INFORMATION MANAGEMENT IN PRACTICE

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Preface

All chapters of this book have been focused on the most important aspects of modern Information Technologies trends. Those trend, widely discussed and described in this book, is the most important as a wide area of the innovation, mobility trends among customers and businesses, Big Data (or Deep Data) analysis or new concepts of cloud computing.

Most of the authors have been reflecting those trends in scientific and practical aspects of IT effectiveness, financial aspects of investing in new cyber economy, to minimize of cost and getting more flexibility out of it. Moreover, those were presented in the face of increasing pressure in effective development of IT solutions (Agile approach) we are faced those days in every industry. Even so, the importance of delivering the final results now so dramatically focus on time and "new versions" is always valid, but in many areas also the process of managing the quality and security of those solutions.

This book is addressed to community of science and corporation – it contains theoretical and practical aspects related to IT future solutions.

First group of subjects presented in the book is reflecting the business side of information management. Those are mainly in areas of business process modeling and redesign combined with the important issue of business model notation. Both are very important those days linked with observation of the market place where many businesses face an unquestionable need for rethinking and redesigning their business model. Another group of subject addresses a second most important business issues – operational excellence understood as a high level of automation in business processes and transactions. In today complex world, business processes have to be supported by business rules and automation standards implemented within automated business management systems. Authors presented this issues based on the IT projects or business cases there were involved in.

Second group of subjects are concentrated on minimizing the cost and affords of delivery IT solutions. In this area main current interest lays in scrum and agile IT delivery issues. Subject is not new in the face of long-lasting discussion between the practitioners and theorists about the advantage of classical waterfall approach against the quick and multistage approach around agile concept of IT development issues. This area is also linked to quality of data management in IT projects. Quality in delivering the final scope of IT projects is extremely important

from dynamics of business development in modern business startups, and it is playing extremely important role in delivering on time and budget.

Functional security of IT platforms is another element of an organization overall security and depends on the correct operation of the integrated IT systems in response to fast moving inputs. The security platform is achieved through building in specialized security configurations into the integration platform. Next group of topics address the dynamic growth of IT architectures and integration layers from one side and fast growing of security issues in IT solutions. Those developed over the last several years have to comply with the new requirements related to systems architecture in terms of quality and functional security. Several aspects of security overlooked from corporate and administrative point of view has been addressed. Additionally during the conference security of documentation and management of lifecycle security systems and separately wide range of the issues related to systems architecture from the security point of view has been presented. Overall looks like, we are at the beginning of developing the methods for identifying and solving issues related to control IT systems, in order to maintain the required level of functional security.

Next papers represent group of the proposition related to "elements of the good practice". To ensure adequate quality of the created IT system, it is necessary to have a high quality of project management in all activities, from the stage of formulating the work concept to the moment of delivery of the ready solution. In the sense of this, quality assurance is understood as a process in which the general results of the project will be evaluated to verify whether the project meets relevant quality standards.

The following works are related to the most critical aspect of modern IT systems in every business, or administration – mobile solution integration with concept of cloud computing. Both concepts represent not only dynamically developing part of the IT market but at the same time moving the whole setup of IT service delivery in completely new dimension. The authors presented two remote concepts of using IT mobility concept. First is presenting of IT system for crowdfunding. The second is analyzing the websites for mobile operators.

The final subgroup of the works has been dedicated to the area of using the IT tools for intellectual property protection and knowledge transfer. This is a rising issues in times when number of innovation is growing very rapidly in any business area.

The aim of this book was to present new ideas and trends in modern Information Technologies. It could also serve act as a guidebook or inspiration for IT Management and decision makers in order to meet they own decisions. It also could be used for some of the concepts and ideas for assuring maximized value of IT not only as a cost generator, but benefit provider. Some of the successful cases pre-

sented in this book, as well as academic approach of quantifying and underlying basics of IT.

The editors and authors of this book point their discussion to the top level enterprise management, leading scientists, business managers, officials and investors. Presented work is the summary of conducted researches and donates innovative solutions which concern variety of industry and public sector.

It is a privilege of editors to thank all Authors involved in creating this book for their valuable contributions and insights. We would like to thank in particular our publisher Faculty of Management at University of Gdańsk, Poland. Special thanks go to Janusz Wielki, gave valuable contributions by his review, encouragement and close support during the writing of the book.

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Chapter 1

The opportunities, impediments and challenges connected with the utilization of the cloud computing model by business organizations

Janusz Wielki

Introduction

The results of numerous surveys clearly indicate the growing interest of organizations of varying types in IT solutions available using the cloud computing model. According to the report by Forrester Research, in 2020 the global public cloud market, alone will reach 191 billion USD. This is a significant correction of the previous 2011 forecast (160 billion USD) and almost two hundred percent growth from the end of 2013 (58 billion USD) [Gaudin, 2014]. The predictions by the analyst firm IDC are even more optimistic. According to their forecast, the global cloud market, including all types of clouds, will reach 118 billion USD in 2015 and 200 billion in 2020 [Gaudin, 2014a]. For Europe according to the European Commission, between 2014 and 2020 the use of publicly available cloud offerings is expected to achieve a 38% compound annual growth rate [EC, 2012, p. 16].

The dynamic growth of the cloud computing market is also confirmed by other data. IDC expects that in 2017 45% of all servers sold will be bought by cloud providers (in 2014 it was 25%–30%) [Thibodeau, 2013]. This estimate can be translated into predictions concerning global data center IP traffic. According to the forecasts of Cisco, the total global cloud data center IP traffic will grow at a compound annual growth rate of 36% from 2012 to 2017 and will increase from 1.2 zettabytes in 2012 to 5.3 zettabytes in 2017. At the same, the traditional data center IP traffic will grow at a compound annual growth rate of 12%, from 1.4 to 2.4 zettabytes. It means that in 2017 the global cloud data center IP traffic will be more than two times bigger than that in traditional data centers [Cisco, 2013, p. 4].

There is a growing number of various types and sizes of organizations which are interested in cloud-based solutions and in utilizing them. This fact is confirmed by the results of various studies. For example, a study conducted by Gartner between June and July 2012 surveyed 556 companies from nine countries and across multiple industries. According to the results of this survey, even at that time 19% of surveyed organizations were using cloud computing for most of their pro-

duction computing, while 20% of them were using cloud-based storage systems for all or most of their storage requirements [Gartner, 2012].

Small and medium enterprises (SMEs) are also interested in the solutions offered by the cloud computing model. In 2013, Ipsos MORI conducted a survey, commissioned by Microsoft, among SMEs employing fewer than 25 people, from 22 European markets and Turkey. According to the results of the survey, 65% of respondents from Central and Eastern Europe confirmed usage of cloud-based services. In the case of respondents from Western Europe the cloud adoption rate was 45% [Boch-Andersen, 2013]. The results of a survey conducted a year later by Idea Bank and Tax Care among Polish one-man companies showed that 60% of those surveyed knew about and used various types of cloud-based solutions [Idea Bank, 2014].

Therefore, in this context of the growing interest in the cloud computing model, it is important to analyse a few of the key aspects connected with it. They include the following issues:

– the reasons for the rapid development of cloud computing;
– the opportunities and benefits which utilization of the cloud computing model brings;
– the most important problems and challenges faced by organizations when using the cloud computing model;
– the key issues connected with the implementation of a cloud-based approach.

An analysis of the above mentioned aspects is the basic goal of this paper.

1.1. The notion of cloud computing and the most important reasons for its development

As far as the cloud computing notion is concerned, the most frequently in this context one indicates various features characteristic for this model of information technology utilization [EC, 2012, p. 3–4]. The most commonly known and cited cloud computing definition was coined by the National Institute of Standards and Technology. According to it "cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" [Grance, Mell, 2011, p. 3].

The cloud computing model is connected with a completely different, from those so far used, approach to IT utilization by organizations. In this computing model, the World Wide Web is treated as a cloud of data, software and hardware

and these elements can be "mixed" and used on-line [Wielki, 2012, p. 16–17]. In fact, it is the practical realization of the marketing slogan "Network is the Computer" coined in 1990 by Sun Microsystems. In such an approach the World Wide Web turns into the World Wide Computer [Carr, 2008, p. 113].

There are three basic service models which can be distinguished within the scope of the cloud computing model. The first (software-as-a-service – SaaS), with its roots in the 1990s, saw its popularity start to fall during the first few years of the new millennium [Rainie, Wellman, 2012, p. 94]. In this model, applications are hosted by a vendor and made available to customers on-line. vendor takes care of the continuity of function, provides security, is responsible for the application's development and adjusts the application's functionalities to the customers needs [Wielki, 2012, p. 120]. Examples of solutions belonging to this model are e-mail services (e.g. Gmail), software office suites (e.g. Google Docs or Google Apps), CRM software (e.g. Salesforce applications) or Big Data tools (e.g. Amazon Elastic MapReduce).

In the case of the second model (infrastructure-as-a-service – IaaS), a third-party vendor provides customers on-line access to a virtualized computing resource (storage, processing power, network infrastructure). The vendor is responsible for the maintenance of this resource and for ensuring it is efficient as well as reliable [Wielki, 2012, p. 120]. Examples of the solutions belonging to this model are such services as Amazon Web Services S3 (storage service), Amazon Web Services EC2 (resizable compute capacity) or Amazon Work Spaces (desktop computing service). A "subcategory" of this model was proposed in 2014 by Hewlett-Packard. It relates to services connected with access to data centers, which HP has termed facilities-as-a-service (Faas) [Thibodeau, 2014].

In the case of the third model, platform-as-a-service – PaaS, a cloud provider delivers a computing platform which allows application developers to create, develop, test and run their own applications [Wielki, 2012, p. 120–121]. Examples of such type of services are Google App Engine, Microsoft Azure, Force.com, BlueMix or BlueMix.

The above mentioned service models can be offered through four types of "clouds". As far as public clouds are concerned, a provider allows users open access to such resources as processing power, data storage, network infrastructure or usage of various types of on-line applications. There are two types of private cloud: internal and external. Internal private clouds are clouds which restrict access to their resources to employees of the host organization. External private clouds function off-premises but the applications run on dedicated servers and are protected by a service provider who provides secure access to the resources by means of a virtual private network. The third type of "cloud", community clouds, can be considered as a variant of a private cloud and their resources are available

for the exclusive use of members of specific communities. They can belong to, be managed by, and operated by one or more of the organizations belonging to the community, a third party, or some combination of the two. The last type of "cloud" is hybrid clouds. These combine the infrastructures of two or more types of clouds (public, private, community). Remaining unique entities they are bound together by technology that enables portability of data and application [Grance, Mell, 2011, p. 3].

There are many reasons for the development of cloud computing model – based solutions. The most important include such issues as:

- growing bandwidth and reliability of networks (Internet links),
- development of Web services and their growing availability,
- processes for information technology commoditization.

1.2. Opportunities and benefits connected with cloud computing utilization

There are many diverse benefits and opportunities arising from the adoption of the cloud computing model. Although cost related issues are very often indicated as a key benefit [EC, 2011, p. 4; Olavsrud, 2013] in fact there are much more important advantages associated with this approach. According to the results of the 2014 Technology Innovation Survey, conducted by KPMG among almost 800 global technology industry leaders, there are four main categories of benefits connected with this technology. They include [KPMG, 2014, p. 15]:

- improved business efficiencies/productivity (37%),
- cost reductions (22%),
- faster innovation cycle (11%),
- accelerated time to market (10%).

Other reports also often indicate such as [Bisson et al., 2013, p. 63–64; Pratt, 2014]:

- increased agility,
- opportunities connected with the implementation of new business models,
- improved collaboration among business units and partners,
- geographic expansion,
- creating new opportunities for SMEs.

The benefits also include improving an organization's productivity, particularly in two key areas [Bisson et al., 2013, p. 65]:

- infrastructure and operating expenses,
- application development and packaged software.

According to estimates by the McKinsey Global Institute, in relation to the first of these, productivity gains will reach 20–30%. They result from [Bisson et al., 2013, p. 65]:

– reduced infrastructure and facilities footprint,
– high task standardization and automation.

In the second case the McKinsey Global Institute estimates that productivity gains will reach 10–15%. They result from [Bisson et al., 2013, p. 65]:

– standardization of application environment and packages,
– faster experimentation and testing.

There are many aspects of the cloud computing model which can result in lower costs. For example, if the physical IT infrastructure is considered the most important aspects include:

1. Reduction or elimination of waste related to the low level of hardware utilization.
2. Reduction of costs connected with hardware maintenance.
3. Lowering costs related to energy consumption.
4. Possibilities for the permanent analysis of costs and selection the optimal service level.

As far as the first aspect is concerned, when using a cloud-based solution, a company uses the resource level it currently needs and settles accounts on the per-use basis. Such an approach leads to the reduction or complete elimination of waste associated with the use of the physical IT infrastructure, such as computing capacity or storage systems. As the results of various surveys have shown, their utilization, in the case of the "traditional" computational model, is very often at extremely low level [Carr, 2005, p. 70; Bisson et al., 2013, p. 63].

The reduction of costs connected with the maintenance of the physical IT infrastructure of an organization is the next area of savings. It results from the fact that the service provider is responsible for the efficient and reliable functioning of the physical IT infrastructure. Utilizing a cloud-based solution results in a lowering demand for IT departments. As a result, some of the financial expenditures previously allocated for this purpose can be released. This fact is confirmed by the results of a survey conducted by Manchester Business School and Vanson Bourne between December 2012 and January 2013, of 1300 companies in the U.K. and the US which used cloud computing. In the case of 60% of respondents, this computing model has reduced the need for their IT team to maintain the physical infrastructure [Olavsrud, 2013].

The utilization of the cloud computing model can also be, especially in the case of large organizations, a source of significant savings in terms of energy consumption. It is estimated that by adopting cloud computing large American

companies could annually save up to 12.3 billion USD in energy consumption [EC, 2012, p. 4].

Savings can also be made in the areas of monitoring, controlling and measuring which the cloud computing model, offers. This is due to the fact that client-organizations have access to automatic report systems which allow them to monitor the level of "consumption" of resources, along with the connected costs. This allows organisations the opportunity to actively manage and improve their cost structures, i.e. by changing their service-level agreement (SLA) to a less costly one, which translates into lower IT costs [Agarwal, 2014].

In the case of software utilization, the cloud computing model can lead to the reduction or elimination of costs connected with:

1. Purchase and installation of software, its maintenance and upgrade.
2. Purchase of wrongly selected software.
3. Low level of software usage.
4. Developing and testing of applications.

If the first aspect is considered, a company uses software which belongs to a service provider who makes it available on-line. Because of this fact, the provider not only incurs all costs connected with the software's creation, installation, maintenance, continuity of function and security, but also its development and for adapting the software's functionality to the user's needs.

The second area of savings connected with software relates to the purchase of the wrong software e.g. not meeting the requirements of end users or duplicating software the company already has. According to the results of a survey conducted by Sage (600 people from EU firms responsible for IT) this last aspect was the main reason for software spend waste in German enterprises [Sage, 2014].

With the third aspect, every organization which buys and installs software incurs costs associated with this, regardless of how much the software is used. If a company uses a cloud-based solution to base their "borrowing" and settling accounts on a "pay-as-you-go" model (also called a consumption model), significant savings can be made as companies only pay for the actual software used [Deeter, 2013, p. 7].

The last significant area of savings connected with the software-as-a-service model relates to the reduction of costs arising from developing and testing applications. This aspect is of particular importance in the case of organizations which build the software they need. By using applications delivered in the cloud model they offload such costs onto a provider.

There are many new factors connected with cloud computing which have an impact on faster innovation cycles. Easy and cheap access to tools for the development and testing of new products or services, e.g. cloud-based Big Data tools, is a good example in this context [Davenport, 2014, p. 163; Intel, 2014]. Big Data

tools are already being used for this purpose by a growing number of companies [FedCSIS, 2013, p. 986].

Simultaneously, as was mentioned earlier, the implementation of cloud-based solutions leads to a diminishing demand for IT department employees responsible for the maintenance of an organization's' physical IT infrastructure and the release of some of the budget previously allocated for this purpose. This allows for the re-investment of the savings on innovative products or services. According to the results of the earlier cited survey conducted by the Manchester Business School and Vanson Bourne, this occurred in the case of 62% of the companies surveyed [Olavsrud, 2013].

Usage of the PaaS model is a good example as far as accelerated time to market is concerned. In this case companies which develop their own software instead of creating their own environment can instantaneously use ready-made tools for the application building process, delivered to them as a service.

If company agility, understood as the capacity of an organization to identify and capture opportunities more quickly than competitors [Sull, 2009], is considered, cloud computing significantly increases the possibilities of companies in this respect, due to the fact that utilization of the cloud-based model considerably broadens opportunities for the quick and flexible adjustment of an organization's IT infrastructure to new needs or new market situations. Such situations can require the implementation of new applications, adding new services or increasing computational capacity. In addition, using cloud-based solutions can be quicker than in the case of using a company's own staff [Bisson et al., 2013, 64].

Utilization of the cloud computing model also provides organizations with numerous new opportunities to implement new business models. In many cases, these business models would not be feasible without usage of this computational model. An innovative business model called *car sharing*, implemented by the Zipcar company is an example of such a situation. This business model is based on a complicated management system of a single set of cars which are shared by many users, which would not be possible without an advanced IT system where one of the key elements is the utilization of the cloud computing model [Griffith, 2009; Kerpan, 2013].

Improved collaboration among business units and partners is made possible by the provision through the cloud of easily accessible, continually developing [Noyes, 2015], applications. This aspect combined with the above mentioned opportunities to build and implement new business models provides organizations with new possibilities for geographic expansion

The cloud computing model also provides small and medium enterprises (SMEs) with significant opportunities, especially in respect of costs. In the case of the smallest SMEs or start-ups with only small levels of capital at their disposal,

this is not in relation to the reduction of costs previously incurred for IT infrastructure but rather opportunities to access hardware and software which would be not achievable in the traditional computational model, because of financial barriers, particularly around purchase of hard and software and the employment of skilled IT workers to cover maintenance. The cloud model and the associated possibilities of "hiring" services connected with physical IT infrastructure or applications, enables smaller firms to more effectively compete with large organizations [EC, 2012, p. 4]. They can also access sophisticated solutions such as the above mentioned Big Data tools or the programming environment in PaaS model. Just a decade ago the costs of accessing such computing power or data analytics tools would have been prohibitive not only for the smallest firms but for most SMEs. In the current market, they have a lot of easily accessible cloud solutions available at low cost at their disposal [Davenport, 2014, p. 163].

1.3. The most significant problems and challenges connected with the utilization of the cloud computing model

As is the case of all other IT solutions, those offered in the cloud model bring not only benefits and opportunities but also problems and challenges. According to the results of the above mentioned 2014 Technology Innovation Survey, there are three main groups of challenges connected with the cloud computing model. They include [KPMG, 2014, p. 15]:

- security (23%),
- technology complexity (16%),
- risk management (15%).

Security anxiety is undoubtedly the key concern connected with this technology, and is confirmed by the results of other studies [Vijayan, 2014; Bisson et al., 2014, p. 66]. According to the Cloud Security Alliance there are various types of security concerns including such aspects as: data loss/leakage; account, service, and traffic hijacking; shared technology vulnerabilities or insecure application programming interfaces [HP, 2012]. Of course the level of the potential risk depends on many factors, including the type of cloud being used, the service provider, the technologies being used (including data encryption) as well as the procedures it uses, or the procedures applied by a client-organization. In the latter case, it also relates to the phenomenon called shadow IT, which is employee usage of cloud-applications not approved by IT department for business purposes [Stratecast, 2013, p. 2].

The spread of the cloud computing model should also reduce the issue of technology complexity, due to the fact that service providers are likely to do everything to make their solutions as simple as possible and easily manageable. Such a trend is already perceivable. An example of such an approach is a management tool called AWS Config, offered by Amazon within Amazon Web Services. Its goal is to make the management of companies' cloud services easier. The significance of such tools will grow as enterprises increase the number of systems in the cloud [Ricknäs, 2015].

The third issue which causes the biggest anxiety among managers is risk management connected with the utilization of the cloud computing model. Apart from the above mentioned security-related issues, some of the most import challenges are those connected with the availability of services. The deeper the dependency of an organization on cloud-based solutions, the more important this issue is. In spite of numerous publicized cases of problems with the availability of cloud services from well known providers, availability of this type of service is generally at a very high level. This fact is confirmed by the results of various studies. In research conducted in France between 2007 and 2012 average availability was 99.917% [Gagnaire et al., 2012]. According to the results of AppNeta, a company monitoring market of cloud-based service providers, the average uptime of cloud services was 9.9948%, which means their average unavailability of 4.6 hours per year [Thibodeau, 2011]. Regardless of the level of availability of cloud services, every organization which utilizes the cloud computing model has to have appropriate procedures and technological solutions in place in case of problems with access to services. The same relates to the management of other types of risks.

Apart from the above mentioned issues, there are other challenges and limitations connected with the implementation and utilization of the cloud computing model. In the case of technical issues, one of the most important, and often underestimated issues, is network capacity [Gittlen, 2012]. This is due to the fact that cloud-based technology is deployed through massive data centres that necessitate high-capacity bandwidth [Bisson et al., 2013, p. 66]. Simultaneously bandwidth requirements can significantly differ depending, for example, on the type of cloud-based application (basic, intermediate or advanced) [Cisco, 2013, p. 14].

The next element can constitute a significant hurdle in the process of adoption of cloud computing approach, which is a reservation regarding the usage of the cloud-based model (lack of trust in cloud-based solutions). Such reservations are typically connected with issues such as concerns about placing sensitive data on third-party servers somewhere in the world. An important element of these concerns is the earlier mentioned issue relating to the reliability of cloud-based solutions. In spite of improvements in cloud technology, high-profile downtime acci-

dents continue to take place. As a result, they affect public perceptions concerning the reliability of cloud-based solutions.

The next significant challenge which can constitute an important barrier to the implementation of cloud-based solutions are structural issues and cultural resistance in organizations' IT departments. It is connected with the fact that usage of such computation model causes deep changes in IT management practices and the functioning of IT departments. It can, and in many cases does, lead to raising concerns about loss of control and the lowering of significance and position of these departments in companies. The newly required skill sets are the next issue which can a source of fear and which can cause resistance. Another significant factor is connected with the complexity of migrating enterprise IT systems to the cloud [Bisson et al., 2013, p. 66].

There are also many legal challenges. They relate to such aspects as: regulations concerning the place of data storage and access to that data, data ownership, privacy and data protection issues, the applicability of the law connected with data protection or the scope of vendors' responsibility (including liability for data residing in a particular online location). These issues have yet to be settled by policy makers, and a significant barrier is the fact that the law in many countries does not address these issues. An important constraint in the ability to take advantage of some of the benefits of cloud-based solutions (especially those connected with public clouds) is fact that in many countries data protection laws restrict the possibility of storage and transfer of some types of data outside their borders [Bisson et al., 2013, p. 68; Van Eecke, 2013].

1.4. The most important elements connected with the cloud migration strategy

Although one could perceive the utilization of the cloud computing model as a relatively simple issue, in fact it is not true. There are numerous potential problems and challenges connected with its implementation and many aspects have to be carefully analysed and planned. It is obvious that implementation of cloud-based solutions is simplest in the case of companies without any previous "burdens" and legacy systems i.e. start-ups. But the bigger the company is, with many complicated business processes, the scale of the challenges significantly grows.

Generally the strategy connected with the utilization of cloud-based solutions and migration to this computation model should be based on three key phase:

1. Preliminary assessment phase.

2. Migration plan creation phase.
3. Implementation and maintenance phase.

In the preliminary assessment phase a management board, or especially established special committee, should make a preliminary assessment of the usefulness of utilization of the cloud computing model in the context of its impact on the organization's functioning. This relates to such issues as:

- assessment of whether the cloud computing approach aligns with the organization's culture e.g. in terms of outsourcing or not outsourcing any of own operations (a culture of risk avoidance [COSO, 2012, p. 10]),
- assessment of whether the cloud computing approach aligns with the organization's objectives and what would be the migration goals (improvement of productivity, cost reduction, increased agility, new business models implementation etc.),
- appraisal of the risk connected with the migration process in the context of the potential impact on it of internal and external factors,
- assessment of which key stakeholders would be impacted by the migration process and how,
- comprehensive assessment of the readiness of the organization to the migration process.

The last aspect is concerned with both technical and human issues. Technical issues relates to the cloud-readiness in terms of the requirements for broadband and mobile networks in the context of the organization's ability to use cloud-based services. In this case there are some characteristics connected with network access (Internet ubiquity) and network performance (download speed, upload speed, network latency) [Cisco, 2013, p. 15]. Human issues relates to the skills required from people such as vendor management or project management [Pivotal, 2015].

In the case of a positive assessment of the sense and advisability of usage of cloud-based solutions, it is then necessary to move to the second phase i.e. development of a migration plan. In its scope it is necessary to analyse more detailed issues (including technical, legal and organizational ones) and make final choices. It relates to such aspects as:

- determination of the final migration goals and choosing the business processes which should be cloud-supported,
- selection of the deployment model (cloud type) which will be used by the organization,
- selection of the delivery model(s) (SaaS, IaaS, PaaS) which will be applied and determination of the scope of their utilization (type of cloud-based applications, elements of the infrastructure which will be moved to the cloud etc.).

It is necessary to underline that choices concerning the deployment and delivery models have significant impact on the issues relating to the level of direct con-

trol of the organization o the solution and risk connected with it [COSO, 2012, p. 7].

Knowing the specific elements connected with the planned delivery and deployment model, the organization can then start the process of selection of a provider of cloud services. In this case it is necessary to determine the parameters (requirements) which should be fulfilled by the services delivered in the cloud mode and working out the metrics as precisely as possible (Key Performance Indicators), allowing for their control [Network, 2014; Oxford, 2014, p. 8]. It is also extremely important to determine requirements for such issues as: data security, back-up procedures, location of data, ownership of data or the scope of the provider's responsibility [Comcast, 2014, p. 8].

Other important issues which have to be planned include:

- the means of integration of the cloud-based solutions with the ones which will be functioning in the traditional way (legacy systems),
- determination of a disaster recovery plan and procedures including risk management program and incident management,
- organizational changes (especially in the IT department) i.e. their scope, their implementation and overcoming potential cultural resistance,
- necessary training and its scope,
- cloud governance model.

The third and final phase of the activities connected with the introduction of cloud-based solutions to an organization is the implementation phase, the maintenance and monitoring of their functioning in the context of performance of the organization as a whole. The key issues which have to realized in this phase include:

- final selection of the service provider and signing the contract including a Service Level Agreement (SLS),
- planning the dates of trainings and their execution,
- planning the date of the beginning of the migration process and its scope,
- testing the functioning of the implemented solutions and making required corrects,
- full realization of the planned migration,
- monitoring the functioning of the implemented cloud-based services based on a previously prepared cloud governance model.

Conclusion

The dynamic development of solutions available in the cloud computing model and the growing interest in them has been noticed over recent years. They are perceived as one element of the next-generation IT infrastructure of contemporary organizations and as one of the disruptive technologies that will transform not only business life, but also the global economy [Gnanasambandam et al., 2014; Bisson et al., 2013, p. 4].

Undoubtedly, cloud-based solutions carry many opportunities. They relate to such issues as the reduction of IT-related costs, productivity improvements, a faster innovation cycle, increased agility or opportunities for the implementation of new business models. More and more organizations are noticing that without cloud-based solutions it would be more difficult to be able to store, analyse and use the rapidly increasing amounts of data critical for their market success and development [Acket et al., 2014].

But cloud computing also brings numerous potential challenges and concerns related to such issues as the reliability of cloud-based systems, data security, privacy or cloud-platforms compatibility. Also the migration process to cloud solutions includes many aspects which have to be well thought out and carefully planned. It relates to purely technical issues but also to organizational and legal ones. Lack of so called "best practices" which could be applied by organizations in their migration process is a real challenge [Pratt, 2015].

In the context of the above mentioned remarks, it is necessary to underline that an incorrect and ill-considered approach to the cloud computing phenomenon or just following some IT market trends can lead to a situation where instead of expected gains some problems will arise, negatively or destructively influencing an organization's functioning and achievement of its goals. Such a situation could arise because of the fact that cloud projects relate to a crucial component of every contemporary organization namely, the IT infrastructure which is the foundation of their functioning.

References

1. Acker O., Schröder G., Gröne F. (2014), *King of the Cloud*, "strategy+business", http://www.strategy-business.com/article/00285?gko=ae08a&cid=20141118enews&utm_campaign=20141118enews&tid=27782251&pg=all, accessed 19.11.2014.
2. Agarwal H. (2014), *Managing the demand for IT infrastructure*, http://www.mckinsey.com/insights/business_technology/managing_the_demand_for_it_infrastructure, accessed 30.04.2014.

3. Bisson P., Manyika J., Chui M., Bughin J., Dobbs R., Marrs A. (2013) *Disruptive technologies: Advances that will transform life, business, and the global economy*, http://www.mckinsey.com/~/media/McKinsey/dotcom/Insights%20and%20pubs/MGI/Research/Technology%20and%20Innovation/Disruptive%20technologies/MGI_Disruptive_technologies_Full_report_May2013.ashx, accessed 30.05.2013.
4. Boch-Andersen L. (2013), *Is there an SMB Cloud Divide in Europe?*, http://www.microsoft.com/eu/Is_there_an_SMB_Cloud_Divide.asp, accessed 06.07.2013.
5. Carr N. (2008), *The Big Switch*, W.W. Norton & Company, New York.
6. Carr N. (2005), *The End of Corporate Computing*, "Sloan Management Review", Vol. 46, No. 3.
7. Cisco (2013), *Cisco Global Cloud Index: Forecast and Methodology, 2012–2017*, http://www.cisco.com/c/en/us/solutions/collateral/service-provider/global-cloud-index-gci/Cloud_Index_White_Paper.pdf, accessed 28.12.2013.
8. Comcast (2014), *Building Cloud Implementation Strategy*, http://www.findwhitepapers.com/force-download.php?id=44336, accessed 14.01.2015.
9. COSO (2012), *Enterprise Risk Management for Cloud Computing*, http://www.coso.org/documents/Cloud%20Computing%20Thought%20Paper.pdf, accessed 06.07.2012.
10. Davenport T. (2014), *Big Data at Work: Dispelling the Myths, Uncovering the Opportunities.* Harvard Business School Press, Boston.
11. Deeter B., Jung R. (2013), *Software as a Service Pricing Strategies*, https://bvp.box.com/shared/static/05d7zb2zi64q7rbv1opl.pdf, accessed 06.08. 2013.
12. European Commission (2012), *Unleashing the Potential of Cloud Computing in Europe*, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0529:FIN:EN:PDF, accessed 30.9.2012.
13. Gagnaire M. et al. (2012), *Downtime statistics of current cloud solutions*, http://iwgcr.org/wp-content/uploads/2012/06/IWGCR-Paris.Ranking-002-en.pdf, accessed 20.06.2012.
14. Gartner (2012), *Gartner Says Public Cloud Services Are Simultaneously Cannibalizing and Stimulating Demand for External IT Services Spending*, http://www.gartner.com/newsroom/id/2220715, accessed 12.11.2012.
15. Gaudin S. (2014), *Public cloud market ready for 'hypergrowth' period*, "Computerworld", http://www.computerworld.com/article/2488572/cloud-computing/public-cloud-market-ready-for—hypergrowth—period.html, accessed 24.04.2014.
16. Gaudin S. (2014a), *Hybrid cloud adoption set for a big boost in 20*15, "Computerworld", http://www.computerworld.com/article/2860980/hybrid-cloud-adoption-set-for-a-big-boost-in-2015.html, accessed 18.12.2014.
17. Gittlen S. (2012), *Bandwidth bottlenecks loom large in the cloud*,"Computerworld", http://www.computerworld.com/article/2500888/cloud-computing/bandwidth-bottlenecks-loom-large-in-the-cloud.html, accessed 04.01.2012.
18. Gnanasambandam C., Huskins M., Sprague K. (2014), *Next-generation IT infrastructure*, http://www.mckinsey.com/insights/business_technology/~/media/mckinsey/dotcom/insights/business%20technology/nextgeneration%20it%20infrastructure/next_generation_infrastructure_feb2014.ashx, accessed 03.05.2014.
19. Grance T., Mell P. (2011), *The NIST Definition of Cloud Computing*, National Institute of Standards and Technology, U.S. Department of Commerce, Special Publication

800–145, http://csrc.nist.gov/ publications/nistpubs/800–145/SP800–145.pdf, accessed 28.10.2011.
20. Griffith S. (2009), *Zipcar: selling cars, one ride at a time*, http://whatmatters.mckinseydigital.com/internet/zipcar-selling-cars-one-ride-at-a-time, accessed 30.12.2009.
21. HP (2012), *Five myths of cloud computing*, http://www.findwhitepapers.com/force-download.php?id=23344, accessed 20.03.2013.
22. Idea Bank (2014), *Małe firmy odważnie korzystają z "chmury"*, http://www.ideabank.pl/ideabank2/doc/ic_chmura.pdf, accessed 30.08.2014.
23. Intel IT Center (2014): *Big Data in the Cloud: Converging Technologies*, http://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/big-data-cloud-technologies-brief.pdf, accessed 30.10.2014.
24. Kerpan P. (2013), *Is Cloud the Zipcar of Computing?*, http://insights.wired.com/profiles/blogs/is-cloud-the-zipcar-of-computing?xg_source=activity#axzz3VyO6kzX2, accessed 14.11.2013.
25. KPMG (2014), *The Changing Landscape of Disruptive Technologies*, http://www.kpmg.com/PL/pl/IssuesAndInsights/ArticlesPublications/Documents/2015/KPMG-Global-Technology-Innovation-Insights-Fall-2014-online-secured.pdf, accessed 28.01.2015.
26. Network Instruments (2014), *3Key Cloud Monitoring Metrics*, http://www.findwhitepapers.com/force-download.php?id=43815, accessed 03.01.2015.
27. Noyes K (2015), *Dropbox for Business gets two new collaboration tools*, "PCWorld", http://www.pcworld.com/article/2898272/dropbox-for-business-gets-two-new-collaboration-tools.html, accessed 18.03.2015.
28. Olavsrud T. (2013), *How Cloud Computing Helps Cut Costs, Boost Profits*, "CIO", http://www.cio.com/article/2387672/service-oriented-architecture/how-cloud-computing-helps-cut-costs—boost-profits.html, accessed 12.03.2013.
29. Oxford Economics (2014), *The Path to Value in the Cloud*, http://www.windstreambusiness.com/resources/published-reports/the-path-to-value-in-the-cloud-strategy, accessed 05.12.2014.
30. Pratt M. (2014), *Cloud computing claims a pivotal role in 2015*, "Computerworld", http://www.computerworld.com/article/2843861 /cloud-computing-claims-a-pivotal-role-in-2015.html?nsdr=true, accessed 10.11.2014.
31. Rainie L., Wellman B. (2012), *Networked: The New Social Operating System*, MIT Press, Cambridge.
32. Ricknäs M. (2015), *Amazon offers troubleshooting tool to Web services users*, "Computerworld", http://www.computerworld.com/ article/2883840/amazon-offers-troubleshooting-tool-to-web-services-users.html?phint=newt=computerworld_da, accessed 12.02.2015.
33. Sage (2014), *Europejskie firmy marnują 9,6 mld rocznie*, http://media.sage.com.pl/PressRelease.278985.po, accessed 19.05.2014.
34. Stratecast (2013): *The Hidden Truth Behind Shadow IT*, http://www.mcafee.com/cn/resources/reports/rp-six-trends-security.pdf, accessed 06.12.2013.
35. Sull D. (2009), *Competing through Organizational Agility*, "McKinsey Quarterly", https://www.mckinseyquarterly.com/article_print.aspx? L2=21&L3=37&ar=2488, accessed 30.12.2009.

36. Thibodeau P. (2014), *HP creates a new way to sell data centers*, "Computerworld", http://www.computerworld.com/article/2488925/data-center/hp-creates-a-new-way-to-sell-data-centers.html, accessed 02.05.2014.
37. Thibodeau P. (2013), *IT managers are increasingly replacing servers with SaaS*, "Computerworld", http://www.computerworld.com/article/2486566/cloud-computing/it-managers-are-increasingly-replacing-servers-with-saas.html, accessed 06.12.2013.
38. Thibodeau P. (2011), *Who Gets Blame for Amazon Outage?*, "Computerworld", http://www.computerworld.com/s/article/9216160/Who_gets_blame_for_Amazon_outage_, accessed 26.04.2011.
39. Van Eecke P. (2013), *Cloud Computing Legal issues*, http://www.isaca.org/Groups/Professional-English/cloud-computing/GroupDocuments/DLA_Cloud%20computing%20legal%20 issues.pdf, accessed 20.01.2013.
40. Vijayan J., *Shadow cloud services pose a growing risk to enterprises*, "Computerworld", http://www.computerworld.com/s/article/print/9250606/Shadow_cloud_services_pose_a_growing_risk_to_enterprises?taxonomyName=Malware, accessed 25.08.2014.
41. Wielki J. (2013), *Implementation of the Big Data concept in organizations – possibilities, impediments and challenges*, Proceedings of the 2013 Federated Conference on Computer Science and Information Systems.
42. Wielki J. (2012), *Modele wpływu przestrzeni elektronicznej na organizacje gospodarcze*, Wydawnictwo Uniwersytetu Ekonomicznego, Wrocław.