

The Black Box Institute

THE ART OF STARTUP VALUATION

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Introduction

Valuations are a hot topic this year. The struggles of WeWork shareholders, who have suffered from a dramatic revaluation, and the poor post-IPO performance of high-profile tech startups such as Uber and Lyft, highlight the challenging nature of valuing startups. When valuing mature businesses, past financial performance can be used to forecast future performance and subsequently derive a present value of the company. On the other hand, early-stage companies are characterized by unproven future potential and a missing track record, and often translate a lack of profitability, and sometimes, even a lack of revenue. This results in valuation of startups being more subjective and often contentious.

There is no avoiding it, however, as entrepreneurs and investors must agree on the value of a startup before capital transactions can be undertaken. Valuations do not have to be precise or perfect. However, they need to be justifiable and based on sound principles and approaches in order to advance the commercial and financial interests of the founders, investors, management, employees and other stakeholders. We are taking a closer look at some of the approaches commonly used to value startups.

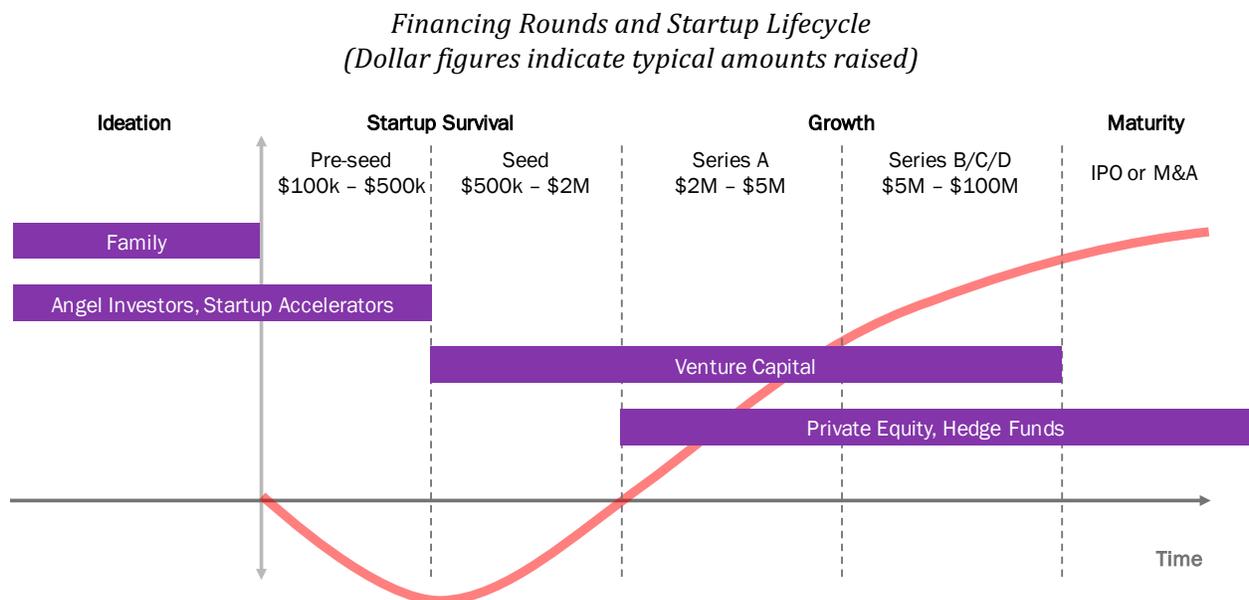
The Foundational Concepts

Intrinsic Value vs Market Value

Classic corporate finance theory distinguishes between two main concepts of asset value: *intrinsic value* and *market value*. Intrinsic value is the value of the company, calculated using tangible and intangible factors, fair assumptions and predictions. The market value is the current price point of an asset offered by the market at any moment.

In a world with perfectly efficient markets, intrinsic value and a market value would be the same. In reality, market value can be impacted by market moods, personal biases, momentum, negotiation position and other factors that cause a deviation from intrinsic value. The purpose of a valuation exercise is to arrive at the *intrinsic value*.

Startup fundraising process and how it impacts valuation



Due to their risky nature, most early stage companies do not have access to liquid markets and therefore often need to rely on family financing, angel investors, venture capital (VC) or private equity

(PE) firms. PE and VC funds, in particular, are powerful financing vehicles that participate in early stage investments via *venture rounds*, which typically represent various stages of company evolution and maturity. For example, a typical first venture round is called a *Seed round* which is then followed by *Series A*, *Series B* and so on. The depiction above shows a startup's lifecycle through venture rounds.

Venture valuers also distinguish two concepts: *Pre-money* and *Post-money* valuation, essentially describing how much a company is worth before and after, respectively, an investment is made. This paper is concerned with determining pre-money value in contemplation of an investment. The post-money value is simply the pre-money value plus the amount of investment made at that valuation.

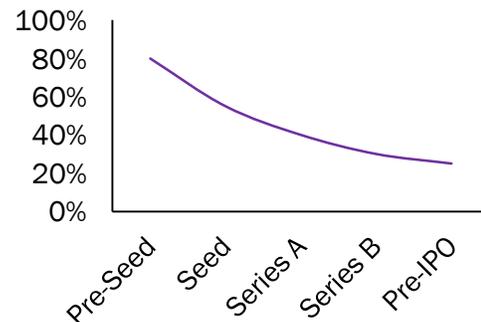
Discount Rate

Investment capital follows fundamental laws of supply and demand. The higher the demand for capital, the more it costs and the higher the supply of capital, the less it costs. The cost of capital is represented by the *discount rate*. The higher the risk of an investment, the higher the return an investor would demand, therefore resulting in a higher discount rate.

A common proxy for deriving the level of risk is the stage of a company's development. Although risks between different startups and industries can vary greatly, it can be assumed that startups in the same industry and operating environment and at a similar stage of development would share a similar level of risk. Surely, each company may have its own unique considerations and circumstances that would require judgment calls and adjustments, but in general, the relationship between stage of development and discount rate can be summarized as shown below¹:

Relationship Between Discount Rate and Venture Rounds

Financing Round/Venture Stage	Discount Rate
Pre-Seed/Pre-revenue:	80%+
Angel/Seed:	50-70%
Series A/Early Growth:	40-60%
Series B/Growth:	30-50%
Bridge/Late-Growth/Pre-IPO:	25-35%



The discount rate is a crucial component of any valuation analysis, as it not only indicates the level of risk or rate of return required by investors, but also reflects the time value of money which needs to be accounted for when estimating the present value of the company.

Valuation Methods

Like many businesses, a startup can and should be valued using several methods. While some methods are more quantitative and assumption-heavy than others, all approaches will require a certain degree of judgment. The following five methods are described in further detail: Comparable Public Companies, Comparable Transactions, Discounted Cash Flow, Venture Capital Method and The Scorecard Method.

Comparable Public Companies

Publicly traded comparable company valuations can provide a good benchmark for a private company valuation.

¹ Sources: finyear.com; quora.com; flylib.com

A comparables analysis involves a few steps:

- 1) First, a peer group of comparable companies is selected through a screening process by considering the following factors, among others: size, industry, geography, product and service offerings, target market, common competitive advantages, areas of expertise, margins, capital structure and growth rate.
- 2) Once the comparable set is identified, trading multiples such as EV/Revenue, EV/EBITDA, P/B, P/E² and others are reviewed. Given that many startups are not profitable at early stages of development, revenue multiple such as EV/Revenue is typically the most relevant.
- 3) Means and medians are then calculated for relevant valuation metrics and applied to the target company's operating metric to arrive at a range of value estimates.

Certainly, there are limitations to this approach as it may be difficult to identify a set of truly comparable companies, but nonetheless, this is a practical method that provides a relative estimate of value. It is also important to note that if public market values are inflated or depressed, this may have an amplified effect on the startup's valuation.

Precedent Transactions

The precedent transactions method follows a process similar to the one described above, using relevant past M&A transactions for comparison. The availability of information on past deals is sometimes limited, which may restrict the effective use of certain multiples.

As with the public comparables method, the quality of analysis is highly dependent on how similar and relevant past deals are to the target company. It should be noted that precedent transaction valuation often results in higher ranges, reflecting a control premium, an amount that a buyer is willing to pay over the market price to acquire a controlling stake in the target company. Control premium can be assumed (typically between 20-40%) and added to the comparable companies valuation range for a fairer comparison between the two methods.

Discounted Cash Flow

The basic concept of a discounted cash flow (DCF) analysis is that a company's worth can be calculated as the present value of its future cash flows. The steps are summarized as follows:

- 1) The company's revenues are projected for the future five years (or more), based on past performance and market assumptions.
- 2) Free cash flow is then forecast:
 - a. Operating margin assumptions are applied to revenue projections to arrive at operating income.
 - b. Effective tax rate is then applied to calculate Net Operating Profit After Tax.
 - c. Non-cash charges, such as Depreciation & Amortization are added back.
 - d. Capital expenditures and changes in net working capital are subtracted to arrive at free cash flows.
- 3) A terminal value needs to be calculated to estimate the value of the business in the distant future (post the five year forecast period). The terminal value can be calculated by:
 - a. assuming that the business keeps operating indefinitely and thus treating it as a growing perpetuity; or
 - b. assuming that the company gets sold for a certain multiple. The multiple can be referenced from the comparables companies or precedent transactions.
- 4) The present values of all the above figures are derived using the discount rate and summed up to arrive at the final value.

² Please refer to Glossary for definition of terms

A DCF approach is the most academically correct method to value a mature business, but its relevance for early-stage companies is arguable. Startups' lack of comprehensive financial history, coupled with the approach's assumption-heavy nature, makes it easy to see why many VCs and valuers neglect this method. Nonetheless, it is a theoretically sound approach that may provide useful data and insight.

Venture Capital Method

The venture capital method is a valuation approach that is based on a company's current stage of financing and a typical rate of return required by investors at that stage (see the Discount Rate section).

For example, if a company has received a post-series A valuation of \$2M and is entering into a Series B round one year later, then the company's pre-series B valuation can be assumed to be equal to the value ascribed by Series A investors plus their expected typical required rate of return, which in this case is 50%. In this case, the implied valuation would be \$3M (\$2M growing at 50% for one year). While this method is a quick back-of-the-envelope calculation, it relies heavily on the assumption that the company is successfully and accurately following its growth plan and trajectory.

The Scorecard Method

This method is commonly used by angel investors because it is relatively quick, simple and applicable to pre-revenue startups. The main premise is to take an average valuation of a typical comparable startup (a "base-line") and adjust it according to different qualitative factors such as stage of development, competitive environment, market opportunity, and others.

As an example:

- 1) The first step is to determine a base-line valuation which is an average valuation for companies in a similar stage of development, industry and geographic region.
- 2) The next step is to compare the target startup to a similar average startup (from which base-line was determined) based on the qualitative factors such as, but not limited to:
 - a. Strength of the Management Team (0-30%)
 - b. Size of the Opportunity (0-25%)
 - c. Product/Technology (0-25%)
 - d. Barriers to Entry (0-20%)

The factors can also be weighted and weights are usually subjective and based on the valuator's judgement.

- 3) The weighted factors are then adjusted by the comparative grading of the startup and then summed.

Comparison Factor	Weight	Company Grade	Weighted Factor
Strength of the Management Team	30%	130%	39%
Size of the Opportunity	25%	100%	25%
Product/Technology	25%	80%	20%
Barriers to Entry	20%	130%	26%
Sum	100%		110%

- 4) The base-line is multiplied by the total weighted factor to derive an estimate of value relative to the base-line.

While this method is heavily skewed toward a qualitative assessment, it can provide a unique perspective and data point compared to other approaches.

Case Study

Qualimed³ is a Health IT company engaged in developing, distributing and supporting software solutions for maintenance scheduling for safety-critical medical devices. Qualimed delivers a software that ensures medical devices will perform reliably to deliver the best possible care to patients. This valuation assessment is performed as of Jan 1st 2019 and management has provided the following financial forecasts:

	2019	2020	2021	2022	2023
	Management Forecasts				
Revenue (\$ millions)	\$ 2.0	\$ 3.8	\$ 8.3	\$ 17.5	\$ 33.7
Growth Rate YoY (%)	125.0%	93.8%	119.6%	110.6%	92.8%
Gross Margin	1.9	3.3	7.2	14.8	28.2
Gross Margin (%)	98.7%	88.1%	86.9%	84.8%	83.5%

The company has no debt and has closed its latest financial round (pre-seed) at a \$2.1M post-money valuation at the end of 2015. The company is not seeking any further financing and is not planning any major capital investments at the moment.

Step 1: Discount Rate

Since Qualimed is an early-stage startup between its pre-seed and seed stage of financing with a finished product and some revenue history, a reasonable discount rate for Qualimed can be assumed at 50%.

Financing Stage	Investor Required IRR / Discount Rate			
Pre-Seed/Pre-revenue:	80%+			
Angel/Seed:	50-70%		Adjustment for Finished Product	-10%
Series A/Early Growth:	40-50%		Adjustment for Key Strategic Partnership	-10%
Series B/Growth:	30-50%		Adjustment for Pilot Revenue	-10%
Bridge/Late Growth/Pre-IPO:	25-35%		Qualimed Discount Rate	50%

Step 2: Public Comparables

Two sets of comparable companies have been identified: medical device software providers and non-healthcare maintenance solution providers.

Upon finalizing a comparable universe, the comparables table can be populated with the relevant financial data, including trading multiples.

³ Company name has been changed, however comparable companies in the case study are real.

Company Name	Market Cap (CAD M)	Enterprise Value (CAD M)	Total Revenue LTM (CAD M)	Gross Margin % LTM	EBITDA Margin % LTM	TEV/ Revenue	TEV/ EBITDA
Medical Device Software Providers							
Volpara Health Technologies Ltd	103	95	2	61%	-	50.9x	NM
INFINITT Healthcare	275	234	80	55%	13%	2.6x	20.8x
Intrasense Société anonyme	10	10	5	-33%	-50%	1.9x	NM
Mach7 Technologies Limited	40	35	9	-10%	-89%	3.6x	NM
Median Technologies SA	174	117	11	-75%	-190%	10.0x	NM
Nexus AG	676	631	191	31%	18%	3.1x	17.2x
Pro Medicus Limited	893	870	32	99%	47%	25.9x	55.2x
RaySearch Laboratories AB	779	776	90	94%	29%	8.7x	29.6x
Medical Device Software Providers - Average (excl. outliers)				33%	11%	9.0x	25.2x
Medical Device Software Providers - Median				43%	13%	6.2x	25.2x
Non-Healthcare Maintenance Solution Providers							
Digital China Information Service Ltd.	2232	2425	1503	21%	5%	1.5x	30.4x
Ideagen plc (AIM:IDEA)	397	386	55	91%	16%	6.6x	42.6x
Infotel SA	584	510	294	54%	12%	1.6x	13.4x
Quotium Technologies SA	57	47	5	65%	47%	9.1x	19.5x
Luxoft Holding, Inc.	1922	1833	1101	38%	11%	1.6x	15.2x
Maintenance Solution Providers - Average (excl. outliers)				52%	13%	3.3x	21.7x
Maintenance Solution Providers - Median				54%	12%	1.6x	19.5x
Peer Group Average				43%	12%	6.1x	23.5x
Peer Group Median				48%	12%	3.9x	22.4x

	Low	High
Qualimed 2023 Revenue	\$ 33.7	\$ 33.7
EV/Revenue Multiple (Median / Mean)	3.9x	6.1x
Size and Illiquidity Discount	-40%	-40%
Future Growth Discount	-10%	-10%
Adjusted Multiple	1.9x	3.1x
Qualimed Value Estimate 2023	65.6	103.3
Cost of Capital / Discount Rate	50%	50%
Present Value Factor	0.13	0.13
Qualimed Present Value	8.6	13.6

To arrive at an estimate of value for Qualimed, public market multiples for EV/Revenue are adjusted to account for the company's size and illiquidity. Given the use of 2023 revenue, the multiples are also further discounted to account for reduced growth prospects in 2023 compared to today. The valuation range for this approach turns out to be between \$8.6M and \$13.6M.

Step 3: Precedent Transactions

The process for the Precedent Transactions valuation is similar to the process used for publicly traded comparable companies. First, a transactions universe is selected. Then, financial data for comparable transactions is populated and multiples are calculated from those deals.

Date	Buyer	Target	Target Enterprise Value (CAD M)	Target LTM Revenue (CAD M)	Target LTM EBITDA (CAD M)	TEV/Revenue	TEV/EBITDA
Feb-18	Varian Medical Systems	Mobius Medical Systems, LP	-	-	-	-	-
Dec-14	Ideagen PLC	Gael Limited	32.7	14.1	2.8	2.3x	11.6x
Apr-14	TexRAD Limited	Feedback PLC	0.3	1.4	-	0.2x	-
Dec-13	Constellation Software	Total Specific Solutions (TSS) B.V.	349.4	228.7	-	1.5x	-
Mar-12	Varian Medical Systems	Infimed, Inc.	14.9	14.9	-	1.0x	-
Jun-11	Elekta AB	Nucletron B.V.	510.5	170.7	34.7	3.0x	14.7x
May-10	N/A: (Spin-off by MGT Capital)	Medicsight PLC	2.7	0.5	-8.2	5.4x	-
May-10	Elekta AB	Resonant Medical Inc.	30.0	-	-	-	-
Jan-08	Elekta AB	CMS, Inc.	75.0	60.6	-	1.2x	-
Feb-05	Nuance Communications	Commissure LLC	36.3	0.4	-2.0	82.5x	-
Feb-05	Analogic Corporation	Merge Healthcare Canada Corp.	412.4	63.5	22.2	6.5x	18.6x
Jan-05	Elekta AB	IMPAC Medical Systems, Inc.	240.6	85.6	9.8	2.8x	24.5x
Average (excl. outliers)						3.0x	17.4x
Median						2.6x	16.7x
<div style="background-color: #e0e0e0; padding: 2px;"> More comparable transactions </div>							

	Low	High
Qualimed 2023 Revenue	\$ 33.7	\$ 33.7
EV/Revenue Multiple (Median / Mean)	2.6x	3.0x
Future Growth Discount	-10%	-10%
Adjusted Multiple	2.3x	2.7x
Qualimed Value Estimate 2023	77.9	90.3
Cost of Capital / Discount Rate	50%	50%
Present Value Factor	0.13	0.13
Qualimed Present Value	10.3	11.9

Finally, mean and median multiples are applied to Qualimed's 2023 revenue and subsequently adjusted to arrive at a Precedent Transactions valuation range of \$10.3M to \$11.9M.

Step 4: Discounted Cash Flows

The DCF analysis is based on several assumptions as well as the forecast of free cash flows.

Assumptions								
Tax Rate	30%	Midpoint Revenue Multiple (Precedent Transactions)				2.5x		
Working Capital as % of Revenue Change	20%	Discount Rate - Mid-point				50%		
Terminal Growth Rate	5%							
Projections								
	2019	2020	2021	2022	2023	2024	2025	
	Management Forecasts					Estimates		
Revenue (\$ millions)	\$ 2.0	\$ 3.8	\$ 8.3	\$ 17.5	\$ 33.7	\$ 47.2	\$ 61.4	
Growth Rate YoY (%)	125.0%	93.8%	119.6%	110.6%	92.8%	40.0%	30.0%	
Gross Margin	1.9	3.3	7.2	14.8	28.2	37.8	42.9	
Gross Margin (%)	98.7%	88.1%	86.9%	84.8%	83.5%	80.0%	70.0%	
EBITDA	(0.4)	(0.8)	1.6	8.6	19.6	23.6	27.6	
EBITDA Margin (%)	-20.5%	-20.1%	18.8%	49.0%	58.2%	50.0%	45.0%	
Less: Taxes at 30.0%	-	-	0.5	2.6	5.9	7.1	8.3	
Less: CAPEX	-	-	-	-	-	-	-	
Less: Changes in Working Capital	0.4	0.4	0.9	1.8	3.2	2.7	2.8	
Free Cash Flow	(0.77)	(1.1)	0.2	4.2	10.5	13.8	16.5	
Discount Years	1	2	3	4	5	6	7	
PV Factor at 50.0%	0.67	0.44	0.30	0.20	0.13	0.09	0.06	
PV of Free Cash Flows	(0.5)	(0.5)	0.1	0.8	1.4	1.2	1.0	

Once the PV of Free Cash Flows is derived, the Terminal Value can be calculated using two methods: *Perpetual Growth* and *Exit Multiple*.

DCF Analysis Output	
Perpetuity Growth Model	
Discount Rate	50.0%
Terminal Growth Rate	5.0%
Terminal Free Cash Flow	16.5
Perpetuity Value	38.5
PV of Perpetuity Value	2.3
PV of Free Cash Flows	3.4
Enterprise Value	5.7
Exit Multiple Model	
Exit Multiple	2.5x
Terminal Revenue	61.4
Terminal Value	153
PV of Terminal Value	9.0
PV of Free Cash Flows	3.4
Enterprise Value	12.4

		Terminal Growth Rate		
		4.0%	5.0%	6.0%
Discount Rate	40%	6.2	6.3	6.4
	50%	5.6	5.7	5.8
	60%	5.2	5.3	5.3

		Exit Multiple		
		2.0x	2.5x	3.0x
Discount Rate	40%	17.0	19.9	22.8
	50%	10.6	12.4	14.2
	60%	6.8	7.9	9.1

Terminal Value is then added to the PV of Free Cash Flows to arrive at the final DCF valuation range of \$5.7M and \$12.4M.

Step 5: Venture Capital Method

At the end of 2015, Qualimed was assigned a valuation of \$2.1M at the pre-seed stage of financing. Assuming the company has been progressing as expected by the pre-seed investors, the company will have generated 80-100% in annual returns (pre-seed discount rate).

	Low	High
Qualimed 2015 Pre-seed Valuation (M)	\$ 2.1	\$ 2.1
Time Horizon (Years)	3	3
Required ROI Range	80%	100%
Qualimed Present Value	\$ 12.2	\$ 16.8

Using this information, we can arrive at the Venture Capital value range of \$12.2M to \$16.8M.

Step 6: Scorecard

Qualimed is assessed on qualitative factors relative to its comparable startup peers.

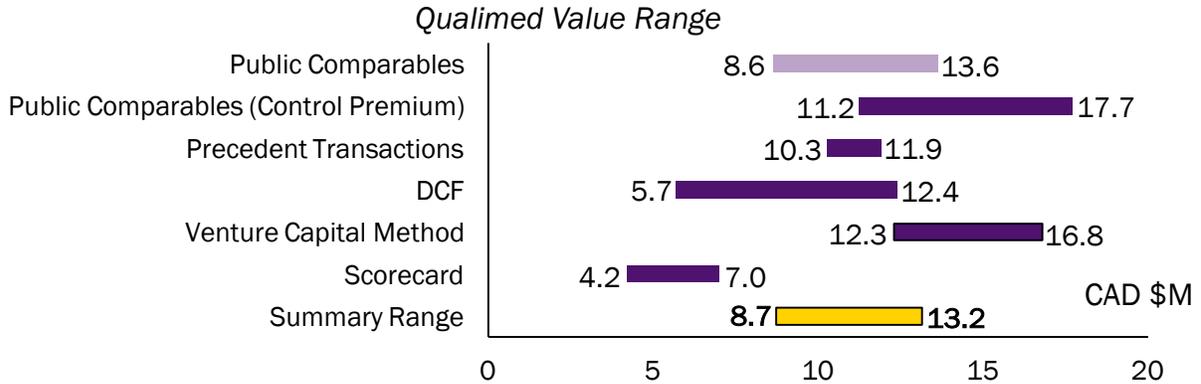
Company Characteristic	Weight	Qualimed Score	Factor	Comments
Strength of the management team	0.18	125%	0.23	Co-founded by a successful serial entrepreneur and an industry expert
Size of the opportunity	0.18	150%	0.27	Considering radiotherapy and radiology markets together
Product / technology	0.18	150%	0.27	The first product for radiotherapy is complete
Competitive environment	0.16	150%	0.24	First mover advantage
Marketing / sales / partnerships	0.16	150%	0.24	Key partnership with Elekta
Need for additional investment	0.14	100%	0.14	
Sum			1.39	

	Low	High
Base-line valuation	\$ 3.0	\$ 5.0
Scorecard Factor for Qualimed	1.39	1.39
Qualimed Value Estimate	4.2	7.0

Base-line value range of \$3M-\$5M is based on the valuation of an average Canadian seed-stage startup in the medical device space. The Scorecard Method results in the range of \$4.2M to \$7M.

Step 7: Football Field

For a clearer visual depiction, the valuation ranges from different methods can be plotted on a 'Football Field' diagram to determine the final summary range. The summary range is calculated as the average of all methods and, in this case, is **between \$8.7M and \$13.2M**.



Final Thoughts

Valuing a business is a challenging task that requires forecasting a company's future financial performance, which is by definition uncertain. Early-stage companies do not just lack a comprehensive financial record, they are also influenced by a greater variety of factors to which judgement and experience needs to be applied. This makes the combination of different principles and methods, both quantitative and qualitative, important in arriving at a "working range" of a company's valuation.

The Black Box Institute is a boutique advisory firm and think tank that provides purposeful and thoughtful guidance to clients. We specialize in complex business, transactional and organizational challenges. Our problem solving techniques incorporate a blend of traditional strategy and financial advisory capabilities with creative design thinking.



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Glossary of Terms

Angel Investor - usually a high net worth individual who provides financial backing for small startups or entrepreneurs.

Discount Rate⁴ - rate of return used to discount future cash flows generated by an asset back in time to estimate a present value of an asset. Also referred to as Required Rate of Return and Cost of Capital.

EBITDA - Earnings before Interest, Depreciation and Amortization.

Enterprise Value - measure of a company's total value including all its securities: debt, shares, etc.

Exit Multiple - method of estimating terminal value of an asset based on the assumption that capital transaction will occur at the end of the projected cash flow period and it will be executed at a valuation multiple comparable to the market.

Intrinsic Value - a calculated estimate of a value based on tangible and intangible factors, fair assumptions and predictions.

Market Value/Price - the most recent market price point of an asset.

P/E multiple - valuation multiple corresponding to Market Price to Earnings Per Share ratio.

P/B multiple - valuation multiple corresponding to Market Price to Book Value per share.

Perpetual Growth - method of estimating terminal value of an asset based on the assumption of a constant stream of identical cash flows with no timeline end.

Post-money Valuation - how much the company is worth after the latest capital injection.

Pre-money Valuation - the value of a company not including the latest round of funding.

Private Equity (PE) - capital that is not listed on a public exchange. Private equity is composed of funds and investors that directly invest in private companies, or that engage in buyouts of public companies, resulting in the delisting of public equity.

Seed Funding - initial funding used to begin creating a business or a new product.

Series A Funding - first time the company is financed by external institutional investors.

Series B, C... Funding - venture financing rounds subsequent to Series A.

Terminal Value - or horizon value, determines the value of a business or project beyond the forecast period when future cash flows can be estimated, typically five to seven years.

Venture Capital (VC) - financing that investors provide to startup companies and small businesses that are believed to have long-term growth potential. One important difference between venture capital and other private equity deals, is that venture capital tends to focus on emerging companies seeking substantial funds for the first time, while private equity tends to fund larger, more established companies that are seeking an equity infusion or a chance for company founders to transfer some of their ownership stake.

Venture Round - discrete round of investment, by which startup companies raise money to fund operations, expansion, a capital project, or some other business purpose.

⁴ The term refers to many things. The provided definition reflects the context of the article.

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