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Accountants and the cloud – Involving the professionals

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Abstract: As the cloud-based technologies gain more customers each day, the need for understanding the "economics of cloud" arises, together with the need for strategic measurement of different cloud or non-cloud-based infrastructure options. In such context, the option for the cloud technologies cannot be the duty of the IT department only, as the economic drivers are at least as important as the technological ones. Economic measurement of the future cloud computing implementations is required for at least two reasons. First, all types of implementations are investment projects and, by consequence, need to be fully justified before being chosen or rejected. Second, once a cloud strategy is adopted and an infrastructure is implemented, the implementation must be continually monitored, so the organization can be sure that it continues to deliver an optimal return on investment. Gaining maximal return on the implementation of a cloud computing strategy is predicated on the ability to understand the economic metrics. Therefore, the accounting professional can no longer be a simple observer in the process of cloud migration and cloud adoption, but a central piece and a "voice of reason" standing between the typical enthusiasm of the IT department and the typical skepticism of the management.

Keywords: Cloud computing economics, accounting profession, CAPEX, OPEX, ROI, TCO

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1. Introduction

Contemporary organizations are the target of a continuous "data bombardment", therefore they quickly reach the need for an efficient way to convert the received data into correctly structured information, able to provide decision support or competitive advantages. Any decision taken at the organizational level, may it be the construction of a new building, or the migration of a business service towards the cloud, requires pertinent and usable information. The accounting professionals working in IT organizations, or in any kind of organization which takes into account the adoption of cloud-based services, often considered that the final decision for or against the adoption of such services exceeds their competence, being the exclusive prerogative of the IT department (Mahlindayu *et al.*, 2014). The current paper is an attempt to demonstrate the way an accounting or audit professional may be implied in the final decision regarding a migration towards the cloud, and also the way such professional may use her own knowledge and experience in order to positively influence the final decision, by providing solid points and properly performed efficiency calculations

This paper aims to create an image as objective and accurate as possible of the cloud migration process, in an environment usually dominated by massive bias and diametrically opposed views. Between the "tech" group in an organization, having advanced technical knowledge that tending to see only the advantages of cloud-based solutions, and the group lacking technical knowledge, which tends to see the migration to the cloud as an unnecessary expense, the accounting professional may be able to exercise a mediation position, by making strong and valid economic points. To this end, the accounting professional may use a number of generally accepted indicators for evaluating investment decisions, whose understanding does not require deep economic and financial knowledge. The paper starts from the premise that the organization's management was confronted in the past with investment decisions and as a result, is familiar with the contents and significance of the proposed indicators.

After describing the research methodology, the paper identifies a number of financial indicators applicable in assessing a cloud based solution and makes a series of proposals on the specific treatment required for the design of these indicators when assessing information technologies. Further, the paper attempted to identify a set of costs-concerning specific issues, to be taken into account in the design of the performance indicators, and a number of specific elements that enable an accounting professional to perform estimates of the cost as close as possible, with a minimum of technical knowledge.

The next section of the paper is a comparative case study that illustrates the manner that the previously proposed indicators can be used in order to support investment

decision in a cloud-based solution. To this end, two different technical solutions were presented: a "traditional" one, incorporating massive capital expenses based on the in-house management of necessary hardware components and on the in-house development of the required software applications; the second one completely based on cloud technologies, incorporating major operational expenses and completely relieving the beneficiary of IT management tasks. As the author believes that a comparison between the two is not relevant in the short term, the paper has opted for a realistic comparison on a timespan of five years for both solutions, the TCO (Total Cost of Ownership) indicator being used for this purpose. The analysis results are synthesized in a tabular format that facilitates comparison, a number of observations on the best manner to correlate the investment decision with the actual situation of the organization (start-up, development, maturity) being made.

In order to deepen the analysis performed by the of the accounting professional, and also, in order to ensure the comparability of potential investment alternatives, the next section proposes a way of calculating the ROI (Return On Investment) indicator, providing alternative computation formulas, and also a number of the author's views on how to interpret the results. In this section, the comparative case study is revisited for exemplification purposes, the ROI indicator being calculated and interpreted for each of the two solutions.

The conclusions section summarizes the author's findings, while cautioning about the limits of the evaluation model and reiterating the original assertion, that the accountant may have a relevant role in the final decision for the adoption or rejection of cloud-based solutions.

2. Research methodology

The paper addressed the issue of the accounting professional’s status in relation to the final decision for the adoption or the rejection of cloud-based services, in the context of a less and less forgiving economic environment. Its main objective is to provide insight regarding the tools that an accounting or auditing professional can use to select between different solutions, without the need for complex IT knowledge, only by applying the standard treatment of any new investment opportunity.

The information is provided in the form of a case study. Two different scenarios are analyzed, each of them considering an option for the investment in a new IT infrastructure. The purpose of the case study is to reveal the actual manner an accountant should approach and form an opinion, when the organization has to choose between an in-house solution and a cloud-based one. The analysis is based on a set of key performance indicators, like the total cost of ownership, the return

on investment or the ratio of the capital and operational expenses, which are traditionally used in the financial analysis of investment options.

The value added by the current analysis consists in approaching the investment options for IT solutions in a manner which considers all the IT implications of each investment opportunity, form the perspective of an IT specialist, but can be used by an accounting or auditing professional when asked to select an option. The advantages and disadvantages of each financial analysis tool for the investment opportunities are also discussed, from both IT and financial perspectives.

3. Financial estimation for a migration to the *cloud*

The final decision on a migration to the *cloud*, usually followed by the development and implementation of a coherent *cloud* strategy, involves the evaluation and consideration of large amounts of information, much of which is not technical, but economic in nature (Sujeet *et al.*, 2016). In these circumstances, the accounting professional's role in formulating the final decision is not just a formal or complacent one, but becomes an important role as the accountant or the auditor has a range of knowledge that makes her to be in the best position to review, organize and synthesize a variety of data and information that cannot be eliminated from the decision-making process. In this context, the accounting professional will be able to start from the information at her disposal in order to compute a number of indicators with high informational content, so as to decide based on the aforesaid indicators whether a *cloud*-based infrastructure is the right choice. Out of these indicators, the leading importance for the final decision belongs to:

- **Total Cost of Ownership (TCO)** – is a financial estimate of all direct and indirect costs associated with ownership of an asset, as, for example, a *cloud*-based infrastructure (Visani *et al.*, 2016). The proper understanding of the costs which are part of the TCO of the existing IT infrastructure helps to understand how the organization and its business processes are able to benefit from such infrastructure. Also, the computation of this indicator is extremely useful when comparing different alternative options for financing a possible migration. When evaluating a *cloud*-based solution, it is necessary to estimate the total cost of ownership both in the traditional way and in the light of the new meaning of TCO: total operating cost.
- **Capital expenditure (CAPEX) and operational expenditure (OPEX)** – CAPEX term refers to the way large purchases having an expected life of more than one year will be managed from an accounting perspective. The ultimate goal is to reconcile the manner an acquisition is used and the income generated by the acquisition (Almeida *et al.*, 2011). OPEX usually

refers to those purchases of an organization which are consumed during the current year.

- **Return on Investment (ROI)** – is an indicator that can quickly and effectively show how financially inspired an investment was. It may also have an important decisional component, when comparing multiple investment options, each with its own estimated value for ROI.

In relation to the manner the indicators described above will be used, the *cloud computing strategy* of an organization can be defined as the medium and long term plan of an organization to adopt and use technologies whose defining characteristics fall within the *cloud* area. The existence and implementation of such a strategy changes the role of the IT department in an organization, which migrates from the design and implementation of solutions, to the delivery of services. It is generally accepted (Al-Ayyoub *et al.*, 2015) that the existence of such strategy inside an organization promotes the innovation process, because migration to the *cloud* can have major effects on the cost and implementation duration of a solution. This is especially noticeable when the organization uses the services of some external providers instead of the in-house development of a solution.

As noted above, TCO involves identifying all the costs driven by the ownership of an asset. The costs taken into account depend on the nature and specifics of the assessed project, and their structure differs from one project to another. The concept of "total cost of operation" extends the basic model for the computation of the cost of ownership, so that it also takes into account the operating costs. According to some authors, TCO can be defined as the total cost incurred by the ownership of an asset and by its operation (Helms, 2016).

In the case of a project for the adoption of *cloud* technologies, the TCO indicator must be a financial estimate which includes all direct and indirect costs involved in the purchase of such a solution, as well as the costs involved by the current use of that solution. For example:

- **Direct costs –** when acquiring information and communications technology, direct costs include purchase cost, installation costs and maintenance costs. Depending on the nature of implementation, direct costs may also include the cost of testing the purchased solution, the cost of the location where equipment was deployed (for data centers, these costs can be considerable), environmental costs, costs to ensure the optimal operation conditions - the fine tuning of air temperature and electricity parameters.
- **Indirect costs** – although not directly associated with the acquisition of *cloud*-based solutions, these costs are real and unavoidable for the implementation to be successful. Costs of this kind should be included in any financial review of an acquisition of technology (Sohn *et al.*, 2015). Indirect costs can include qualification and specialization of personnel,

losses due to planned or accidental unavailability of service, different types of security breaches (physical or virus-related in nature), the ability to deal with a disaster and to resume work after a disaster, other development related costs, or even the expenses with the decommissioning of the investment.

- **Operating costs** – are costs associated with operating a *cloud*-based infrastructure. They have as their main component the purchase cost of services from the corresponding suppliers. If the *cloud*-based solutions require the employment of additional staff, the cost of the additional staff will also be included in the operating costs.

The following table (Table 1) summarizes the main components that require to be taken into consideration when estimating the TCO indicator of a *cloud* based solution. In such cases, the assessment of direct costs and operational costs is easily achieved, but determining the indirect costs may prove to be much more difficult (Plaza, 2015). However, it is essential that any necessary and probable indirect cost to be included in all financial estimates.

Table 1. Total cost of ownership structure

Direct costs	***Indirect costs***	***Operating costs***
Purchase price	Training	Additional staff needed to support *cloud* implementation
Maintenance	Outage	
Installation	Breach	
Upgrades	Disaster preparedness	Cost of services from *cloud* service and data providers
	Disaster recovery	
	Floor space	
	Testing	
	Development	
	Decommissioning	

An in-depth analysis of the migration process to a *cloud*-based solution reveals a number of aspects which are specific to this situation. The following list is not considered to be exhaustive, but still could be a valid starting point for analyzing the phenomenon of migration to the *cloud*:

- *Cloud*-based infrastructure should lead to a high level of innovation – an increase in the level of innovation may require a high growth of the computing infrastructure and, as a result, an overall increase in cost levels. Such increases can lead to additional costs for the personnel involved to operate facilities, or other cost categories covering the need for the additional infrastructure.
- *Cloud*-based infrastructure should provide better conditions for working remotely – a *cloud*-based implementation has as an important consequence the fact that any employee can work anywhere there is a reasonable Internet connection and a suitable device available (laptop, tablet,

smartphone, etc.). This can lead to additional costs for the Internet connection, the required devices, and also, it may require major changes in the organizational culture.

- The cost of the software licenses, the hardware and the facilities needed in order to properly host the hardware change significantly in the case of a *cloud*-based infrastructure. Although migration to the *cloud* has the ability to reduce these costs in the initial phase, the total cost of operation may be higher over time, when compared with the total operating cost of an in-house solution. The decision to migrate to the *cloud* should take into account all benefits of such a solution, but also all the involved expenses, so that the ROI indicator can be calculated correctly, or, at least, to a reasonable level (Misra & Mondal, 2011).

The total cost of operation has different values in different scenarios, especially when the development of an in-house applicative solution and the purchase of the necessary services from the *cloud* service providers are compared in terms of effectiveness. When the hardware infrastructure and the corresponding software are built in-house, there are significant costs for development, and, most of all, significant time-related costs, because the development effort is time-consuming, there is a need of a coherent testing system for the internally built applications etc. When the needed services are purchased, many of the costs described above are significantly reduced or even disappear, but instead, the organization may face important costs for the integration of the new external services purchased with the existing internal business processes and the existing internal infrastructure. In many cases, the decision to build or purchase may be finally determined by the value of the length of time that the organization has to wait in order for the in-house solution to be designed, developed and implemented, in contrast with the ability to immediately benefit from those services through their purchase from a *cloud* service provider. Although the differences in the cost structure, in the case of a "build or buy" decision, are more numerous than those described herein, the provided examples allow to form an overall idea on the differences between the two approaches.

The total cost of operation may be an extremely useful and important indicator in comparing multiple options, because some variants cost significantly more compared to others, when evaluation is performed for their entire useful life, and not limited to the time of purchase, or the first few years following the acquisition. Evaluating several options, each one requiring different costs of ownership and costs of operation, can lead to very different values of the overall TCO, calculated for the lifetime of the solution. While TCO is not the only financial indicator that should be considered, is one of the most important. Along with TCO, the professional accountant in the position to decide the optimal solution should consider the ROI, the value of the time factor expressed as money, the cost of the investment capital sources, the effects of the investment on the financial statements

of the organization, the tax implications of the investment, and the net present value of the investment (Liu *et al.*, 2016). It is of utmost importance that every financial indicator taken into account in order to estimate an investment alternative, or to compare multiple investment variants, to be calculated (where possible) for the lifetime of the investment, not only for the initial access thereto (or start-up costs). Proper use of the TCO indicator has the ability to provide quite a clear image on how the investment in infrastructure, may it be traditional or *cloud*-oriented, will affect the financial position of the organization over time (Alkhanak, 2016). In no case analysis should be limited to the costs of start-up or the first year, but has to be performed for the whole lifetime of the investment.

The main proposal of this article is that the accounting professional becomes a mediating factor between any existing contrary opinions, for and against the adoption of cloud-based solutions. However, some recent studies (Gullhav & Nygreen, 2016) reveal that many practitioners in the field of accounting and law are seriously reluctant to achieve a transition to the cloud-based technologies, particularly due to the perceived losses in the field of security and data protection, and also due to the complexity of the overall IT system. This perspective is, in the author's opinion, a subjective one, while cloud-based technologies, like any product of human intelligence, have their own set of strengths and weaknesses.

The contemporary accounting professional is often put under pressure by the management of the organization to increase its work efficiency and become competitive. In these circumstances automating the accounting activity as much as possible is the obvious answer, but not all technologies are created equal.

The migration of an organization’s accounting function to the cloud can enable the accounting department to pay only for what they use, eliminating the need for purchase and installation of software licenses (Koutsandria *et al.*, 2016). The business model where the amounts paid for the use of software applications increase or decrease depending on the volume of activity allows a very good alignment of costs to the added value created by applications and to the benefits obtained. In an unstable accounting environment, heavily burdened by taxation (as is the case of Romania), the costs of making quick updates at short intervals, largely due to changes in the regulatory and legislative environment, are no longer relevant to the client organization, building and implementing updates being the exclusive contractual duty of the cloud service provider. On the other hand, professional accountants should consider not only the cost savings involved in migration to the cloud, but also the cost increases. For example, if a management or accounting information system has already outsourced some of its components to the cloud, the interconnection of each subsystem with the main cloud-based system, may prove to be much more expensive than it appears on a first examination. The interfaces between cloud systems can be much more complicated than the simple transfer of text or database files (He *et al.*, 2016).

Cloud-based technologies enable access to information and the ability to process it at any time and from any location. Receiving information in real time allows the accountant to work faster and to be better informed, but also increases the level of pressure that the accounting professional must bear in order to sync own activities with the "speed of the organization". The scalability feature of cloud-based accounting information systems allows flexible adaptation to the increases or decreases in the volume of activity, the payment being made based on the monthly number of transactions registered, processed or stored. In terms of flexibility and scalability, not all IT solutions are equivalent. For increased flexibility, certain functionality may be enabled or disabled on request (Shuja *et al.*, 2016), and some solutions provide a modular approach, allowing the organization to choose and pay for only those components it needs and actually use. According to the author, it is recommended to avoid organizational "lock-in" by purchasing a very long term subscription for a very consistent application package.

In the case of a very large accounting department, or if accounting information supports validation on multiple levels (from the control department, internal audit department, external auditors, etc.), the ability to define multiple users and grant them individual rights can prove to be a major advantage, facilitating collaboration between participants to the process, regardless of each one's location. The implementation of customized user roles and the integration of audit trails attached to each transaction, can facilitate detection and in-depth analysis of any fraudulent transactions before they manifest their effect on the financial statements.

According to some authors (Carniani *et al.*, 2016), a key issue that must be considered when opting for a cloud based accounting solution is its ability for horizontal integration. The authors state that a vital importance criterion is the ability of the cloud-based accounting applications to integrate in the cloud with other managerial applications from the organizational ecosystem (human resources management, production management, financial management, budgeting), thereby increasing not only the overall versatility of the organization's business processes, but also the general level of control exercised.

Traditionally, a number of accounting professionals avoid the cloud-based accounting solutions for reasons related to the loss of security (Lins *et al.*, 2016). Their perception may be inaccurate, in the sense that the cloud-based solution may benefit more rapidly and efficiently from updates, patches and other security enhancements when compared to an in-house solution, where the skill level and the experience of the organization's own IT department is the maximum limit up to which they can get in terms of security. However, in the author's opinion there are also some potential drawbacks, which are not too large to completely compromise the cloud migrated accounting solutions, but should be taken into account when the option for or against the cloud is made, and the accounting professionals should

consider minimizing their negative effects, either through contractual terms or through equivalent methods:

- For a start-up or a small business, a package of cloud-based accounting software will always involve higher costs, when compared to a package of desktop accounting applications, and the extra cost will be completely unjustified if the included online backup service of the cloud-based solution not wanted or used.
- Storing accounting information in the cloud involves a loss of control which the accounting professional and the organization as a whole suffers for its own data and the place where it is stored. The most important manner the organization might be affected by this fact is a potential legal issue, where data may be under the law of the country or area where it is stored, instead of the law of the country or area where the organization exists. Sometimes, private or governmental external entities may require the cloud service provider access to the organization's accounting data for audit or control purposes, and the service provider would have to allow access under the law of the area where data is stored.
- Regardless of the chosen cloud accounting package, there will always be limitations on the available applications, operating systems and infrastructure options, in other words, there will be things that the cloud-based accounting application will not make. In these conditions, some cloud-based applications may be more rigid and more difficult to set up compared to their desktop counterparts.
- Although almost all cloud-based accounting applications are offering online storage as part of the package, very few of them offer real tools for local backup, in other words, the possibility that the accounting professional to download accounting data from the cloud to his own server and, if applicable, export the data to a different provider, or use it to build custom statements and reports that the cloud-based application does not offer. Switching to another service provider or keeping existing data for a long time without paying the subscription fee can raise serious issues, if not dealt with explicitly in the service level agreement contracts.

Considering the advantages and disadvantages of a cloud-based solution, it can be concluded that the recourse to such an accounting solution allows the accounting professional to better focus on the core business of the organization without wasting time with the repetitive tasks of updating applications and assuring compliance with the accounting and fiscal normative environment.

4. Financial measurements for a migration to the *cloud*

Starting from the perspective of the analysis based on the TCO type indicators presented above, two indicators of a financial of financial may be considered whose value estimate is essential for any initiative to migrate to the *cloud*:

- The ratio of operating expenses (OPEX) and capital expenditures (CAPEX);
- The value of return of an investment (ROI).

It is considered that the use of a perspective based on the total cost of ownership and the total operating cost, together with the CAPEX/OPEX ratio and ROI provide sufficient data for the organization to make informed choices on the opportunity of the migration to the *cloud*, even in the absence of knowledge of a technical nature. In the following, the paper will present two scenarios by means of which it will be explained how a professional in accounting or auditing can understand the impact of the migration to the *cloud* on the organization, even without advanced technical knowledge in the field.

- **Option 1**. An organization acquires information and communications technology in the amount of €150,000 (including hardware infrastructure and software applications), with an estimated useful life of five years. If the investment is depreciated using the straight-line method, the estimated expenditures will be in the amount of €30,000 per year, which means that the organization's income will be reduced by the same amount annually. These expenses should be compared against any revenue generated during the period. It is assumed there is also a needed additional amount of €65,000 as start-up costs, an annual maintenance expenditure of €59.500, and also €160,000 are needed annually in order to maintain the level of employees' qualification and the adequate working conditions for the equipment (these expenditures are estimated to increase by 5% per year).
- **Option 2**. The organization decides to move its IT services to an external *cloud* services provider. In this case, the development of the necessary applications will involve an initial cost of technology of €15,000, annual associated costs of installation and configuration of €15,000, personnel costs of €75,000, maintenance costs of €5,400, and total costs of the *cloud* service of €210,000 (personnel costs, maintenance and *cloud* services are estimated to increase by 5% per year).

A major element to be considered when evaluating a migration of the IT infrastructure to the *cloud* is represented by the major trade-offs which occur between capital expenditures (CAPEX) and operational expenditures (OPEX). In the case of a private *cloud* solution, which can even be operated by the beneficiary, the trade-offs from CAPEX to OPEX can be significantly reduced, or even non-existent (Altmann & Kashef, 2014). The CAPEX/OPEX ratio depends on context, to a large extent, and it should be assessed separately for each considered scenario.

If organizations make major IT infrastructure investments, these are traditionally treated as CAPEX, which means that are recorded as assets on the organization's balance sheet and depreciated over time. On the other hand, when the organization makes operational expenses in the normal course of business, these expenses are normally settled in the same year in which they were realized. Accordingly, the purchase of infrastructure the organization needs in order to operate its own IT solution is CAPEX, while the purchase of services from a *cloud* services provider is OPEX. When the organization's applications are migrated to an external *cloud* services provider, there is a trade-off of expenditures from CAPEX to OPEX, these two options being regarded as two fundamental models of financing the implementation of an IT solution, each having its own set of effects on the organization's balance sheet and income statement:

- In the CAPEX-based financing model, the organization requires cash, which can be obtained from its own funds, or borrowed, in order to purchase an asset. Therefore, the organization assumes a series of long-term liabilities in relation to the acquired asset, which it owns. Moreover, if the organization no longer needs the asset (may it be depreciated or not), it must decide how to dispose of the asset. During the useful life of the asset, the organization's staff is responsible for that asset's management. This creates some requirements of a financial nature, which may also be regarded as disadvantages:
  - The costs associated with the purchase, maintenance and disposal of the asset;
  - The personnel cost required to operate the asset;
  - A proactive effort to keep the asset in a condition to generate value, since the organization has invested in it.
- In the OPEX-based funding model there are no long-term liabilities of the organization and the initial cash requirements will be significantly reduced as compared to the previous option. The organization will pay a subscription (usually on a monthly basis) to use the IT assets of an external *cloud* services provider, who has ownership of the assets. The subscription value is usually calculated based on the leased computing power or on the filled storage space (although other charging models are available). The asset's ability to generate value throughout its useful life is the exclusive concern of the provider. When the organization does no longer want to use those assets, it simply waives the subscription without assuming any liabilities associated with the assets, in terms of disposal or realization thereof. Also, the OPEX model involves a trade-off in terms of responsibility and the involved personnel. The organization's staff is responsible only for managing applications, while the *cloud* services provider has the responsibility to manage the IT assets which provide these applications. It can be concluded that this type of relationship creates the following trade-offs in the IT solution funding model:

- The IT assets are owned by a third party, and the organization only pays for what they use (e.g., computing power, storage space, live memory etc.), instead of assuming long-term liabilities regarding the assets they use;
- The organization does not require personnel to maintain the infrastructure in operation, it only requires the necessary staff for the operation of the applications received as a service from the provider;
- The initial capital needed for the investment will be significantly reduced, as compared to the previous option, but the total operating costs for the project's useful life will be higher. These issues must be considered and analyzed for each project, so that it can be determined which option provides optimal results. It should be considered the fact that a significant decrease of the project's initial costs may constitute a solid foundation for entrepreneurship and innovation initiatives across the organization.

The fact that the organization no longer needs to assume long-term financial liabilities for an asset is important, but this solution can generate significantly higher costs than the ownership of that asset. When an organization leases an application from an external *cloud* services provider, a trade-off occurs between CAPEX and OPEX. However, it rarely happens that the implementation of an IT solution requires only one type of the two expenditures. Even an organization that relies heavily on external *cloud* services providers will still hold an internal infrastructure (although much more reduced), which will have to be managed. Even in these conditions, a migration of costs will happen, having effects on organizational strategy and on its financial position. Generally, a CAPEX and OPEX analysis is necessary when a decision must be made in terms of an organization's specific IT solutions. The services of an external *cloud* provider can be recorded as expenditures during the current accounting year, while the purchased infrastructure (as in option 1 above) is recorded as capital expenditure and depreciated over time. From a financial perspective, analyzing IT costs, in order to determine whether it is advisable to develop a proprietary solution or to use a *cloud* services provider entails the analysis of how the effects of these decisions are reflected in the balance sheet of the organization, its income statement, as well as the level of taxation. Under GAAP, when the company makes a capital expenditure, the amount will be allocated over the entire period in which associated economic benefits flow toward the company. To exemplify, the costs for the first option are described in Table 2, the costs of the second option are described in Table 3, and a comparative analysis of the two options is described in Table 4.

Table 2. Total costs of an in-house solution (in Euro)

VARIANT 1 – ACQUISITION OF AN IN-HOUSE SOLUTION						
		Year				
	Start-up costs	One	Two	Three	Four	Five
CAPITAL EXPENSES						
Initial in-house ICT	150.000	30.000	30.000	30.000	30.000	30.000
In-house setup	65.000	13.000	13.000	13.000	13.000	13.000
Annual CAPEX		**53.000**	**53.000**	**53.000**	**53.000**	**53.000**
Total 5-year CAPEX						**215.000**
OPERATING EXPENSES						
In-house personnel		160.000	168.000	176.400	185.220	194.481
In-house ICT maintenance		59.500	62.475	65.599	68.879	72.323
Annual OPEX		**219.500**	**230.475**	**241.999**	**254.099**	**266.804**
Total 5-year OPEX						**1.212.876**
EXPENSES TO THE PROFIT AND LOSS STATEMENT						
Annual expenses		**262.500**	**273.475**	**284.999**	**297.099**	**309.804**
Total 5-year expenses						**1.427.876**

Table 3. Total costs of a cloud-based solution (in Euro)

VARIANT 2 – ACQUISITION OF AN EXTERNAL CLOUD SOLUTION						
	Start-up	Year				
	costs	One	Two	Three	Four	Five
CAPITAL EXPENSES						
In-house setup	15.000	3.000	3.000	3.000	3.000	3.000
Annual maintenance		15.000	15.000	15.000	15.000	15.000
Annual CAPEX		**18.000**	**18.000**	**18.000**	**18.000**	**18.000**
Total 5-year CAPEX						**90.000**
OPERATING EXPENSES						
In-house Personnel		75.000	78.750	82.688	86.822	91.163
In-house IT maintenance		5.400	5.670	5.954	6.251	6.564
Cloud computing service		210.000	220.500	231.525	243.101	255.256
Annual OPEX		**290.400**	**304.920**	**320.166**	**336.174**	**352.983**
Total 5-year OPEX						**1.604.643**
EXPENSES TO THE PROFIT AND LOSS STATEMENT						
Annual expenses		**308.400**	**322.920**	**338.166**	**354.174**	**370.983**
Total 5-year expenses						**1.694.643**

Table 4. Costs comparison for the two solutions (in Euro)

SUMMARY	*VARIANT 1*	*VARIANT 2*
Total 5-year CAPEX	215.000	90.000
Total 5-year OPEX	1.025.005	1.604.643
Total 5-year expenses to Profit & Loss Account	1.240.005	1.694.643
Year 1 Cash Needs	400.500	380.400
5-year Expenses	1.240.005	1.694.643

Analyzing the three tables presented, there can be noticed the CAPEX to OPEX migration in the case of the *cloud*-based solution, as well as how this migration affects profit or loss. By analyzing the comparative data in Table 4, there can be noticed the following consequences of the migration from an in-house IT solution to a *cloud* services provider:

- CAPEX and OPEX values are very different in the two scenarios, with important consequences for the organization's balance sheet and its income statement;
- The required initial cash investment, as well as its evolution over the useful life of the investment is very different for the two options. *Cloud*-based infrastructure will require lower costs at the beginning (during the first year), but the total cost, over the useful life, will be higher.

Such differences may cause the *cloud*-based services to become a very attractive option, financially. In addition, as the emphasis moves from CAPEX to OPEX, there is a decrease of the accumulation of assets in the balance sheet of the organization. In the second option (the *cloud*-based one), the total expenditures will change, the majority of purchases will be recorded as expenses, and the value of assets in the balance sheet will decrease massively as compared to the first option. This can be viewed as a positive or a negative effect, depending on the organization's overall financial strategy.

The life cycle of a business, presented in Figure 1, summarizes the position of an organization, as it progresses from the start-up phase to the maturity and then to the maintenance phase. The evolution stage of an organization in relation to its lifecycle should be considered when discussing the implementation of a *cloud*-based infrastructure. In the early stages of the lifecycle, many organizations are limited in terms of available cash and, therefore, a *cloud*-based solution may seem like a good idea, with its reduced cash requirements for the first year and with the strong emphasis on operating expenses. This approach may also be desirable for investors (especially those who operate in the capital brokerage business). Investors may be concerned that, in the case of business failure, they will be burdened by expensive infrastructure, which will have to be sold for less than the cost of purchase. As the business progresses and develops, entering the stages of growth, maturity and maintenance, the value of available cash may be significantly higher and, from an accounting perspective, an OPEX-based model may not be attractive enough. A business having reached maturity will prefer to develop their own assets, focusing on CAPEX. This does not mean that a *cloud* infrastructure is excluded. It only means that a private *cloud*-based solution or a hybrid solution may be preferred, involving significant capital expenditures. Whichever the selected model, the CAPEX and OPEX balance should be considered, based on the financial needs of the organization.

5. Return on investment (ROI)

Value returned by an investment (*Return on Investment – ROI*) is an accounting valuation method. The comparison between ROI values for the various investment options, including those in information technology, is an extremely useful indicator. In its simplest form, the ROI can be calculated as ratio between net income generated by an investment and the book value of assets associated with that investment. In accounting practice, ROI is also determined using other formulas such as, for example:

ROI = (Net income + Interest) / Book value of assets

The formula can be modified to take into consideration a number of factors that influence the cost and outcome of the investment. For example, the ROI associated with the implementation of a project can be calculated using the formula:

ROI = (Gain from investment - Cost of investment) / Cost of investment

The way in which ROI is calculated should include those values which are the best indicators for the organization. As a result, a professional in the marketing department can determine ROI as the ratio between the revenues from each product and the associated costs, an IT manager can include in the formula the parameters in which he is the most interested. Table 5 includes a number of estimates of income for each of the two types of investment decisions described above:

Table 5. ROI comparison for the two variants (in Euro)

EXPECTED REVENUE FROM THE NEW SOLUTION						
			Year			**TOTAL**
	One	**Two**	**Three**	**Four**	**Five**	
Revenue	260.000	286.000	314.600	346.060	380.666	**1.587.326**
VARIANT 1 – ACQUISITION OF AN *IN-HOUSE* SOLUTION						
Annual CAPEX	43.000	43.000	43.000	43.000	43.000	**215.000**
Annual OPEX	234.500	246.225	258.536	271.463	285.036	**1.295.761**
Total Annual Expenses	277.500	289.225	301.536	314.463	328.036	**1.510.761**
Return on Investment	**-6.31%**	**-1.12%**	**4.33%**	**10.05%**	**16.04%**	**5.07%**
VARIANT 2 – ACQUISITION OF AN EXTERNAL *CLOUD* SOLUTION						
Annual CAPEX	18.000	18.000	18.000	18.000	18.000	**90.000**
Annual OPEX	290.400	304.920	320.166	336.174	352.983	**1.604.643**
Total Annual Expenses	308.400	322.920	338.166	354.174	370.983	**1.694.643**
Return on Investment	**-15.69%**	**-11.43%**	**-6.97%**	**-2.29%**	**2.61%**	**-6.33%**

In Table 5, the indicator ROI was calculated using the formula:

ROI = (Gain from investment - Cost of investment) / Cost of investment

As a result, in this example ROI considers the cost associated with each investment option, as well as the predicted earnings for each option. It was assumed that income has the same value in both scenarios. However, if there are additional information available in this regard, different amounts of income may be considered for each option. Once the accounting professional makes an adequate quantification of TCO and expected revenues, ROI can become a very useful tool for selecting the option with the highest investment results. The interpretation of ROI values (for the previous formula) are as follows:

- If ROI is a negative amount, the investment cost is higher than its outcome. In these circumstances the organization should not make the investment, unless it is mandatory to comply with legal requirements, in which case it will select the option with the lowest negative impact on ROI;
- If ROI is used to compare investment alternatives, the option with the highest value of ROI will be selected.

Calculation of ROI enables the organization's management to determine whether the level of investment results is acceptable, before initiating an investment project. Assuming, for example, that an organization intends to evaluate its potential investment in an infrastructure upgrade; the accounting or auditing professionals can determine the costs of upgrading infrastructure, estimating also the additional earnings obtained from the investment. However, it should be noted that the accounting valuation method based on ROI has some limitations and overestimates the value of the indicator for the following reasons:

- Projects whose implementation requires massive time resources will have an overestimated ROI value. The longer the implementation, the stronger the overstatement of ROI.
- The time lapse between the beginning of the investment and the moment it generates earnings can alter the accuracy of estimates, which do not account for the time lapse between expenditures and revenues, considering them simultaneous.
- Organizations that operate in markets where market share, revenues or expenses increase rapidly will have lower ROI values, as compared to companies in stagnating or slowly growing markets.

It can be considered that, despite the aforementioned limitations, the ROI indicator provides a sufficient primary estimate, being a useful tool for assisting in the understanding of financial effects of different investment options.

6. Discussion and conclusions

This paper is an effort towards strengthening the role of the professional accountant or auditor in deciding on an investment in *cloud*-based technology services, where, on first examination, only members of the IT department would have the knowledge to select the correct option. To this end, there were presented three

important tools (ROI, TCO and the CAPEX/OPEX ratio) that a professional accountant can use to assess the true costs and effects of an IT investment option, or to compare options, when it is prompted to choose between an in-house option and one based on the services of an external *cloud* supplier.

In calculating the CAPEX/OPEX ratio, the value of ROI or any other indicators considered to be useful in the analysis, it is recommended to use the "TCO approach", i.e. estimating these indicators throughout the life of the investment, not only for the first year or for part of its useful life. The analysis of the CAPEX/OPEX ratio is important because it highlights different expenditure types needed to implement an in-house solution or to migrate to the *cloud* and it allows the selection of an option that aligns with the organization's overall financial policy. The ROI indicator is important because it summarizes the potential income from a specific investment option.

Analyzed concurrently, TCO, CAPEX/OPEX and ROI form the foundation for the analysis of IT investment options and for determining the quality of the desired IT infrastructure, regardless of its type: the organization's own infrastructure or infrastructure "leased" through the *cloud*. The use of these indicators can be generalized as follows:

- TCO is a mixture of ownership costs and operating costs when using *cloud*-based services from an external supplier. This means that the analysis process requires a sufficient level of detail, so that all costs and all categories of expenses are taken into account.
- From the perspective of the CAPEX/OPEX ratio, an internal infrastructure implies that the amount is capitalized for a number of years – the CAPEX model. Using an external provider of *cloud*-based services means that the organization can benefit from lower initial costs, but will incur higher total costs over the lifetime of the investment, which requires further analysis.
- ROI allows to estimate the investment outcomes and can be used to choose one of the available options, when the costs are known and the revenues can be estimated for each of the options considered. In addition, ROI can also be used retrospectively, with certain values of financial data.

All presented indicators and all implementation options proposed should be used to make an organization to increase its agility. Business agility is the ability of an enterprise to grasp and react quickly and accurately to changes in its economic environment. Such changes may be, for example, the fact that a competitor exits the market or introduces a new product, the gain or loss of significant customers, significant legislative changes etc. An organization's ability to seize and respond to the changes in the economic environment depends on how all its employees addresses the relationship with the organization; accounting professionals are included in this group. Many signals from the economic environment are not

accessible to members of the IT department, requiring advanced economic knowledge. In these circumstances, accounting and auditing professionals should consider *cloud*-based technologies as a way to respond rapidly and effectively to the challenges of the economic environment. Recourse to the *cloud* enables an organization to reduce the overall duration of business cycles, to increase the level of innovation, to react faster as a general trend, increasing its chances of success on the market.

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References

Al-Ayyoub, M., Wardat, M., Jararweh, Y. & Khreishah, A. A. (2015) "Optimizing expansion strategies for ultrascale cloud computing data centers", *Simulation Modelling Practice and Theory*, vol. 58, no. 1: 15-29

Alkhanak, E.N., Lee, S.P., Rezaei, R. & Parizi, R. M. (2016) "Cost optimization approaches for scientific workflow scheduling in cloud and grid computing: A review, classifications, and open issues", *Journal of Systems and Software*, vol. 113, no. 3: 1-26

Almeida, H., Campello, M. & Weisbach, M. S. (2011) "Corporate financial and investment policies when future financing is not frictionless", *Journal of Corporate Finance*, vol. 17, no. 3: 675-693

Altmann, J. & Kashef, M. (2014) "Cost model based service placement in federated hybrid clouds", *Future Generation Computer Systems*, vol. 41, no. 12: 79-90

Carniani, E., D'Arenzo, D., Lazouski, A., Martinelli, F. & Mori, P. (2016) "Usage control on cloud systems", *Future Generation Computer Systems-The International Journal of Escience*, vol. 63, no. 1: 37-55

Gullhav, A.N. & Nygreen, B. (2016) "A branch and price approach for deployment of multi-tier software services in clouds", *Computers & Operations Research*, vol.75, no.1: 12-27

He, L., Huang, F., Zhang, J., Liu, B., Chen, C., Zhang, Z., Yang, Y. & Lu, W. (2016) "Dynamic secure interconnection for security enhancement in cloud computing", *International Journal of Computers Communications & Control*, vol. 11, no. 3: 348-357

Helms, T. (2016) "Asset transformation and the challenges to servitize a utility business model", *Energy Policy*, vol. 91, no. 4: 98-112

Koutsandria, G., Skevakis, E., Sayegh, A. A. & Koutsakis, P. (2016) "Can everybody be happy in the cloud? Delay, profit and energy-efficient scheduling for cloud services", *Journal of Parallel and Distributed Computing*, vol. 96, no.1: 202-217

Lins, F., Damasceno, J., Medeiros, R., Sousa, E. & Rosa, N. (2016) "Automation of service-based security-aware business processes in the Cloud", *Computing*, vol. 98, no. 9: 847-870

Liu, S., Chan, F.T.S. & Ran, W. (2016) "Decision making for the selection of cloud vendor: An improved approach under group decision-making with integrated weights and objective/subjective attributes", *Expert Systems with Applications*, vol. 55, no. 8: 37-47

Mahlindayu, T., Siti, Z., Abdul, R., Bakhtiar, A. & Rusli, A. R. (2014) "Cloud computing awareness and adoption among accounting practitioners in Malaysia", *Procedia - Social and Behavioral Sciences*, vol. 164, no. 12: 569-574

Misra, S. C. & Mondal, A. (2011) "Identification of a company's suitability for the adoption of cloud computing and modelling its corresponding Return on Investment", *Mathematical and Computer Modelling*, vol. 53, no. 3–4: 504-521

Plaza, M. (2015) "Balancing the costs of human resources on an ERP project", *Omega*, vol. 59, no. 3: 171-183

Shuja, J., Gani, A., Shamshirband, S., Ahmad, R.W. & Bilal, K. (2016) "Sustainable cloud data centers: A survey of enabling techniques and technologies", *Renewable & Sustainable Energy Reviews*, vol. 62, no. 1: 195-214

Sohn, S. Y., Jeon, J. & Han, E. J. (2015) "A new cost of ownership model for the acquisition of technology complying with environmental regulations", *Journal of Cleaner Production*, vol. 100, no.8: 269-277

Sujeet, K. S., Ali H. A.B, Srikrishna, M.G. & Al-Kharusi, M. (2016) "Predicting motivators of cloud computing adoption: A developing country perspective", *Computers in Human Behavior*, vol 62, no. 09: 61-69

Visani, F., Barbieri, P., Di Lascio, Marta L. F, Raffoni, A. & Vigo, D. (2016) "Supplier's total cost of ownership evaluation: a data envelopment analysis approach", *Omega*, vol. 61, no. 6: 141-154