THE VALUATION OF MODERN SOFTWARE INVESTMENT IN THE US

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ABSTRACT: *To know whether the investment made profits or losses, value analysis is done on the asset or the project. In the current time, value analysis is critical for business managers and an enterprise. This makes the enterprise owner able to negotiate the price of the assets or items when conducting commercial transactions. Since the US is the largest tech and software market globally, this article classifies the various methods used to do value analysis for modern software investment in the US. Therefore, the method is evaluated and presented according to the Model-Driven Interoperability theory, which includes cost, income, and intellectual capital markets to measure the value of software. The main importance of this research paper is to clarify the reason for the need to introduce proper investment valuation models in software. The research methodology is based on the inferences of the methods of software valuation, while the attention is based on various historical existing literature and practical examples. This study demonstrates the different aspects of current valuation methods to determine software value. Analysing the existing literature shows various valuation models under the income, market, cost, real option and cost-benefit analysis approaches used to value the software. Furthermore, this research recognised various methods that can be relied upon to estimate the value of software. Some of them include direct assessment for the future income, which estimates the income of a given software, real option valuation, which depends on the opportunity of software to generate income in future. Moreover, the relief from royalty method estimates the value of software based on hypothetical royalty payment that the company saves. The suggested methods in this paper would help business managers uncover the value of modern software and better decision-making when acquiring or developing software.*
KEYWORDS*: software, valuation, methods, investment,*

INTRODUCTION

An investment can be defined as the act of owning an asset or holding items to generate income as a result of increasing the value of assets or items over a period of time [1]. Software is one of the company's investments that can be classified as one of the intangible assets that are neither physical neither are they financial materials. The contribution that intangible assets like software make in the market is so prominent that they must be assigned a value like goodwill. Software investment is a fundamental key for every firm that uses modern technology in the current environment. Software

development is critical as it can make the business more accessible, easily access customer details, product ledgers and other important details can be captured quickly, including the details of the company's employees.

A well-developed software is usually characterised by better customer support where clients can easily be reached through their reviews and feedbacks, therefore, developing a good relationship between the customer and the company. A company that has heavily and smartly invested in software development has had a long-time solution characterised by increased productivity because the software keeps track of all the activities, including how the employees are working [2]. Software is an affordable way of managing enterprise as the company can attend to their customers, giving them a better experience to transact with the business again [3]. According to IDC and compita (2021) report, the US is the largest tech and software market globally and representing 33% of the total, or approximately $1.6 trillion for 2021. The need for software valuation results from economic development due to globalisation, followed by a high flow of capital to the growing countries. Since there are no comprehensive uniform regulations for systematically evaluating software investment. The researcher aims to introduce practical methods for more accurate value assessment of the software. Software valuation includes the process of estimating the price of software that effective management of the company can use to generate income in the future. The software has an outstanding contribution to the general market. Therefore, proper valuation method of an intangible asset such as software is necessary for business managers to evaluate their future growth opportunities and opportunity costs. This research's core importance is to clarify why there is a need for improvement in the code of conduct and the standards for the valuation of software investment [4, 5]. The main essence of the research is to show the applicable valuation methods for valuing modern software in the U.S.

The research questions that need to be answered and to understand the current topic are as follows:
1.   Why is software valuation important?
2.   To analyse the methods theoretically/practically used to evaluate the value software
3.   Present the applicable methods for software valuation based on current literatures

The main essence of the study is to show the value for the modern software investment in the U.S. Fair value depends on the estimation of risk and cash flow which requires measurement tools for estimating the future risk of the software. Software invention is different from hardware and physical science due to different ways of protecting them, regulating, or developing them; therefore, the traditional methods of valuing them might be irrelevant or tiresome. Better valuation methods help the company make decisions about acquiring new software or making decisions about software investment.

LITERATURE REVIEW

Software valuation involves a set of assessments, analysis, and procedures to estimate the value of the software in monetary units during a given time. The contemporary facts of the economic market and globalisation have made software valuation a fundamental process in the economy. The valuation

analysis is a necessary action as it is the basis for decision making in terms of company investments [6]. The valuation is an estimation of properly analysed data about software by specialised experts who collect information and utilise it to come up with the valuations. In this section, the various methods of valuations are discussed in detail. Multiple issues are of concern when valuing software like, the uncertainty over the strength of protection for a given software or maybe the inherent dissimilarity of the software [7]. Due to the changing economic processes, it is essential to establish specific regulations and standards that legally control valuers' valuation. The international valuation standards have set guidelines recommended in the analysis process [8-11]. The approaches for software valuation can be classified into 1) the cost approach, 2) the income approach, 3) the market approach and some modern approaches such as 4) real options and 5) relief from royalty methods.

Cost approach
The cost approach for valuing software is usually based on how much the software costs to create or recreate and maintain it [12]. Under the cost approach, the software can be valued using different methods like book value method, replacement method and adjusted net asset method. Book value is the most straightforward technique for finding out the value of software, and it is the value recorded in the balance sheet [13]. The book value is the financial measure of a company, and it is the total value of its assets minus all its liabilities; in other words, the book value is cost minus depreciation. However, book value has limitations; depreciation is a number that is allowed under tax systems. Therefore, applying depreciation will cause a reduction in value. On the other hand, if the software is beneficial enough for investors' purpose, the value will be going up. Consequently, there is little relationship between book value and the actual market value. Accurate forecasting of software development costs is an essential issue in good management decisions and determining the correct amount of effort and time required for project managers, analysts, and system developers. Many software cost estimation methods are available, including COCOMO II, algorithmic methods, analogical estimation, expert judgment method, top-down method, and bottom-up method. None of the methods is necessarily better or worse than the other; their strengths and weaknesses are often complimentary. Understanding their strengths and weaknesses is crucial when evaluating the projects [14].

The following table present how Scale Factors (SFs) and Effort Multipliers (EMs) used in COCOMO II. Significance values are computed by dividing the largest by the smallest value defined by COCOMO II's rating scale. SF values depend on projects with 100 KLOC [2].

Table 1: COCOMO I

Cost driver	SF	EM	Signif.
Product Complexity (CPLX)		×	2.38
Analyst Capability (ACAP)		×	2.00
Programmer Capability (PCAP)		×	1.76

Execution Time Constraint (TIME)		×	1.63
Personnel Continuity (PCON)		×	1.59
Multisite Development (SITE)		×	1.56
Required Software Reliability (RELY)		×	1.54
Documentation Match to Life-Cycle Needs (DOCU)		×	1.52
Applications Experience (APEX)		×	1.51
Use of Software Tools (TOOL)		×	150
Platform Volatility (PVOL)		×	1.49
Main Storage Constraint (STOR)		×	1.46
Process Maturity (PMAT)	×		1.43
Language& Tool Experience (LTEX)		×	1.43
Required Development Schedule (SCED)		×	1.43
Data Base Size (DATA)		×	1.42
Platform Experience (PLEX)		×	1.40
Architecture/ Risk Resolution (RESL)	×		1.38
Precedentedness (PREC)	×		1.33
Developed for Reusability (RUSE)		×	1.31
Team Cohesion (TEAM)	×		1.29
Development Flexibility (FLEX)	×		1.26

Income approach
The income approach is the valuation approach assumes the value of an asset is based on its discounted cash flows (DCF). Which in this case on numerator is the sum expected future cash flows that software will generate and in the denominator is being discounted to their present value [15, 16]. Allee, Erickson [17] conducted a survey, evaluated 172 experts, asked about valuation models they use, and estimated long-term growth and the cost of capital for intellectual properties. The result shows that they prefer the Discounted Cash Flow model on their professional judgment. Under the income approach,

discounted cash flow or the discounted future earnings method could be a tool to value the software. A study from Ritter and Wells [18] shows a positive association between intangible assets such as software value and realised future period income. The results from Daneshgar, Low [19] suggest that large organisations are likely to pursue a long-term vision when deciding on the software acquisition method. However, a sample of 1,210 business performance of small independent software vendors (ISVs) in the enterprise software industry is associated with increased sales and a greater likelihood of issuing an initial public offering (IPO). And show that these impacts are more significant when ISVs have greater intellectual property rights [20]. When an investor is investing in the present to buy an asset with expectations that the investment will generate income in future, the DCF method is suggested.

The following equations show how to use discounted cash flow analysis to determine value.

Discounted   Free   Cash   Flow   Method:

$$V_0 = \sum_{n=1}^{t=\infty} \frac{FCF_N}{(1+r_{wacc})^N} + \frac{V_N}{(1+r_{wacc})^N} \qquad (1)$$

where:
V_0 = the equity value
FCF = free cash flow
r_{wacc} = weighted average cost of capital
N = periods
V_N = terminal value

Often, the terminal value is estimated by assuming a constant long-run growth rate g_{FCF} for free cash flows beyond year N, so that

Terminal Value:

$$V_N = \frac{FCF_{N+1}}{r_{wacc}-g_{FCF}} = \left(\frac{1+g_{FCF}}{r_{wacc}-g_{FCF}}\right) \times FCF_N \qquad (2)$$

where:
V_N = terminal value
FCF = free cash flow
r_{wacc} = weighted average cost of capital
g = growth rate

Direct assessment for future income
When determining the future income of software, it requires an estimation of the income resulting from the intellectual property in all the future years over which the software would be [21, 22]. The net income and the amount sold for every unit after the routine sales and the distribution cost is deducted to get the future income. If the intellectual property is used internally, then the savings that are as a result of the software can as well be calculated. The estimations of the software value usually require an estimate of the sales volume for its lifetime. Such sales are costs like the cost for maintenance,

marketing costs and frequency for similar software. These estimations can be due to experience gained using similar products or prior experience with the product [23]. According to Reilly [12], Tkachenko, Rogova [24] four critical parameters need to be looked at very closely when estimating future income, and these are; the amount of net income that the software is expected to generate, the period over which software is expected to generate the income, the value for the present value discount rate for the future income and the risk of realising the future income.

Multiperiod excess earning method
The multiperiod excess earning method is a variation of discounted cash flow analysis. Instead of focusing on the whole entity, the multiperiod excess earnings isolate the cash flow directly associated with a single intangible asset like software and measure their fair value by discounting them from the present value [25]. This formula is best for assets like software, a primary driver for the firm, and its cash flow can be isolated from its total cash flows. The process for MPEEM involves various stages, which include.
- Project the financial information of the enterprise like the cash flows, expenses and revenue.
- Subtract the cash flow attributing to all the other assets through the contributory asset charge.
Calculate the cash flow that can be attributed to the software and discount them from the present value.

Relief from royalty method
Relief from royalty is a valuation method that estimates the value of software based on the hypothetical royalty payments that would have been saved if the company decided to own the software rather than licensing it [26-28]. The concept of this formula is that owning then software means that the software doesn't have to pay for the privileges of deploying the software. This formula is mainly used to value licensed computer software, trademarks, domain names, other development projects that can be traced to a specific stream of revenue and license fees, plus data from royalty market transaction is available. The relief from royalty method has the following steps.
- Project the financial information of the whole enterprise: the growth rates, tax rates, and revenue estimates that are usually obtained from the company management.
- Estimate the most applicable royalty rate for the software regarding the analysis of the royalty rates for similar software.
- Estimate the useful life of the software.
- Apply the royalty rate to the estimated stream of revenue.
- Estimate the discount rate after deducting the tax from royalty saving and the discount for the present value of the software [29].

The following table present the royalty from relief method of valuation for software.
Table 2: The royalty from relief valuation process

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6-31
Revenue						
Growth rate						

Pretax royalty savings
Less: taxes
After-tax royalty savings
PV of after-tax royalty savings
Sum of PV of savings
Amortization benefit multiplier
Par value of software

The royalty from relief method includes assumptions from market (royalty rate) and revenue approach (revenue estimation, growth rate, tax rate, discount rate).

Market approach

The market approach used for valuing software is based on the patent royalty rates, licensing rates, or similar software sales from one company to another. Experts have stated that it is good to use any of the multiples from comparable analysis to estimate the value of software operating within the same line of business. However, it would be best if the same financial metrics are used and compared. The uses of comparable transactions and comparable profitability methods are best used for software valuation [30, 31]. Some of the more conventional multiple valuation methods include the EV/EBITDA and EV/sales.

One of the valuation multiples used in the finance to measure the value of a firm is enterprise value (EV) to EBITDA (earnings before interest, taxes, depreciation, and amortisation). The multiple considers the enterprise value to EBITDA, and free cash flow.

$$EV/EBITDA = \frac{V_0}{EBITDA_1} = \frac{FCF_0/EBITDA_1}{r_{wacc} - g_{FCF}} \qquad (3)$$

where:
V_0 = enterprise value
EBITDA = earnings before interest, taxes, depreciation, and amortisation
FCF = free cash flow
r_{wacc} = weighted average cost of capital
g_{FCF} = growth rate

Enterprise value (EV) to sales is another financial valuation measure that compares the enterprise value (EV) of a company to its annual sales.

$$EV/Sales = \frac{MC + D - CC}{Annual\ Sales} \qquad (4)$$
where:
MC = market capitalization

D = debt
CC = cash and cash equivalents

Market capitalisation
The software's market worth can be obtained by subtracting the enterprise book value from the total market capitalisation value. The value allocated to software in the market can be substantial, where for a manufacturer, is most likely going to dominate. For situations of diversified enterprise where the software to be valued is a part of the enterprise products, then a further allocation must be made. Market capitalisation is based on the marketplace to value software. When conducting market capitalisation then several keynotes should be noted, and these are: an active existing market for the software, a sufficient number of similar software in the recent past, value information about similar software exchanges to the public and the exchange be between different and independent parties [32-34].

Real option
Software is an intangible investment that can help the firm generate more income or reduce expenses in the future, but it is currently yielding zero at the current time or maybe a negative return. Real option valuation is a formula derived from financial options that are applied to value investment projects. According to Brandão, Dyer [35] the value of an investment depends on its investment opportunity in future, and this means that an opportunity is just an option. Real option valuation views investment in intellectual property as an option to develop the current asset regarding the circumstances at the option date and the facts at the current date. The most important dates to be noted are; product release dates, key development dates and the profitability milestone dates. The only disadvantage with this formula is that many variables depend on option pricing, which leads to a higher risk of improper valuation, especially for the options that are not in the public marketplace. Real option valuations are usually conducted for internal purposes of the company or maybe by some trusted experts.

Cost-benefit analysis
Since there are few software investments sides, investors need to consider the investment's benefit, cost, and impact on the business growth. And not all software (like HR) generates income to apply the income valuation method. But this software may indirectly free cash flow somewhere else. Hence, the cost-benefit analysis (CBA) would assist business managers in making software investment decisions. Depending on the range of input data used can determine a software's costs and benefits. Therefore, the potential costs of the software(s) should be significant enough to justify the allocation of resources to forecast, measure and evaluate anticipated benefits, costs and impacts [36, 37]. The historical transactions evidenced that software with higher cash flow and positive net present value (NPV) cost almost five times more for enterprises to purchase. So, the ultimate option probably would be to go for less cost, lower cash flow and NPV in the transaction time and develop the software over the period. Any financial decision investor wants to know what the cost is and what cash flow can generate.
Some assumptions need to be made to compare various software developments and conduct the right decision making: 1) The benefits of creating software 2. Identify the impact(s) software will make 3. Compare various investment opportunities to choose the most appropriate software.

The following are methods of cost-benefit analysis to determine the economic efficiency of software. The typically used methods are

1.   Benefit-Cost Ratio (BCR)

$$BCR = \frac{\sum B_i/(1+d)^i}{\sum C_i/(1+d)^i} \qquad (5)$$

where:

B_i = the software's benefit in year i, (i = 0 to n years)
C_i = the software's costs in year i, (i = 0 to n years)
d = the discount rate

2. Incremental Cost-Benefit Ratio

$$Incremental\ BCR = \frac{\sum B_1 - \sum B_2}{\sum C_1 - \sum C_2} \qquad (6)$$

where:

$\sum B_1$ = total benefits for software 1
$\sum C_1$ = total costs for software 1
Here compare them based on their costs.

3. Net Present Value (NPV)

$$NPV = \sum_{t=1}^{n} \frac{FCF_t}{(1+r)^t} - I \qquad (7)$$

where:

FCF_t = Net cash inflow generated by project at date t
r = cost of capital
I = Initial cash outflow

4. Payback Period

$$Payback\ Period = \frac{I}{CF - CoS} \qquad (8)$$

where:

I = Initial cash outflow
CF = Cash flow generated by the project during the year
CoS = Cost of servicing

LITERATURE REVIEW SUMMARY

Technology develops every day while the valuation models are not developed regularly; therefore, there is a big gap for coming up with one standard set of formula for evaluating the software. In order to fill the gap, in the literature section, the researcher parents five classifications of valuation methods used and suggest in previous studies. In underneath of each class presented some models that are the most fit with software valuation. - The cost approach demonstrated the weakness of the book value method, yet the COCOMO II is one of the practical methods for determining the cost of the software.

- In the income approach, DCF is exhibited as one of the most used methods to determine the value of software. However, practised direct assessment for future income, the multiperiod excess earning and relief from royalty methods showed the applicability to software valuation. - Within the market approach, multiples include the EV/EBITDA and EV/sales. Finally, they followed with - real option and - cost-benefit analysis to look at different sides of valuation.

Theoretical framework

The method is evaluated and presented according to the Model-Driven Interoperability method [38] that is; cost, income, and intellectual capital markets, which are used to measure the value of software investments in the USA [39, 40], in regards to the present characteristics of current valuation methods. The other theoretical framework in this paper drives the used valuation approach such as discounted cash flow valuation that is concerned about discounting cash flows at a risk discount rate to estimate the corporate value of software and arbitrage pricing theory that estimates the software return concerning the software's return and the macroeconomic factors that affect the risk of the software [41]. The arbitrage pricing theory aims to establish the fair market price of assets that might be temporarily priced incorrectly. Arbitrage pricing theory is a much more flexible and complex alternative for the capital asset pricing method. This theory provides analysts with an opportunity to customise for future research. Arbitrage pricing theory uses a pricing model that entails several sources of risks and uncertainty, which helps the management to consider the various risks that cannot be eliminated through diversifying.

METHODOLOGY

The research methodology was based on historical perspective and qualitatively [42] reviewing the scientific literature and conclusions from recently published software evaluation methods. To answer the research questions, choosing the appropriate articles relevant to the study is essential [43]. Various available databases for performing literature search has been selected and pulled 263 latest published articles from different scientific databases. Afterwards, manually screened the articles, then the related articles selected and analysed. The current study also examines the existing practical examples, relevant models and key elements used in estimating the value of the software. The research methodology showed the need to improve appropriate methods and evaluation standards. Therefore, presented the Model-Driven Interoperability concept [40] to enhance practical evaluation methods. At the same time, the researcher has shown the need to develop valuation methods and a further search for measuring fair value for software based on the analysis of numerical data in practical examples.

DISCUSSION AND CONCLUSION

This paper resolved the importance and methods of software valuation based on the historical research approach. Previous studies practised asset (cost)-based, income, comparable, real option approach and cost-benefit analysis to value the intangible assets like software.

As for determining the suitable methods for valuing software depend on the management needs and condition, they can apply various valuation methods. First, - to develop software start from scratch for operational convenience purposes. So that the cost of producing the software concerned, then applying the combination expert judgment or analogy with COCOMO II is the best way to evaluate [2, 14]. Then using the cost-benefit analysis would help the manager's decision-making to choose the suitable investment. The second - is when acquiring a developed software which is best to apply the combination of any multiples to compare peer group, presented models in income approach and real option valuation method will assist in estimating the proper value for software.

The study performed the analysis in terms of a new system and which problems arose in asset(cost)-based methods. There is a possibility of preparing new guidelines that modernise the quality and reliability of the requirements for determining the financial value of software to solve the existing gaps. In this study, the analysis and classification of asset(cost)-based software valuation methods was one of the solution basis for software valuation [44]. This analysis was done on the literature review of achieving the study's objectives. There is a need for significant progress in valuation standards and proper methods because there is a difficulty applying software valuation methods. There are several procedures, conditions, and practises of software valuation described in the study and the reasons for the contemporary crisis in software valuation, and the directions for future development. This study is concerned with developing solutions to the objective patterns and the standards for software valuation. A suitable software valuation model should show total value, indicate the source of its creation, and consider all the components that affect the value of the software. The use of various valuation approaches in the study provides a chance for comparison when making enlightened decisions to the closing value of Software.

Regarding the literature review, there is a great need for more research to introduce proper methods for the best set of software valuation methods. The main weak points of the existing literature about software valuation are lack of practical examples and presenting the exclusive method of valuation. Further research needs to be done on the models of evaluating software to develop a more advance standard valuation procedure.

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