ISSUES IN UPDATING AN ERP SYSTEM: A CASE STUDY

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Abstract

The Indianapolis International Airport has been using Oracle ERP for over 20 years. For a variety of reasons discussed in this case, the time has come to look for a replacement. This case study provides an overview of a situation at the Indianapolis International Airport involving the search for a new ERP solution. The System Development Life Cycle (SDLC) is followed using the waterfall approach, and assessments are made using the Multiple Criterion Decision Analysis (MCDA) technique. As a teaching case, questions are provided for students to answer including identification of alternative software and the development of a second MCDA for analysis and optimal solution identification.

Keywords: Teaching Case, Case Study, Enterprise Resource Planning (ERP), Multiple Criterion Decision Analysis (MCDA), Systems Analysis and Design

INTRODUCTION

Enterprise Resource Planning (ERP) is a computer-based system that allows an organization to manage its various core business processes on a single integrated platform. This type of system provides management with a complete view of all functional areas of a business from a singular point of reference. Using a database management system, to integrate data from various business units, the software provides real-time access to any of the data being contributed by any business units (Almajali, 2016). The Indianapolis International Airport relies on ERP to provide real-time access to information and the use of automated workflows in order to optimize the efficiency and responsiveness of their operations.

Oracle ERP, currently used at the airport, has been ranked number two in both market share and revenue (Pang, 2012). Oracle is ranked number 5 for Enterprise users of over 1,000 employees, in terms of satisfaction (Crowd, 2017). For a variety of reasons which will be identified along with the Problem Statement, the Airport administration wants to replace the current Oracle ERP system with another application. Due to the complexity of the system, ERP implementation is

not a simple task (Daneva, 2008; Thomas, 1998). The administration at the Indianapolis International Airport wanted to conduct an in-depth study and to be sure to select the optimal solution that might meet their needs so that they are no longer faced with the difficulties they are currently experiencing.

Developers of commercially available ERP software often design systems around industry best practices in order to provide immediate value upon deployment (Kraemmetand, 2003). However, they may also allow customization through alternative settings and choices, in case the customer uses alternative practices in their organization (Vilpola, 2008). The Airport administration realizes that there are many issues that they must consider in order to update the current ERP system so that it will be the most effective and efficient system possible. This is paramount if the airport is to continue to provide quality service to its patrons.

BACKGROUND

The Indianapolis International Airport (IAA) has been a fundamental service provider to Indianapolis and surrounding communities since its founding in 1931. With the dramatic growth over the decades, the airport has grown and evolved based on the changing demands of its patrons. Today, nearly eight million travelers use the airport's facilities each year, and it provides employment opportunity for nearly 10,000 people. It is ranked the 8th largest cargo center in the United States and 22nd largest in the world. As their 2nd largest facility, Federal Express alone accounts for one million tons of cargo being handled here per year (Airport, 2017).

It is essential that the Indianapolis International Airport maintains a high level of efficiency and organization. With this in mind, an Oracle Enterprise Resource Planning (ERP) system was initially implemented in 1996 to improve the handling of overall workflow and finances (Oracle, 2017).

In terms of scope, this project is focusing on the IAA's need for an ERP system to handle the financial records for daily operations of the airport facilities. This includes such things as building operations, grounds, parking lots, sanitation, business functions, etc. It does not include the Federal Aviation Administration (FAA) systems which the FAA manages themselves. Vendors such as shops and restaurants use the airport's network but manage their own software and data.

An independent team of consultants was asked to provide a recommended course of action. The Systems Development Life-Cycle was followed using the Waterfall approach. A summary of the relevant findings and conclusions in the Planning and Analysis phases is provided. Students will be asked question regarding the Design and Implementations phases using relevant information from the case.

PROBLEM STATEMENT

A root-cause analysis was conducted to identify the problem, which was identified as: *the Indianapolis International Airport never fully integrated their workflow processes in the ERP system when it was implemented.*

The explanation leading to this problem statement is that in the years since Oracle ERP was implemented the software has been updated, but the airport's workflow procedures were never fully integrated into the software. As a result, work-around procedures started to appear. Employees knew what information was needed in order to perform their jobs properly; but since the software would not provide it for them, they found other ways of working around the system. This lead to personalized procedures which were not consistent across the organization. This created information-hogs, procedure-hogs, and bottlenecks as these employee-developed "personal procedures" were incorporated into the organizational workflow.

Over time, as employees needed new capabilities, additional software was purchased to compensate for the *perceived* incapability of Oracle. The additional software only complicated the procedures; and created additional trouble in areas such as data transfer procedures, data incompatibility, more opportunities for human error, and slower-than-necessary procedures. In some cases, the additional software wasn't really necessary as the functionality was already available in Oracle, but was either not functional due to previous workarounds, or was unknown to the employees.

In an attempt to solve the problem, an analysis of the situation was mandated. The airport opted to use the traditional System Development Lifecycle process, using the waterfall method, to assess the possible solutions to their ERP problem (Dennis, 2006; Gido, 2009). While there are other methods that could be applied to analyzing business systems, the SDLC is generally considered to be the most thorough means to understanding each step of the process since proper documentation of the analysis phase is required for review.

PROJECT RISKS

Many risks were identified for this project. Project risks are defined as, "*an uncertain event or condition that, if it occurs, has an effect on at least one project objective*" (PMI, 2008). In the airport's situation, many of the identified risks were common among typical projects involving software selection and implementation, such as Unknown or Inadequate Requirements, Accelerated Time Scale, Political Interference, Compliance Issues, Underestimating Implementation Time, Business Disruption, etc. A few risks were identified as specific or critically important to this project based on the situation and conditions at the airport:

Risk of Lack of User Acceptance

Two characteristics of the current employees make a lack of user acceptance a strong possibility. First, they did not like the current system. There is a strong chance that this attitude may carry over to any new ERP system that is implemented. Second, some of the employees have been dealing with the current system since it was implemented over 20 years ago, others were hired into the current system and may not know any other way of doing business. Either way, in spite of the promise of a better system, employee resistance to change is likely to be high – compounded by the fact that many of the workarounds have become points of pride or enablers of powerful information-hogging or process-hogging.

Risk of Loss of Current Functionality

The employees know their jobs, and they know what information needs to exist. Over time, when they were unable to obtain what they needed from the current system, they developed personal workarounds to get the job done. Some of these workarounds involved individually developed spreadsheets and other tools. In the process of converting to a new system, one of two things will need to happen: every function currently performed by employees needs to be available in the new system, or the new system accommodates every function currently being performed by employees. Since the employees are the source of these workarounds, the likelihood exists that some of the lesser known, albeit critical functions may be overlooked in the new system. The potential of the new system overlooking some of these functions is real and there is a high risk that this omission may negatively impact other functions, records, calculations and decisions.

Risk of Loss of Data and/or Data Integrity

Because of the personal workflow workarounds and additional software implementation over time, there is a significant risk of historic data loss from the new system implementation. Loss of data results in inaccurate records, which would prohibit the use of past data for forecasting and decision making, let alone the record-keeping problems associated with regulatory compliance. This lack of data integrity could well become a major issue in implementing an updated system. Data conversion problems often create major obstacles in ERP systems implementation.

SYSTEM REQUIREMENTS

Oracle could possibly be its own best solution to solving this problem by going back and implementing the proper workflows (Oracle, 2017). However, the employees at the airport are extremely frustrated with Oracle. User acceptance

would never be achieved in the change management process that would need to take place during a re-implementation. An alternative solution is needed.

After conducting and successfully passing a feasibility study; a list of system requirements was developed for the project, including:
- Full integration with the airport's workflow
- All appropriate users need necessary levels of access to the system
- Must integrate with the INFOR Enterprise Asset Manager (EAM) software currently in use
- Must maintain all historical financial records
- Must be capable of assigning appropriate security clearance levels for each user
- Must simplify the purchase order approval process
- Must integrate with the Converge project procurement application currently in use
- Real-time financial reporting capability
- Automated accounts payable procedures
- Capable of Scaling up
- Compatible with Prop Works property leasing application
- Reduced Total Cost of Ownership
- Capable of generating printable reports

ALTERNATIVE DIRECTIONS

Before beginning the search for an appropriate application; the airport's organizational capabilities and budget were assessed to determine what type of solution was most appropriate. Regardless of the unique features provided to the users, the software must first be an appropriate match for the organization it will serve, in terms of system administration and associated costs. Considerations such as software development, how and where it will be housed, and who will maintain it are vital to the long term success of the solution.

Based on this analysis, four alternatives were considered and evaluated: Commercial-Off-The-Shelf Solutions, Custom Developed Software, Third Party Hosting, and In-House Development.

Commercial Off-The-Shelf Solutions (COTS)

COTS are applications that are developed for widespread distribution within an industry. It is perceived to be a one-size-fits-all solution because the developer intends that it will satisfy the widest feasible market. Additionally, many COTS solutions are capable of extensive customization once installed, but customization also leads to the increased cost of implementation (Definitions, 2017)

Custom-Developed Software

Custom-developed software is designed around the specific needs of a single customer. It requires a vendor working directly with the customer to assess and understand their specific, unique requirements and expectations (Morris, 2001). Unlike COTS, there is a single customer paying for the development; this usually results in an expensive one-of-a-kind solution. Developmental time requirements are also an important consideration.

Third-Party Hosting

Third-party hosting offers a wide field of options. For purposes of this project, the third-party hosting alternative would consist of a vendor providing Software as a Service (SaaS). This option is helpful when the client is not prepared (or chooses not) to install and maintain the software themselves. The software is housed and maintained by a third party. An added benefit is that the cost can usually be reduced to a stable, predictable monthly fee (Patterson, 2010).

In-House Development

In contract to custom-development, the term 'in-house development' is used to describe a mixed-breed solution consisting of software, hardware, and other components sourced from a variety of vendors. The COTS-type components are assembled within the organization in a custom configuration to solve the organization's problem.

EVALUATION OF ALTERNATIVE DIRECTIONS

Each of the four solution categories was quantifiably evaluated by the consulting team based on the Multiple Criterion Decision Analysis (MCDA) technique (Belton, 2002). This tool is widely used in situations where various alternative options need to be considered in a scenario where many issues must be evaluated. Six decision criteria were developed. In consultation with the Airport personnel, weights for each criterion were assigned according to its overall importance to the airport within the scope of the solution. A scale of 1-10 was used for the weights, with 1 representing the lowest level of importance, and 10 indicating the highest importance. The selected criteria were: Risk, Compatibility, Cost of Implementation, Cost of Maintenance, Ease of Training, and Workflow Integration.

Low Implementation Risk

The 'low risk' criterion was assigned a weight of 10. The implementation risk criterion refers to the risk of failure or delays during the implementation. The airport operates 365 days of the year; downtime is not an option. There is a small

window of time every day when a minimal number of operations are going on. Shortly after the last plane lands every evening, until the airport begins morning preparations for the day; there is a window of about 2 hours when implementation and maintenance can be conducted – and this needs to be scheduled in advance. It is vital that the implementation runs smoothly, with as little interruption as possible to airport operations.

Compatibility

The 'compatibility' criterion was assigned a weight of 3. Compatibility with existing software is a vital criterion. In particular, it is critical that the new ERP system is compatible with the INFOR Enterprise Asset Management (EAM) software currently in place (Infor, 2018). If a chosen solution is not compatible, there are automated solutions available to help create the needed compatibility. However, they come with additional costs and risks.

Low Cost of Implementation

The cost of implementation criterion was assigned a weight of 7. The cost is a major up-front expense to the budget. It includes not only the initial price of the software but also all of the post-sale processes involved in proper installation, configuration, conversion and other costs associated with the new ERP solution. It should be noted that when it comes to ranking this criterion, lower cost is better, and will receive a higher ranking.

Low Cost of Maintenance

The cost of maintenance was assigned a weight of 2. Maintenance is a long-term consideration. It is generally not considered in the up-front cost and comes from a separate, on-going, relatively inflexible operational budget. It should be noted that when it comes to ranking this criterion, lower cost is better, and will receive a higher ranking.

Ease of Training

The training criterion was assigned a weight of 7. Training is vital in the airport's situation. The employees are already frustrated with Oracle. The last thing they want is yet another difficult and confusing system. Their first impression will be during training, and that will set the overall attitude toward the software going forward.

Workflow Integration

The workflow integration criterion was assigned a weight of 6. Workflow integration is defined as the ability of the chosen solution to become compatible

with the workflow of business processes used at the airport. While this is the primary problem with the current software, it is not the highest-rated criterion. In this case, consideration is given to the possibility of modifying some of the workflow procedures already in place at the airport if it makes sense to do so. In many cases, ERP software comes with built-in workflow based on the best practices in use at many previous customers' locations. These would be evaluated on a case-by-case basis to see if it makes sense to change the airport's workflow or to change the configuration of the software.

Each of the criteria was used in the evaluation of the alternative solution categories. Each of the solutions was rated on a scale of 1-10 (10 being the best) as to their potential to meet the expectations of the criterion. All weights and rates were used in an overall evaluation, using a Multiple Criterion Decision Analysis (MCDA) technique (Belton, 2002). The weight of each Criterion was multiplied by the rating assigned to each alternative category. Resulting scores for each alternative were summed. The winning solution was determined by the highest total score. The resulting MCDA is displayed in *Table 1: Multiple Criteria Decision Analysis for Alternate Solution Categories*.

TABLE 1
Multiple Criteria Decision Analysis for Alternate Solution Categories

Criteria	Weight	Off the Shelf		Custom Software		In-House Development		Third-Pary Hosted	
		Rating	Total	Rating	Total	Rating	Total	Rating	Total
Low Risk	10	8	80	5	50	3	30	9	90
Compatibility	3	7	21	10	30	5	15	7	21
Low Cost of Implementation	7	6	42	2	14	4	28	8	56
Low Cost of Maintenance	2	7	14	1	2	4	8	9	18
Ease of Training	7	7	49	6	42	5	35	8	56
Workflow Integration	6	6	36	10	60	7	42	6	36
Totals			242		198		158		277

The results of the MCDA indicate that with a score of 277, the Third Party Hosted solution will be best for the Airport. In spite of a preference to manage most of their resources internally, a hosted solution will have some important benefits such as: alleviating the need for maintenance downtime, reducing any down-time while the conversion is taking place, and assurance that the most up-to-date software is being used. It does, however, impose additional operational risk associated with the availability of Internet connectivity. This risk is already being mitigated due to

the need for the airport authority to provide Internet access for all of the airlines' business operations (including ticket agents) and vendors that are currently leasing space for operations in the airport facilities.

QUESTIONS FOR STUDENTS

Now that the decision has been made to use a Third-Party Hosted (SaaS) solution, the airport needs to determine the specific optimal vendor and software to be implemented, and the steps required to implement it.

1. Do you agree that a solution in the Third-Party Hosted (SaaS) category would be best for the airport? Why or why not?
2. What are the viable software solutions within the Off the Shelf category?
3. What Criteria should be used to evaluate the viable software solutions in the Off the Shelf category?
4. Prepare a Multiple Criterion Decision Analysis for three to four viable alternative software solutions.
5. Prepare a report and presentation to recommend an optimal software solution to IAA's CIO.
6. Prepare an appropriate implementation plan for the chosen software application.

TEACHING NOTES

This case presents a straight forward waterfall-approach to the Systems Development Life Cycle applied to a problem in which the Oracle ERP software needs to be replaced at an airport. Relevant portions of approximately the first half of the SDLC (Planning and Analysis) are presented so that students can glean pertinent information need to solve the Design (and potentially Implementation) phases.

The case is well suited for an undergraduate senior course in Systems Analysis, Systems Design, Capstone IS course; or a graduate-level IS course in Systems Analysis.

A Multiple Criterion Decision Analysis (MCDA) is presented in the Analysis discussion as a decision-making tool. Students are able to see how it works, and are asked to use it again in the Questions For students as part of the Design phase. While the human side of systems and consulting work is important, this case is more focused on the methods and techniques. Other than the user's actions and sentiments which affect the analysis and viable alternative solutions, the human-factors involved in consulting are largely overlooked.

Learning Objectives and Related Concepts

Learning objectives for the case include fundamental Systems Analysis and Design concepts such as:
- Planning Phase
    - Learning the fundamental Systems Development Life Cycle and it's four phases
    - Understand some of the component steps and techniques included in each phase of the SDLC
    - Understanding how each phase of the SDLC cumulatively builds on the tasks and techniques used in previous phases; and relies on the accuracy of those phases.
- Analysis Phase
    - Understand the importance of thorough requirements identification
    - Understand the four alternative methods of acquiring a system: Off the Shelf, Custom, In-House, and Third-Party Hosted
    - Create an Alternative Matrix (Multiple Criterion Decision Analysis)
- Implementation Phase
    - Describe a Migration Plan
    - Critically Evaluate the alternative Conversion Strategies based on common understandings of typical airport operations
    - Describe an appropriate Post Implementation Review

Related concepts include the human-factor in systems, users, and developers:
- No system is perfect
- Human users can make a mess of things
- Analysis, Consultants, Developers, Vendors, etc. are not infallible
- The MCDA is a quantitative assessment of qualitative measures. As such, it is not infallible, and may be subject to critical review. But it does give a basis for explaining the how decisions are made based on the information available at the time.

Final Outcomes

In the analysis of specific software solutions, four viable alternatives were considered in an MCDA: Epicor, Intacct, Microsoft Dynamics GP and INFOR. The recommended solution was Intaact, by approximately an 11% margin over INFOR. These results were based on relevant information and available software at the time of the analysis.
At the current time, implementation has not yet begun due to extenuating considerations which were not relevant to the objectives of the case study; and were therefore omitted.

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