System Migration Phase - a Hurdle to Successful Information System Implementation: a Success Case of Information System Development in a Private University

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Abstract *- System migration can be defined as the process of migrating from the old system to the new system. Many have regarded it only as part of implementation or deployment phase within a system development processes. Yet, case revealed in this study shows how a system conversion could consume lots of effort and even more time compared to the system implementation phase. With no intention to reduce the significance of other phases, this study suggest that system migration is an important phase that should receive equal attention as any other phases in developing an information system. This study also explains how a successful system migration can be done in a relatively complex information system development case with hope that findings from the case might be applicable to other cases with similar circumstances.*

Keywords*: System Migration, System Development Life Cycle.*

1.INTRODUCTION

System migration can be defined as the process of migrating from the old system to the new system. This process is often known as a process within a complete system development process with different stressing. While some authors such as Laudon & Laudon [1] consider the migration as a single phase in a system development process, most only consider it as part of the implementation or deployment phase in a system development processes ([2],[3],[4],[5],[6]).

More attention to system migration phase is required as it hold a critical role to determine an information system development project success. Ross and Vitale [7] stated the migration system as a highly disruptive process thus they named the system migration as "the Dive" since this process could significantly degrade an organization's business performance (see Figure 1). Their argument aligned with findings from the Conference Board who surveyed 117 organizations regarding their ERP (Enterprise Resource Planning) implementation outcomes (Cooke et al., 2011 cited from [8]). The survey confirmed that 75% of those organizations experienced a severe "productivity dip" during their first six to twelve months after "go live". Further, Shang and Seddon's [8] findings on four Australian utility companies also confirm that most organization experience a drop in performance during the first year of new system implementation and those organizations begin to harvest benefits of their new system after they manage to solve problems such as the corrupt data and inadequate user training. In other words, it is critical for an organization to be able to complete the system migration as soon as possible to minimize loss and start obtaining the expected benefits from the new system implementation.

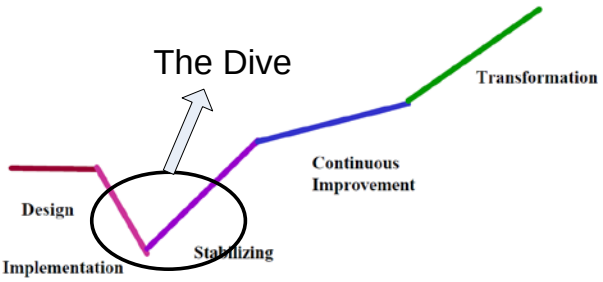

Figure 1. Stages in the ERP Journey [7]

Acknowledging the above necessity, this study will focus on revealing how a system migration phase can be done by thoroughly evaluates a case study of an information system development in a private university. To answer the research question, this paper will be started with a review on system migration, followed by an explanation regarding the case study, discussion around the findings, and finished with a conclusion.

2. LITERATURE REVIEW

System migration has been discussed in many literatures under various headings such as: conversion ([1],[2],[6]), legacy system migration ([9],[10]), legacy information system migration [11], evolution and inception [3], and cutover [4]. Although it has been discussed under different headings, essentially, system migration can be defined as the process of migrating from the old system to the new system.

Various approaches to do the system migration have been promoted, each with its own advantages and disadvantages. Among many, the following are the most frequently discussed system migration approaches:

- Pilot Implementation ([2],[4]) which is also known

as pilot study [1] or pilot system [6] is a system migration approach where the new system is firstly implemented in a small area of business. Once proven to be reliable and able to promote satisfactory among the stakeholders, the new system will be installed into other areas of business.

- Immediate cutover ([4],[6]) or direct cutover approach seeks to quickly revolve the old system by immediately plunging the new system to replace the old system at the appointed date and time. Such approach offers an immediate affects with relatively smaller effort, resource and time requirements. However, those benefits have lots of risks as it closes the opportunity to revert to the old system in case something went wrong. Thus this immediate approach is only recommended for small system implementation in a small organization.
- Phased approach ([1],[2],[6]) seeks to introduce the new system and replacing the old system in stages either by functions or by organizational units. Such approach is considered saver then the immediate cutover as the negative impact, that might occurs when something goes wrong with the new system, will only affect a small and contained area. Such traits has made the phased approach more popular than the immediate cutover for big scaled projects [4].
- Parallel cutover ([1],[2],[4],[6]) obligated implementers to maintain the old system while ensuring the applicability of the new system. In other words, during the cutover phase, organization must use and maintain both the old and the new system until the new one is proven to be working as expected. Such approach is considered as the safest cutover approach as if anything goes wrong with the new system, then the organization could revert back to the old system at any time with no considerable loss of data. However, the downside of this approach, it also requires the biggest resources as users need to input and do all activities twice (i.e. once using the old system and once again using the new system).

2. THE CASE STUDY

The case study selected in this paper is the case of integrated information system development in a private university in Surabaya, Indonesia (for discussion purpose, the university will be called as university X). As home of more than 8.000 active students, University X is considered as one of the biggest and also one of the best private universities in Indonesia [12]. In 2011, the university has six faculties offering five diploma programs, eleven bachelor degree programs, and six postgraduate degree programs.

In early 2009, the university starts an initiative to build an integrated information system which is intended to support the administration of new student admission, student academic administration, and student tuition fee administration. In term of organizational involvement, the integrated systems involve jobs from three major units: the directorate of finance, the bureau of student academic administration, and the directorate of information system management. The directorate of finance is involved due to its jobs to setup and maintain the students' tuition fee payment. The tuition fee itself is determined based on each student academic status which is administered by the student academic administration bureau. Lastly, that information is to be processed and served to both internal and external stakeholder (e.g. students, deans, rector, and government) by the information system management bureau. In short, the project will cope most of the university's strategic information and involve three major supporting units of the university.

Next, necessary details over the project will be discussed. Started with a brief description about the old information system, the case study will then present explanations regarding the new information system and how conversion from the old to the new system was done.

3.1. The Legacy Information System

Prior the integrated information system era, each of the three units involved utilize various systems which could not connect to systems utilized by other systems. Variation occurs in many ways including variation in the input and output device (e.g. one system only accept the old tape device while other only support disk), the data structure (e.g. different data type and size for the exact same data), the programming language (e.g. C, php, Delphi, Microsoft Access, etc.), the database (e.g. dBase, mySql, Microsoft Access, FoxPro, etc.), and many other disparate data between units.

> *"…in the era of internet where people could easily connect to other people around the globe, we still use thrownet where a unit needs to throw a disk to other unit for data communication purpose…"*
>
> Manager of the Information System Management Department, 2009

Those variations have incurred many redundancies which caused many unnecessary efforts, unnecessary resources, long response time, and low quality of data. The university heads (i.e. rector and vice rectors) often complain about the data inaccuracy especially when different units came up with different figures where it actually referring to the same object. For example, the number of new students enrolled in a given period that is counted by the directorate of finance is almost always different than the figure as counted by the bureau of academic administration.

Other than problems with integration, several systems also lack in capabilities to adapt with the university's current requirements. For example, tuition fee payment

method as suggested by the university is via direct debit from each student's bank account. To do so, the university engaged a close relationship to a bank and provides each student with a bank account for direct debit purpose. In 2008, the university decided to change its bank partner. This decision directly impacts the directorate of finance jobs as now, they will need to carefully separate old students (prior 2008) who hold account from the old bank partner from the new students (2008 and afterwards) who has account from the new bank partner. Sequentially, the directorate also needs to prepare direct debit bills to conform both banks standards. Such requirement has introduced a new major workload to the directorate as the old system is not designed to prepare two different bills. The directorate staff members ended up having to prepare both bills manually every month.

The last but not the least problem with the legacy system is aging which raises the difficulties to sustain the old system durability. For example, up to 2008, legacy system used by the bureau of academic administration aged almost 20 years. Replacement for the hardware used is becoming rare and expensive. Moreover, support of software developer who has the knowledge maintain the old software is very difficult to be located. This support issue has become an urgent matter as the server used has become less durable over time and in 2009, the only backup server used by the academic bureau for new student admission is going down and is stated as irreparable.

3.2. The Integrated Information System

Initiated in early 2009, development of the integrated information system is sponsored by the vice rector of academic and is scheduled to be finished in 12 (twelve) months. The development team itself is comprised of many important stakeholders such as the director of information system management and the head bureau of academic administration who actively analyze and design the system. On top of those two figures, other key persons such as the director of finance along with managers and coordinators in the three units were also actively involved during the analysis and implementation phases.

Learning from the old system experience, the new system is designed to seamlessly integrate the administration of new student admission, student academic administration, and student tuition fee administration processes. In addition, to improve the long term maintainability of the new system, the integrated system is developed as open source software running on top of an open source operating system and utilizing an open source database server.

Due to the huge scale of the project and the critical data that it involves, the project team decided to migrate from the old to the new system in phases. Sequence of modules to be implemented in each phase is determined based on the corresponding module's urgency and events related to the modules.

The First Phase: The Admission System

During the third quarter of 2009, the new admission system is implemented. New student admission cycle last for almost a year started every the third quarter of year minus one intake (e.g. the 2010 intake opens on the third quarter of 2009). Therefore, the third quarter of 2009 (i.e. the 2010 intake) is sought as the ideal entry point for the new system implementation. If this scheduled is missed, then it is likely that the new admission system implementation will have to wait for the 2011 intake which starts at the end of 2010. Further supporting the need to start implementing the new system by the end of 2009 is the university's new admission regulation that could not be supported by old system.

Since the old system is no longer capable to deal with the mandated business process, the immediate cut over is the only feasible cutover approach option to implement the new admission system. To mitigate risks that might occur due to the adoption of the so called the most dangerous system migration approach, the admission team decided to intensify backups made in hard copy (i.e. paper based). If anything bad should happen, the worst case scenario is the admission team will spend times to do and re-do things manually based on the physical backups. Fortunately, the university never had to do the mitigation strategy as the new system managed to administer the admission processes smoothly.

The Second Phase: The Graduation System

Graduation system involves validating list of students graduated in a certain graduation period up to preparing the graduation ceremony. The university held two graduation ceremonies per year, one ceremony for each graduation period. During each period, each faculty will issue list of students to be graduated and based on that list, the bureau for academic administration will issue the graduated students' academic transcript and degree certificate.

Based on the above description, it can be concluded that administration activities involves during graduation is mainly about validating and printing the graduated students' transcript and degree certificate. The old system utilizes two separate systems to do that. Function to validate and print the academic transcript is embedded within the old database system that is developed using C running on SCO Unix server. This old database system will then export list of the graduated student profiles using a disk to the second system: Microsoft FoxPro to print the degree certificate.

Entry point for the new graduation system is made during the fourth quarter of 2009 where the university is preparing the November 2009 graduation ceremony. Considering the circumstances, the university decided to utilize two distinct approaches to replace the two graduation system. Due to the criticality of the academic transcript and the many points that the new

graduation system might went wrong, migration of the academic transcript printing system is done using the parallel cutover approach. In November 2009, the old system is used to print the graduated students' academic transcripts using the official paper which will then be signed and distributed to the graduated students. Meanwhile, the new system printed the transcript in plain white paper. The academic administration staff will then match the printing result of both systems to ensured validity and reliability of the new system. In April 2010 during preparation for the sequencing period, the parallel system is done on the other way around. The new system produced the official transcript which will be matched against transcript that is printed using the old system on plain paper. During the subsequent graduation period, the old system completely deprecated its graduation modules and is replaced by the new one.

In contrast, migration procedure to replace the degree certificate printing is very straight forward. As described, the old system worked based on data passed from the C system thus it has no functionality other than printing the graduated students profile according to the university's template. Therefore, the immediate cutover is taken and since November 2009, the new system already responsible in printing the graduated degree certificates and the old system is deprecated immediately.

The Third Phase: The Academic Cycle and Tuition Fees Management System

The academic cycle and tuition fees management are considered as the most crucial part of the integrated system as it represent most of the administration activities in both directorate of finance and bureau of academic administration. It records all necessary details regarding all academic activities from the beginning of semester (e.g. subject enrollment, leave of absence) until the end of semester (e.g. exam and student results' issuance). Many of those academic activities require students to firstly settle their tuition fee payment. For example, prior enrolling to subjects in a particular semester, a student should have paid all tuition fees that already due. Therefore, a robust communication between the academic and tuition fee payment administration is required.

Considering the significance of each data involves in this third phase, the university decided to exercise the parallel approach to convert from the old to the new system. The tuition fee payment administration parallel process is done within three payment periods which span over three months in the first quarter of 2010. Normally, tuition fee payments are made using auto debit where the university send list of students' bank account and the amount to be debited to the university's partner bank one day before the period due. During the migration period, both the old and the new system generate the require debit list. However, only the old system's list is used. The new system's list is matched against the old system's result. In the first month, there was a big gap between figures generated from the old and the new systems. After a thorough investigation, the developer team found that the gap was caused by miscalculation in both the new and old system. Therefore, revision is made on both systems. The gap lessen during the second month of parallel processing and on the third month, the only discrepancy found between the old and new systems' result are due to problems in the old system. Therefore, after three months of parallel processing, the university gained confidence that the new system is as or even more valid and reliable than the old one. Hence, on the following month, the old system is scrapped and replaced with the new tuition fee management system.

Migration in the academic administration system was done in two academic semesters (the second semester of 2009 and the first semester of 2010) which span over twelve months. As noted in the literatures [4], having to do all administration in parallel for a long time, as occurs in the university's administration related to academic cycle and tuition fees, requires lots of time and resources. For that reason, the university decided not to conduct a complete parallel system. In the first semester of parallel processing, all academic data from all departments was inputted using the old system. Meanwhile, the new system is used only to record academic data from several departments which are considered able to represent the other departments. The university then compares results produced by the two systems. In the second parallel semester, the process is done the other way around. In the first semester of 2010, the new system is used to produce academic result output such as the academic transcript and partial parallel processing is done using the old system for several departments to validate the new system results. After the first semester of 2010, the old system related to academic and tuition management systems are stated as obsolete and are replaced by the new system.

4. RESULTS AND DISCUSSIONS

While each phase on developing an integrated system is interesting to be discussed, this paper focuses on discussing the system migration phase. Interesting point to note in the above case is that time required to develop the system could be less than the time required to migrate the system. Development starts in early 2009 and able to meet the expectation to finished in twelve months. That twelve months are slightly less time than the period to migrate the system which is started at the end of 2009 (i.e. the beginning of the admission system migration) and finished by the end of 2010 (i.e. the end of academic and tuition system migration).

Such fact is an interesting phenomenon as it provides a solid evidence that system migration is not a mere sub part of some phase within a system developing life cycle. Indeed, time required to migrate a system will heavily depend on the migration approach used. Further, when the parallel cut over is selected, the parallel period length will mostly affected by the cycle

time of the system to be replaced. As mentioned earlier, the university case is using "double" parallel migration approach to replace a system that last over a whole semester (i.e. six months). Hence, the university spent more than twelve months to do the parallel sessions, analyze the results and justify the new system appropriateness before completely shutting down and replacing the old system with the new one.

Another point of interest showed by the case is that, sometimes, justifying the performance of a new system is not as simple as match it against result of the existing system. If the new system is designed to perform better and a more complete computation than the legacy system, then it is likely that discrepancies of results produced by the two systems will remain to exist. Such traits will increase the complexities in validating the new system's performance.

Further, while the university agreed that new system provides better performance and capability than the old one, journey that needs to be done to convert from the old to the new system could consume lots of time and resources. In many parts, staffs need to double their daily routines by entering data twice. Such redundant activities require more than just additional budgets to pay the overtime and other necessary expenses, but also strong leadership to convince all stakeholders that the long and exhausting processes of parallel processing are necessary measure to achieve the desired goals safely.

Aligned with Huy and Mintzberg [13] arguments, the case shows how change can be done in sequence combining various techniques to mitigate risk and leverage the possibility of success. As noted from the case, migration of a huge scaled system will require the use of multiple conversion approach and modification of the basic theory according to adapt the context's circumstances. For example, to reduce cost and effort, the case shows how parallel conversion approach can be done partially by selecting faculties that are considered as representative.

Although the case shows how a system migration process could consume more time than a system implementation process, it does not mean that migrating processes requires more attention or resources than the implementation processes. Nevertheless, facts in the case show that migration processes is no less important that other phases in a development life cycle (e.g. analysis, design, implementation, testing). Thus, its requirement should be clearly planned and managed with equal attention as any other phases in development life cycle.

5. LIMITATION AND FUTURE STUDY

This study focuses on revealing a system migration case in a private university in Indonesia. While findings in this case might be applicable to other information system development in other universities in Indonesia, system developer on other kinds of business are likely to encounter different circumstances. Consequently, different migration approaches might be required.

An interesting direction for future study would be to compare cases of system migration from various kinds of business. Such comparison might enrich current knowledge on how system migration can be done in various environments and the necessity of system migration in general information system development.

6. CONCLUSIONS

System migration can be defined as the process of migrating from the old system to the new system. Though many literatures consider system migration only as a part of the implementation or deployment phase within the whole system development life cycle, case shown in this study contradicts it. With no intention to reduce the significance of other phases, this study suggest that system migration is an important phase that should receive equal attention as any other phases in developing an information system. As revealed in the case, time and efforts required to completely finish a system migration is significant and in some case, the time required to convert a system could exceed the time required to migrate a system. Careful planning and execution of system migration is a must to ensure a successful transition and minimize risks of the new system implementation.

The primary contribution of this paper is promoting the significance of system migration role within a system development cycle. Hopefully, such stimulation will promote interest for many other researchers to conduct further researches in this area and appreciate the system migration phase as a crucial key to a successful information system development. Secondly, this study also reveals how a successful system migration can be done in a relatively complex information system development case with hope that findings from the case might be applicable to other cases in similar circumstances.

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