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Monika Szałkowska-Strzelecka[*]

FINANCIAL BENEFITS OF PRIVATE CLOUDS FOR THE LOCAL GOVERNMENT UNITS

Abstract. The main objective of this paper is to discuss financial benefits of a private cloud for the local government. A traditional approach in financial analysis of using IT in the public sector is analysed. At first, the article describes some methods used to assess the benefits of using IT in the context of the existing literature. Then considerations are presented concerning investment processes of IT in the units of local government. The issues related to nature of co-financing of IT projects from European Funds are discussed. In addition, legal and organisational requirements for this are indicated. In the following part we present the local administration's perception of financial advantages of cloud computing. These considerations are supported by the material derived from interviews conducted in several local government units. The summary contains conclusions and talks about the need for developing a method that would allow to analyse the financial benefits for the local administration generated by a private cloud.

Keywords: cost benefits; financial benefits, cloud computing; private cloud; the local government unit

JEL: H720, H, H7

1. INTRODUCTION

One of the current directions in the development of information technology is the uprising of increasingly complex systems of services based on the model of cloud computing (*CC*). This technology is very often associated with supporting innovation, making changes and transforming organizational processes. The most popular definition proposed by the NIST[1], defines a cloud as: "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." (Mell, Grance 2011).

There are four cloud deployment models: public, community, private and hybrid cloud. The public cloud infrastructure is open use and delivered by a cloud provider.

[*] Szkoła Główna Handlowa, Kolegium Analiz Ekonomicznych, Instytut Informatyki i Gospodarki Cyfrowej, szalwija@onet.eu

[1] The National Institute of Standards and Technology.

The private cloud infrastructure is designed for a single organization's exclusive use. The community cloud is available for members of certain communities, and the hybrid cloud is a composition of two or more of these models (Mell, Grance 2011).

In recent years the cloud computing has become a way to deliver public administration services.

This paper is focused on the issue of private clouds created by the local government. According to the definition given by NIST a private cloud for local administration is exclusively used by the local government institutions. It is owned, managed, and operated by the unit. A municipality may use the cloud as: local public administration contact point, a method for transmitting data or a way of training via multimedia.

The objective of this paper concerns financial benefits produced by private clouds for the local government. It has been stated that the traditional approach is not appropriate for the analysis of the financial benefits created by a private cloud for the local government.

The first section contains the introduction.

The second section describes various approaches found in literature concerning the analysis of financial benefits of IT in the public sector. Creating these benefits include, for example, reducing costs and fees as well as savings made by the better use of resources. The traditional view on financial advantages for public administration is being discussed. There is also a review of the indicators which are used to assess the profitability of IT systems.

In the third section some of the key factors affecting the estimation of the value in reference to IT systems used in the local administration are presented. It is indicated that the traditional approach is not adequate to estimate the financial benefits created by a private cloud in an administrative unit. This kind of situation is caused by a financing method, legal conditionality and the role of public organisation. What is also shown, is the need for taking account of these conditions in the evaluation process and analysis of any financial advantages of using the cloud computing for public institutions.

The fourth section includes interviews conducted in the government units, which contain questions about the possibility of the CC technology implementation by the local administration. Respondents were questioned about the types of investment necessary to build private clouds, about potential savings created by new systems and the adequacy of the costs to the benefits. Received answers indicate that building a private cloud presupposes expenditure on the whole investment process. Because of high costs these projects are implemented with the use of European funds. Grants for new IT systems are treated as financial benefits. Simultaneously, reduction of ongoing costs and lack of savings due to direct spending on IT were not observed. However, because of the non-financial benefits, the adequacy of expenditure was claimed.

The last section provides conclusions from the analysis of the costs of using private cloud in public sector.

2. MEASUREMENT OF FINANCIAL BENEFITS OF IT INVESTMENTS FOR THE PUBLIC SECTOR

The traditional way of benefiting financially is based on the construction of Total Cost of Ownership model (*TCO*) and the assessment of the profitability. The most commonly used approach is estimating benefits of investment and the calculation of chosen indicators. In the public sector the financial benefits are measured by the value of savings that are the result of the implementation of a new system. A short review of existing methods on estimating return of public investments on IT is presented below.

The most important indicators of profitability include Return On Investment (*ROI*), Payback Period (*PP*), Net Present Value (*NPV*) and Internal Rate of Return (*IRR*). NPV and IRR belong to the discount indicators.

The ROI definition can be described by the following formula (Vossey, Srivastava, Franca 2009: 8):

$$ROI = \frac{V_f - V_i}{V_i} \tag{1}$$

where:
V_i – *initial value of the investment*
V_f – *future value of the investment.*

By V_f we understand the value of the benefits obtained in a given period of time.

Because in public sector financial benefits are measured as reduced costs or costs avoidance, ROI can be calculated in the following way (Osuszek 2013: 359):

ROI = (savings and additional profits) / implementation costs (2)

ROI is used to determine which of the projects is characterized by a higher return.

This indicator was adapted by the American method – Value Measuring Methodology (*VMM*) (CIO Council, Best Practices Committee *Value Measuring*... 2002).

The expansions of ROI are called Social (*SROI*) and Political ROI (*PROI*). These indicators relate to the social and political benefits. ROI, SROI and PROI together have become the basis of the Public ROI analysis. However, this method also takes into account non-monetary benefits (Al-Raisi Ahmad, Al-Khouri 2010: 0–5).

Another index that may be used is the Payback Period. The formula is as follows (Pawłowski 2012):

PP = initial value of the investment / annual income from the investment (3)

This indicator specifies the time after which the project returns the previously invested costs.

In order to estimate the difference between the discounted revenue and expenditure the Net Present Value indicator can be used. NPV is calculated by the following formula (Vossey, Srivastava, Franca 2009: 9):

$$NPV = \sum_{t=1}^{n} \frac{C_t}{(1+r)^t} - C_0 \tag{4}$$

where:
t – time of the cash flow
n – the number of accounting periods
r – the discount rate
C_0 *– the first net cash flow (t = 0)*
C_t *– the net cash flow at the time t.*

A positive NPV means that the investment is profitable.

On the basis of NPV methodology, the German method – Wirtschaftlichkeitsbetrachtungen (*WiBe*) – was built, which supplemented traditional calculation by extending NPV and including non-financial benefits (Rothig 2011).

Another frequently used indicator is the Internal Rate of Return. IRR is the discount rate for which NPV = 0 (Pawłowski 2012).

Financial benefits of the local government cloud don't concern costs' reduction only. For example, the cloud can lower charges for electricity or for paper correspondence. Implementation of the cloud may also lead to the reorganization of work processes and better involvement of the staff.

To sum up, the above mentioned indicators are not well suited to the analysis of IT projects for local government units. The next section will describe the reasons for this situation.

3. CONDITIONS OF CREATING THE FINANCIAL BENEFITS BY PRIVATE CLOUDS FOR THE LOCAL GOVERNMENT UNITS

Processes of investing in IT by the local government units encounter several specific difficulties. According to the article of M. Niedźwiedziński, H. Klepacz, E. Nowak-Jamróz there are following problems associated with the implementation of IT projects in the public sector (Niedźwiedziński, Klepacz, Nowak-Jamróz 2014):

– The way the investment budget is created – the annual budgeting cycle and the deadline for budget approval leave too little time for the accurate preparation of the projects

– A limited selection of providers caused by procedural shortcomings in the tendering process

– Accounting methods for investments – the need for a formal settlement of an investment at the end of the accounting period is the cause of the unfinished acceptance systems

– Abuse in the tender process

– Local government authorities' fear of investing in IT due to difficulty in estimating the outcomes and the insufficient support of the local political and social environment.

Assessing benefits created by IT investments in the public sector is a very complex issue. Although there are some methods of estimating the profitability of IT, there are also some situations when the traditional approaches are not appropriate for the local government investments. This is caused by the methods of financing, legal conditionality and the role of public organisation. All of them will now be discussed.

One of the most important benefits of the cloud, considered in literature, is the costs' reduction (Cypryjański 2013). However, it should be clarified that very often "implicitly by the cloud" means the use of services delivered by an external provider within the public cloud. Main sources of savings in this model are the transfer of investment costs to the provider and the use of *pay-as-you-go* form of payment.

This paper focuses on a private cloud made for a local government. This means that the government unit is the owner of the cloud and manages all the services. The implementation of a private cloud requires large expenditure. Moreover, the maintenance of the new systems results in even more additional, ongoing costs.

The amount of expenditure pushes the local administration to finance investment processes in IT from European funds. In the years 2004–2013, 6733 projects in the categories of ICT and e-services were implemented from European funds (The Ministry of Infrastructure and Development – Mapa dotacji). Grants from the European Union budget are additional funding, so they are seen as benefits. In this case the traditional approach using indicators of profitability is not sufficient to assess financial advantages.

In the case of IT systems implemented with European funds one should take into account the planned results and the effectiveness of fundraising (Dziurbiejko 2006).

Simultaneously, the research conducted in the local government units confirms that there is no savings in the current phase of system maintenance. Implementation of the cloud makes it necessary to maintain the new system. This results in additional costs, which cancel out any potential savings.

From this point of view, IT investment increases the amount of resources available to the unit, but does not affect the costs' reduction. In this context it

would be advisable to analyse the influence of the implemented cloud on the resources and the value of services that the cloud provides.

The local government units carry out investments and ongoing tasks. Investment activities increase the municipality assets, and current tasks consist of providing administrative services (Opałka 2011). Different nature of these tasks requires a different approach to each of them.

Due to the provisions of the Public Finance Act, the local government units should separate investments from current expenditure. Budget resolutions are constructed in reference to this principle. A similar rule has to be applied for any budgetary reports (Public Finance Act).

Therefore, traditional methods do not ensure good alignment to the existing documentation.

In addition, the units' plans for spending the budgets are prepared according to the principle of material unity (the Public Finance Act). This principle means that there is no coherence between the capital expenditure and the sources of revenues (Opałka 2011). As B. Opałka says, this does not allow the full analysis of the investment capacity. In order to study the cash flows, the budgets of local government units should be transformed (Opałka 2011).

These considerations are consistent with the statements of the local government units' authorities. The following section will shown how, in practice, the possibility of obtaining financial gain from implementing the cloud by the local administration is perceived. The opinions are derived from interviews conducted in the local government units.

4. OPINIONS OF THE LOCAL GOVERNMENT UNITS' REPRESENTATIVES ON THE POTENTIAL FINANCIAL BENEFITS OBTAINED FROM CREATING PRIVATE CLOUDS

This section provides some opinions from the interviews conducted from July to October 2014 in the local government units. The main topic was the possibility of implementation of systems using cloud computing in the local administration. The research involved ten local government units. Interviews were pursued in two county offices, seven city halls and one commune office. The population of these units covered the range of 17 000 to 210 000 citizens. People answering the questions were employed in the IT departments or were directly related to decision-making processes. Table 1 contains the detailed information of these particular units.

Table 1

Data of government units

Administrative unit	The number of residents	Executive authority	Interviewee
county	87 000	district governor	CIO[2]
county	82 000	district governor	employee of Administrative – Economic Department
municipality	210 000	president of the city	Vice Director of Department of ICT
municipality	120 000	president of the city	CIO
municipality	58 000	president of the city	Director of the Cabinet of President
municipality	53 000	president of the city	employee of Information Department
municipality	22 000	president of the city	Head of Office of the City
municipality	28 000	mayor	Secretary of the City
municipality	17 000	mayor	Head of Information Department
rural commune	18 000	commune head	CIO

Source: own elaboration.

Five units were included in the trial use of the cloud computing. Three of them decided to implement the private cloud. However, only two were found to obtain financial benefits from the implementation of the clouds.

Respondents received a set of questions, among which three were directly related to financial issues.

Questions about financial aspects were as follows:

1) What are the categories of investments required to build a private cloud in your unit?

2) Has the implementation of the cloud resulted or can it result in savings in IT or out of IT?

3) Do you think that the expenditure incurred in a cloud is equivalent to the obtained benefits?

In response to the first question, the main categories of investment outlays were indicated, such as expenditure on infrastructure, hardware resources and dedicated equipment for virtualization services. What has also been mentioned was the expenditure for training and promotion of the new services. One respondent declared that there is a need for the new staff employment. The

[2] Chief Information Officer.

costs associated with ensuring security were considered to be a very important issue. In general, respondents stated that it was necessary to finance the whole investment process. The implementation of CC technology would require large financial resources. Due to high costs it is difficult to build a system using cloud computing only from the units' own resources. Therefore, investments of this type are often co-financed with funds from the budget of the European Union.

Giving the answer to the second question, most respondents said they had not perceived any savings resulting from the implementation of the cloud. The potential savings are balanced by increasing, ongoing costs. Sometimes even a loss occurred. For example, losses may be the result of having to keep paper documentation simultaneously. However, many respondents reported that it was too early to assess the occurrence of savings on the long run, and perhaps financial profits would be achieved in the future. However, a high level of maturity is required in order to exploit the potential of the cloud. It is not dependent on the actions taken solely by the local government unit. It is necessary to cooperate with other regional and national institutions. In one of the interviews, the respondent suggested that cooperation between several municipalities to build common clouds could, in accordance with economies of scale, bring savings. Yet, not all of the units are interested in the cooperation because of the diversity of needs.

When it comes to the third question, most respondents were of the opinion that expenditures corresponded to benefits. The decision to implement the cloud would not be dependent solely on the possibility of obtaining financial profits.

It should be added that a few respondents had difficulty in responding to questions from the interview. The problems were related to the determination of benefits, the indication of the categories of expenditure and the estimates of potential savings.

5. CONCLUSIONS

The existing approaches are not suitable for analysis of the financial benefits generated by the private cloud for a local government unit. Current methods do not take fully into account the specificities of the local administration functioning. There is a need to create a method which would allow local government authorities to estimate the value of the benefit obtained through the IT systems using private cloud computing. The method should take into account the possibility of financing IT from European funds and the lack of savings in the cost of ongoing maintenance. The development of such method is the subject of the author's research.

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Monika Szałkowska-Strzelecka

KORZYŚCI FINANSOWE TWORZONE DZIĘKI WYKORZYSTYWANIU PRZETWARZANIA W PRYWATNEJ CHMURZE OBLICZENIOWEJ JEDNOSTKI SAMORZĄDOWEJ

Streszczenie. Artykuł dotyczy omówienia wybranych aspektów finansowych wpływających na kształtowanie się korzyści finansowych powstających dzięki wykorzystywaniu przetwarzania w chmurze obliczeniowej. W części wstępnej znajduje się wprowadzenie na temat sposobów oceny korzyści finansowych w IT w sektorze publicznym w ujęciu literaturowym. Następnie opisane są uwarunkowania prowadzenia inwestycji IT w jednostkach samorządu terytorialnego. Poruszane

są zagadnienia związane ze specyfiką współfinansowania przedsięwzięć informatycznych ze środków pochodzących z funduszy europejskich oraz wskazane wymogi prawne i organizacyjne związane z procesem planowania i rozliczania tworzenia systemów IT. W dalszej części przedstawione jest, w jaki sposób postrzega się na poziomie lokalnej administracji możliwości powstawania korzyści finansowych dzięki wykorzystywaniu przetwarzania w chmurze. Rozważania te są poparte materiałem pochodzącym z wywiadów, przeprowadzonych w kilku jednostkach samorządowych. Podsumowanie zawiera wnioski dotyczące potrzeby opracowania metody analizy korzyści finansowych powtających dzięki prywatnej chmurze obliczeniowej administracji lokalnej.

Słowa kluczowe: korzyści finansowe; chmura obliczeniowa; chmura prywatna; jednostka samorządu terytorialnego