TCO VOFI for eLearning Platforms

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Abstract. *The use of Open Source Software (OSS) in different domains is becoming more important for many profit and non-profit organizations. The common argument for OSS is the absence of the license costs, which are an important but not the only criterion of rational choice. In 1987, the Gartner Group presented a model named TCO (Total Cost of Ownership), which defines a method to measure the total costs of IT infrastructures (e.g. PC workstations) and software during the whole life cycle. The main theoretical shortcoming of the TCO model implemented by Gartner Group is that it uses cost accounting instead of capital budgeting although the analyzed objects would normally correspond to a long-term decision. VOFI (Visualization of Financial Implications), one of the capital budgeting methods, in combination with TCO, called TCO VOFI model, gives a better approach for this problem. This paper applies the TCO VOFI model to the domain of eLearning. In particular, it compares the financial consequences of using Open Source and commercial eLearning platforms.*

Keywords. eLearning, TCO (Total Cost of Ownership), Open Source, investment, capital budgeting, financial plans, VOFI (**V**isualization **o**f **F**inancial **I**mplications).

1. Introduction to the TCO Model from Gartner Group

In 1987 Gartner Group introduced a study which highlighted that most companies only calculate the *purchase cost* of PC workstations within their cost accounting, although the purchase costs only amount to 20% of the *total costs*. With this background, Gartner Group developed a "Total Cost of Ownership" (TCO) model in which the total costs of the examined object are calculated during its *life cycle*. This is also known as *life-cycle costing* [4].

In the mean time, Gartner Group has created a comprehensive definition for the TCO model named as "TCO Model v4.0 – Distributed Computing Chart of Accounts". This model helps companies to identify their real costs and defines the *total costs* as the sum of *direct* and *indirect costs* [4].

The main critique of this TCO model is that it exclusively uses costs, which belong to the domain of *cost accounting*. Cost values are mostly based on historic values. Therefore, this method is only suitable for a *short term* analysis. For a *long term* analysis it is rational to use withdrawals and payments, which belong to the theoretic field of *capital budgeting*. Capital budgeting also considers the *capital lockup*, which determines one of the crucial factor, namely the *payment of interest*. The *opportunity rate of interest* of the *internal funds* and the *outside capital rate of interest* are the two components defined in the payment of interest.

To compare alternatives, one should consider *the performance* and *the usefulness* of the analyzed objects. The TCO model ignores these factors completely, by only considering the costs. Another important point is *tax payment* or *refund*, which should not be forgotten if a profit organization is involved in the analysis.

2. TCO VOFI

There are traditional methods available in capital budgeting such as *static method* and *time-adjusted method*. Capital budgeting *with visualized financial plans*, simply called "**V**isualization **O**f **F**inancial **I**mplications (VOFI)", has many advantages compared to those traditional methods. Therefore, VOFI should be used to extend the TCO model [1] [2]. This new model will be called "TCO analysis with VOFI" or simply "TCO VOFI". In [3], this model is developed and applied to the domain of investment planning for workstations.

Figure 1 shows the process of building the TCO VOFI model [3]. This process consists of following steps:

Step (1): first of all, the data have to be collected for the analysis. On one side we have the *original data* from the standard TCO model, such as investment outlays. On the other side we use capital budgeting, which means that the *financial* and *tax data* must be included in the analysis.

Step (2): with those data we create a *VOFI for the investment* and a *VOFI for the opportunity* (= what will happen, if the internal funds would be invested directly in financial assets).

Step (3): the TCO Analysis collects all the TCO VOFI results and builds the value of *total cost* as defined by the TCO model.
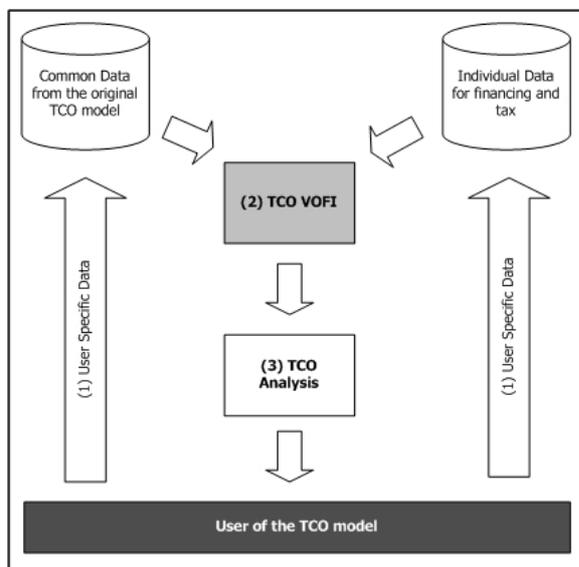

Figure 1. TCO VOFI Model [3]

3. TCO VOFI for eLearning Platforms

3.1 Main Data (Step 1)

This section demonstrates the TCO VOFI model developed in [3] by showing an example of the TCO analysis for a *commercial* and an *Open Source* eLearning platform.

Two types of *users* are involved in this example: a *profit* organization (all kind of companies) and a *non-profit* organization (state universities, schools and other state facilities). Both organizations will introduce an eLearning platform to their employees and students respectively. Depending on the analysis result they will use either the commercial or the Open Source eLearning platform. Figure 2 shows the

TCO result combination matrix, which describes the TCO result in relationship with *user types* and *eLearning platform types*.

Figure 2. TCO Combination Matrix

In this example, both platforms, commercial and Open Source, meet all the *functional* user requirements such as offering a course management and communication tools (e.g. chat rooms, collaborative facilities, discussion). Both platforms also provide open APIs (Application Programming Interfaces) for integration with other information systems.

All the data are collected, evaluated and analyzed for institutions in Germany. Therefore, the validity of the results is subject to situational factors. The real product name of each eLearning platform will not be mentioned in this example.

The TCO calculation for a "well-known" commercial eLearning platform uses the following data: investment outlay for the *hardware*: 2 x Dell PowerEdge 1650, 1 CPU, 4 GB RAM, 140 GB RAID, 3 years 24x7 support, pre-configured with Linux und Apache, price: 15,009 EUR each, total: 30,018 EUR; s*oftware license* for unlimited users: 2 x academic licenses each 5,000 EUR/year, total: 10,000 EUR/year; a full-time *administrator* for both servers: 35,000 EUR/year; c*reation of contents* estimated: 5,000 EUR/year; s*alvage value of the hardware* after 3 years estimated 3,000 EUR/each, total: 6,000 EUR.

The financial part of the data looks like following: investment outlay should be paid from the internal funds. The payments should be financed from the *loan in current account* which counts for a 10% rate. The opportunity rate of interest for the internal funds is 15%. The *tax rate* is 40%. All the prices, taxation and

depreciations are calculated according to German regulations.

The use of Open Source eLearning platform takes the same data as above but without the payment for the software license (10,000 EUR/year). The TCO VOFI model will be used to calculate the TCO value for profit and non-profit organizations as stated above. The difference between those organizations in our model is that the profit organizations have to pay attention to the *taxations* and *depreciations*.

3.2 TCO VOFI Result (Step 2)

For the details of VOFI please refer to [1] [2]. In this result we only show the TCO VOFI model for the *profit organizations* using the *commercial eLearning platform*. In Figure 2 this corresponds to the *TCO Result 2*. This combination is taken as an example because it is the most complex calculation. On the one hand, profit organizations have to pay attention to the tax payments/refunds and depreciations. On the other hand, commercial eLearning platforms induce license fees which are absent in their Open Source counterpart. Other VOFIs (TCO Result 1, 3 and 4) can be calculated similarly.

First of all, we have to identify the series of payments [Table 1], which correspond to the main data above (step 1).

Timeline (year)	0	1	2	3
Hardware	30,018			
Software		10,000	10,000	10,000
Content creation		5,000	5,000	5,000
Administration		35,000	35,000	35,000
Outpayments	**30,018**	**50,000**	**50,000**	**50,000**
Salvage value of the hardware				6,000

Table 1. Series of Payments

The result of capital budgeting with VOFI, *TCO VOFI for the investment*, can be found in Table 2.

VOFI Investment					
Timeline (year)	0	1	2	3	Total
Inpayments				6,000	**6,000**
- Outpayments	30,018	50,000	50,000	50,000	**180,018**
Series of payments	**-30,018**	**-50,000**	**-50,000**	**-44,000**	
Internal Funds	30,018				
Loan in Current Account					
+ Credit intake		25,998	27,557	25,611	

- redemption					
- debtor interest			2,600	5,356	**7,955**
Taxes					
- Payment					
+ Refund		24,002	25,042	23,745	**72,789**
Net Funding	0	0	0	0	
Balances Loan in Current Account		25,998	53,555	79,166	
Net Balances	**0**	**-25,998**	**-53,555**	**-79,166**	

Table 2. TCO VOFI for the Investment

To calculate the taxes [Table 2] we need to determine the depreciation value first. It has to be noticed that in Germany the computer hardware can be depreciated within 3 years (= *operating life*). There is an option to choose between *declining* and *linear* depreciation to reach the depreciation value. The declining depreciation is set up to 30%. The linear depreciation can be calculated by dividing the book value of the hardware by its operating life.

The summary of the depreciations and tax payments/refunds (in this example we get tax refunds) calculation for the investment are shown in Table 3 and Table 4 respectively.

Timeline (year)	1	2	3
Book Value in January	30,018	20,012	10,006
Depreciation (declining)	9,005	6,004	3,002
Depreciation (linear)	10,006	10,006	10,006
- Maximum Depreciation Value	**10,006**	**10,006**	**10,006**
Book Value in December	**20,012**	**10,006**	**0**

Table 3. Depreciations for the Investment

Timeline (year)	1	2	3
Net Payment	-50,000	-50,000	-44,000
- Depreciation	10,006	10,006	10,006
- Interest Payment	0	2,600	5,356
+ Interest Earning	0	0	0
Tax Base	**-60,006**	**-62,606**	**-59,362**
Refunds	**24,002**	**25,042**	**23,745**

Table 4. Taxations for the Investment

To be able to calculate the TCO value we also need to calculate the *VOFI for the opportunity*. This means, if the internal funds (30,018 EUR) are not used for investment in eLearning platforms, instead, it could be invested in financial assets. The VOFI calculation for

opportunity is not shown in this example, but following are the most important results. At the end of the period we get an end value of 38,874 EUR. The total of the credit interest amounts to 14,760 EUR and the total of the tax payment is 5,904 EUR. (Don't forget: If we earn money from our credit interest, we have to pay tax for it!).

3.3 TCO Analysis Result (Step 3)

The last step is to make the TCO analysis. Table 5 shows the details of this final step.

TCO Calculation	EUR
Standard Earnings	0
+ Exceptional Earnings (salvage value hardware)	6,000
- Expenses (total outpayments - total depreciation value)	150,000
- Depreciations	30,018
= Real Profits (before reinvestment earnings and interest payments)	-174,018
+ Reinvestment Earnings	0
- Interest Payments (total debtor interest from VOFI investment)	7,955
= Real Profits (before tax)	-181,973
+ Tax Refund (from VOFI investment)	72,789
= Real Profits (after tax)	-109,184
- Imputed Creditor Interest (from VOFI opportunity)	14,760
+ Tax Payment (from VOFI opportunity)	5,904
= Imputed Total Profits	-118,040
= TCO	**118,040**

Table 5. TCO Analysis

4. Conclusion

All results are summarized in Table 6.

Software/Organization	non-profit	profit
commercial	205,154 EUR	118,040 EUR *(calculated in example above)*
OSS	172,054 EUR	98,939 EUR
Difference	**33,100 EUR**	**19,101 EUR**

Table 6. TCO VOFI Result

Both calculations for profit and non-profit organizations used the same data, except for the license payment which amounts to the difference of 10,000 EUR for each year.

Obviously, the use of the OSS eLearning platform has a *lower* TCO value (= *better*) for both profit and non-profit organizations. It is interesting to see that the difference for the profit organizations is not that high as for the non-

profit organizations. In fact, profit organizations have to pay tax or *get refunds from tax* and can *depreciate* hardware purchasing costs. These two factors reduce the TCO value.

The TCO value should be calculated with care and each decision should be modeled individually. The use of the TCO VOFI makes the TCO calculation more accurate and considers the financial consequences of IT-investments which are of vital interest for the shareholders of the organization. In the long run, this will likely avoid wrong IT-decisions based on simple cost-centric models.

Compared to the traditional TCO model presented by the Gartner Group, the numerical effort to model a TCO VOFI is higher. In practice, the modeling process can be efficiently supported by use of spreadsheet programs. Consequently, the TCO VOFI can easily be used by controllers in profit and non-profit organizations in order to model long-term financial effects induced by eLearning platforms and other IT-investments.

5. References

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