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Approach of the economic analysis using Cloud Computer in Technical Wholesale

Approach to the integration of sustainable methods of economic analysis using Cloud Computer in Technical Wholesale

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Abstract: Cloud computing is becoming increasingly important as it is recognizable in the growing market of services in the IT infrastructure, development platforms and software sectors. For companies in the technical wholesale sector, this results in new opportunities to reorient their IT needs. The central assessment criterion here is the economic benefits that arise from the use of cloud offerings in comparison to the acquisition and operation of company-owned it. A comprehensive assessment by the company includes both quantitative and qualitative factors, which suggests an enhanced cost-benefit analysis for cloud computing. For this reason, these contributions formulate approaches that enable a cost-effectiveness view of cloud computing in enterprise use and support the comparison to the acquisition and operation of company-owned systems.

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1. Introduction

The term "cloud computing" stands for the use of IT resources over the Internet, which are billed on demand [1]. This will differentiate between infrastructure services (infrastructure-as-a-service), such as computing power and storage space, platforms for developing IT services (platform-as-a-service), and applications (software-as-aservice). For technical wholesale companies, using cloud-computing opens up more flexible ways to meet their IT needs.

The many business models in Clouds and the underlying Dynamic Usage Model [2] make the use of cloud computing in enterprises diverse. In addition to the scenario of obtaining any information technology from the cloud, a combination with existing IT resources is just as conceivable as a successive use of Infrastructure-as-a-Service (IaaS), Platform as a Service (PaaS) and Software-as-a-Service (SaaS). The fundamental question is which form of cloud deployment - whether complementary or substitutive to the acquisition and operation of in-house IT - entails the long-term most economically advantageous situation. The core construct that needs to be highlighted is therefore the benefit (economic benefit) that can be generated through the use of cloud computing in the enterprise. For companies with (newly added) IT needs, the existing IT capacity and the (new) IT needs to be covered from an economic perspective provide three basic ways of covering this, purely through cloud resources (substitutive), purely on the acquisition and operation of company-owned systems or on a hybrid of cloud and corporate environment (hybrid model or complementary deployment) [3].

For companies that are considering using cloud computing, the scenarios give rise to company-specific assessment questions. The purpose of the paper is to help companies analyze the added value of cloud computing versus the acquisition and operation of in-house IT, and to draw conclusions about the appropriate mix of in-house systems and cloud resources. With a high demand for computing power and fluctuating capacity requirements, cloud offerings are an efficient alternative by dynamically adapting billing to actual needs.

Common goals of deploying cloud computing include cost and time benefits [4], increased operational and strategic flexibility, and the benefits of resource virtualization [5] to improve enterprise IT performance. By sourcing IT resources from the cloud, cost savings can be realized, both in terms of running costs and in terms of eliminating initial investment costs. Effects on the IT cost structure are also to be expected, since the use of cloud services results in a shift from fixed to variable costs.

2. Economic Considerations

In addition to traditional approaches to the economic analysis of IT purchases, there are considerations on how cloud computing can be economically evaluated in comparison to the acquisition and operation of company IT. Costs and benefits represent the primary economic factors of IT solutions [6] and thus also the core of economic considerations. Direct benefit arises from cost advantages and is the easiest to determine. Existing cloud-specific approaches focus on the cost aspect and primarily review the cost advantage of using a cloud solution to purchase and operate on premises systems. In a make-or-buy approach to cloud computing, the focus is on costs.

It is assumed that, in certain company-specific starting situations, the external sourcing of IT via the cloud has a cost advantage compared to the in-house creation of IT services (acquisition and operation of company-owned IT systems). This model allows a computational assessment of the benefits of using a cloud. A further differentiated framework for the company-specific comparison of cloud offers with a company-owned IT variant offers a TCO framework. The basis of this purely cost oriented approach is the breakdown of IT costs according to the Total Cost of Ownership (TCO). The result of this comparison of Cloud Model and a comparison model, which relates to in-house IT, is an absolute cost advantage over the entire useful life of the considered IT. Since costs as directly and indirectly quantifiable factors represent only one, albeit important, sub-aspect of economic considerations and also incorporate qualitative aspects, an extension of the pure cost analysis to qualitative benefit effects is suggested, in order to depict the

economic effects of cloud offers in business use to compare company alternatives. This includes the evaluation of indirectly monetarily measurable or intangible (not monetarily quantifiable) benefit contributions from cloud computing. However, as these have a significant impact on the overall economic situation and development of a company in the long term, integration is important. Worth mentioning here are, qualitative factors with sometimes significant strategic importance such. Flexibility by the nature of available IT resources, high availability performance (business continuity, disaster recovery) [5] or user satisfaction. Possible is a combination of cost-focused approaches with qualitative methods of economic analysis.

3. Methods of Economic Analysis

Because IT investments are costly, irreversible, and have long-term, enterprise-wide implications [7], a detailed cost-benefit analysis is essential. Therefore, there are already numerous methods for economic analysis. In business practice, capital value accounting, the payback method (return on investment or return on investment (ROI)) is widely accepted, and for investment in IT where most of the benefit cannot be quantified in monetary terms, an investment calculation becomes a qualitative one Method and in many cases the utility value analysis is used [7].

The already established methods of economic analysis have to be adapted to the valuation problem of the use of cloud computing. Since most cloud offerings do not incur any significant initial investment costs, traditional investment bills will become obsolete at first sight, and a general superiority of cloud use over company IT in terms of profitability is likely. However, if cloud offers are used as complementary (complementary) to already existing or to be acquired in-house IT components and there are several possible combinations to be compared, a profitability analysis makes sense again. For this reason, [3] has developed a combined cost-benefit approach for cloud computing, which is described and explained below.

4. Methods of Extended Value Analysis

Since a pure cost analysis is to be regarded as too one-sided, on the other hand a purely qualitative procedure contradicts the rationality principle of economy, which implies the use of quantity and value reference quantities, a combined cost-benefit evaluation approach is presented, which includes as many factors as possible, at the same time but also integrates the no less important soft (qualitative) factors.

category	criteria
Parent criterion	Fulfilment of business requirements
Direct monetary value contribution of the cloud service	Profitability (ROI)
	Cost structure
	Profitability of IT security
Indirectly measurable value contribution of the cloud service	Operational flexibility
	Efficient design of processes
	Business IT Performance (Quality)
	Flexibility of personnel deployment
Intangible (qualitative) value contribution of the cloud service	Strategic flexibility at the corporate level
	Strategic flexibility in IT
	Concentration on the core business
	Usability
Risks of the cloud service (qualitative costs)	dependence
	Risks related to data sensitivity
	Risks related to loss of control
	Risks related to business processes
	compliance
	Action flexibility in the worst case

Table 1: Summary criteria catalog for extended usage of cloud services

The main framework of the approach is the utility value analysis, since it can be adapted to specific companies or cases and represents an easy-to-use instrument through the subjective approach of the evaluation [7]. As with the investment calculations, this is not a mathematical, but a qualitative procedure, in which firstly target criteria are determined,

on the basis of which alternatives are to be evaluated, as well as weighting factors, which reflect the significance of the criteria. The (subjective) evaluation of the alternatives then takes place via the allocation of points (weighted: partial benefit values), the comparison over the sum of the weighted point values (total benefit value) [8], [9].

However, because the main method is supplemented by a detailed cost comparison of cloud and proprietary IT alternatives and, if possible, capital values or profitability measures, the approach is called extended utility value analysis. For the design of the extended utility value analysis, target criteria are first defined, which relate to the factors cost and benefit (see Table 1). The breakdown of the cash flow IT costs is based on the total cost of ownership over the entire life cycle or the entire period under review in order to provide a detailed view of the costs of cloud services and services in the manner of the TCO framework Compared to this, when acquiring and operating company-owned IT.

For cost analysis, individual cost calculations for the cloud and company IT alternatives must first be carried out. Following this, the respective benefit - if monetarily quantifiable - must be determined. The result of the cost-benefit relationships are key figures (for example, ROI, net present value), which are qualitatively evaluated within the framework of the extended value analysis. These represent the numerical basis of the utility value analysis. In addition, indirectly monetarily assessable and intangible benefit effects are scored with points according to utility value analysis methods. These include, for example, increasing operational [6] and strategic flexibility [10], time advantages, improving business process continuity (e.g., through virtualization) [5] or employee satisfaction, and thus productivity. In particular, the strategic flexibility is to be taken under the intangible benefit effects, since the results are not measurable in monetary terms and often come to light in the long term. Nevertheless, they have a long-term significance for the economic situation of companies [11].

In addition to the cost and benefit criteria, criteria for technical and legal security of IT resources should be included in the utility analysis. This is related to the importance for

companies, as cloud-specific risks are key impediments to business leaders, using cloud computing, putting their data in the cloud, and thus in the hands of an outside vendor.

Total Costs						Specifics cloud service over corporate IT	
	Period					Cloud alternative	Traditional IT
Costs	0	1	…	10	total		
Direct costs							
Power						✓	-
Bandwidth						✓	-
Storage						✓	-
IT investment costs							
Hardware						✓	✓
Software						✓	✓
Implementation						-	✓
training costs						✓	✓
communication						✓	✓
Ongoing costs (operation, processes)							
energy						✓	✓
hosting						-	✓
maintenance and development						-	✓
Administration						✓	✓
services						✓	✓
IT staff costs						✓	✓
Indirect costs							
Opportunity costs by end users						✓	✓
Down time related costs						✓	✓
TOTAL COST OF IT							

Table 2: Cost analysis schema of a cloud offering compared to proprietary IT

In addition to the fear of loss of control over corporate data, data security, and the separation of processes on shared virtualized resources, data protection and deficiencies

in transparency regarding provider-user relationships, provider activities and pricing models play a role.

However, concerns about being tied to a particular vendor or compatibility with corporate compliance also play an important role in the selection and evaluation of cloud services. Table 2 shows a catalog of criteria that serves as the basis for the extended utility value analysis and includes economic as well as risk-related aspects. This is to be adapted in practice to company priorities.

Based on the company-specific IT indicator system which ideally exists in the company for systematic IT controlling [12], e.g. checking in detail whether certain IT areas can be made more efficient by using cloud resources. Analysis categories in further differentiation may e.g. technical infrastructure, software and system structure (applications) as well as IT personnel [12].

The cost breakdown by TCO requires a determination of direct and indirect costs. Direct costs include material and personnel costs incurred directly in connection with the IT infrastructure, both in the form of initial investment and during the operating phase [6]. Looking at cloud offerings, costs associated with using the cloud service are relevant: cost of computing, bandwidth, and storage. Since these are consumption-dependent and purchase costs for physical hardware are eliminated, there is a shift from fixed to variable costs. The difficulty in forecasting cloud costs is that IT needs have to be estimated accurately.

Here, there is a double problem that can lead to estimation inaccuracies: (1) The future need for capacity needs to be estimated accurately, so that a potential cost advantage through on-demand billing compared to the acquisition and operation of in-house IT in the amount of direct costs is reflected; (2) Many cloud offerings are based on non-linear pricing models (Sensitive Prices), which flexibly adapt to the requested service and the amount of capacity [3]. Sensitive prices exist for non-linear pricing models, e.g. there are price scales depending on IT requirements.

Extended utility analysis		decision alternatives			
		Substitute use of cloud computing		Complementary use of cloud computing	
decision criteria	weighting factor	Point comparison	Weighted score	Points	Weighted score
Direct benefit contribution (assessed in monetary terms: economic efficiency, ie.)					
Profitability (ROI)					
Cost structure (fixed / variable costs)					
Indirect benefit contribution (qualitatively assessed)					
Operational flexibility					
Efficient design of processes					
Business IT Performance (Quality)					
Flexibility of personnel deployment					
Intangible (qualitative) benefit					
Strategic flexibility (entire company)					
Strategic flexibility					
Concentration on core business					
Employee satisfaction (usability)					
Technical and legal security					
Profitability of IT security (ROSI)					
dependence					
Risks related to data sensitivity					
Risks related to loss of control					
Risks related to business processes compliance					
Action flexibility in the worst case					
Total (tendency)					

Table 3: Example of an extended utility analysis matrix

To solve the estimation problem, a two-stage method is proposed in which in the first step the estimation of a forecast, minimum and maximum value of the IT requirement is made and only in the second step, the estimation of a forecast, minimum and maximum value of the costs. In the transition from the first to the second step, a sensitivity analysis is carried out to determine the supplier-side price levels if sensitive prices are available. Following this, the indirect costs are to be determined for the alternative comparison. For both direct and indirect costs, risk adjustments (risk premiums) are to be carried out based on three values (forecast, minimum and maximum). This risk effect can, for example, be

achieved by a combined procedure of arithmetic mean of the assumed values and standard deviation. In the determination of revenues (monetary benefits of the alternatives), risk adjustments must also be carried out, which are deducted as risk deductions from the forecast values.

Table 3 shows a cost analysis schema that shows the differences in the costs of cloud services and in-house IT; in particular the shift in the cost structure (fixed to variable costs). After the determination of relevant evaluation criteria (costs, benefits and risks), the individual cost and benefit analyzes and the determination of meaningful key figures as well as the weighting of the individual criteria, the qualitative evaluation of the results is summarized. The final result should be recorded in a utility analysis matrix containing a score and weighting factors for the individual criteria.

5. Embedded extended Value Analysis in the Selection Process

The evaluation of cost-effectiveness represents a significant step in the takeover of cloud services in companies. However, it is to be connected to a pre-selection of suitable cloud offers.

The suitability is to be determined by requirement analyzes and can be created as a three-stage procedure. At level I, we check which cloud services meet the required technical requirements and have specific specificity. Due to the importance of safety and legal requirements and the quality of service continuity [3], a list of availability and security criteria for cloud services deployed should be formulated and a risk assessment of the services preselected at level I should be carried out at level II. Here, among other things, it has to be determined whether the cloud service meets the sensitivity of affected corporate data, i. if the company data is "cloud-ready". After this filter step, the profitability analysis can be carried out at level III. In line with the criteria presented in Figure 1, if necessary, a company-specific, refined list of criteria should be developed and an extended value analysis should be carried out as described in the previous section.

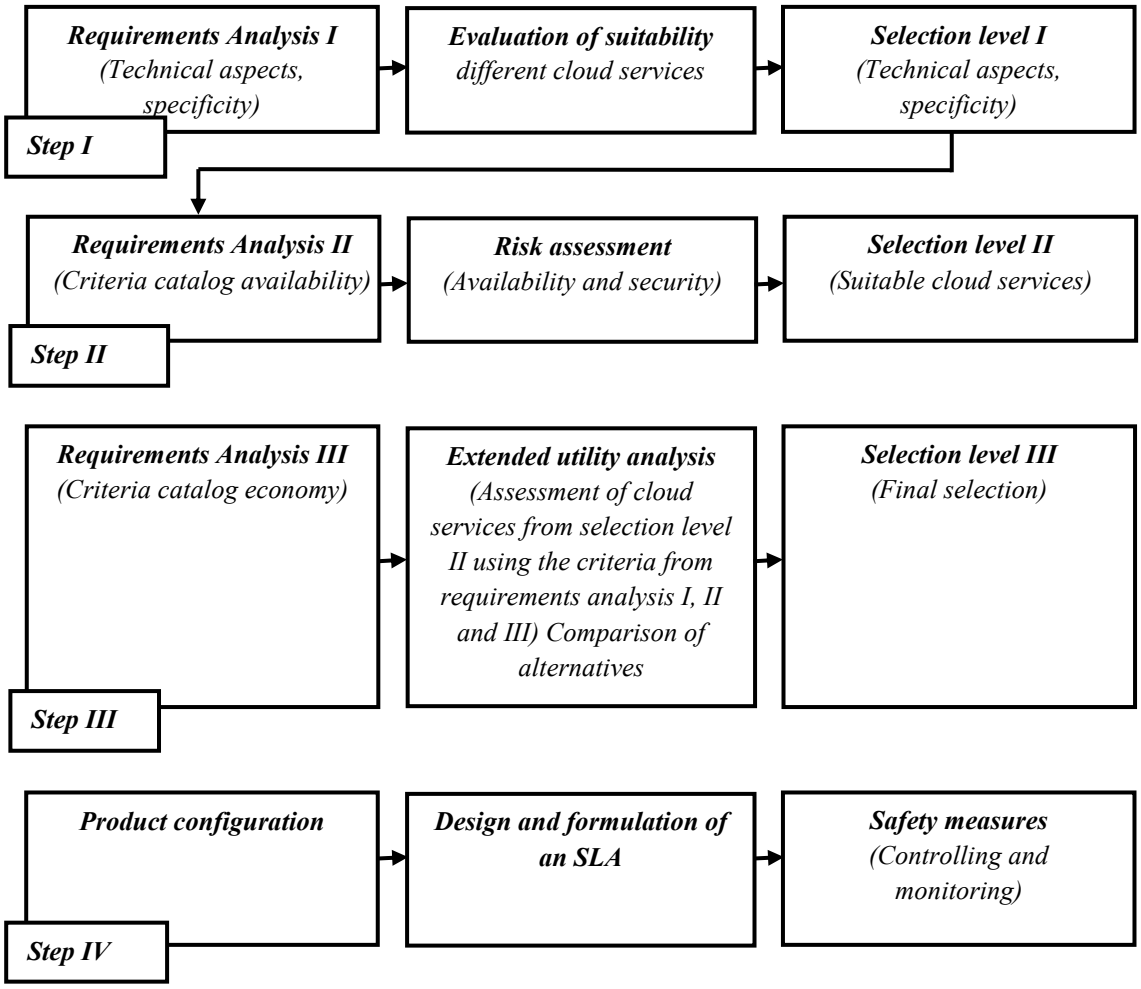

Figure 1: Procedure model for selecting and evaluating cloud services

The list of criteria is based on the criteria for specificity, safety and cost-effectiveness determined at levels I, II and III. After the extended utility analysis, which generates a utility analysis matrix with the target criteria, the alternative comparison of cloud services, proprietary IT alternatives, and mixed models follows.

To guarantee the quality of service, a Service Level Agreement (SLA) is formulated [4]; not least to counter risks and concerns about the loss of control over company data. However, risk-based measures should not be completed with the SLA. Rather, systematic monitoring and controlling of the cloud service or provider over the entire service life can reduce cloud-related risks.

6. Conclusion

The Extended Benefit Analysis presents an approach that integrates and customizes both hard and soft factors. However, it can be seen that the valuation process used to determine the economics of different cloud offerings or combinations with proprietary IT is a complex and time-consuming process, not least because the breakdown of IT costs into indirect and direct costs is due to possible estimation inaccuracies and risk mitigation techniques, especially in the calculation of cloud costs bottlenecks. As it was only hinted at in the procedure with the selection of a cloud service, beside the economical ness of the employment of cloud computing in enterprise IT security and legal aspects play a central role. Also, the fear of the cloud customer companies against loss of control over their data and dependence on the cloud provider can be purely through economic benefits, albeit significant, not compensate. Since these points are essential, it makes sense to carry out a risk analysis and early exclusion of unsuitable cloud services or service providers in the run-up to a profitability analysis. In addition, security and legal criteria can be included in the Advanced Benefit Analysis as a target criteria when data is cloud-ready, but different cloud providers or solutions have very different security and service levels. The profitability analysis is thus never alone and cost-benefit criteria with regard to cloud computing are always to be embedded in a company-specific overall catalog of requirements. The presented approach serves as a rough framework and lives from the company-specific adaptation. The procedure can therefore not be generalized. Advantages can be seen in the fact that, even if there is insufficient numerical basis, a useful statement can be made about the suitability and economic viability of using cloud computing, provided that a detailed target criteria catalog is formulated and the utility value analysis is used as the basis.

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