ASSESSMENT INSTRUMENT FOR INTEGRATED INFORMATION SYSTEM SUCCESS IN INSTITUTION OF HIGHER LEARNING

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ABSTRACT

Assessing Integrated Information System (IIS) in organisations is an important initiative as it would enable Information System (IS) managers and the top management to judge whether or not their investment for IS integration have been successful and worthwhile. Current research on IIS assessment is rare and focuses on the assessment of technical aspects of IIS without considering the organisational and strategic aspects. This study tries to establish success factors and criteria of IIS which are used as the basis for constructing the instrument to assess IIS in an organisation. A list of relevant success factors and criteria for IIS was discovered through literature and was grouped into three main domains of IIS which are technical, organisational and strategic. Manual and online surveys to establish the factors and criteria for IIS assessment were conducted among IIS experienced practitioners. Factor analysis was carried out to confirm the strength of the factors and criteria within their respective domain groups. Using the factors and criteria compiled from the survey, an instrument for IIS assessment is constructed. Result from factor analysis has established three main technical success criteria which are system quality, timeliness and reliability, and information quality. The result also has established three main organisational success criteria namely organisational impact, user and service satisfaction, and positive usage. Furthermore, it has also established five main success factors which are project management and communication, project quality and culture, management support, project team and technical support, and knowledge and priority. Verification from three institutions has shown that the instrument is reliable and able to provide meaningful representation of IIS success status in organisation. The Pearson correlation coefficient value (r) between success factors and criteria are 0.88, 0.57 and 0.88 respectively, which indicates that the identified success factors have strong influences on the success criteria. These results support that the proposed assessment instrument is able to provide descriptive values as well as the level and factors of success that contributes to the success or failure of an IIS. This research contributes to the development of an assessment instrument by incorporating technical, organisational and strategic domains for IIS to be used in Institutions of Higher Learning.

ABSTRAK

Penilaian kepada Sistem Maklumat Bersepadu (IIS) di dalam organisasi adalah inisiatif penting untuk membolehkan pengurus Sistem Maklumat (IS) dan pengurusan atasan menentukan sama ada pelaburan terhadap integrasi IS itu berjaya dan bermanafaat. Penyelidikan mengenai penilaian IIS dijalankan masa kini adalah kurang dan tertumpu kepada penilaian aspek teknikal IIS sahaja tanpa mengambil kira aspek organisasi dan strategik. Kajian ini cuba untuk mewujudkan faktor dan kriteria kejayaan sesebuah IIS dan dikumpulkan ke dalam tiga domain utama iaitu teknikal, organisasi dan srategik. Tinjauan menggunakan kaedah manual dan atas talian telah dibuat di kalangan pengamal berpengalaman dalam IIS bagi mencari kekuatan faktor dan kriteria tersebut. Analisa Faktor telah digunakan untuk mengesahkan kekuatan faktor dan kriteria di dalam kumpulan domainnya. Berdasarkan faktor dan kriteria terhasil dari tinjauan tersebut, satu instrumen untuk penilaian IIS telah dihasilkan. Analisa Faktor menggunakan data tinjauan telah menghasilkan tiga kriteria utama kejayaan teknikal iaitu kualiti sistem, kekinian dan keutuhan data, dan kualiti maklumat. Analisa ini juga menghasilkan tiga kriteria utama kejayaan organisasi iaitu impak organisasi, kepuasan pengguna dan perkidmatan, dan penggunaan positif. Seterusnya, analisa ini menghasilkan lima faktor kejayaaan utama iaitu pengurusan projek dan komunikasi, kualiti projek dan budaya, sokongan pengurusan, kumpulan projek dan sokongan teknikal, dan pengetahuan dan keutamaan. Verifikasi di tiga institusi telah membuktikan instrumen boleh dipercayai dan berupaya menyediakan perwakilan bermakna kepada status kejayaan IIS di sesebuah organisasi. Nilai pekali korelasi Pearson (r) antara faktor kejayaan dan kriteria kejayaan adalah 0.88, 0.57 dan 0.88 menunjukkan faktor kejayaan berkenaan mempunyai pengaruh yang kuat kepada kriteria kejayaan. Keputusan ini telah menunjukkan bahawa instrumen ini boleh menyediakan bukan sahaja nilai deskriptif, malah tahap dan faktor kejayaan yang menyumbang kepada kejayaan atau kegagalan sesuatu IIS. Kajian ini memberi sumbangan kepada pembangunan instrumen penilaian IIS meliputi domain teknikal, organisasi dan strategik untuk digunakan di institusi pengajian tinggi.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Assessment is a process of measuring and evaluating the status, quality, ability, extent or significance of a product, person or service. There are many types of assessment which can be related to individual well-being or quality of a service or state of being, such as educational, health, nursing, psychiatric, psychological, risk and tax assessments. An assessment process can lead to clarity of the success or failure status, and bring up the required actions into focus. The main purpose of assessment is to understand the current well-being and to provide meaningful insight about the situation. Assessment is used in organisations to help identify areas of improvement which could further support business decisions and create positive work environments. It gives organisational information that helps in structuring strategic change and in measuring progress. Assessment can lead to increased awareness and inspire people to learn and grow.

IIS assessment can follow common method of assessment which has also been used in educational program assessment. The assessment steps includes establishing assessment objectives, constructing assessment design, collecting and analysing of data, reporting of results, and utilisation of results. Several approaches can be used for assessment such as diagnostic test, self-assessment, peer assessment or independent panel

assessment where the application of an approach is based on its suitability in meeting the assessment objectives.

During the early 1990s, many organisations started using Information System (IS) based on per need basis from their departmental requirements. Realising the benefits of having an enterprise system that integrates all subsystems available in an organisation, many organisations started pushing their IT department to consolidate all the subsystems to be integrated into one enterprise system. Thus, the term Integrated Information System (IIS) has been used to represent a system that comprises of the subsystems integrated together to support the enterprise and stakeholder requirements and business functions. The aim is to enable the user to effectively access the required and correct information from different subsystems in an organisation.

In practice, integrating various subsystems into one integrated system requires different approaches depending on the system's condition before the integration. Issues on technical strength of the current system, organisational and strategic direction of the organisation will influence the approaches taken for the integration. Finnegan and Khairil (2009) stated that IS integration is often viewed by some researches as a technical state involving the connectivity of interdependent computer systems that physically and logically link the information resources of different organisational units (Hasselbring, 2000; Gulledge, 2006), while others argue that IS integration is defined as a function of the structural configurations of the organisation that support optimal decision making (Fiedler, *et al.*, 1996). The nature of IIS, which can be explained by combining the views above, is the result of technical consolidation of various systems and supporting organisational and structural change that enable the organisation to use its information resources in an optimum manner. The process for IS integration is diverse and its end product is the Integrated Information System (IIS). The IS managers who are responsible for the product need to understand, manage and ultimately able to assess the product, in order to justify its return on investment and to improve the system.

This research focuses on the assessment of an Integrated Information System (IIS). Various researchers have conducted IS assessment in the past. Mendoza *et al.* (2006) assessed IS Integration management using Critical Success Factors, Wendt *et al.* (2005) assessed the components in IS integration, and Chien and Tsaur (2007) assessed the success of packaged integrated software. These efforts have contributed to better understanding of assessment issues for IIS, but fall short of looking at the IIS assessment in a broad perspective. Thus far, the assessment is focused more on the technical aspect or on the product itself, but has not covered all domains in IS integration. IT Managers of several higher education institutions in Malaysia have indicated that the product of Integrated Information Systems in their organisation has, most of the time, successfully fulfilled the technical requirements, but still did not satisfy some of the users or stakeholders requirements. Thus, there should be an assessment approach to IIS that can assist the IS management in understanding the overall state of IIS in the organisation, and to maintain the effectiveness of IIS implementation.

1.2 Problem background

Assessment is an essential requirement of a feedback loop for continuous improvement of the IS function and such improvement relates directly to the overall performance of the organisation as measured by its effectiveness (Myers, 2003). Thus, IIS assessment provides a measure of the effectiveness of IIS to the organisation. The first step in making improvements is to identify the current status of performance. Without proper assessment, an organisation does not know its current position, which consequently affects their judgment on what further actions that should be taken. However, IIS assessment is not well established in the current literature and more research is needed in this area (Alaranta, 2005). Zaitun and Zaini (2008) have evaluated the performance and the effectiveness of ERP in an organisation, but focused only on ERP as software and the benefits obtained from its implementation.

Many attempts have been made to illustrate the view of IIS, and most of the views can be summed up into technical and non-technical domains. The most comprehensive view was conducted by Wainwright and Waring (2004) when they strategically looked at the whole issues in IS integration and stated that the issues can be categorised into three main domains, namely technical, organisational and strategic domains. Examples of issues in the technical domain are whether there is a technology that can cater to the technical requirements, what tool is best suited for the integration, and how to integrate the current systems with the new requirement; while in the organisational domain, it is concerned with the readiness of people to accept the change caused by the integration, their commitment and understanding to the responsibility and rights from the initiative; and examples of strategic domains issues are on whether the policy, strategic planning, long-term and short-term objectives of the organisation have taken the IIS into consideration, whether the integration is based on the proposed business plan or on ad-hoc basis, and how the job and responsibility of the integration effort being distributed and supported in the organisation.

There are a number of approaches for IIS assessment available in the market offered by IT-based organisation such as BEA, SAP, IBM and Patni, and these approaches are aimed to assess both business and technical needs of an organisation. The approaches are primarily used as input by the System Integration Service Providers, before they can assist their clients in developing an integrated IS system either using their own product technology such as WebLogic by BEA, SAP software by SAP, WebSphere by IBM or a combination of products like Patni. However, the IIS assessment technology currently available does not take into account elements such as culture, structural, social and history of the organisation.

The focus of current literatures and practices are on technology solution to IIS (Wainwright and Waring, 2004); however there is no single tool that addresses all integration problems (Themistocleous *et al.*, 2002). Yet, Wainwright and Waring (2004) stated that many researchers continue to promote technical solutions to what they see as technical problems without acknowledging other domains, namely organisational and

strategic, that will impact upon the success of IIS as a whole. Such developments and hype in terms of technical integration are not only problematic in their own right, due to the exploding diversity of technology and tools, but they fail to recognise the organisational difficulties, which arise when functional boundaries are crossed. The focus on assessing the technical aspect of IIS may assist the organisation to find the 'right' technology, but assessing the IIS on technical aspects alone, as previously argued, is inadequate since organisational and strategic aspects in IIS are neglected in the assessment.

Wainwright and Waring (2004) identified seven layers of system integration: Physical, Data, Schedule, Functions, Attitudes, Principles and Purpose; the last three layers, namely, Attitudes, Principles and Purpose, need closer examination of the 'softer' aspects of integration. With the same purpose of defining integration for Computer Integrated Manufacturing (CIM), Voss (1989) proposed five dimensions of integration, namely strategy integration, material flow integration, technical integration, information integration, and organisational integration. O'Sullivan (1992) was more explicit about what integration entails and how it might be achieved. He proposed that integration should comprise social as well as technical elements. In fact, DeLone and McLean, in their 10-years review of their IS Success Model, suggested that more field study research should investigate and incorporate organisational impact measures.

The consequence of not having a wide-ranging assessment is like getting incomplete information on the IIS success status. The experience of IT Managers in the institutions of higher learning in Malaysia who claimed that they have successful systems but did not get support from some of their stakeholders indicate the incompleteness of its assessment element which did not include organisational and strategic contents.

Success Factors of IIS are the factors or issues that become the necessary conditions for IIS success. These factors strategically assist and become catalyst to the successful implementation of IIS and meeting its desired outcomes. Failure to consider

success factors during the IIS development stages (either at the planning, analysis, design or implementation stage) will affect the IIS project outcomes. Teamwork in development team and support from top management are examples of success factors that has to be consider during the IIS activities. IIS Success Criteria, on the other hand, are the attributes, characteristics, or elements that are used as the benchmarks against which the effectiveness, efficiency and benefits of IIS as a whole, is measured. System quality is an example of important success criterion that can be used to assess the success of IIS.

Comprehensive IIS assessment in this study is about determining the effectiveness and success or failure of IIS using IIS success criteria as success indicators that results in knowing the strengths or weaknesses of IIS, and knowing which success factors influence the outcomes. Hussein (2005) has stated that factors affecting IS success are equally important in evaluating the effectiveness and success of IS. She had investigated the antecedent factors and their combined effect on IS success. She used organisational, technological and individual factors as the antecedent, while system quality, information quality, perceived usefulness, and user satisfactions are identified as the success dimensions for the study. This study is using the similar understanding where IIS success factors are the antecedent to the IIS success criteria.

The assessment of IIS success must not only include the success criteria of IIS, which has been used by DeLone and McLean's in their IS Success Measures, but it should also include success factors as being used by Mendoza *et al.* (2006) and Chien & Tsaur (2007). The term 'comprehensive IIS assessment instrument' used in this study is about constructing an IIS assessment instrument which uses both IIS success factors and success criteria as a basis for the assessment's measurement items, which at the same time cover all the three domains (strategic, organisational, technical) of Wainwright and Waring (2004)'s Strategic Model of IS integration.

1.3 Problem Statement

It is noted from Mendoza *et al.* (2006), Wendt *et al.* (2005) and Alaranta (2005) that current approaches to IIS assessment are not well-established and comprehensive to measure the state of IIS in terms of its effectiveness to the organisation. Based on vendors' published documents, current available assessment approaches used in the market such as IBM PLM Enterprise Integration Executive Quick Assessment®, BEA Business Integration Assessment® and Patni Integration Assessment Methodology®, are vendor-based and focused on assessing the current situations of the organisation only to be used subsequently in customising solution based on their product. Furthermore, most literature on IIS focus more on technical assessment, rather than assessing the integration in a thorough manner by looking not only at the technical aspects, but the organisational and strategic dimensions as well.

The DeLone and McLean's IS Success Model is considered the most exhaustive assessment model. However, since the model focuses on establishing an IS success model, it only addressed IS quality, IS use and organisational impact from IS. It did not address the integration issues from organisational and strategic perspectives as required in IIS assessment.

It is noted that the IS assessment focuses on the essence of IS as a product and its impact to the organisation and users, while IIS assessment covers all the IS assessment aspects as well as the factors associated to the successful implementation of IIS, including the integration and strategic factors. However, research efforts looking into extensive IIS assessment that cover technical, organisational and strategic domains is lacking. Based on these issues, the main concern of this research is 'How to establish a comprehensive assessment for IIS?'. To respond to the main question, the following research questions are therefore addressed:

i. What are the success factors and success criteria for IIS?

ii. How can the IIS assessment instrument using the identified success criteria and success factors be formulated?

iii. How can the proposed IIS assessment instrument be validated and practically used?

1.4 Objectives of the study

There are three main objectives of this study. The first objective is to establish IIS success factors and success criteria that are important to Integrated Information System. Thus, there is a need to identify and consequently verify these factors and criteria associated with IIS. This factors and criteria are integral elements to be used as basis to comprehensively measure the success of IIS.

The second objective is to develop an instrument for assessing the state of IIS. The instrument is based on the success criteria and critical factors identified for IIS, and it includes the approach on developing the instrument. The third objective is to verify the validity and reliability of the instrument and assessment approach within the context of Institute of Higher Learning (IHL). Selected IHL had participated in using the instrument to assess the success of their organisations' IIS. To verify the validity and reliability of the findings, assessment results have been collected and analysed.

1.5 Scope of the study

The area of research is in the Information Systems Research domain; while the study area is in the area of IIS, focusing on success factors and success criteria as success indicators in IIS assessment instrument. This study tries to identify, analyse and classify various success factors and success criteria that contribute to effective Integrated

Information System which will then be tested in the context of Institute of Higher Learning in Malaysia.

The study tries to view the IIS assessment from the perspective of three main domains of IS integration namely technical, organisational and strategic, and to classify IIS success factors and criteria according to these domains, and applying it in the context of selected Institute of Higher Learning in Malaysia. The term 'comprehensive instrument' is used to describe the IIS instrument that includes both IIS success factors and criteria in the assessment, while ensuring that the factors and criteria covers all the three domains in strategic IS integration framework. The study will be based on empirical research and the instrument will be tested on with selected Institute of Higher Learning in Malaysia as a sample case.

1.6 Significance of the study

This study has significant contributions as follows:

i. It will contribute towards better understanding of the effectiveness of IIS in organisations in the fields of Enterprise Information System.

ii. It will enrich the knowledge on IIS success assessment; the IIS success assessment is a subset of Enterprise IS methodology.

iii. It will assist the IS managers of any organisation, especially in Malaysia, in understanding their IIS initiatives.

iv. It will provide complete information about the IIS, and the possibility of a successful integration effort will be improved if this information is used in developing a new plan for IIS.

1.7 Organisation of the Thesis

The remaining chapters are organised in the following manner. Chapter 2 outlines literature review of previous research in Integrated Information System, Models and Methodology of Information System Integration, and Assessment Methods and Measurements. Chapter 3 outlines the methodology used for this study. Chapter 4 outlines the process of establishing IIS success factors and criteria. Chapter 5 outlines the design and development process of IIS assessment instrument. Chapters 6 present the verification of the proposed instrument through sample case done at three selected institutions. Finally, Chapter 7 presents general discussion and conclusions for this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This study focuses on the assessment of Integrated Information System (IIS). The purpose of this chapter is to review previous works on assessment of IIS, related issues on IIS assessment methodology and measure. First, the discussion is on the IIS frameworks and model to see how best IIS be viewed in an organisation. These frameworks are the basis for constructing a comprehensive IIS assessment instrument and approach. Then, several IS integration methodologies which have direct effect to the success of IIS are explored. Next, several current assessment methods for IIS are discussed. Lastly, previous measurement tools for IIS assessment are explored before summarising this chapter.

2.2 Information System and Integrated Information System

Firstly, it is important to understand the difference between Information System (IS) and Integrated Information System (IIS), as this will rationalise the need to have specific method of assessment of IIS. An information system (IS), in term of product, is