KNOWLEDGE AS A KEY FACTOR OF IT MIGRATIONS

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Abstract:
Active knowledge management is a significant feature of contemporary organizations. It brings various benefits to them. It facilitates decision-making capabilities, stimulates cultural change and innovation, accelerate production chains, etc. Although these benefits can help companies to become better in their market, they are still areas with companies reluctant to implement and start using it. IT migrations belong among them. Every IT migration requires a huge amount of information and knowledge managed and shared during its completion. Its absence causes the projects failures or improper application. The focus of our paper is to analyse this problem and introduce a new approach to IT migration projects. Our proposed method walks through all stages of IT migration and, from knowledge management perspective, explains what knowledge-intensive activities are their components and how to exploit them in order to guarantee its successful realisation.

Keywords: knowledge management, IT migration, sustainability, project execution

1. INTRODUCTION

Change is the only constant in business. New challenges arise every day. Creating a sustainable future requires the right mindset and skill set. Acquisitions, mergers, and improvement initiatives represent approaches how to tackle new challenges. The IT migration belongs among them as a strategy to resolve the company's business and IT challenges (Syntel Inc., 2006). 38% of IT migrations fail (Howard, 2011). Every failed IT migration temporarily holds back vital business processes i.e. damages the company's business position and reputation.

One of the reasons of IT migrations' failure is lack of knowledge (Experian QAS, 2013) and (Morris, 2012). The methodology described in this paper tackles this weakness. It proposes to active knowledge management as an implementation strategy and incorporates it into IT migration activities.

In our paper, standard IT migration activities are briefly introduced. Their description is based on traditional IT migration methods (described below) as well as on best practices collected by the authors. Subsequently a description of how knowledge management and its features can be applied during each stage of IT migration is provided. The paper also discusses advantages and disadvantages of the methodology together with research results which have proved that our proposed method of IT migration helps to increase probability of its successful completion and quick resumption of the company business functions.

2. IT MIGRATION

IT migration is defined as (Kažimír, 2012): "*IT migration is type of repeatedly occurring transitional change. Its duration is determined by the activities needed for the transition from the old state to the new state. Its purpose is to accomplish a transition of company's IT resources aiming to improve its function and enhance business.*"

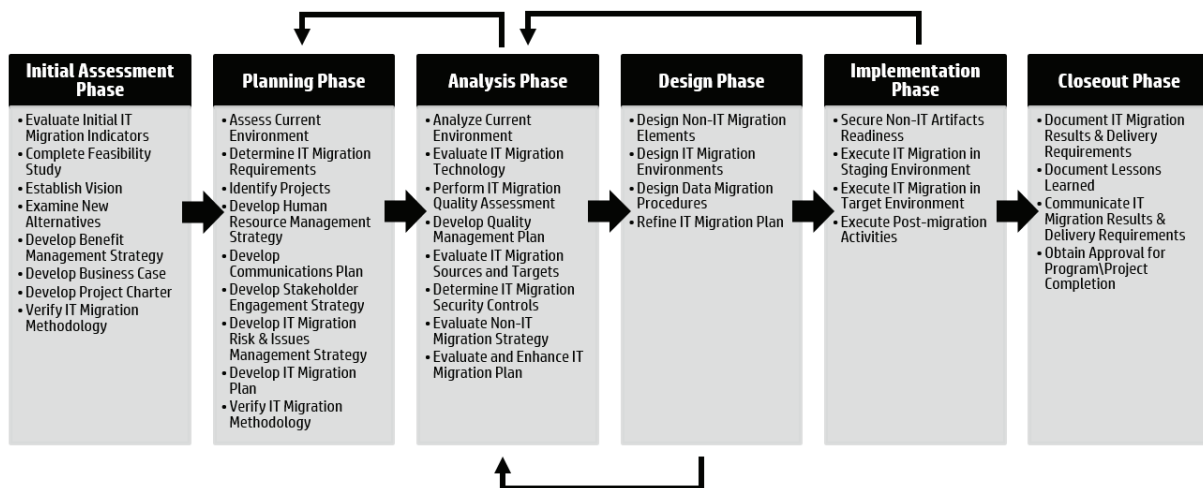**Figure 1:** IT Migration Types
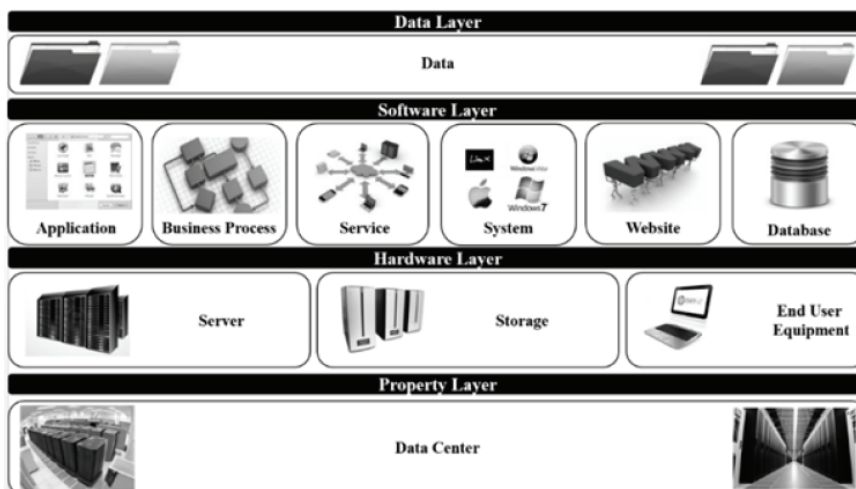
Source: (Kažimír, 2012)

The definition clearly shows that IT migration is not here to support work like regular updates or maintenance which is performed during standard company operation. It is here to perform a significant change to "business as usual". There are various types of IT migrations (Kažimír, 2012): application, business process, data, database etc. Their overview is illustrated in Figure 1.

IT migration consists of activities. They are grouped in phases and their complexity can vary depending on the size and scope of the particular project. These phases and activities form the IT migration lifecycle. The lifecycle depicted in Figure 2 has been created for robust migrations which can be used for all types of migrations, including their combinations. It has been designed using methodologies and best practices of various companies (NetApp Global Services, 2006), (IBM, Inc., 2007), (Russom, 2006), (FSA, 2007). More details about the individual stage can be found in (Kažimír & Hvorecký, 2014).

Figure 2: IT Migration Lifecycle with High Level Activities

Initial Assessment Phase	Planning Phase	Analysis Phase	Design Phase	Implementation Phase	Closeout Phase
• Evaluate Initial IT Migration Indicators • Complete Feasibility Study • Establish Vision • Examine New Alternatives • Develop Benefit Management Strategy • Develop Business Case • Develop Project Charter • Verify IT Migration Methodology	• Assess Current Environment • Determine IT Migration Requirements • Identify Projects • Develop Human Resource Management Strategy • Develop Communications Plan • Develop Stakeholder Engagement Strategy • Develop IT Migration Risk & Issues Management Strategy • Develop IT Migration Plan • Verify IT Migration Methodology	• Analyze Current Environment • Evaluate IT Migration Technology • Perform IT Migration Quality Assessment • Develop Quality Management Plan • Evaluate IT Migration Sources and Targets • Determine IT Migration Security Controls • Evaluate Non-IT Migration Strategy • Evaluate and Enhance IT Migration Plan	• Design Non-IT Migration Elements • Design IT Migration Environments • Design Data Migration Procedures • Refine IT Migration Plan	• Secure Non-IT Artifacts Readiness • Execute IT Migration in Staging Environment • Execute IT Migration in Target Environment • Execute Post-migration Activities	• Document IT Migration Results & Delivery Requirements • Document Lessons Learned • Communicate IT Migration Results & Delivery Requirements • Obtain Approval for Program\Project Completion

Source: (Kažimír & Hvorecký, 2014)

3. APPLICATION OF KNOWLEDGE MANAGEMENT PRACTICES

As mentioned above, implementation of active knowledge management into IT migration should increase a chance for success. The critical success factors are:

1. Performing the IT Migration as an independent project, ranging from budgeting through to testing,
2. Establishing and managing users' expectations throughout the process,
3. Understanding all current data and business requirements and their future desired format and function,
4. Identifying individuals with their expertise related to the legacy data,
5. Collecting available documentation regarding legacy system(s),
6. Defining IT Migration project roles and responsibilities clearly,
7. Performing a comprehensive overview of data content, quality, and structure,
8. Adopting a formal methodology that has been examined and tested,
9. Synchronizing knowledge and coordinating processes with business owners and stakeholders in order to determine importance of affected business data and processes as well as criteria of their quality.

Our former research (Kažimír, Bureš, & Otčenášková, 2012) shows that knowledge management can address all above factors. Below we provide more information on how to implement active knowledge management into IT migration phases in Figure 2. The goal of any implementation is to improve IT migration and to achieve higher comfort of all IT migration stakeholders during its execution, which in turn increases probability of success and decreases the user's adoption time to the newly-built infrastructure. In order to achieve this goal following techniques have been incorporated in our methodology: DIKW (Data-Information-Knowledge-Wisdom) pyramid (Ackoff, 1989) and SECI (Socialization-Externalization-Combination-Internalization) Model (Nonaka & Takeuchi, 1995), (Nonaka, 1994). Furthermore knowledge and experience from 4 knowledge management methodologies is used: A. Tiwana's KM Toolkit (Tiwana, 2000), K. Wiig's set of 16 common building blocks (Wiig, 1998), APQC Road Map to Knowledge Management Results (APQC, 2003) and PRORAD Road Map (PRORAD, 2000).

Several other methodologies have also been considered. However, four above methodologies have been picked due to their simplicity to adopt knowledge-intensive techniques using the following criteria:

1. The methodology should be defined as an implementation methodology leading to a new state of the organization,
2. Information technology usage should be an integral part of the methodology,
3. The methodology should contain tools for creating, sharing and enhancement of knowledge present during IT migration,
4. The methodology should contain techniques and methods helping to identify this type of knowledge and to facilitate its transfer,

5. The methodology should be in good correlations with project management methodologies,
6. The methodology should be a mixture of methodologies created by academicians (i.e. exactly specified and formulated) and methodologies used by practitioners (i.e. executable by trained professionals).

3.1. Initial assessment phase

The initial assessment phase starts with "Evaluate Initial IT Migration Indicators". They help to identify the stakeholders' satisfaction rate with the current infrastructure. If it is low, a new architecture should be introduced. Their needs and the organization's ability to fulfil them has to be further analysed through "Feasibility Study". It should provide detailed information about the current environment, the ways of its exploitation and the users' familiarity with them. The outcomes are then taken as inputs to the next step - design and validation of alternative solutions. Presuming that IT migration is the most appropriate option, its vision should be developed and benefits specified. The role of knowledge management here is rooted in collecting knowledge from stakeholders, their business processes and data organization. It is important to document all benefits in order to increase the probability of getting the company's executives approval and for getting them involved. In the companies without a knowledge management system, it could be incorporated into the solution as well.

All potential benefits of active knowledge management should be documented not only in benefit management strategy but also in business cases and project charter. The charter should also contain the name of the assigned project manager. All collected information is then provided to business executives for their final approval. Business executives should identify a project sponsor who will represent them in the next phases.

3.2. Planning phase

The steps of planning phase are repeatedly used during IT migration. The assessment of current environment can exploit Zack Framework-based Strategic Knowledge Gap Analysis, Five Meta-components of the Knowledge Management Technology Framework or Bohn's Framework described in (Tiwana, 2000). They help to ensure that project benefits will be aligned to business strategy. It also helps to identify main knowledge flows together with information sources, how information is mapped between various sources and where information and knowledge can be exchanged. Furthermore they help to enhance the list of requirements in the next step "Determine IT Migration Requirements" which can run concurrently with the previous one and ensures that goals of end users and support teams will be reached.

Figure 3: High-level Zack Framework-based Strategic Knowledge Gap Analysis
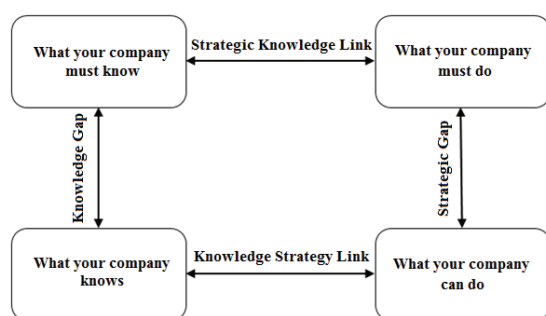
Source: (Zack, 1999)

Zack Framework-based Strategic Knowledge Gap Analysis could be applied at point where 'As-is', 'To-be' states and gaps between them have to be documented properly. Consequently the information can be used in a presentation for stakeholders to show what exactly will be different in the future from what is currently in place. This activity is very important mainly for stakeholders because they will feel more comfortable about the change after they have all the information.

The completion of first two steps in a collection of information about current environment and change requirements. The project manager should develop the migration plan. It should start from a high level perspective – project steps i.e. activities like development of new architecture, development of

migration procedures and pilot implementation of knowledge management. The whole *program* of IT migration is then distributed among project managers responsible for the partial steps. A description of this process can be found in (Office of Government Commerce, 2011), (PMI, 2013), (Office of Government Commerce, 2009).

Knowledge-intensive IT migrations must also include the step called "Develop Knowledge Management Strategy". Its purpose is to acquire, share and incorporate business-processes-related knowledge within project teams and between project teams and stakeholders. Appointment of CKO (Chief Knowledge Officer) is a necessary action which needs to part of the strategy. His/her responsibilities are described in (Tiwana, 2000). In order to establish right approach to actively pursue knowledge management DIKW pyramid and SECI model should be taken into account. In minor migration projects, the CKO functions could be another role of the project manager.

DIKW

The first two phases collected data and information. In order to get the best out of them they need to be understood so that detailed plan can be created. Even after final plan is approved the information and metadata included there can change during its execution. Metadata is defined broadly as the necessary and structured data associated with either an information system or an information object for the purposes of description, administration, legal requirements, technical functionality, use and usage, and preservation (El-Sherbini & Klim, 2004). It means that the IT Migration team have to continue to collect new information and metadata, understand them and make decisions until they successfully finish IT Migration, in best case, or IT Migration fail or is cancelled, in worst case. The success of decision making heavily relies on what information is available and its understanding. Plain information will not tell anything to the decision maker. This is where intangible assets (i.e. the science of knowing what to do, operative processes, employees' capabilities, relations with the shareholders etc.) come into play. Intangible assets will provide better understanding of the situation and make decision making more effective either prior or during IT migration. The above statements make it clear that the never-ending cycle of getting new knowledge and go from the bottom of DIKW pyramid to the top every time new information and metadata come up during IT Migration is unavoidable. Therefore it is very important to understand concept of DIKW pyramid and adapt the KM strategy to the particular project accordingly.

Figure 4: DIKW Pyramid
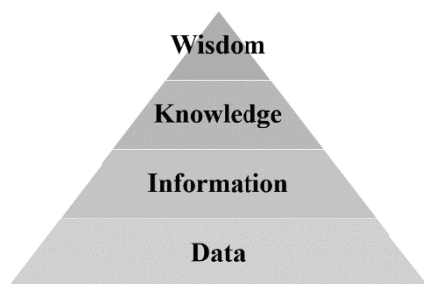
Source: (Ackoff, 1989)

SECI Model

DIKW shows the way how to create knowledge from data which are the most important part of IT migration. Although it is a step forward there is still a need to create a model in which knowledge could be easily created, shared and enhanced. This is what SECI model and knowledge creation process (Nonaka, Toyama, & Konno, 2000) can support and provide wider perspective on how to manage intangible assets. The model of knowledge creation helps to understand how organizations create knowledge dynamically. It consists of three elements: (a) the SECI process model, the process of knowledge creation through conversation between tacit and explicit knowledge; (b) BA, the shared context for knowledge creation; and (c) Knowledge Assets, the inputs, outputs and moderator of the knowledge-creating process. The three elements of knowledge creation have to interact with each other to form the knowledge spiral that creates knowledge (see figure 5).

CKO should take these three elements as a guidance in order to create a strategy for managing intangible assets. In case of SECI, it should be about what trainings, conferences, workshops, etc. should be prepared and scheduled in order to maximize creation, sharing and enhancement of knowledge managed during IT migration. BA should define where the knowledge will be captured and subsequently shared i.e. conference calls, office premises, sharepoint, etc. In terms of third element - knowledge assets – there is a need firstly to define high level what knowledge is required for IT execution. This can be extracted either from scope of the project, 'As-Is' documentation or 'To-Be' documentation. As project progresses more data, information will become available as it was depicted in DIKW. These will then become new knowledge assets and will need to be managed as well.

Figure 5: Knowledge Creation Process
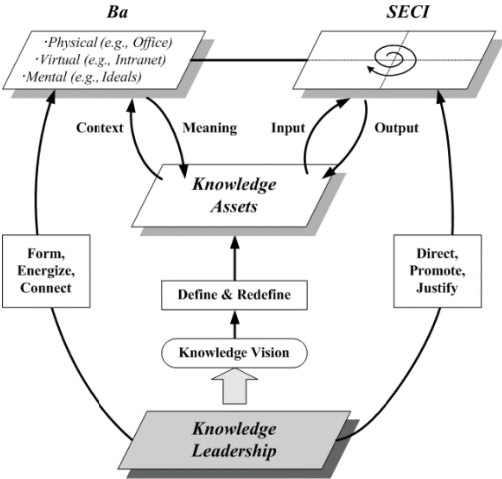
Source: (Nonaka, Toyama, & Konno, 2000)

Established KM strategy has to have metrics defined. Later in the project there should be also 'To-Be' metrics defined. Guidance on this can be found in (Tiwana, 2000). Pilot implementation of knowledge management system should be considered as well. This would help with managing of knowledge assets. In case of successful pilot it could mean a way for the organization to start spreading knowledge management throughout the whole organization. Defined knowledge management strategy has an impact on next steps related to human resources, communications, stakeholder engagement and risks and issues management. It is very important to setup reward structure not only for project related work but also for knowledge management tasks during "Develop Human Resource (HR) Management Strategy" step. This will help with integration of active knowledge management. In addition trainings for project members and for end users should be documented as well. During steps "Develop Communications Plan" and "Develop Stakeholder Engagement Strategy" KM strategy will provide guidance to project manager on communication flow, how and what information will be collected from stakeholders (i.e. CMO, FMO requirements, etc.) and how and what information will be distributed. During previous steps knowledge management could help to uncover gaps which normally would not be identified. These gaps can pose a threat to success of IT migration and therefore need to be documented as part of "Develop IT Migration Risk & Issues Management Strategy" step.
The next-to-last step "Develop IT Migration Plan" will integrate all of the information from the previous steps into a final plan. In addition to the plan project manager should not avoid PMBOK (PMI, 2013) steps (known as knowledge areas in PMBOK) which were not mentioned i.e. integration, scope, time, cost and procurement management and include them into the final plan. The plan is validated and approved in the last step "Verify IT Migration Methodology" by project sponsor and business executives.

3.3. Analysis phase

Once the approval to proceed to the next phase is provided then the thorough analysis will take place by moving to step "Analyse Current Environment". This step should not be only about collecting existing documentation, analyse and come to some results. It is about understanding of not only what is documented but also about things which are not documented.

Knowledge management strategy should be applied during execution of this step and help to create comprehensive picture about 'As-Is' state. Features worth to mention here are service paradigms (Wiig, 1998), knowledge maps (Wiig, 1998), knowledge audits (Tiwana, 2000) and Five meta-components of the knowledge management technology framework (Tiwana, 2000). Knowledge audit can be considered as a viable option, in case project team has sufficient time to perform it. This would give full picture of what knowledge was not captured properly in CMO and what knowledge is required in FMO. Service paradigms and knowledge maps helps with capturing of knowledge gaps. In case of service paradigms it is more focused on products and services which are managed and in case of knowledge maps it is focused on people. Five meta-components of the knowledge management technology framework can provide better overview of gaps in linkages between data and information and help with their understanding. More information about the use of knowledge management features during IT migration is available in (Kažimír & Hvorecký, 2014).

The results of the analysis will be used in the next step together with information about FMO requirements. Existing architecture and tools should be evaluated and checked if they meet the requirements of FMO. Next two steps "Perform IT Migration Quality Assessment" and "Develop Quality Management Plan" should ensure that quality in CMO environment is checked and that FMO quality requirements will be established. All information should be captured in quality management plan together with guidance on how to resolve quality issues.

Sources and targets are checked for their dependencies and relationship between various technologies in "Evaluate IT Migration Sources and Targets" step. What level of security is required and how security should be setup is part of "Determine IT Migration Security" step. Non-IT elements like infrastructure, office premises, project team and operational team skills are evaluated in "Evaluate Non-IT Migration Strategy" step. In case of people skills knowledge maps should be considered which can give better overview of what is required.

All information captured during this phase should be included into overall IT Migration Plan and provided for evaluation by project sponsor and business executives. As one can see IT migration plan contain a lot of information about the whole project. Therefore CKO has to have a strategy established from the previous step on how to manage knowledge so that it will be easily captured and spread across the project teams as needed and easily understood so that all project members are on the same page.

3.4. Design phase

This is the phase where knowledge captured during planning and analysis phase will be used to design a solution. It is not only about developing of architecture and migration procedures but also about non-IT elements of IT migration. As new information become available the project team iteratively use steps from planning and analysis phase as depicted in figure 2 and refine the project plan. Project manager and CKO should evaluate plans and strategies on a regular basis based on new information. If pilot for knowledge management system has been approved then information about infostructure (Tiwana, 2000) can be used as a guidance for designing of the system.

3.5. Implementation phase

Designs from the previous phase are developed during this phase according to IT Migration plan. This is also where knowledge transfer will be performed based on the strategy which CKO have developed. Knowledge captured during previous phases and transformed into new operation mode, processes, technology should be used for implementation of new state in this phase. Although if previous phases have been executed very precisely new information can still become available at this stage. Project manager together with CKO should ensure that information are captured and understood as quickly as possible that the reaction could be immediate and impact as low as possible.

3.6. Closeout phase

If all activities have been executed and company has been migrated successfully to new environment final results and knowledge acquired during the project should be documented and properly communicated throughout the company. As part of acquired knowledge should be also methodology used during the project. Methodology has been created as part of real project. The document was

called 'guidance model' and it provided information about actions and templates used in particular phases of the project. It was very helpful for IT Implementation Manager in the situation when his leader of project managers/solution architects was leaving his position and he could not find a proper replacement with required skills. Fortunately the guidance model helped him as he said "To ensure that proper guidance is in place and that his project managers/solution architects know what to do even after my move to a new position. It also helped to lower the impact of the leave on the program timelines". In addition one of the project managers/solution architects said "The guidance model helped me to increase my confidence during leading of my assigned projects and decrease a risk of project failure". Furthermore lessons learned collected throughout the project should be finalized and kept so that the knowledge acquired could be used for future IT Migration Projects. The final step is to formally "Obtain Approval for Project Completion".

4. CONCLUSION

The main goal of the introduced methodology – created via waterfall approach - is to increase a probability of IT migration success. The methodology tackles it by application of active knowledge management and its features directly into IT migration phases. It was shown through relationship between IT migration and Knowledge management and IT migration critical success factors that IT migration must consider necessary changes in intangible assets. Furthermore it was shown that knowledge management supports identification and understanding of intangible aspects. If this is done prior to the migration then not only plans can be adjusted more effectively but also company's readiness for the change can be improved. Obviously this has positive effect on IT migration stakeholders and improves their comfortability during the project. In overall the advantages are: 1. Understanding of CMO, 2. Project Communication, 3. Stakeholder Engagement, 4. Perform Knowledge Transfer, 5. Knowledge Management System. There is also a disadvantage which is: knowledge management goals are not directly related to goals of IT Migration which can lead, in worst case, to failed project due to missed milestones or exceeded budget. Description of advantages and disadvantages is available in (Kažimír & Hvorecký, 2014). The methodology is not specifically created for someone specific however it is advisable that the person who is going to use it should have project management basics. In case someone would like to use more agile approach it is possible. In that case the methodology phases would have to be split into iterations or sprints with one important things keeping in mind: the new functionality cannot be switched each iterations. Everything (i.e. people, infrastructure, etc.) needs to be ready for the change.

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