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Depreciation Methods and Life-Cycle Costing (LCC) Methodology

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Abstract

Fixed assets are tangible assets that are used by a business to produce income. Accounting fairness refers mostly to the fair presentation and, therefore, to the measurement or valuation of an element recognized in the entity's financial statements. Depreciation is the process of allocating costs to an asset over its entire life. This allocation is done in a way that the cost of the asset (depreciation expense) is charged to the accounting periods during the economic life of the asset and decreases the net value of fixed assets. Applying different depreciation accounting and valuation methods across firms or countries makes financial statements incomparable to each other. The research objective of the paper is a presentation of depreciation methods in comparison with life-cycle costing (LCC) methodology. Both LCC and depreciation methods are applied to: i) a typical commercial property asset – an office building, as part of a real property developer's fixed assets portfolio – and ii) a vessel – a Handymax, as part of the fixed assets of a shipping company – in order to explore the relationship between these methods when applied to the valuation of fixed assets and how these methods correlate with each other. Following the above mentioned procedure, our aim is to provide answers to the following questions: i) 'which depreciation method is more appropriate to be used as the accounting method for fixed assets?' and ii) 'in what way the LCC methodology is associated with depreciation methods and more broadly with accounting methods and practices?'

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Keywords: Fixed Assets; Depreciation Methods; LCC; Accounting.

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1. Introduction

According to microeconomics, *property* is defined as a good able to provide a constant flow of services, such as housing services or a source of cash inflow. *Assets* are consumer durable goods held either by households for housing needs, or by firms in order to install their business activities necessary to operate. As goods traded in the market, asset prices are defined through the law of demand and supply. In markets under equilibrium current values must reflect the assets' present values taking into account the time value of money. Any variations from the valuation under present values leave space for moving from the equilibrium spot and the movement will continue until all current values reflect present values. Economics recognize the financial return of the asset by consumption or sale as a capital gain arising from the increase of the value of the asset. By establishing variable accounting treatments for assets, assets have developed into a prosperous investment tool for companies in order to obtain economic benefits, not only through consumption (own use) or sale, but also through investing. Accounting fairness refers mostly to the fair presentation – and therefore, measurement or valuation – of an element recognized in the entity's financial statements. According to the Generally Accepted Accounting Principles (GAAP) across countries, two basic methods exist for asset valuation: the accounting of *fair value* and the accounting of *historical cost*. Fair value is a rational and unbiased estimate of the potential market price of a good, service, or asset. It takes into account such objective factors as: acquisition/production/distribution costs, replacement costs, or costs of close substitutes; actual utility at a given level of development of social productive capability; supply vs. demand; and subjective factors such as risk characteristics; cost of and return on capital; and individually perceived utility. In accounting, fair value is used as a certainty of the *market value* of an asset (or liability) for which a market price cannot be determined (usually because there is no established market for the asset). Historical cost states that each financial effect of a realized transaction stated in the firm's financial position shall be recorded at acquisition cost. Applying different accounting methods across firms or countries makes financial statements incomparable to each other. Even within the International Financial Reporting Standards (IFRS) framework the choice between the two valuation models for certain asset portfolios is a given option. US GAAP, also seem to have a different approach in property valuation. Under US GAAP (FAS 157), fair value is the amount at which the asset could be bought or sold in a current transaction between willing parties, or transferred to an equivalent party, other than in a liquidation sale. The latest edition of the International Valuation Standards (IVS, 2007), clearly distinguishes between fair value (as defined in the IFRS), and market value (as defined in the IVS): so, as the term is generally used, fair value can be clearly distinguished from market value. It requires the assessment of the price that is fair between two specific parties taking into account the respective advantages/disadvantages that each will gain from a transaction. Although market value may meet these criteria, this is not necessarily always the case. Fair value is frequently used when undertaking due diligence in corporate transactions, where particular synergies between the two parties may mean that the price that is fair between them is higher than the price that might be obtainable on the wider market. In other words, a *special value* may be generated. Market value requires this element of special value to be disregarded, but it forms part of the assessment of fair value.

Depreciation is the process of allocating costs to an asset over its entire useful life. This allocation is done in a way that the cost of the asset (depreciation expense) is charged to the accounting periods during the economic life of the asset and decreases the net value of fixed assets. Applying different depreciation accounting and valuation methods across firms or countries makes financial statements incomparable to each other. Furthermore, no account is taken for the *life-cycle costing* (LCC) of the asset and there is no formal framework that imposes LCC calculations in fixed assets valuation, in spite of the fact that LCC is a field of continuous growing interest and substantial amounts of research can be found in the literature. Hence, although funding and insurance organisations are strongly interested in LCC its application has not been implemented into standard practice (Davis Langdon, 2007).

The aim of the study is to explore the relationship between depreciation and LCC methodologies when these are applied to the valuation of fixed assets and how these methods correlate with each other. The methods are applied to: i) a typical commercial property asset (an office building, as part of a real property developer's fixed assets portfolio) and ii) a vessel (a Handymax, as part of the fixed assets of a shipping company).

2. The accounting framework of fixed assets

Fixed assets are tangible assets that are used by a business to produce income like: buildings; plant; equipment; transportation means; machinery; computers; anything that will probably bring future economic benefits. Fixed assets share common characteristics: they are used in the production of business income; they have a useful economic life of at least one year; and they are used up or wear out over time. As accounting elements, assets are ruled by a set of basic aspects such as: cost (cost of land, construction cost etc.), residual value, useful life estimation and depreciation impact. The above elements are correlated with type and the use form of the asset. Asset accounting is subject to the accounting framework instituted by the Accounting Board of each country. The most famous Accounting Boards are the International Accounting Standards Board (IASB – IFRS, IASs) and the Financial Standards Board (FASB – US GAAP). Both the IASB and FASB aim to develop a set of high quality global accounting standards that require transparent and comparable information in general purpose financial statements. In pursuit of this objective FASB and IASB co-operate with national accounting standard-setters to achieve convergence in accounting standards around the world. The accounting framework provides a general set of accounting principles. Some of the principles that apply to this study are: prudence; historical cost; substance over form; going concern; and true and fair view. Other principles and qualitative characteristics of the financial statements are: matching principle; accrual basis; understandability; relevance; materiality; reliability; faithful representation; comparability; neutrality; completeness; timeliness; materiality; cost and benefit balance and consistency. According to IFRS, *fair value* is the price at which the property could be exchanged between knowledgeable, willing parties in an arm's length transaction (IAS 40). According to US GAAP *fair value* is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date (FAS 157).

3. Cost accounting vs. fair value accounting principles

Accounting fairness refers mostly to the fair presentation and, therefore, measurement or valuation of an element recognized in the entity's financial statements. According to the GAAP across the countries, two basic valuation methods exist under the estimate that the firm is under going concern: The accounting of fair value and the accounting of historical cost. Applying different accounting methods across firms or countries makes financial statements incomparable to each other. Even within the IFRS framework the choice between the two valuation models for certain asset portfolios is a given option. US GAAP, also seem to have a different approach in measuring property. The measurement method choice is of great importance because it affects the comprehensive income of the firm (income and shareholder's equity). Valuation of property results, therefore, to a change in financial statements. This result can directly affect contracts linked to accounting numbers, e.g. it can loosen the stranglehold of debt covenants and reduce the informational asymmetry. The accounting frameworks of US GAAP, IFRS and Greek GAAP differ between each other. US and Greek GAAP are more prudent in compare to IFRS. Also, US and Greek GAAP are rule-based, while IFRS are principle-based. Therefore, IFRS leave decision choices to the management of the firm, while US GAAP set also numbered boundaries above or under which the accounting treatment methods change. IFRS comprise the most 'fair' approach, because they provide the choice of the presentation of financial statements at fair value, although calculation of fair value of fixed assets is a difficult issue which requires professional skills. The full convergence of the three studied accounting frameworks in a common-global framework is a challenge. The framework that is proposed shall use fair values, meaning values that will resemble economic reality at measurement dates, as much as possible, as the accounting valuation principle used to value fixed assets irrespectively of their use and their portfolio categorization. Revaluations shall affect the firm's equity special reserve by passing P/L, as unrealized gain or loss and shall be recycled to the firms' profit and loss only by realization, e.g. sale, disposal, destruction. Such a framework eliminates any motivations of the management to classify property in certain portfolios and prohibits the choice between avoiding and undertaking the risk of affecting the profit and loss account when revaluating assets. Therefore, profit becomes more prudent and balance sheet becomes more timely and relevant, resulting to uniformity of financial accounting and representation of fixed assets and succeeding comparability between firms and countries.

4. Depreciation methods for fixed assets

The acquisition value for each fixed asset is generally measured by the cash outlay required to obtain the asset. *Fixed assets are valued at actual cost or, if the cost is not readily determined, at estimated cost.* Acquisition cost includes the purchase price or construction cost, as well as all costs incurred to place an asset in its intended location and in an operable condition. Such costs associated with an asset include: freight and transportation charges; installation costs; site preparation expenditures; professional fees (including title costs and surveying fees if appropriate); legal costs directly attributable to asset acquisition; and cost of necessary easements and right-of-ways.

Depreciation is the process of allocating asset costs over its life. This allocation is done in a way that the cost of the asset (depreciation expense) is charged to the accounting periods during the economic life of the asset. The following are the purpose of charging depreciation of fixed assets: to ascertain the true profit of the business, to show the true presentation of financial position, to provide fund for replacement of assets and to show the asset at its reasonable value in the balance sheet. The following factors are to be considered while charging the amount of depreciation: the original cost of the asset; the useful life of the asset; and the estimated scrap or *residual value* of the asset at the end of its life. The Basic Asset Life-Cycle: an asset is acquired and added to the asset ledger; at the end of each period, depreciation expense for qualifying assets is recorded for each book; Journal entries are generated for the posting book to specified accounts in the General Ledger; at some point, ownership interest in the asset is relinquished and the asset is disposed. Depreciation accounting is helpful to ascertain the true profit and the real financial position of the entity. Accumulated depreciation is deducted from the related asset account on the balance sheet to compute the asset's book value. The certain commonly used terms for depreciations are: *Original cost of the asset* is the cost incurred in making the asset available for use in the first instance; *Salvage value* is the expected recovery of the sales value of an asset at the end of its useful life; *Useful life* is the expected time period for which the asset provides economic services, that is, the period in which the asset could be used for an entity's production or operational activities; *Depreciable cost* is the original cost less expected salvage value. This is the amount of expenses the enterprise will be incurring on amount of expired costs of the machine over its useful or economic life; *Written down value* of an asset at any point of time is original cost less depreciation to date (i.e. accumulated depreciation). It is also referred to as book value. To assess depreciation, the accounting practice uses several criteria, such as: the economic life; the volume of activity produced; the interest rate, etc. The different depreciation methods aim to allocate the cost of an asset to different accounting periods in a systematic and rational manner. Each method produces a different pattern of expenses over time. In order to correct measuring of depreciation it is essential to know the conceptual meaning of *depreciation, depletion and amortization*: Depreciation is treated as a revenue loss which is recorded when expired utility fixed assets such as plant and machinery, building and equipment etc.; The term *depletion* refers to measure the rate of exhaustion of the natural resources or assets such as mines, iron ore, oil wells, quarries etc. While comparing with depreciation, depletion is generally applied in the case of natural resources to ascending the rate of physical shrinkage but in the case of depreciation is used to measure the fall in the value or utility of fixed assets such as plant and machinery and other general assets; The term *amortization* is applied in the case of intangible assets such as patents, copyrights, goodwill, trademarks etc., Amortization is used to measure the reduction in value of intangible assets; *obsolescence* means a reduction of usefulness of assets due to technological changes, improved production methods, change in market demand for the product or service output of the asset or legal or other restrictions.

The following are the various methods applied for measuring allocation of depreciation cost:

- Straight Line method (SLM)
- Written Down Value (WDV) method
- Annuity method
- Sinking Fund method (SFM)
- Revaluation or Appraisal method
- Insurance Policy method
- Depletion method
- Sum of the Years' Digits (SYD) method
- Machine Hour Rate method.

5. Depreciation methods used in the research

5.1. Straight-Line method (SLM)

The *straight-line method (SLM)*, also known as the fixed installment method, allocates an equal amount of an asset's cost to each year of its expected useful life. This allocation assumes that an equal amount of an asset's potential is consumed in each period of its life. However, this may not be true under all circumstances. The repairs and maintenance cost will be lower in earlier years of use but will gradually be higher as the asset becomes old. Moreover, the asset might have different capacities over different years of its life. The amount of depreciation for each period is computed by deducting the asset's expected residual value from its acquisition cost, and dividing the result by its expected economical and useful life. The rate of depreciation is the reciprocal of the estimated useful life. This may be presented as follows:

$Annual\ Depreciation = (Cost\ of\ the\ Asset - Residual\ Value) / (Estimated\ Economic\ Life)$ or

$Annual\ Depreciation = (Depreciation\ per\ Unit\ of\ Output) \times (Number\ of\ Units\ Produced\ during\ an\ Accounting\ Period)$ where

$Depreciation\ per\ Unit\ of\ Output = (Cost\ of\ Asset - Residual\ Value) / (Estimated\ Output\ during\ Economic\ Life)$

5.2. Written-Down Value (WDV) method

Under the *written-down value (WDV) method* of calculating depreciation, the amount charged for depreciation declines over the asset's expected life. This method is suitable in cases where: (a) the receipts are expected to decline, as the asset gets older; and (b) it is believed that the allocation of depreciation should be related to the pattern of asset's expected receipts. The WDV method is also known as the reducing, diminishing, or declining balance method. The depreciation charge is calculated by multiplying the net book value of the asset (acquisition cost less accumulated depreciation) at the start of each period by a fixed rate. Under the WDV method, it is impossible to reduce the asset value to zero, because there is always some balance to reduce the asset value even further. When the asset is sold, abandoned, or retired from use, the WDV appearing in books is written-off as depreciation for the final period. Under this method, the fixed depreciation rate used charges the acquisition cost less salvage or residual value of the asset over its service life:

$$r = 1 - \sqrt[n]{\frac{s}{c}} = 1 - \left[\frac{s}{c}\right]^{\frac{1}{n}}$$

Where:

r = Rate of depreciation or a fixed percentage

n = Number of years of asset's useful life

s = Salvage value or residual value

c = Acquisition cost of the asset

Depreciation at a certain rate is applied to the WDV of the asset as at the beginning of each year. The effect of this method is that the depreciation amount charged every year is an amount less than the previous year. In other words, larger amounts are charged to depreciation during the initial years of the asset's useful life.

5.3. Sum-of-the-Years'-Digits (SYD) method

The *sum-of-the-years'-digits (SYD) method* of depreciation charges larger amount of asset costs to expenses in the early years of life, and lesser amount in later years. The depreciation is calculated by multiplying an asset's depreciable cost by a declining ratio derived from the sum of the number of years in the asset's expected life. To calculate the appropriate SYD ratio, first the sum of the digits in the expected life is found. For example, the SYD for an asset with a life of 5 years is calculated as $(5 + 4 + 3 + 2 + 1) = 15$. Next, the appropriate ratio for each year of the expected life is determined. Each balance year is divided figure by the sum of the digits (e.g., $5/15$, $4/15$... $1/15$). Finally, the depreciable cost, that is the acquisition cost less the residual value, is multiplied by the ratio for each year to determine the annual depreciation. This method applies a changing rate to the depreciable cost which is constant, whereas the declining balance method applies a constant rate to a changing book value. The SYD method

is designed on the basis of Written-Down Value Method. Under this method the amount of depreciation to be charged to the Profit and Loss Account goes on decreasing every year throughout the life of the asset. The formula for calculating the amount of depreciation is as follows:

$$\begin{aligned} \text{Rate of Depreciation} &= \\ &= \frac{\text{Remaining Life of the Asset (Including current year)}}{\text{Sum of all the digits of the life of the assets in years}} \times (\text{Original Cost of the Asset}) \end{aligned}$$

SYD depreciation is an accelerated depreciation method that allocates a greater percentage of the asset to early periods and a smaller percentage of the asset to later periods. The basic premise of this method is that as an asset ages, it begins to wear out, thus providing less value. SYD uses a formula to calculate the rate of depreciation. Unlike double-declining-balance, the rate of the SYD changes from each period and never switches to straight-line depreciation. The SYD is equal to $N(N+1)/2$ where N equals the asset's useful life.

5.4. Sinking Fund method

Under this method, while calculating the amount of depreciation, a fixed amount of depreciation is charged for every year of the estimated useful life of the asset in such a way that at a fixed rate of interest is calculated on the same amount had been invested in some other form of capital investment. In other words, depreciation charged for every year refers to interest losing or reduction in the original cost of the fixed assets. The amount of depreciation is charged with the help of *Sinking Fund* Tables. Under this method an amount equal to the amount written-off as depreciation is invested in outside securities in order to facilitate to replace the asset at the expiry useful life of the asset. In other words, the amount of depreciation charged is debited to depreciation account and an equal amount is credited to Sinking Fund Account. At the estimated expiry useful life of the asset, the amount of depreciation each year is invested in easily realizable securities which can be readily available for the replacement of the asset.

6. Life-cycle costing (LCC) methodology for fixed assets' valuation

The first International Standard for property life-cycle costing (LCC), BS ISO 15686-5:2008 'Buildings and constructed assets – Service life planning – Part 5: Life cycle costing' (BSI, 2008) defines LCC as the: 'methodology for the systematic economic evaluation of life cycle costs over a period of analysis, as defined in the agreed scope'. Life-cycle cost, in turn, is defined as the 'cost of an asset, or its parts throughout its life cycle, while fulfilling the performance requirements'. In order to achieve LCC objectives, the following critical variables have been identified in numerous papers and textbooks on the subject (Flanagan and Norman, 1983; Ferry and Flanagan, 1991; Hoar, 1993; Bull, 1993; Norman, 1993; Kirk and Dell'Isola, 1995; Woodward, 1997; Kishk *et al.*, 2003 among others): project life-time (the analysis period); the discount rate (to address the 'time value of money'); inflation and taxation; construction cost; operating cost; repair and maintenance cost; occupancy cost; end of life/disposal cost; non-construction costs; incomes; externalities (social/environmental costs/benefits); uncertainty (risk assessment/sensitivity analysis). LCC analysis requires the following steps (Constructing Excellence, 2003): to identify/estimate all property costs and incomes in its entire life-cycle; to employ an effective Cost Breakdown Structure (CBS); to decide when these costs and incomes are likely to occur; to use 'discounted cash-flow' techniques to bring costs and incomes back to a common basis – items should normally be entered into the analysis at the current cost / income and a discount rate applied; to address uncertainty issues by undertaking risk assessment and/or sensitivity analysis of the variables such as the discount rate, the study period, the predicted design lives of various components, assumptions about running costs, etc. The objectives of LCC identified by the Royal Institute of Chartered Surveyors are: to enable investment options to be more effectively evaluated; to consider the impact of all costs rather than only initial capital costs; to assist in the effective management of completed buildings and projects; to facilitate choice between competing alternative. The LCC approach identifies all future costs and benefits and reduces them to their present value by the use of the discounting techniques through which the economic worth of a project or series of project options can be assessed. In order to achieve these objectives the following elements of LCC have been identified: initial capital costs; life of the asset; the discount rate; operating and maintenance costs; disposal cost; information and feedback; uncertainty and sensitivity analysis.

According to the work of Liapis *et al.* (2014), the traditional NPV equation as found in Kishk *et al.* (2003) is transformed to a prototype LCC methodology introducing a number of variables that affect the valuation of fixed assets, after analysing a number of components like: the operating and net cash flows (OCF and NCF); the relationship between Price and Revenue of real property; the discount factor or Weighted Average Cost of Capital (WACC); tax rates; inflation and risk-free rates; risk premium; and expected capital gains. The analysis resulted in the development of an easy to use integrated LCC model based on the following mathematical expressions:

$$NCF_t = [(R_t + RV_T) - (C_0 + O_t + M_t)] \cdot (1 - \varphi_t^y) \tag{1}$$

$$AC_t = [(i_{FR} - \varphi_t^p)(1 - \varphi_t^y) + \delta_t] \tag{2}$$

$$i_S = \exp\left(\frac{\ln 2 \cdot \ln(1+g)}{\ln\left(\frac{AC_t + \Delta_t}{AC_t + \Lambda_t - g}\right)}\right) - 1 \tag{3}$$

$$WACC = i_D \cdot (1 - \varphi_t^y) \cdot \left(\frac{D}{D+S}\right) + i_S \cdot \left(\frac{S}{D+S}\right) \tag{4}$$

For any year ‘y’ of property life-cycle, the remaining Value of fixed asset is the sum of the (discounted) values of the NCFs from year ‘y’ until the end year ‘T’ of its useful life (UL):

$$Value_y = \sum_{t=y}^T \frac{NCF_t(1-\varphi_t^p)}{(1+WACC)^t} \tag{5}$$

Where:

- NCF_t : Net cash-flow of the project at year t
- t : 1, ..., T and T = End year of UL
- y : 1, ... y ..., T any year of UL
- WACC : The discount rate or the Weighted Average Cost of Capital
- R_t : Revenue (income) at year t,
- RV_T : Residual value of fixed asset
- O_t : Operating costs at operating year t
- M_t : Maintenance costs at operating year t
- ϕ_t^y : Corporate tax rate, Income tax on property yield (annual rent)
- C₀ : Acquisition Cost
- NCC₀ : Acquisition Expenses
- ϕ_t^p : Property tax rate
- i_{FR} : Risk-free rate of interest, where: i_{FR} = i* + i_{inf}
- i* : Risk-free rate of interest in an economy without inflation
- i_{inf} : Inflation rate
- δ_t : Rate of operating, maintenance, where: δ_t = $\frac{(O_t+M_t)}{(C_0+NCC_0)}$
- Λ_t : Risk premium, for commercial property investments
- EG_{t+1} : Expected capital gains at year t+1, but in terms of WLC is closely to 0
- AC_t : Direct cost of property asset which is equal to cost ratio exempt risk premium and capital gains, thus: AC_t = [(i_{FR} - ϕ_t^p)(1 - ϕ_t^y) + δ_t]

7. Estimations and findings

The research objective of the paper is a presentation of depreciation methods in comparison with LCC methodology. Both LCC and depreciation methods are applied to: i) a typical commercial property asset – an office building, as part of a real property developer’s fixed assets portfolio – and ii) a vessel – a Handymax, as part of the fixed assets of a shipping company – in order to explore the relationship between these methods when applied to the valuation of fixed assets and how these methods correlate with each other.

7.1. Real property fixed asset – Office building

Using the above mentioned LCC methodology (Liapis *et al.*, 2014), the assumptions and basic calculations are provided in Table 1:

Table 1. LCC calculations – Office building (total gross floor area of 1.000,00 sq.m.).

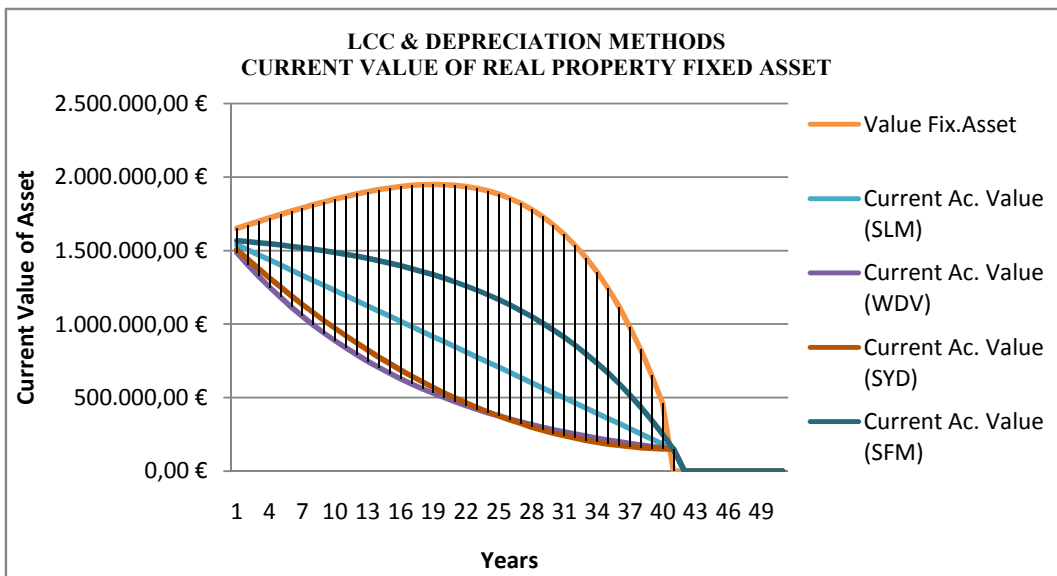
	QUANTITY MEASURE (QM – SQ.M.)	FINANCE		RATES/QM (€/SQ.M. or % A.C.)	VALUES (€)
		DEBT (D) 0 %	EQUITY (S) 100 %		
REVENUE/YEAR	1.000,00	W.A.C.C.	7,25 %	180,00	180.000,00
ACQUISITION COST (A.C.)	1.000,00	CREDIT SPREAD	3,00 %	1.500,00	1.500.000,00
ACQUISITION EXPENSES (% A.C.)	1.000,00	INFLATION RATE	2,00 %	5,00 %	75.000,00
OPERATION EXPENSES	1.000,00	FREE RISK RATE (NO INFLATION)	2,00 %	20,00	20.000,00
MAINTENANCE EXPENSES	1.000,00	TOTAL FREE RISK RATE	4,00 %	10,00	10.000,00
RESIDUAL VALUE (% A.C.)	1.000,00	RISK PREMIUM	6,00 %	10,00 %	150.000,00
ACQUISITION PERIOD (YEARS)	10	GROWTH RATE	0,10 %		
PLANNING TO SALE (YEARS)	50	TAX ON INCOME	25,00 %		
TOTAL LIFE-CYCLE PERIOD (YEARS)	50	PROPERTY TAX	1,00 %		

The amounts of LCC value and current accounting values per depreciation method are provided in Table 2 and LCC curves in Figure 1.

Table 2. Fixed asset value and current accounting values per depreciation method – Office building.

YEAR	FIXED ASSET VALUE (€)	CURRENT ACCOUNTING VALUE OF FIXED ASSET PER DEPRECIATION METHOD (€)			
		(SLM)	(WDV)	(SYD)	(SFM)
10 (ACQUISITION)	1.650.894	1.540.244	1.487.214	1.507.143	1.568.790
15	1.768.384	1.366.463	1.116.447	1.192.683	1.530.299
20	1.869.110	1.192.683	838.114	919.599	1.475.675
25	1.936.571	1.018.902	629.169	687.892	1.398.159
30	1.945.269	845.122	472.316	497.561	1.288.155
35	1.856.270	671.341	354.566	348.606	1.132.047
40	1.610.630	497.561	266.172	241.028	910.514
45	1.119.707	323.780	199.814	174.826	596.136
50 (RESALE)	-	150.000	150.000	150.000	150.000

Figure 1. Curves for fixed asset value and current accounting values per depreciation method – Office building.



7.2. Shipping company’s vessel – Handymax

LCC assumptions and basic calculations are shown in Table 3:

Table 3. LCC calculations – Vessel (Handymax)

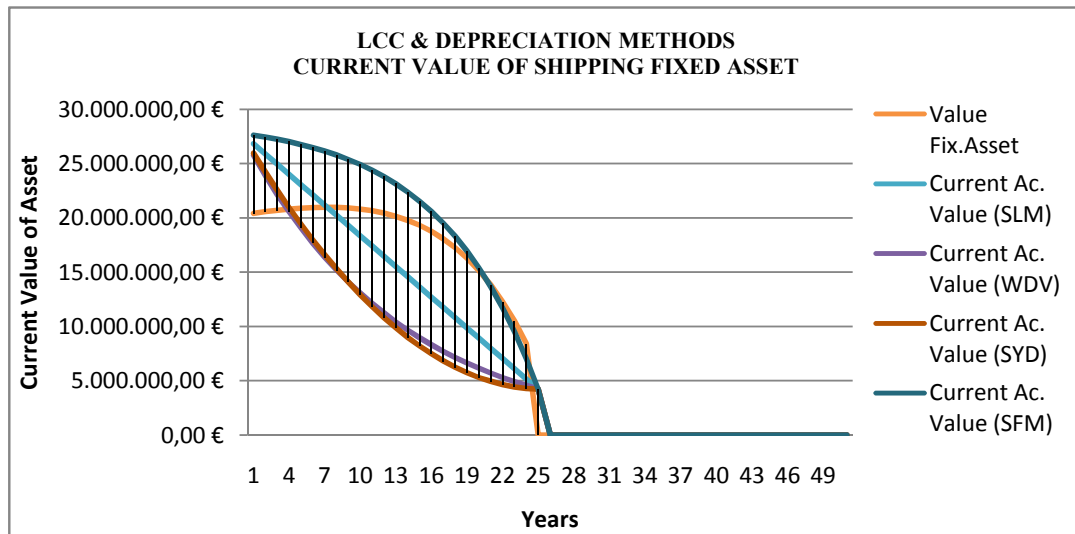
	QUANTITY MEASURE (QM – NO. OF SHIPS)	FINANCE		RATES/QM (€/NO. OF SHIPS or % A.C.)	VALUES (€)
		DEBT (D) 0 %	EQUITY (S) 100 %		
REVENUE/YEAR	1,00	W.A.C.C.	12,77 %	4.614.330,00	4.614.330,00
ACQUISITION COST (A.C.)	1,00	CREDIT SPREAD	5,00 %	27.500.000,00	27.500.000,00
ACQUISITION EXPENSES (% A.C.)	1,00	INFLATION RATE	1,50 %	1,00 %	275.000,00
OPEX	1,00	FREE RISK RATE (NO INFLATION)	2,00 %	2.191.825,00	2.191.825,00
MAINTENANCE EXPENSES	1,00	TOTAL FREE RISK RATE	3,50 %	-	-
RESIDUAL VALUE	1,00	RISK PREMIUM	6,00 %	4.220.000,00	4.220.000,00
ACQUISITION PERIOD (YEARS)	1	GROWTH RATE	0,10 %		
PLANNING TO SALE (YEARS)	25	TAX ON INCOME	0,00 %		
TOTAL LIFE-CYCLE PERIOD (YEARS)	25	PROPERTY TAX	0,00 %		

The amounts of LCC value and current accounting values per depreciation method are shown in Table 4 and the associated value curves in Figure 2.

Table 4. Fixed asset value and current accounting values per depreciation method – Vessel (Handymax).

YEAR	FIXED ASSET VALUE (€)	CURRENT ACCOUNTING VALUE OF FIXED ASSET PER DEPRECIATION METHOD (€)			
		(SLM)	(WDV)	(SYD)	(SFM)
1 (ACQUISITION)	20.418.157	26.832.800	25.758.490	25.963.077	27.618.032
5	20.888.751	23.064.000	19.053.982	19.440.154	26.762.530
10	20.804.370	18.353.000	13.071.259	12.917.231	24.916.390
15	19.314.718	13.642.000	8.967.040	8.206.231	21.550.135
20	15.159.456	8.931.000	6.151.496	5.307.154	15.412.101
25 (RESALE)	-	4.220.000	4.220.000	4.220.000	4.220.000

Figure 2. Curves for fixed asset value and current accounting values per depreciation method – Vessel (Handymax).



8. Conclusion

In this work, the accounting framework of tangible assets using IFRS and US GAAP and the depreciation methods together with fair value accounting following LCC methodology are examined. The LCC valuation method with the main depreciation methods are being tested for two kinds of tangible assets: a commercial real property asset and a vessel Handymax. The contribution of the paper consists of: a framework of good practices in tangible assets management building upon the assertion that LCC is fundamental for securing *best value for money* on property valuation; a literature review (IFRS and US GAAP principles and accounting standards for fixed assets); a literature review for depreciations methods; a critical perspective of the used accounting depreciation frameworks, providing a comparison of each framework against LCC methodology. Fixed asset management is not an easy case. Management of the firm must 'confront' several difficult issues when acquiring an asset, such as the classification, the valuation method and measurement, the monitoring, the depreciation of its value and the effects of each decision, relating to fixed assets, in the income statement and shareholders' equity. Depreciation as an accounting practice has the same point of view with LCC methodology. Thus, cost accounting and depreciation methods and the fair value accounting following LCC facing the same problem, the *time value* of tangible assets.

The results of the empirical analysis indicate that the most appropriate method of depreciation is the Sinking Fund Method which is based on a financial approach to depreciated assets only when the asset is profitable.

From a practical point of view, this paper contributes to the construction of an automated mechanism for the valuation and depreciation of a fixed asset assisting in decision making for the management of tangible assets.

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