

IT Migration - a Way to Business Sustainability

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Abstract

Companies aiming to provide a value to the customers on a continuous basis are permanently facing threats caused by fast and never ending development of the IT environment. In order to overcome all obstacles and achieve better results they have regularly to undergo innovations which can be very expensive and therefore their implementation need to be carefully considered. In addition, innovations in IT-rich organizations have their specifics. Often, the companies' business strongly depends on their legacy systems, i.e., their sustainability requires their successful and effective migration into their new IT environment. This article provides an overview of the problem and analysis of the term 'IT migration'. Subsequently, various IT migration justifications are discussed.

Keywords: IT migration, IT flexibility, Sustainability of IT-dependent businesses

1. Introduction

IT world has undergone a lot of changes in the last few decades. It is an enormously growing area which influences companies, industries, and cultures across the whole world. It was shown in (Menbere Workie Tiruneh, 2011) that investment in human capital and technology generates not only higher level of labor productivity and economic growth but also sustainable living standard, albeit with time lag. This means that information technology significantly influences our lives, businesses and services provided to the consumers. This is also indicated by (Ward and Peppard, 2002), "information technology has become inextricably intertwined with business". This is not going to stop in the future and IT will have an increasing impact on businesses. The main concern then crops up is how can we ensure that IT continuously supports business strategy objectives in the most effective way in terms of time, costs, and quality, and bring expected results, and revenues? It is a question that increasingly worries organizations and their management (Galliers, 2003), (Computer Sciences Corporation, 2001).

The problem of aligning IT with business strategy is the subject of many researches. The big breakthrough in this research area was done by (Duncan, 1995) who has stated that IT flexibility is the key element for the company to be successful. Furthermore, the information systems have to be able to accommodate some degree of change, bearing in mind the needs of the business processes that are being supported. The review of literature about relationship between IT Flexibility and Business Strategy was issued by (Saeid Jorfi, Khalil Md Nor, and Lotfi Najjar, 2011). Based on the above articles, 'flexibility of IT' should be considered as the essential part in every business. This is so because the lack of flexibility can stop the system from being used in some conditions and makes exemptions of important handling. To make matters worse, the lack of flexibility decreases the duration or life of systems especially in situations where it stops the systems from making any changes. Let's remind us the situation which happened at the end of 20th century when IT systems weren't prepared to change date from 1999 to 2000.

The situation described in the above paragraph raises questions like "*Is change needed?*" If yes then "*How do we know what indicators should be monitored in order to warn us about the need to improve or develop new IT Infrastructure to make IT service more flexible?*" The term which is widely used by IT companies for this matter is "Migration Project". What exactly the term "Migration" means and why migration is a viable solution in some cases is described in the next sections.

2. Migration

A word migration can have different meanings. If we take a look into the nature we can find the following expressions:

- Gene migration (Rogers, 2006) – It is the movement of genetic diversity, usually within a species.
- Animal migration (O’Malley and Griffin, 2011) – It is the periodic movement of an animal from the place where it has been living to a new area and its subsequent return journey. The reason could be climate or food availability.
- Human migration (Khan, Mahmood, Yasin and Shahbaz, 2010) - It is the movement of people from one place to another (usually across a political boundary) for the purpose of taking up permanent or semi-permanent residence.
- Bird migration (Powlesland, 2009) - It refers to the regular seasonal journeys undertaken by many species of birds, often between breeding and wintering sites. It includes movements within national boundaries and between countries with suitable climates in order to find food sources and wetlands that are not frozen during winter.
- Fish migration (Alvarez-Vázquez, Martínez, Vázquez-Méndez and Vilar, 2006) - The journey undertaken on a regular basis, on time scales ranging from daily to annual, and with distances ranging from a few meters to thousands of kilometer. The purpose of the journey is usually connected to breeding, feeding and wintering sites.
- Diel vertical migration (Pennington and Emlet, 1986) – The movement of free-swimming larva of sea urchins and ophiurans which ascent into food-filled shallow water at night, and descent into relatively food-depleted depths during the day.
- Plant migration (Rogers, 2006) - It occurs through pollen dispersal, seed dispersal, and movement of vegetative propagules, such as suckers or rhizomes, in species that can reproduce asexually.
- Forest migration (Miller, Vandome and McBrewster, 2010) – It is the movement of large seed plant dominated communities in geographical space over time.

As we can see there are many types of migration present in the nature. The definitions vary for different types. The purpose of migration in the nature was also a subject of a research in (Dingle and Drake, 2007). The outcome led to three observations:

1. It is a natural selection which produces specific behaviors and responses to the environment to solve common problems that distinguish migration from other forms of movement (Kennedy, 1966), (Dingle, 1996).
2. The migration should be seen as a behavioral, ecological, and evolutionary phenomenon rather than as an event that occurs in a particular taxon.
3. The final observation states that there is a need to distinguish between different kinds and degrees of migration.

Based on the above definitions and observations, one can conclude that the migration is linked with natural phenomena is present in our lives and is inevitable. It has to be also noted that all activities taken place during migration has a predefined start time and end time. If we summarize and simplify above statements then the word “Migration” linked with natural phenomena can be described as:

- Movement
- Transport
- Journey
- Process
- Travel

occurring in a specific period of time. Primarily, the outcome of migration and related activities is a change. The change occurs in all companies for example as a reaction to the current situation or future needs in order to achieve better results, higher revenues, satisfy customer needs, etc. Change is unavoidable and therefore the ability of companies to handle changes has an impact on their business sustainability. This was also point out in one of the famous Darwin’s quotes: *“It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to change.”* Changes are not always easy and they can differ in their nature and therefore we should be able to categorize them as its type likely relates to a type of migration guaranteeing its success. Types of changes are described in the following section.

3. Categorizing Change

There are a number of ways in which change can be categorized. Most are related to the extent of the change and whether it is seen as organic (often characterized as bottom-up) or driven (top-down). Ackerman (Ackerman, Anderson and Marquardt, 2007) has distinguished between three types of change: developmental, transitional and transformational. (See Figure 1)

- Developmental change may be either planned or emergent; it is first order, or incremental. It is change that enhances or corrects existing aspects of an organization, often focusing on the improvement of a skill or process.
- Transitional change seeks to achieve a known desired state that is different from the existing one. It is episodic, planned and second order, or radical. The model of transitional change is the basis of much of the organizational change literature (see for example (Kanter, 1983), (Beckhard and Reuben, 1987), (Nadler and Tushman, 1989). It has its foundations in the work of (Lewin, 1951) who conceptualized change as a three-stage process involving:
 - unfreezing the existing organizational equilibrium
 - moving to a new position
 - refreezing in a new equilibrium position.

(Schein, 1987) further explored these three stages. He suggested that unfreezing involves:

- disconfirmation of expectations
- creation of guilt or anxiety
- provision of psychological safety that converts anxiety into motivation to change.

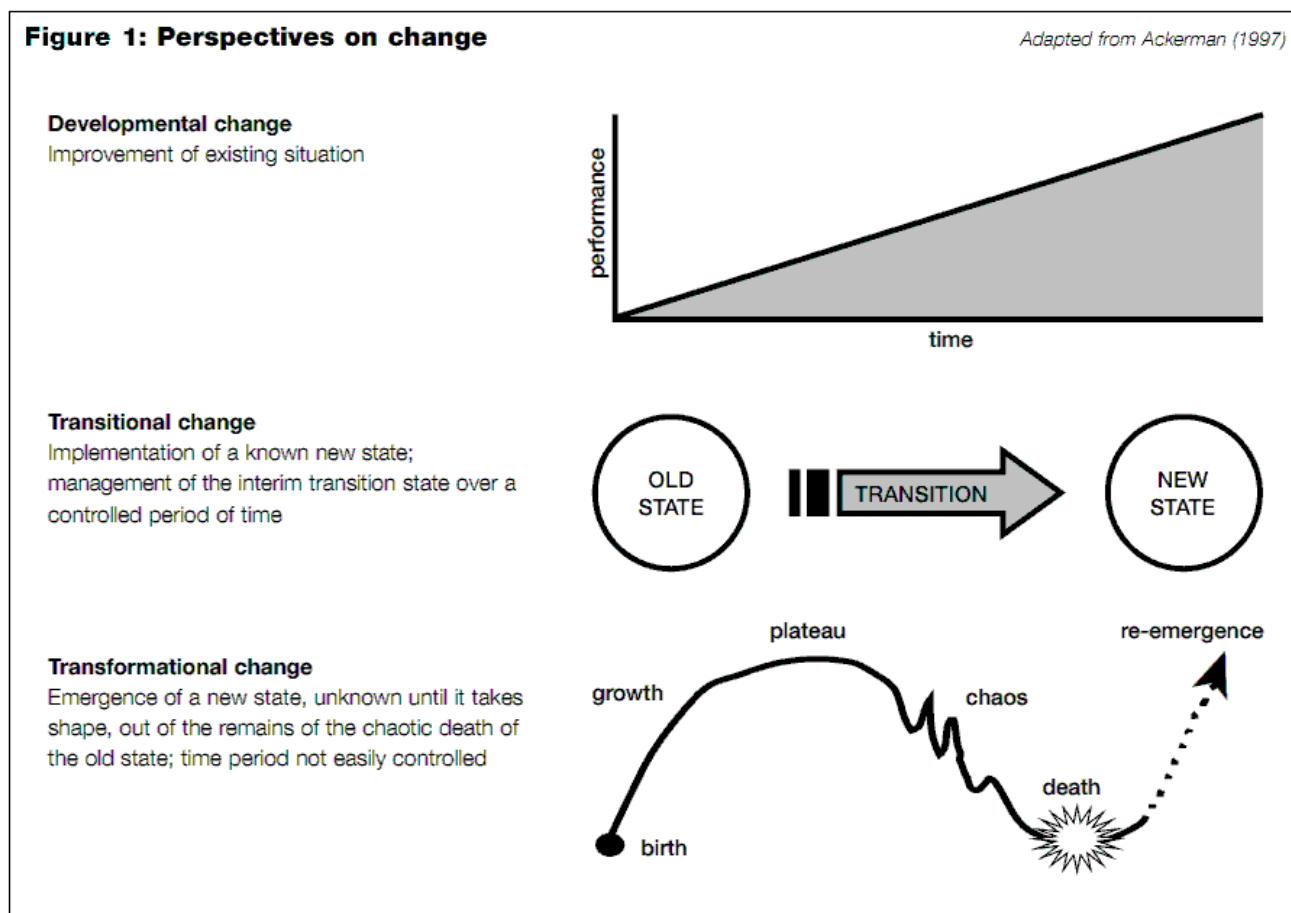
Moving to a new position is achieved through cognitive restructuring, often through:

- identifying with a new role model or mentor
- scanning the environment for new relevant information.

Refreezing occurs when the new point of view is integrated into:

- identifying with a new role model or mentor
- scanning the environment for new relevant information.
- the total personality and concept of self
- significant relationships.

- Transformational change is radical or second order in nature. It requires a shift in assumptions made by the organization and its members. Transformation can result in an organization that differs significantly in terms of structure, processes, culture and strategy. It may, therefore, result in the creation of an organization that operates in developmental mode – one that continuously learns, adapts and improves.

Figure 1: Perspective on change.

4. IT Migration

IT migration can emerge from various reasons. Many organizations are adopting IT migration as a strategy to resolve their business and IT challenges (Syntel Inc., 2006). Examples of such challenges could be mergers, acquisitions, business optimization, reorganization to attack new markets, respond to competitive threat etc. The motivation for IT Migration execution will be described in more detail in the chapter “Why IT Migration”. Different types of IT migration occur repeatedly in companies (QLOGIC, 2008) which can vary in their characteristics and specifications. The overview of various types of IT migration based on different points of view: research area, companies offering and IT community, is provided in alphabetical order below:

- Application migration – It is the most essential aspect of moving traditional systems in to newer, contemporary technologies which can give the businesses a leading edge while preserving original business objectives, model and investment (CGI, 2011), (ITGroup®, 2011). It is the process of redeploying an application, typically on newer platforms and infrastructure. The process involves the staging of the new environment before the actual cutover and requires coordination of IT teams at the time of cutover (CISCO, 2010). Today big boom can be seen in cloud computing. Cloud can provide IT infrastructure services such as servers, storage, network and network services, or infrastructure as a service (IaaS); an application deployment platform with application services such as databases, or platform as a service (PaaS); or subscription-based software applications, or software as a service (SaaS). Cloud in this type of migration can offer for example platform as a service which might be an option for migrating business applications that are based on standard application server software such as Java EE 5 or Microsoft’s .NET platform. Before migration the following criteria should be considered: SLAs, data portability, long-term costs, user management, and security.

- Business process migration – A business process is a series of steps designed to produce a product or service. Most processes are cross-functional, spanning the ‘white space’ between the boxes on the organization chart. Some processes result in a product or service that is received by an organization’s external customer. We call these primary processes. Other processes produce products that are invisible to the external customer but essential to the effective management of the business. We call these support processes. (Rummel and Brache, 1995) Business process migration (BPM) or business processes reengineering (BPR) is defined as “the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed” (Hammer and Champy, 1993). Most BPR projects aim at converting business organizations from hierarchical centralized structures to networked decentralized business units cooperating with one another (Aversano, Canfora, De Lucia, 2003). Such migration can require the movement of data from one storage device, database or application to another to reflect the changes to the organization and information about customers, products and operations. One of the objectives of this kind of migration could be to accelerate the integration of BPM initiative and platform into organization’s infrastructure by reducing manual effort and preemptively addressing potential problems. The tasks included in BPM could be: turning company’s current (“as-is”) and process documentation into flowcharts, converting company’s current flowcharts or process maps to BPMN, mapping company’s processes including recommendations for process improvement.
- Data migration – It is a basic IT migration. It is basic because all IT migrations have to ensure that correct information from the old system will be preserved and transferred to the new system. Information is stored as data in IT world and therefore all IT migrations include movement of data. In other words IT migration will not occur without data migration which is described in (Seagate Recovery Services, 2010), (Ltd.Q., 2011), (Bartkus, 2011) as the process of transferring data between storage types, formats, databases applications or computer systems. There are various data migration approaches and methodologies in order to have proper data in the new system (Department of Education Office of Federal Student Aid, 2007), (Pick, 2001), (NetApp Global Services, 2006) but in summary high level activities which need to be executed are following: planning, analysis and design, implementation and closeout. All these activities should have scheduled exact timelines of their occurrence. Three most common tasks for data migration are: extract, transform and load (ETL). Before data migration is even started, a pre-migration validity test should be run to verify the data. These tests are run so that the pre-migration data can be compared to the post-migration data. The actual data migration should be then the smoothest step, if the correct precautions are taken into account. After the migration of data is complete, the data must be validated so that the contents of the new system or drive perfectly match those of the old drive. Without validation, one can never be sure that the drive is a perfect clone of the original drive nor ready for network access.
- Data center migration (EMC Corporation, 2011) – Data center or server farms consists of servers stored in a confined space on premises of the company in need of IT services. The purpose of the data center often circulates around the following three fields of IT: data storage, communications, and computing. Data center migration is defined as relocation of servers to a more convenient location to meet the needs of the company, software and databases it runs and take an advantage of more energy efficient and higher computing density units. In order to execute successful data center migration company’s need to address the whole relocation lifecycle including application and business process discovery, application bundling, scheduling, logistical planning, physical move execution, and vendor recertification. Company’s need to be careful about the implication of removing any cable, network device, server, storage volume, database, application, service or person within your core business during your move.
- Database migration (Polishchuk, 2008), (SAP Managed Services, 2006) – The goal is to transfer data from one database to new hardware, or a different operating system platform, or even a new database vendor in order to ensure that data resides in fully integrated system architecture or improve performance, lower the service costs, etc. Such an example of database migration could be that a target platform is Windows, while the source could be a combination of Windows, Linux, and UNIX. It can also happen that target platform is 64-bit Linux, while the source one is 32-bit. Two main tasks of database migration are: export and import, but before they occur proper planning needs to be done. During planning the following needs to be addressed: consider a transfer point on the file system and ensure there is enough disk space for the export, acquire a complete understanding of schema changes (how and when key tables get altered/modified, to include data transformation processes), establish a work schedule (does every DBA need to be present the entire time, or can schedules be staggered?)

- End user equipment migration (MicroAge, 2012) - It is the process of transferring the entire user environment (i.e. personal documents and settings) between two computer systems. Major activities included in this migration are: movement of the workstation to end-user workspaces, migration of end-user profiles and data to temporary network storage, set-up of new equipment, migration of end-user profiles and data onto the new workstation, and removal of old workstations and packing materials. This type of IT migration can lead to: increased employee productivity by reducing confusion in the workplace, increased ROI from IT investments, etc.
- Server migration (Oracle, 2008) - It is a process in which a server instance, and all of its services and data, is migrated to a different physical machine. The server migration can be executed for various reasons, i.e. security reasons, replacement of equipment, etc. During the migration process, data can be temporarily inaccessible. The most common items which need to migrate are: server roles, features, operating system settings, and other data and shares to computers that are running within the same network domain. In order to have all items migrated server migration tool can be used. It is very important to have all firewalls opened before execution takes place.
- Service migration – It is a process of moving the pinned services from one server instance to a different available server instance within the cluster (Oracle Corporation, 2008). The most common problem identified is packaging the service binaries and data in a fashion that allows it to be restarted at a remote site and locating a service after it has migrated (Meehean and Livny, 2005). Service Migration often occurs to increase an availability and quality of a service (Oracle, 2008). Such example of service migration could be migration of complete account, group and organizational unit (OU) migration to Active Directory (AD) including migration of file and directory and synchronization of public folders, calendar information and mailbox data. After migration set of permissions need to be provided to business users.
- Storage migration – The purpose is rationalization of the physical media to take advantage of more efficient storage technologies (NASI, 2011). It can also enable a running virtual machine to move between two physical hosts (servers) with no perceptible interruption in service. This allows customers to avoid costly downtimes associated with hardware maintenance and upgrades, and facilitates automated load-balancing. Approaches to storage migration follow a similar pattern. A virtual disk(s) is migrated (copied) from a source volume to a destination volume. Initially, a running virtual machine is using the virtual disk on the source volume. As the disk on the source is copied to the destination, bits are still being modified on the source copy. These changes are reflected to the destination so that source and destination ultimately converge. Once the two copies are identical, the running VM can be retargeted to use the destination copy of the virtual disk (Mashtizadeh, Celebi, Garfinkel and Cai, 2011).
- System migration (Lenovo, 2011) – It is a movement of programs, individual data and settings from old system to new system. Migration can involve downtime, while the old system is being replaced with a new one. Specifically system migration should migrate user, system, and network settings, e-mail and data from one computer to another. Migration tools developed today can be run under specific conditions on source and target computers. The conditions could be following:
 - Installed operation system supported by migration tool.
 - Specific amount of free disk space for installation files.
 - The hard drive on the source computer should have enough free disk space for the temporary files that are created during the capture phase. The disk space required depends on the size of the migration file created by migration tool.
 - The target computer must be able to access the migration file. In order to access the file local area network (LAN), a removable medium (such as a USB hard drive), or an Ethernet crossover cable can be used.
 - For a PC to PC migration, the target computer should have free space on the disk amounting to twice the size of the temporary files.
 - For a file transfer migration with default settings, the migration file destination should have free space on the disk equal to the total size of the migration files.
- Website migration (Cocker, 2006) - It is the process of moving the files of a website from one web hosting company to another. A migration can happen for many reasons:
 - Due to expansion of a website and need for more web space.
 - Due to need for more features (i.e. a database, shopping cart or multimedia file hosting).

- Due to better deal on web site hosting

Website migration can include:

- Moving all web site HTML files and images.
- Moving all web site media files.
- Moving any web site scripts or applications and testing to make sure they continue to work without problems.
- Moving any MySQL databases.
- Replicating e-mail configuration.
- Modifying domain name servers to point old domain to new account on new servers.
- All steps can be completed for the majority of web site almost without any downtime.

In general as we can see all types of IT migration are described as a movement of data, application, system, server or process from the old environment into new environment. Based on the descriptions above one can also notice that almost every type of IT migration requires data migration (i.e. database, server, service migration) but there could be also exception when movement of data is not necessary (i.e. application migration). One can also conclude that IT migration can be executed only if proper actions and processes take place with defined timelines which can help us to define the term “IT Migration” more accurately in the next section.

5. Change, Migration and IT Migration

Previous chapters describe characteristics and features of particular elements of Change, Migration and IT migration. We can find indications that migration is a change which occurs repeatedly in the nature in the second chapter. Several definitions of migration linked with natural phenomena are in the third chapter followed by changes which can be seen in organizations and businesses. Subsequently fourth chapter describes various forms of IT migration.

This chapter summarizes previous chapters and derives the definition of IT migration based on our deeper analysis of relationships between migration, IT migration and three above types of change. From this point of view, the IT migration is somehow related to the below cases:

- **Developmental change** – This change is described basically as improvement of existing situation which means mostly to create or make changes to existing environment. In IT world it could mean to make changes to existing business applications and IT infrastructure in order to correct errors or deal with new business settings. Consequently one can clearly see that developmental change is not a movement from one state to another to which the term “Migration”, described in the section ‘Migration’, is referring to. It is only an enhancement of the existing environment, which in terms of IT could be enhancement of IT infrastructure and business applications and therefore this type of change can't be considered as a candidate equalizing the term “Migration”. However activities and results of the developmental change process can be used as inputs to decide whether it is still worth to stay in the current environment/territory or update/upgrade the existing IT infrastructure on an ongoing basis or it is better to move to new area or develop a wholly new IT infrastructure and new business applications to overcome challenges or take an advantage of new opportunity.
- **Transitional change** – It is described as implementation of a known new state including management of activities which need to occur to transfer the existing environment from the old state to the new state over a controlled period of time. The new state can be a new place to which birds migrate in order to find food sources or new IT infrastructure which will accommodate customer needs for less cost. The way how to get to new state from the existing one is for example in case of birds to undertake a journey or in case of IT to transfer data from the old environment to newly developed environment. Furthermore in order to get to the final state either birds or companies have to carry out activities which need to be managed. It can be also noticed that journey, travel, transfer or movement is not a one time job but it occurs repeatedly. The characteristics of transitional change fits the elements and features of migration and IT migration and therefore it can be considered as very good candidate to define the term “IT Migration”.
- **Transformational change** – It is also described as a movement from the old state to the new state which is the case of transitional state but there is one big difference.

- The main difference is in the timing while transitional change occurs over a controlled period of time transformational change is the outcome of the chaotic death of old state (i.e. natural disasters, collapse of IT infrastructure, bankrupted company, etc.) which cannot be controlled and therefore timing can not be clearly specified. This situation usually occurs when the future of animal species or a company is blurry and the only way to come out of it is through restructuring. The definition of transformational change is not also a candidate to express the term “IT Migration”.

Based on the above analysis it can be concluded that transitional change is the best candidate which fits the meaning of the term migration and IT migration. Therefore we can derive the definition of the term “IT Migration” from the definition of transitional change and from the description of basic characteristics and features of migration, written in the second chapter. Consequently, the concept can be specified as:

“IT Migration is a 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.”

As we know there could be a lot of projects executed by IT companies and the definition of “IT Migration” should help us to differentiate migration project from other projects.

6. Why IT Migration?

The previous chapters have described the meaning of IT migration and have provided various types of IT migration. Prior to arriving at the decision to migrate there has to be a strong business case why IT migration is the best solution to resolve issues with IT infrastructure and consequently accommodate business needs. This chapter discusses why companies should consider IT migration.

IT world changes every day and IT systems which are the best today can become obsolete tomorrow. The obsolete IT systems are accompanied by following issues (Syntel, 2006):

- Increased maintenance costs of current IT environment.
- Limited resources with specialized skill sets.
- Lack of interoperability among disparate systems.
- Lack of scalability and functionality in the current system.
- Lack of agility to incorporate new features rapidly.

IT Migration offers an opportunity to move to new IT infrastructure and resolve all these issues. The possible consequences of not migrating to new system could be rapidly increased maintenance costs, lost customers or major, potentially catastrophic, failure of IT infrastructure. Companies should avoid all these issues and ensure that neither of consequences occurs. IT migration can help them to accomplish this mission. Furthermore IT migration provides solution to these issues followed by other benefits (Syntel, 2006), (CISCO, 2008), (Shanker, 2008), (Varia, 2010):

- Enhanced and protected business investments – New applications which need to be developed in order to migrate ensure increased performance, reduced total cost of ownership (TCO), simplified maintenance, better security and faster deploying time to market.
- Improved applications – IT migration enables the rejuvenation of existing business systems and leverages application use, offering opportunities that current and future technologies provide, implements advanced features and brings applications onto a single development platform. The benefit is in improved system integration, performance, scalability, productivity, integration, reliability, security, and extensibility. In addition, reduced cost overheads are realized by eliminating the need to maintain multiple platforms.

7. Conclusion

The article issued one of the business opportunities: IT migration. Firstly, a description of the existing migrations which can be experienced as natural phenomena was provided. Secondly, while IT migration is very closely connected to the term ‘change’, various types of change were discussed. Thirdly, the topic followed by providing information about various types of IT migration. Based on the findings from all three chapters the definition of IT migration was formed.

It was point out that IT migration is a type of change which occurs in a specific period of time with predefined timelines. In the end, the reasons of why IT migration should be executed and what the business benefits are were provided. The article showed that IT migration can resolve issues connected with obsolete IT infrastructure and align IT with business strategy which ensures sustainable business. The paper didn't address the topics which would show when IT migration should occur, what factors company needs to track and analyze in order to be able to make a decision whether to undergo an IT migration.

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