RFID in libraries: a case study on implementation

Shamshul Bahri and Amir Ibrahim

Introduction

The library has always been at the forefront in implementing emerging information technologies (IT) to enhance the delivery of services to patrons (Kajewski, 2006). Emerging IT can be defined as innovations that have the potential to create a new industry or to transform an existing one (Myers, 2006). Besides improving services to patrons, IT is a solution in meeting the demands for better customer services (Kathryn, 2004). The implementation of emerging IT started with index cards, barcodes and now radio frequency identification (RFID).

Problem statement

The implementation of emerging IT is fraught with difficulties and challenges. One of the most biggest challenges is lack of knowledge (Day and Schoemaker, 2000). As a result, the implementation involves a great deal of trial-and-error which presents a significant amount of risks to implementers; something that library management would be keen to avoid (Davis, 2009). Emerging IT also poses new ethical issues such as privacy and security (Moor, 2005). Furthermore, librarians need to relearn and adapt to new roles (Goetsch, 2008).

Despite the above difficulties and challenges, there is very little guidance to libraries in implementing new IT solutions. A review of the relevant literature (discussed in more detail in below) showed that there is no model of implementation that libraries can refer to. The lack of such models significantly increases the risk of introducing new technologies into libraries. A systematic approach would be a model that describes and discusses the essential activities and their sequences in managing an implementation of emerging IT.

Literature review

Studies of emerging technologies

Admittedly, the number of studies on emerging technologies is small. However, three main themes were identified: the politics of emerging technologies, their implementation, and their consequences.

The literature on politics of emerging IT addresses the difficulty in handling their novelty. For example, Kica and Groenendijk (2011), described the difficulties faced by the European Patent Office. In addition, citizens are concerned with the potentials of these technologies in enabling governments to intervene in their lives (Bannister and Wilson, 2011). The complexity of the technologies also present ethical issues (Stahl, 2011). Therefore, it is important for governments to cultivate trust in sources of information on emerging technologies through the use of media (Anderson et al., 2012).

A large number of studies were found on the implementation of emerging technologies. Many of the studies in this theme address the question of how to evaluate the technologies, especially at the conceptual stage (Davey et al., 2011). Some studies presented techniques to assess the risks associated with implementing emerging technologies (Dietrich and Cudney, 2011; Kuzma and Priest, 2010; Pidgeon et al., 2011). For example, Kuzma and Priest (2010), proposed two approaches to assess and manage the risks: cognate-product approach and whole-technology approach.

Meanwhile, other studies on implementation described possible approaches in determining the value of emerging technologies. Gillier and Piat (2011) suggested that the value can be determined by identifying potential applications. Deng and Yong (2011) asserted that the amount of investment in research and development (R&D) on the technologies can be established by assessing whether they are market-driven or technology-driven (Deng and Yong, 2011). In another study, Phaal and Routley (2012) suggested an “emergence road mapping workshop method” to estimate potential future value of emerging technologies. Due to the cognitive and geographical diffusion of technology studies, researchers on emerging technologies throughout the world have formed communities of practice (Leydesdorff and Rafols, 2011). On an organizational level, emerging technologies can affect the network structure and network position of organizations that are coordinated their efforts (Low and Johnston, 2012).

Libraries and emerging technologies

One of the biggest challenges faced by libraries is the high cost of implementation which include infrastructure and the preparations involved to prepare librarians to use them (Cunningham, 2010). In order to overcome such challenges, a number of meetings have been conducted by librarians (Deards, 2011). One of the outcomes of these meetings is the consideration of general tools to enable communication and collaboration among librarians (O’Dell, 2010). These meetings have produced a number of suggestions. One, is the establishment of a committee to identify, assess and initiate emerging technologies (Ergood et al., 2012). Other suggestion includes developing competence in managing
technologies among librarians through a structured program (Johnston, 2012). Managing emerging technologies requires a different set of skills, knowledge and attributes because the most important feature is personality traits, not just qualifications (Patridge et al., 2010).

Unfortunately, there is no ready model that can be used by libraries in implementing emerging IT. However, there is a large body of knowledge on RFID implementation. Although RFID is pretty ubiquitous now, it was considered an emerging technology in 2000. Modeling the implementation process of that technology by the first public library in the UK from which this paper is based provides an insight into how libraries should go about implementing an emerging technology. The model will describe the relevant activities and their sequences in the technology’s deployment. The following sections will describe and discuss the process.

The research process

The study employed the qualitative research method. The method was chosen because it enabled the encapsulation of the emerging technology’s implementation process through the experiences of those involved in leading the implementation. From their experience, the study has been able to reveal the socio-technical aspects of the implementation process (Galliers and Land, 1987).

Under the methods associated with the qualitative research method (Cresswell, 2003), the case study research (Gummesson, 2000; Stake, 1995) and the grounded theory (Locke, 1996; Strauss and Corbin, 1998; Turner, 1983) approaches were combined and utilized. The case study approach was employed to enable the first public library in the UK to employ RFID to be studied as a case of an emerging IT implementation. The grounded theory approach provides appropriate tools to guide the selection of informants and the development of the process model. This approach has been recognized as an applicable technique to study emerging domains (Sutton et al., 2011). Under the grounded theory approach, the forcing stream (Strauss and Corbin, 1998) was chosen over the emerging stream (Melia, 1996) because it allows existing knowledge on IT implementation to be used as a guide in the development of the process model.

Before data collection took place, an initial model of the emerging technology’s implementation process was developed. The model was developed from the relevant implementation factors derived from the RFID implementation literature. The factors were then arranged sequentially and divided into three stages according to Lewin’s change model (1947): unfreezing (before the installation of the system), moving (during the installation of the system), and refreezing (after the installation of the system). This model which formed the basis of the interview with the informants of the study will be explained in more detail in the next section.

The empirical data were collected from the first library to implement RFID in the UK. Data were collected through in-depth personal interviews with the library’s RFID managers and librarians. Two interviews were conducted with two RFID managers and one focus group interview was conducted with three librarians. The managers and librarians were asked to relate their experiences during the technology’s implementation. Their responses were recorded, transcribed verbatim and passed back to them for verification.

To refine the initial model, implementation factors were compared with responses from the informants. Factors that were not in the model were added. Factors that were similar to the ones in the model were compared to identify whether a more generic implementation factor could be established (Strauss and Corbin, 1998; Locke, 1996). The emerging factors also went through the same process. The process continued until the model has reached “maturity”, i.e. no new factors can be added nor the existing factors can be realigned to form more generic factors. The model also identifies the issues involved in the implementation process.

The initial model

Table I shows the implementation factors derived from the literature.

From the above factors, an initial implementation process model was developed (Figure 1). The process starts when a library presents the case for the implementation of RFID to its senior management. The purpose of this activity is to obtain the consent of the management team and eventually the funding required to kick start the project. Next, the implementation process proceeds with the selection of RFID vendors. In this activity, vendors will submit their proposals for the RFID project. The library will shortlist the potential vendors, interview them and finally decide who will be installing the system.

Afterwards, the process branches into two activities. The first involves tagging the library’s materials with RFID tags. The second activity involves installing the RFID system. The latter activity involves designing and installing the technology’s infrastructure in the library.

The emerging model

In the case is the first public library in the UK to implement RFID the technology was implemented along with the opening of the library’s brand new building. During the study, some new implementation factors emerged that are presented in Table II.

Figure 2 shows the model of emerging IT implementation process. The process starts with the library soliciting requirements for the new RFID system. The requirements were solicited mostly from IT vendors, who have a better idea on how RFID could be used in a library setting. After the requirements have been solicited, the library has a better idea on what it would like to achieve with the technology. The library then went on to underline what they would like to achieve with RFID. In this case, the library wanted to develop a RFID-based self-service system that its patrons can use for the purpose of borrowing and returning library’s materials. The outcomes guided the library in selecting the IT vendors for the RFID project. Eventually, a four-way partnership was formed between the library and three IT vendors, each one specializing in the RFID system, software or tags.

Once the partnership has been formed, the implementation process proceeded into the installation stage.
Three activities occurred in parallel: developing and installing the RFID system, tagging the library’s materials and obtaining vendor support. The most extensive of these activities was tagging the library’s materials. In this activity, the library has to decide what data to be entered into the tag, which materials are to be tagged, where the tag would be located in each item and who is responsible for tagging. In installing the RFID system, the most crucial decision to be made was how to link the system with the library management system (LMS). Meanwhile, obtaining vendor support ensured that the vendor representative would be on location to troubleshoot any problem arising from the new system.

Once the RFID system was in place, training was given to librarians and staff on how to use the new RFID-based self-service system. Despite the training, the library did face some resistance from the librarians. Because RFID was still an emerging technology, there were many instances when the new self-service system malfunctioned. It either failed to record lending or did not library users tried to take the materials home. The patrons vented their anger on the staff who in turn vented their concerns to the library management. The RFID partners had to work doubly hard to overcome the system’s technical problems before the resistance subsided.

After the installation was over, two activities occurred in parallel. First, the library enhanced the RFID system by purchasing new RFID readers and tags, and upgraded the software to allow patrons to renew their materials. Second, the library planned to extend the use of the system to the branch libraries in the county.

Discussion and conclusions

The findings from this study concur with the existing literature on the difficulty of emerging technologies implementation. First, there is a lack of knowledge on how to optimize the technology (Day and Schoemaker, 2000) and determining its value (Gillier and Piat, 2011). As a result, the library has to depend on vendors to provide the necessary guidance at the implementation stage. Second, because the technology was still immature at the time, the RFID system had many technical problems and these posed a huge risk to successful deployment (Davis, 2009; Dietrich and Cudney, 2011; Kuzma and Priest, 2010). These problems frustrated library staff and led some of them to resist using the system. Third, the librarians had to relearn and adapt to new roles (Goetsch, 2008). In this case, the librarians had to change...
their roles from merely processing library transactions to assisting patrons in finding relevant materials.

The findings concur with larger studies on information systems implementation (Alavi and Joachimsthaler, 1992; Sabherwal et al., 2006). First, the study found that facilitating conditions such as technical support provided by the RFID vendor hugely facilitated the technology’s deployment. Second, the study also suggested that user-situational variables such as training and attitude contributed towards the successful implementation of RFID.

Third, system quality (or the lack of it) nearly jeopardized the RFID project. Thankfully, the vendor had stationed an engineer on-site to quickly troubleshoot the problems with the RFID system. The study also identified implementation factors that are unique to RFID implementation, especially in

<table>
<thead>
<tr>
<th>Emerging implementation factors</th>
<th>Definitions</th>
<th>Quotes from the interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solicit requirements</td>
<td>The features of the system are identified and determined</td>
<td>“There were initial meetings involving [the system vendor] and ourselves to actually go through what we wanted to actually see out of it. That is where it’s defined the requirements and then came back with a proposal of what they’ll provide”</td>
</tr>
<tr>
<td>Set implementation objectives</td>
<td>The outcomes from the project are determined</td>
<td>“We chose RFID because it was an emerging technology and we felt that we could use it and it has a potential for us to use it, to help us develop our service”</td>
</tr>
<tr>
<td>Form a RFID partnership</td>
<td>Identify the RFID vendors who will participate in the project</td>
<td>“So, we can said to our system supplier, we want to do RFID and we want to do it in partnership with you and so we ended up with a four-body partnership really. There was us, the library service. There was our system supplier . . . and they did the work of locating partners and they located a tag supplier . . . and a RFID system supplier which was Intelligent”</td>
</tr>
<tr>
<td>Train the librarians</td>
<td>The librarians are trained to use the RFID system so that they can then help the patrons to use it</td>
<td>“We train people in how to use the technology. We train people in how to do learning sessions and that kind of thing. So, yeah, they are trained to deal with the public and we do a lot of training on customer care and on diversity and disability”</td>
</tr>
<tr>
<td>Obtain vendor support</td>
<td>Get the vendors to provide experts who can troubleshoot problems with the system</td>
<td>“So, we do have somebody on duty […] and if there’s a problem, they get sorted out. There’s a hardware problem, it get sorted out. There’s a reading problem with the RFID equipment it get sorted out. The response […] is often very good and very quick”</td>
</tr>
<tr>
<td>Manage staff’s resistance</td>
<td>Overcome the dissatisfaction from the staff over the new RFID system that could lead to them refusing to use it</td>
<td>“We were one of the first places in the UK to install RFID. And so, we had to deal with a lot of problems that we weren’t anticipating. To deal with read rates, to deal with the fact that the RFID antenna had quite big read ranges […] So, there is some stress issues there. Yeah, they were quite vociferously complaining about that”</td>
</tr>
<tr>
<td>Enhance the RFID system</td>
<td>Improve the reliability of the new system</td>
<td>“We have regular, not complaint sessions, but we have regular sessions where we take feedbacks from staffs about how we can improve the way we went, the conditions of work and all of that kind of staff and we recently introduced an anonymous ask detail later”</td>
</tr>
<tr>
<td>Plan for RFID expansion</td>
<td>Prepare a program on how to extend the technology in the library</td>
<td>“We recently upgraded, as I’ve said, we upgraded the system and made it, the new tag readers that we purchased seem to be of better quality than the old tag readers. So, we do not have as many problems as tags that do not read and that kind of thing”</td>
</tr>
</tbody>
</table>

With regard to the rest of the libraries, that is something that there is currently a project team looking at to decide where we go next. Self-service is given. We must achieve higher levels of self-service throughout the county.”
the library setting. Some of those factors, such as justifying the RFID project, selecting the RFID vendor, tagging the library materials and installing the RFID system were found from the literature on RFID implementation in library. Other factors, such as soliciting requirements, setting implementation objectives, managing staff’s resistance, enhancing the RFID system, and planning for the technology’s expansion emerged from the study. The study then went a step further by combining these factors to develop a model of the emerging IT implementation process.

The model developed in this study was based on the RFID technology. The extent to which this model can be generalized to other types of emerging IT remains to be seen. There is no such model from previous studies on emerging technologies from which comparisons can be made with the model developed in this study. Thus, the model can be used to develop other types of emerging IT implementation process model. Only then can comparisons be made and the model refined.

ACKNOWLEDGEMENTS

The authors would like to thank Professor James Thong of Hong Kong University of Science and Technology for his valuable feedback on the initial draft of this paper.

REFERENCES


ABOUT THE AUTHOR
Shamsul Bahri (esbi@um.edu.my) is a Lecturer in the Department of Operations and Information Systems, Faculty of Business and Accountancy, University of Malaya at Kuala Lumpur, Malaysia. He received his PhD from Brunel University, London, UK, his Master in Business Administration (MBA) from University of Malaya and his Bachelor of Business Administration (BBA) from Universiti Kebangsaan Malaysia. His research interest lies in the implementation of information systems, especially emerging IT.

Amir Ibrahim (Amir888@yahoo.com) is currently a Research Officer with the Faculty of Economy, University of Malaya, Kuala Lumpur, Malaysia. He received his Master in Public Administration and Bachelor in Social Science from the University of Malaya.