The Development of a LMS Decision Making Model: Evaluating the Importance of Non-Financial Measures in LMS Decision Making at Universities

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Abstract: *This research examined how managers in universities incorporate non-financial measures in their Learning Management System (LMS) decision-making processes. A LMS decision-making model which includes six multi-dimensional perspectives, incorporating financial and non-financial criteria and indicators, was developed and evaluated. The outcome of this study is a LMS decision-making model developed as a tool to support a more effective evaluation of Information Technology (IT) alternatives. Results also indicate that there was substantial support for using a multi-dimensional decision making model among IT decision makers at universities, and that they believed that non-financial measures are important and should be considered in a LMS decision making process.*

Keywords: IT/IS investment decision, Learning Management System, E-learning

1. INTRODUCTION

Organisations all over the world are investing in information technology to gain competitive advantage. The advent of internet and world-wide-web technology has enable businesses to expand their operation on the web and no longer confine to physical location. This set of technology is commonly referred as e-business (Thuraisingham, Gupta, Bertino, & Ferrari, 2001). Within the commercial realm, one of the most adopted e-business technology is e-commerce which allow customers to carry out their transactions on the web such as buying and selling product. The benefits reaped from e-business technology in the commercial sector have stimulated the acceptance in higher education sector. Faced with intense competition in the market, especially in student recruitment and retention, many higher education institutions have realized the importance to adopt e-business technology to improve their operation and services. E-learning, which is another key e-business technology, allow universities to provide a better educational experience thus gain an edge over their competitors (Ubell, 2000).

Leveraging information technology in higher education has been perceived to be able to improve teaching and learning processes (Chua & Dyson, 2004; Lakhan & Jhunjhunwala, 2008; Mott & Granata, 2006). The ability of technology to enable the reuse and sharing of teaching and learning materials using technology contributes to cost reduction initiatives by higher learning institutions (Laurillard, 2007). The implementation of e-learning in higher education has also been claimed to be able to establish and sustain students' engagement in their learning (Coates, 2006). Nevertheless, the positive growth in the use of technology in higher education, seem to result in an increased pressure on universities to adopt technology to achieve their higher education goals (Fletcher, 2005).

Although the use of technology in education has been asserted to be of much benefit to universities, it has been reported that IT leaders have been facing difficulties in justifying their decisions to adopt technology in teaching and learning. Researchers posited that the reason to this is mainly because the benefits from IT investments in education, like IT investments in other sectors, are very difficult to measure due to their strategic and intangible nature

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(Goldstein, 2004; Mott & Granata, 2006; Wier, 2004). Studies also show that many universities face the dilemma of relatively tight financial budgets with increases in demand for technology use (Lueddeke, 1999; Mott & Granata, 2006; Wier, 2004).

McGovern and Armstrong (2005) found that the criteria used in justifying proposals in e-learning implementations at universities were limited to arguments around costs and technical issues, thus making it difficult to justify the real value of e-learning implementation in universities which are mostly strategic and intangible benefits. Therefore, McGovern and Armstrong (2005) proposed that the criteria used in making decisions on e-learning solutions should take into consideration non-financial measures, instead of considering solely financial and technical measures.

Apart from this, several other multidimensional criteria methods were also being developed by researchers to assist decision makers in justifying investing in IT in organizations: for example, the Value Analysis Method (Strassmann, Berger, Swanson, Kriebel, & Kauffman, 1988), Critical Success Factors (CSF) (Crescenzi & Reck, 1985) and the Balanced Scorecard (BSC) (Kaplan & Norton, 1993; Kaplan & Norton, 2007). However, there are few studies that focus on how higher learning institutions decision makers incorporate multi-dimensional criteria methods in their IT investments decisions and what are the non-financial criteria that are included in the decision making processes.

This study investigates how IT leaders in universities incorporate multi-dimensional decision making criteria in their IT investments, in particular, the Learning Management System (LMS) decision. Our definition of LMS incorporates the definition by Klobas and Gill (2010) who describe LMS from a managerial point of view, and regard it as having functions used in supporting and managing teaching and learning processes. They define a LMS as "an information system that facilitates e-learning by supporting teaching and learning activities and the administration and communication associated with them" (p. 115).

3. PURPOSE OF STUDY

It is important to understand the process of IT decision making and to explore the use of evaluation methods in decisions about IT investments in universities. It is also felt that there is a need to develop a model that incorporates both financial and non-financial measures (multi-dimensional) as

important elements of justifications. This will assist in better decision-making processes in universities, which in turn, contribute to the value realisation from IT investments. Better decisions made in deploying technologies in universities will yield a higher expected value from IT investments and contribute more effectively to the university's strategic goals.

2. METHODOLOGY

The overriding objective of this research was to identify whether the inclusion of non-financial measures in decision making models can improve IT investment decision making processes. In the case of this research, it specifically aims to improve LMS decision making in universities.

The research involved four phases. The first phase involved obtaining an overview of LMS decision making. The second phase involved the refinement of the initial design of the model, and during the third phase a detailed design of the model was undertaken. In the fourth phase, a LMS decision making model was developed and evaluated. This paper focuses on the results of the evaluation of the detailed design of the LMS decision making model. The design of the model was carried out by adopting a Design Research (DR) approach. Hevner et al. (2004) proposed that all research projects using a DR approach should comprise the following major phases: awareness of problems, suggestions, development, evaluation and conclusion.

A mixed-methods approach to data collection was used involving both interviews and questionnaires. The qualitative data from the interviews were coded and analysed. A descriptive coding method using thematic analysis was used for the data coding. The qualitative data were analysed using an inductive approach where the categories of criteria and indicators were not determined before the interview. Descriptive analysis and frequency tests were conducted on the quantitative data obtained from the questionnaire. The participants in this research (including both pilot and actual data collection) were five members of LMS decision-making teams at two different universities in Australia and 24 participants from different universities in Malaysia who were involved in LMS decision- making processes at their universities.

4. THE DEVELOPMENT OF AN LMS DECISION MAKING MODEL

A LMS decision making model was developed in this research as a tool to support management in making more effective evaluations of LMS alternatives. Six perspectives were included in the initial LMS decision making model based on the perspectives from the IT Balanced Scorecard (Van Grembergen, 2000) and Murphy's "Five pillars of benefit realization" (Murphy, 2002).

Table 1: The perspectives and criteria included in the LMS decision making model

PERSPECTIVE	CRITERIA
1. Direct Payback	Reuse of content across multiple courses
	Cost effectiveness in terms of software licensing and purchasing options
2. Impact On University's Processes	Data integration
	Work automation for lecturers
	Flexibility in teaching and learning approaches
3. Human Capital	Enhancing lecturers' knowledge of state of the art technology
	Increasing students' active participation in collaboration and interactive learning
	Enhancing students' academic integrity
	Enhancing interaction and student engagement level in distance learning courses
	Enhancing technical staff expertise
4. IT Infrastructure	Support for content sharing and migration
	Flexibility to customize the system according to university's specifications
	Ability to integrate with third party software
	Ability to integrate with existing systems in the university
	Ability to adapt to emerging technologies
	Ability of the LMS to efficiently serve the university with the current LMS storage capacity
	Durability of the system
	Security from unauthorized access
	Support for software development and technical assistance
	User-friendly and easy to learn features
	Ability to test the system
5. Risks And Uncertainties	Usage of overall LMS functionalities
	Misuse of online communication tools for non-academic use
	Rapid change in technology
	Problems in upgrading to newer versions
6. Strategic Alignment	University's image and reputation
	Best practices in other universities
	Enhancing teaching and learning using technology

After the process of evaluating and refining the perspectives, the finalised set of perspectives in the LMS decision making model were: Direct Payback, Impact on University's Processes, Human Capital, IT Infrastructure, Risks and Uncertainties, and Strategic Alignment. Under each perspective, important criteria and indicators associated with them were identified and evaluated.

The finalised LMS decision making model consisted of 28 criteria under the six perspectives included in the model. Table 1 presents the six perspectives and the important criteria for each perspective.

4.1 Direct Payback perspective

Murphy (2002) asserted that non-financial measures should be considered important in IT decision making. However, favourable direct payback, particularly in financial terms such as increased revenue cost reduction and cost avoidance, is still commonly required in justifying an IT decision. In this research, the Direct Payback perspective is described as elements that are seen to contribute towards the direct financial benefits derived from LMS implementation, as well as benefits in terms of improvement in teaching and learning performance.

The participants considered the ability of the LMS alternative to enable the reuse of content across multiple courses as very important in LMS decision making. The availability of features that enable the LMS to store teaching materials that can be used for the same subject in the coming semesters was deemed important. The stored teaching material could also be shared with other lecturers teaching the same subject, (with the consent of the lecturer). The ability to reuse content and provide content sharing among lecturers would also save a lot of time. The availability of features that enable the reuse of content in the LMS alternative was seen as an important indicator, which could be used to measure this criterion. The findings were consistent with past research in this area (Collis & Strijker, 2002; Laurillard, 2007). Collis and Strijker (2002) asserted that time saved resulting from the ability to reuse course content was important in making a LMS decision. Though time saved can be categorised as a non-financial measure, it can also be valued as a financial gain.

Cost effectiveness in terms of software licensing and purchasing options was also considered an important criterion. The growing and popular open source LMSs, such as Moodle (www.moodle.com) and Claroline (www.claroline.net) generally offer the opportunity to cut costs in terms of licensing and service fees, while providing most of the features

required by universities. Consistent with other research in this area (Lakhan & Jhunjhunwala, 2008; Surry & Land, 2000), the results indicate that many universities have turned to open source systems. This may be partially because universities do not actually require the full features available in a proprietary LMS. The ability to customize an open source system in order to include only the features required adds to the appeal of open source systems and explains why universities consider this criterion as important.

The research results reflected that Malaysian universities generally still have concerns about financial constraints that relate to fixed budgets for IT/ICT initiatives. The managers from universities that have adopted open source technology largely considered the technology to be sufficient to achieve the strategy of embedding technology into teaching processes outlined by the university and the Ministry of Higher Education (MOHE). The ability to offer similar features to those in proprietary systems has driven many universities to adopt open source systems. This provides evidence that decision makers also put emphasis on other measures rather than just considering the alternative to reduce costs and meet the university's budget objectives.

Overall, these findings add value to the literature, as they show that decision makers have considered not only financial but non-financial measures in identifying the direct payback expected from an IT investment. This supports assertions by researchers that decision makers need to realise that IT evaluation methods based on the traditional accounting based methods are less than optimal for making IT investment decisions. A more sophisticated evaluation method that incorporates non-financial measures is needed (Anandarajan & Wen, 1999; Ivantysynova, et al., 2009; Mott & Granata, 2006). In summary, the direct payback expected from an LMS adoption was considered very important and had a significant role in the process of LMS decision making.

4.2 Impact on University's Processes

The impact of LMS adoption on universities' processes has been discussed by researchers who have suggested that LMS adoption may have impacts in terms of effectiveness of lecturers meeting the demands of students (Lawrence & Sharma, 2002), as well as impacts on the flexibility of learning. This in turn could influence student engagement in learning activities (Coates, 2006) and their completion times, as well as graduation rates

(Mott & Granata, 2006). Researchers have also suggested that administrative processes such as course scheduling, exam scheduling and evaluating student performance could be improved by LMS adoption (Reigeluth et al., 2008). Results from this research show that decision makers felt that the ability of the LMS to improve teaching tasks and administration processes was considered to be crucial in the decision about an appropriate LMS. For example, the ability of the LMS to enable data integration among different systems in the university was considered an important criterion in LMS decision making. Several researchers have explained that data integration is important as it can provide a uniform interface to a collection of data sources (Levy, 2000). Therefore, integration can contribute to efficiencies in data sharing among different users at the university and provide users with a unified view of data (Lenzerini, 2002). In other words, data integration resulting from LMS adoption provides the possibility to achieve overall improvements in administrative processes, which include the integration of student and staff data, course and exam scheduling information and student performance results.

The automation of tasks related to teaching and learning was suggested as an important criterion in LMS decision making. The findings of this research suggest that the automation of a lecturer's tasks in terms of the use of evaluation tools for online quizzes and assignments were considered important. In addition, the ability of the LMS to provide automation of administration tasks such as generating student class attendance reports was also suggested as important in LMS decision making. This is in line with previous research which contended that automation of tasks resulting from the use of IT could "provide operational savings and improve quality by performing structured, routine, operational tasks reliably and efficiently" (Leidner & Jarvenpaa, 1995, p. 272).

Decision makers also stressed the importance of gaining flexibility in teaching and learning approaches from LMS adoption. The ability to make video recordings of class lectures, as well as having online discussions when the lecturers are unable to conduct the class were considered valuable. Researchers have studied the pedagogical implications of using enhanced technology in learning, and some have reported that these technologies can be successfully exploited for learning (Mott, 2010; Ullrich et al., 2008). The results from this research are consistent with past research which discussed the features available in

the various types of LMS, suggesting they are able to support innovation and enhancements in teaching and learning, as well as meeting the diversity of lecturers' and students' needs (Lewis, et al., 2002; Lonn & Teasley, 2009). Overall, the findings are consistent with other work in this area which has suggested that technology is an excellent complement to traditional teaching methods and can also contribute to creating a more proficient and creative learning environment (Leidner & Jarvenpaa, 1995; Masiello, Ramberg, & Lonka, 2005).

4.3 Human Capital perspective

Decision makers suggested that lecturers' knowledge of the enhanced features in the LMS technology was essential for them to optimally utilize the technology in their teaching. The amount of training provided was seen as an indicator to measure the degree of knowledge required by lecturers in order to efficiently utilize the LMS. Some universities have made training compulsory for all lecturers and training session attendance is monitored by management. Overall, decision makers considered it important to assess the ability of the LMS to assist in enhancing IT knowledge among lecturers. This was considered valuable so that lecturers have the skills to utilize the technology and realise its full potential. This view is consistent with past research which argued that the IT knowledge and skills of lecturers is important in order to effectively deliver online course components and support student communication in a technology enhanced learning environment (Shannon & Doube, 2003).

The decision makers felt that a criterion that measures the knowledge and skills of the IT technical support staff should be included in the LMS decision making model. This was felt to be crucial to enable the future development and maintenance of the system, as the technical skills provided to the technical staff could be used to further enhance and develop the LMS. This is consistent with the literature which suggests that a continuous upgrade of the IT skills of staff through training and development is essential for successful system adoption (Keyes, 2005; Wainwright, et al., 2007).

Interestingly, the criteria considered important by decision makers with regard to the Human Capital perspective did not only revolve around skills and knowledge enhancement of lecturers and support staff, but also concerned students. Students' participation in collaboration and interactive

learning, their academic integrity (as a result of using enhanced technology in learning, particularly anti-plagiarism software integrated with a LMS); and the level of students' interaction and engagement in distance learning courses, were all considered to be important criteria in LMS decision making. These findings are consistent with research conducted by Venter, Jansen van Rensburg, and Davis (2012) who examined the drivers of LMS use in a South African open and distance learning institution. They found that the ability of students to obtain various benefits was important, as they are the ultimate users of the LMS and are an important stakeholder in the university.

4.4 IT Infrastructure perspective

The largest number of criteria identified in this research was listed under the IT Infrastructure perspective. It is crucial that these criteria are taken into consideration to ensure that the LMS provides the functionalities desired, and that future growth and development can be supported.

In particular, decision makers stressed the need for serious evaluation as to whether the features in the LMS they were choosing could support content sharing and migration, as this was generally considered to be the essence of implementing an LMS in an institution. They contended that compliance with LMS standards like Sharable Content Object Reference Model (SCORM), which enables interoperability, accessibility, and reusability of Web based learning content, was usually a requirement for an LMS implementation in most universities, making this the most important criterion under the IT infrastructure perspective. According to Chu, Chang, Yeh, and Yeh (2004), SCORM is important in order to ensure that the LMS supports content compatibility as it provides a model for content exchange between different LMS to "achieve accessibility, interoperability, durability and reusability within SCORM compatible content" (Chu, et al., 2004, p. 1).

The ability to adapt to emerging technologies and third party software was also considered crucial, as decision makers understood that keeping abreast with increasing evolution in technology was vital in order to maximise the benefits offered by the technology. At the same time, the level of security offered by the system was also considered to be equally important in the process of decision making.

4.5 Risks and Uncertainties perspective

In this study, the risks that were considered important for assessment were mainly related the underutilization of features in the adopted LMS. The decision makers were particularly concerned about the possibility of features already integrated with the LMS not being fully utilised, resulting in failure to realise the value of the LMS implementation. A possible reason for this was that lecturers could take a long time to become familiar with the new LMS, having become comfortable with the current one. This, in turn, could result in the lecturers losing interest and not fully utilising the new system. This is consistent with a study done by Embi (2011), who explored the status, trends and challenges of e-learning implementation in Malaysian institutes of higher learning. He reported the main challenges faced in LMS implementation were: staffs were too complacent with the current teaching practices; staffs were too busy with research and publication; and they were burdened with heavy teaching loads, resulting in a low number of system adopters.

There was a concern about the possibility that the interactive and collaborative features in the LMS could be misused for non-academic purposes. As a result, some universities implemented processes that prevented any use of social network or social media applications during the teaching period. However, this has the potential to prevent flexibility and full utilization of the system. While this might be a very conservative approach, future research could help in understanding the impact of being too conservative towards the process of learning in the technology era. Approaches to solving this could include the adoption of measures that would prevent misuse of the technology while allowing full utilization of the system.

The risk of problems while upgrading to newer versions of the LMS was of considerable concern. While this problem primarily relates to open source systems, which can be customized and enhanced by installing other third party software, a problem arises when the LMS is highly customized. This may make it difficult to run upgrades due to incompatibility of the features that were customized or enhanced by third party software. This is supported by Wainwright, Osterman, Finnerman, and Hill, (2007) who highlighted that customization and installation of third-party modules to be integrated with the LMS should be done cautiously. This is due to the risk that the added functionality may not always be upgraded at the same time with the core code, thus increasing the risk of running unsupported software.

4.6 Strategic Alignment perspective

The role of top management in LMS adoption at universities in Malaysia was found to be very significant. This was evidenced by *Majlis e-Pembelajaran IPTA Malaysia* (MEIPTA), the committee established to manage and share knowledge about the LMS used by universities in Malaysia. Participants indicated that in Malaysia, generally the LMS decision making at universities needed to align with one particular strategic thrust formulated under the National Higher Education Strategic Plan (NHESP): "Enculturation of lifelong learning". It also needs to align with items regarding e-learning and lifelong learning in the Critical Agenda Project (CAPs) established by the MOHE to transform the Malaysian higher education system to a world class standard. It was therefore clear that the IT strategies at universities in Malaysia needed to be aligned with the government's strategies rather than with the university's strategy itself. Hence, the university's executives are moving towards achieving the government's strategies and world class standard. However, this would not be the case in all countries. Therefore, the criteria and indicators in the LMS decision making model, if it is adopted in LMS decision making in universities, would needed to be adapted according to the context of different countries.

In this research, it was noted that sharing knowledge about the best practices in other universities was regarded as one important process and the MEIPTA committee was used as the platform for Malaysian universities to achieve this. Consideration of best practices from other universities was seen to be important as a criterion under the Strategic Alignment perspective, as it relates to the government's directives that require universities in Malaysia to adopt enhanced technology in teaching and learning.

5.   CONCLUSION

The LMS decision making tool developed in this research was evaluated and tested by practitioners in the field. The results indicated that decision makers valued highly the non-financial measures included in the model and acknowledged that the tool could assist in better LMS decision making. This confirmed that decision makers at universities have a positive perception towards the inclusion of non-financial measures in decision making models. They

believe that non-financial measures, if included, would be able to improve LMS decision making processes.

The outcomes from this research make a valuable contribution to the body of knowledge, particularly to the IT decision making literature. Overall, the results provide valuable insights into IT decision making, particularly in Malaysian universities, and illustrate how decision makers value nonfinancial measures in IT decision making.

The emergence of the non-financial measures in the LMS decision making model developed in this research reinforce that decision makers believe that non-financial measures are important and should be considered in a LMS decision making process. The

results of this research also show that there is appreciation of the importance of multi-dimensional perspectives and support for the use of a multi-dimensional decision making model among IT decision makers at universities.

Overall, this research contributes to the literature, particularly in understanding the role of non-financial measures in LMS decision making, and in IT decision making in general. However, there is a need for further research to explore the practice of LMS decision making in other countries' higher education institutions and to explore IT decision making in other settings. The outcomes of this research have contributed to the body of knowledge, especially in the area of IT decision making in higher education, as well as to practitioners in the field.

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