and project on-going monitoring [9]. Most organisations adopt the strategy largely to reduce costs of ICT operations [10]. Other reasons include improving the efficiency of their ICT services whilst

focusing on core businesses and the lack of in-house experts. Unfortunately, the strategy has significant risks that must be recognized and managed [1]. Recent studies reveal that information security risks are amongst the highest risks in ICT outsourcing [3, 4] that need to be addressed to ensure maximum benefit.

2.2. Information Assets in ICT Outsourcing Cycle

Information asset is one of the asset groups in ICT projects associated with all information security domains [11]. It refers to a collection of facts in the form of paper or electronic messages, content, subject matter and substance form from which conclusions may be drawn for executing the missions and objectives of the organisations [11, 12]. The following fourteen information asset categories involved in the ICT outsourcing cycle were highlighted in a recent study: Business and Financial Records, Clients' Profiles, Business Continuity Plan, Archived Data/ Information, Policy & Procedure Documents, Financial Proposal Document, Technical Proposal Documents, Solution Requirement Specification, Business Requirement Architecture, Systems Documentation, Electronic Files and records, Training Material, Legal & Contract Documents and Databases & Data Files [13]. Fig. 1 illustrates the relevant information assets.
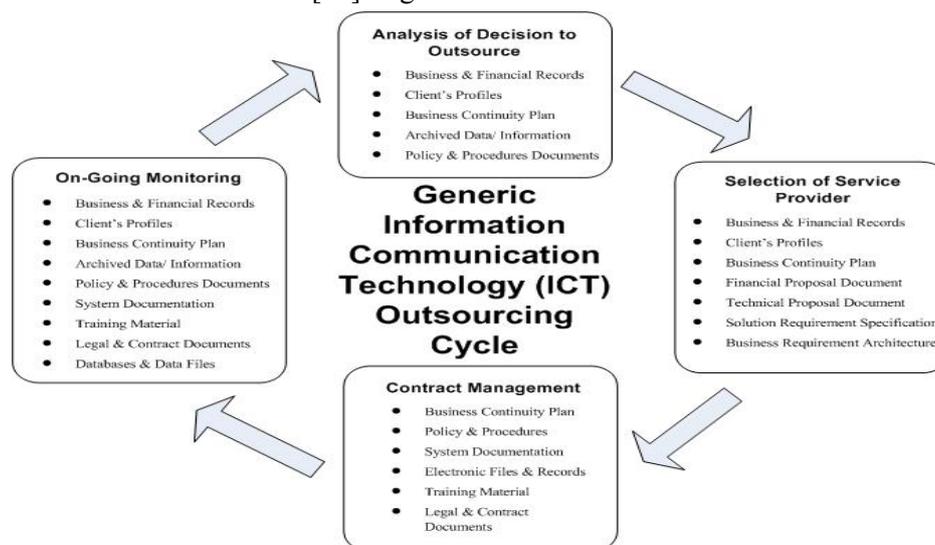

Fig. 1: ICT Outsourcing Phases and Set of Information Assets

2.3. Information Security Principles

Information security is an organisational approach to maintain confidentiality, availability, integrity, non-repudiation, accountability, authenticity and reliability of IT systems [14] and is highly required as the technology applied to information creates security risks. Information assets might be improperly disclosed due to its confidentiality being exposed, modified in an inappropriate way if its integrity is jeopardized, and destroyed or lost because its availability is threatened [15]. Confidentiality, integrity and availability are the core principles of information security [16, 17] and broadly used in most fields of studies [13]. Confidentiality refers to limits on who can obtain different kinds of information [16, 17, 18, 19]. Integrity is the guarantee that information has not been manipulated [16, 17, 18, 19] while availability is ensuring that authorized users have access to information and associated assets when required [16, 17, 18, 19]. In this study, two of the information security principles were measured and statistically analyzed, being confidentiality and integrity of information assets in the ICT outsourcing cycle.

3. Methodology

Primary and secondary data were used to achieve the objectives. An empirical study was conducted using questionnaires as the research instrument. The information assets in each phase of ICT outsourcing was determined from previous research (refer to Fig 1) and were used to determine the confidentiality and integrity of information assets among private and government agencies in Malaysia. The content validity of the research instrument was established via feedback from practitioners of ICT outsourcing. In previous studies reliability tests were conducted on (i) a set of 5 information assets confidentiality and integrity items involved during analysis of decision to outsource, (ii) a set of 7 information assets confidentiality and integrity items during selection of Service Providers, (iii) a set of 6 information asset confidentiality and integrity items during contract management and (iv) a set of 9 information assets confidentiality and integrity items during on-going monitoring. The results showed high alpha readings ($\alpha > 0.8$) [13] for all item sets,

indicating that the entire sets of measured items were excellent. To collect primary data, purposive sampling method [20] was applied via electronic and postal mail to 300 respondents, with a return rate of 36 % or 110 respondents. This is considered to be relatively normal [21]. The sampling method required information gathered from specific groups of people on some rational basis, thus organisations that outsource their ICT projects were the specific groups selected for the study. Analysis of primary data was supported by the application of appropriate statistical techniques.

Based on the Conceptual framework of IT outsourcing [9], a research model (Fig. 2) was developed focusing on the confidentiality and integrity of the related information assets during phases of the ICT outsourcing cycle.
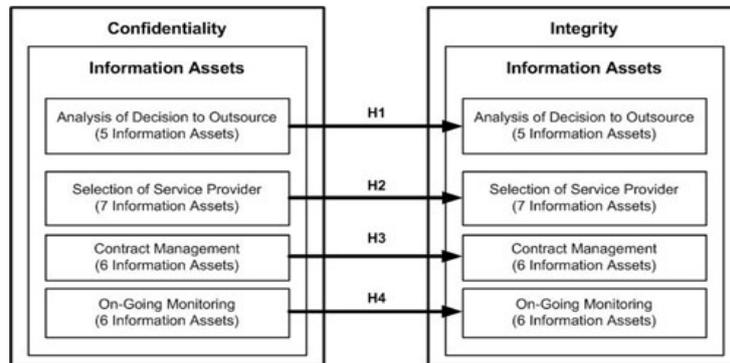

Fig. 2: Research Model of Association between Confidentiality and Integrity of Information Assets.

The research hypotheses H1 to H4 were formulated based on the research model in Fig. 2 to test for positive associations between each set of information asset confidentiality level and each set of information asset integrity level. The hypotheses are listed below:

H1 : There is a positive association between confidentiality and integrity of information assets during analysis of decision to outsource phase

H2 : There is a positive association between confidentiality and integrity of information assets during selection of service provider phase

H3 : There is a positive association between confidentiality and integrity of information assets during contract management phase

H4 : There is a positive association between confidentiality and integrity of information assets during on-going monitoring phase

4. Results and Findings

The survey captured the respondents' demographic profile and opinions on the confidentiality and integrity of information asset in each phase of ICT outsourcing.

4.1. Respondents' Demographic Profile and ICT Outsourcing Characteristics

The sample data comprised of ICT project managers and senior information system officers from various industries and agencies. 18.2% respondents had working experience of less than 5 years, 15.5% of those with 11 to 15 years as well as 15 to 20 years experience. The majority, 40.9%, had been working for 6 to 10 years. The majority of respondents are from government agencies (79.1%), 11.7% from government-linked companies (GLCs) and 9.1% from private companies. Nonetheless, various businesses are represented in this survey.

The ICT Outsourcing projects' characteristic analysis revealed that 57.3% of the projects concerned Application System Development, ICT Infrastructure Maintenance (26.4.3%), IT/IS Strategic Planning Results (6.4%), ICT Security Maintenance (5.5%), ICT Knowledge Transfer & Training (2.7%) and ICT Application Maintenance at 1.8%. Most of the respondents practiced Joint-Venture-Outsourcing (43.6%). Selective Outsourcing approach accounted for 30.9% and Total Outsourcing approach, 25.5%. For the majority (16.7%), the main reason for outsourcing ICT projects is the unavailability of in-house resources/ expertise. The highest response came from organizations that outsource their ICT projects to only one service provider (58.2%). Most of the project durations were medium-term being between 1 to 3 years (62.7%), while short-term (less than 1 year) and long-term (more than 3 years) were 18.2% and 19.1%

respectively. The highest response was also received from organizations with ICT outsourcing projects costing between RM 1 Million to RM 5 Million (23.6%).

4.2. Confidentiality and Integrity of Information Assets

There appears to be high potential frequency of confidentiality and integrity of information assets from the respondents' perspectives. As seen in Table 1, the information assets confidentiality (4.0436) and integrity (4.0691) level were the highest during analysis of decision to outsource phase and at the lowest, confidentiality (3.9374) and integrity (3.9556) during the project on-going monitoring phase. Confidentiality and availability level of information assets decreases towards the end of the ICT outsourcing cycle.

Table 1: Summary of Mean Score for information asset confidentiality and integrity in ICT Outsourcing Phases

ICT Outsourcing Phases	No. of Respondents (N)	Information Assets Confidentiality		Information Asset Integrity	
		Mean (Overall)	Std. Deviation	Mean (Overall)	Std. Deviation
Phase 1 - Analysis of decision to outsource	110	4.0436	0.64017	4.0691	0.66495
Phase 2 - Selection of Service Provider	110	4.0039	0.65721	3.9571	0.68622
Phase 3 - Contract management	110	3.9879	0.62878	3.9833	0.68251
Phase 4 - Project on-going monitoring	110	3.9374	0.58631	3.9556	0.62424

4.3. The Association between Confidentiality and Integrity of Information Assets

The Bivariate Pearson Product-Moment Correlation test was then administered on the research hypotheses formulated for confidentiality and integrity of information assets to determine the association strength. The correlation coefficient *(r)* was derived to explain the association strength. A result of *p-value* < 0.01 is considered significant. Weak association is indicated by a *(r)* value of less than 0.4, values between 0.4 and 0.7 indicate moderate association and a strong association has a value higher than 0.7.

Table 2: Results of Hypotheses Tests for the significant Associations between Confidentiality and Integrity of Information Assets

Hypotheses	Correlation Coefficient (*r*)	Sig. (*p-value*)	Decision	Results
H1	0.714	0.000*	Significant	Strong +ve association
H2	0.761	0.000*	Significant	Strong +ve association
H3	0.718	0.000*	Significant	Strong +ve association
H4	0.835	0.000*	Significant	Strong +ve association

*Correlation is significant at the 0.01 levels (2-tailed)

As shown in Table 2, the results of the hypotheses tests indicate strong and positive correlations for the four hypotheses. H1, H2, H3 and H4 were accepted and the null was rejected based on significant *p-value* < 0.01. The correlation coefficient (*r*) values were 0.714 for H1, 0.761 for H2, 0.718 and 0.835 for H4. The lowest association strength level between confidentiality and integrity of information assets was during the analysis of decision to outsource phase. Meanwhile, the association between level of confidentiality and integrity of information assets peaked during the on-going monitoring phase. Thus, there is the probability of increased integrity with increased confidentiality in each phase of ICT outsourcing.

5. Conclusion

This study empirically establishes the significant association between confidentiality and integrity of the Information Assets during the ICT outsourcing cycle for private and government agencies in Malaysia. As Information assets confidentiality and integrity level dropped towards the end of the cycle, confidentiality and integrity of the information assets must be given greater priority in the early stages of ICT outsourcing. It was recognized that the confidentiality level influences the integrity level during the implementation of ICT outsourcing projects and that strong, positive associations exists between confidentiality and integrity in every phase of ICT outsourcing. Therefore, the higher the confidentiality level, the higher the integrity level of the information assets. ICT outsourcing entails careful planning and these findings provide the basis for the provision of a cogent strategy to deal with information security risks.

6. Acknowledgements

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