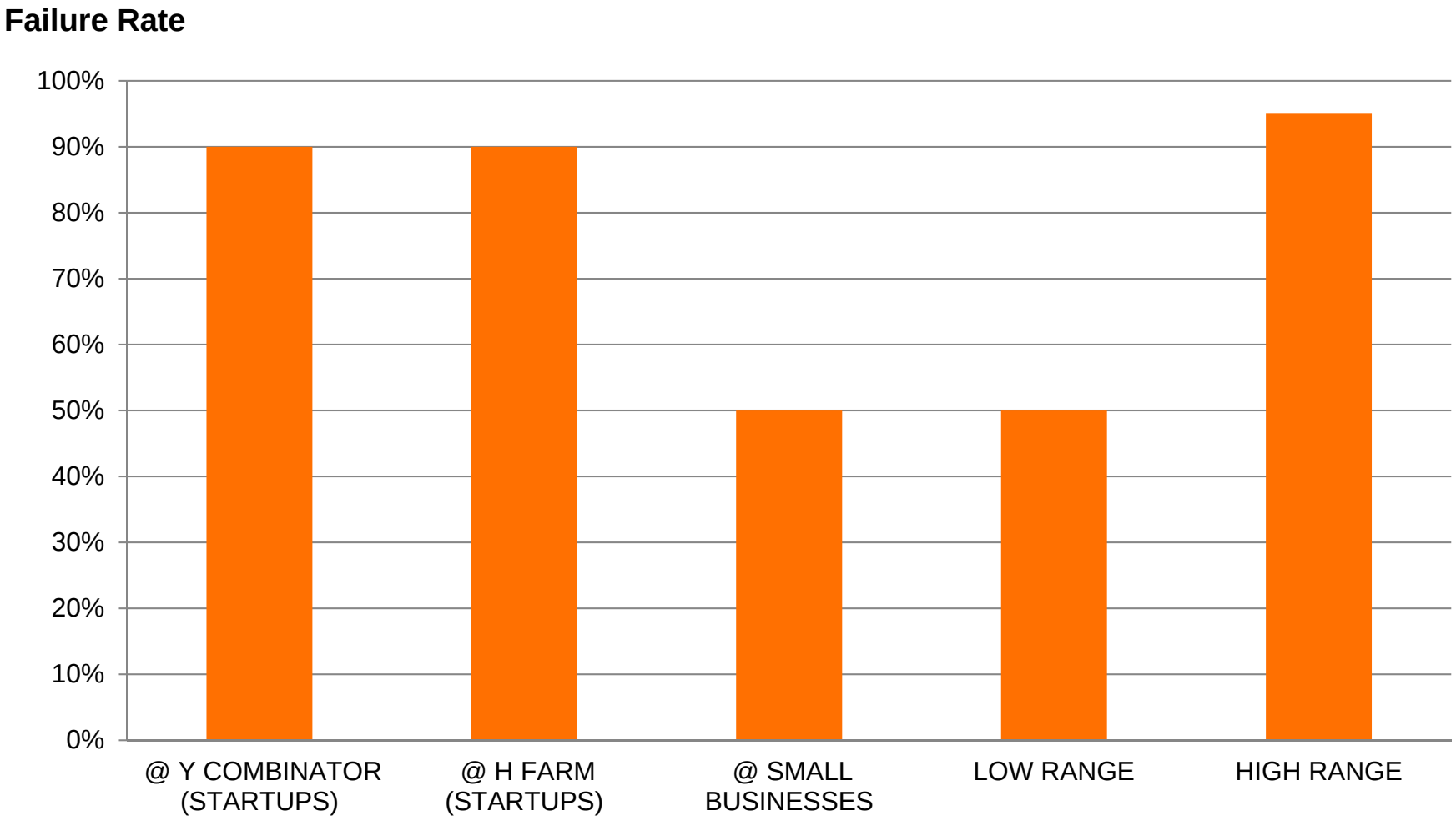
Ordine dei
Dottori Commercialisti
e degli Esperti Contabili
di Ivrea, Pinerolo, Torino

Innovazione e Valutazione delle Start-Up

Torino, 11 aprile 2017

Stefano Branca
sbranca@unito.it
sbranca@3hpartners.com

Dietro ogni Start-up c'è un ampio spettro di rischio e di incertezza…

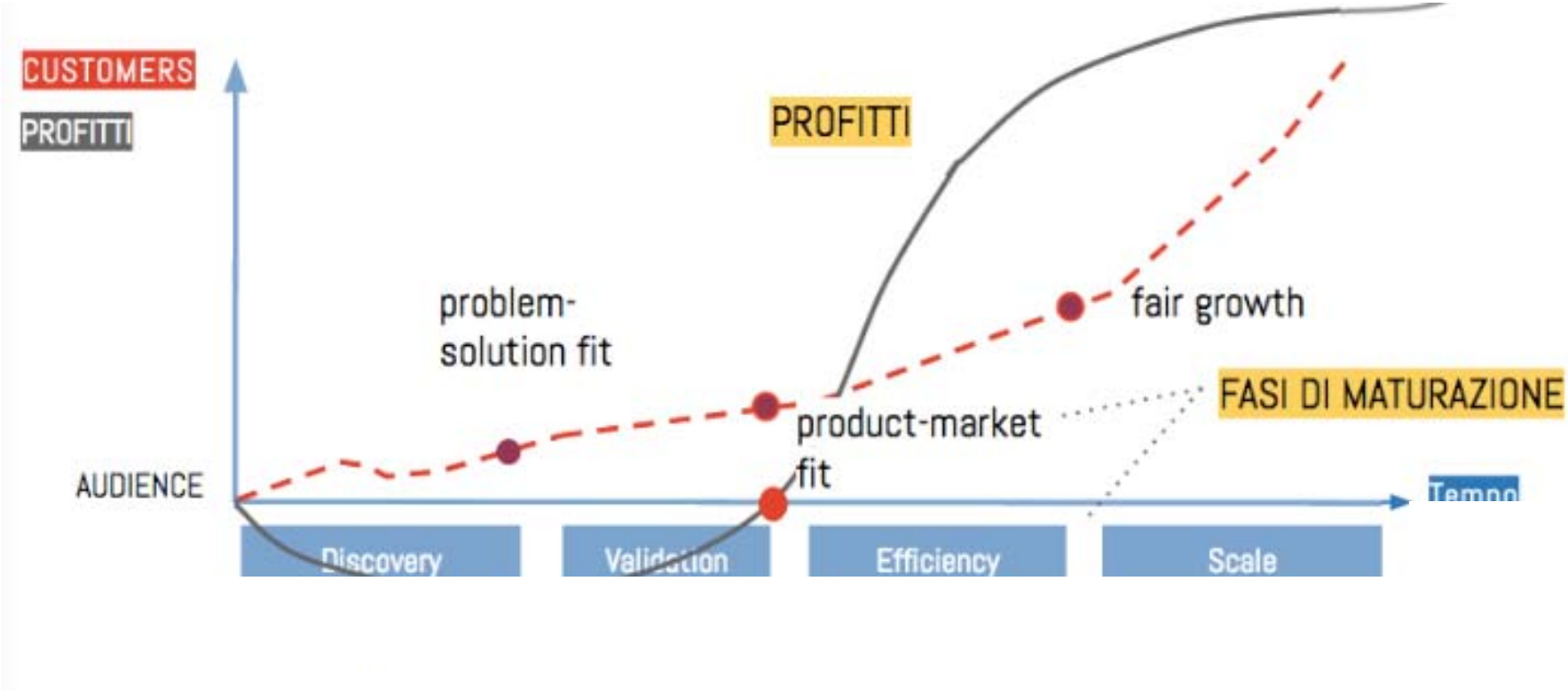


Fonte: http://hbswk.hbs.edu/pdf/item/6496.pdf; Adams, Marjorie. "Findings from the PDMA Research Foundation CPAS Benchmarking

…ma questo non è un buon motivo per rinunciare ad utilizzare un metodo di valutazione

In fase di early stage, determinare il valore d'azienda non è facile dato il livello di incertezza, dato che non esistono ancora un fatturato, una reputazione, dei bilanci.

I metodi di valutazione tradizionali standard non sempre si possono applicare, quindi come si risolve il problema della valutazione?



Per cominciare, occorre separare il concetto di valutazione pre-money e post-money

Valore pre-money: valore della start-up al momento dell'investimento

Valore post-money: valore della start-up dopo l'investimento

Gli investitori tipicamente utilizzano una valutazione pre-money per determinare la quota da richiedere in cambio del capitale investito.
La comprensione del valore pre e post-money è determinante per calcolare l'effetto di diluizione.

***Esempio**: un investitore ottiene il 20% della Start-Up A a fronte di un investimento di 10m€*

***Valore post-money:** 10m€ x (100 / 20) = 50m€*

***Valore pre-money:** 50m€ - 10 m€ = 40 m€*

Il fondatore ha un effetto diluizione che lo porta all'80%

Nel tempo sono stati sviluppati diversi metodi per valutare il pre-money di una start-up

	Metodo	Descrizione
Pre-Revenue	**1) Venture Capital**	Calcola il valore sulla base del Valore di Uscita (Exit Value) e del ROI atteso sull'investimento
	2) Berkus	Calcola il valore sulla base di 5 fattori di successo: *Idea* (valore base), *prototype* (tecnologia), *management* (esecuzione), *go-to-market* (mercato), *roll-out or sales* (scalabilità produttiva/ di ricavi)
	3) Scorecard (Payne)	Il valore base viene adeguato sulla base di 12 fattori di rischio ponderati: 1.*management, 2.stage, 3.legislation/political risk, 4.manufacturing risk, 5.Sales and marketing risk, 6.funding/capital raising risk, 7.competition risk, 8.Technology risk, 9.Litigation risk, 10.International risk, 11.Reputation risk, 12.Potential lucrative exit*
	4) Risk Factor Summation	Il valore base viene adeguato sulla base di 6 fattori di rischio ponderati: *1.Management (30%), 2.Size of opportunity (25%), 3.Product or Service (10%), 4.Sales channels (10%), 5.Stage of business (10%), 6. Other factors (15%)*
	5) Transazioni Comparabili	Il valore viene determinato sulla base di una serie di multipli relativi a transazioni comparabili: e.g. numero di POS (retail), WAU (app)
Post-Revenue	**6) First Chicago**	Calcola il valore sulla base della media ponderata della probabilità di diversi scenari alternativi: base, best e worst
	7) Discunted Cash Flow	Il valore è determinato sulla base dei flussi di cassa attualizzati prospettici dell'azienda

Il Venture Capital Method (Sahlman, 1987)

Anticipated exit — Target ROI — Post-money valuation

$100M / 20x = $5M

Amount invested — Pre-money valuation before adjusting for dilution

$5M – $1M = $4M

Anticipated dilution of 30% — Pre-money valuation after adjusting for dilution

$4M x 70% = $2,8M

Table 2: Venture Capital Target Rates of Return – Stage in Life Cycle

Stage of development	*Typical target rates of return*
Start up	50-70%
First stage	40-60%
Second stage	35-50%
Bridge / IPO	25-35%

Fonte: Damodaran (2009)

Descrizione

- Il calcolo si basa ROI atteso e sul Terminal Value presumendo che non vi siano sostanziali variazioni nella quota di partecipazione dell'investitore fino al momento dell'exit o del disinvestimento
- Per individuare il Terminal Value si possono utilizzare vari metodi: multipli di uscita o (raramente) il DCF
- Il ROI anticipato, invece, dipende dalla rischiosità dell'investimento. In generale è plausibile aspettarsi che 9 investimenti su un portfolio di 10 falliscano o non siano in grado di offrire un ROI superiore all'1x. Per questo motivo, tutti gli investimenti, prima di essere effettuati, devono essere plausibilmente in grado di offrire un ritorno tra 10x e 30x

Il rendimento annuale di un investimento che fa 20x in 5 anni è l'83%...ma in un portafoglio di 10 investimenti, di cui 9 insuccessi, il range è il 15-25%

Un investimento che fa 20x in 5 anni deve avere un ROI dell'83%

Investimento (€)	1
Rendimento (%)	83%
Anni	5
Terminal Value (€)	**20,5**

In un portafoglio di 10 investimenti, di cui 9 falliscono, il ritorno è il 15%

# investimenti da 1€	10
Rendimento (%)	15%
Anni	5
Terminal Value	**20,1**

Un portafoglio di 10 investimenti da 1€, di cui uno ritorna 20x e gli altri 1x, il rendimento è il 24%

# investimenti da 1€	10
# investimenti ritorno 1x	9
# investimenti ritorno 20x	1

Anni	0	1	2	3	4	5
Euro	-10,0	0,0	0,0	0,0	0,0	29,1
TIR	**24%**					

Il motore del valore è sostanzialmente basato su 3 fattori chiave

VALORE: identificare un modello di business che sia in grado di generare profitto

CRESCITA: il modello deve poter essere scalato facilmente ed in poco tempo mantenendo la profittabilità

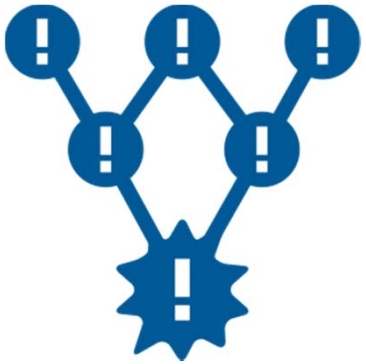
SOSTENIBILITA': la start-up deve essere in grado f strategic initiative is not easily replicable by competitors and fully integrated into the organization

Source: Sola (2012)

Il professionista può supportare lo *"startupper"* nella gestione dell'incertezza rispettando i 4+1 principi della "creative entrepreneurship"…

La **Creative Entrepreneurship** è la capacità di disciplinare la creatività per identificare e misurare un'**Opportunità** (non un'idea), per costruire un **Modello di Business** su di essa

1



Distinguere tra un'Opportunità e un'Idea

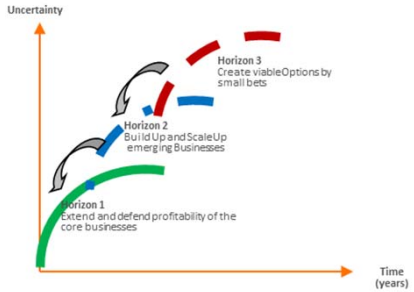
2

Disciplinare con un processo la "creatività" dello startupper

3

Costruire un Sistema di impresa sostenibile e scalabile

4



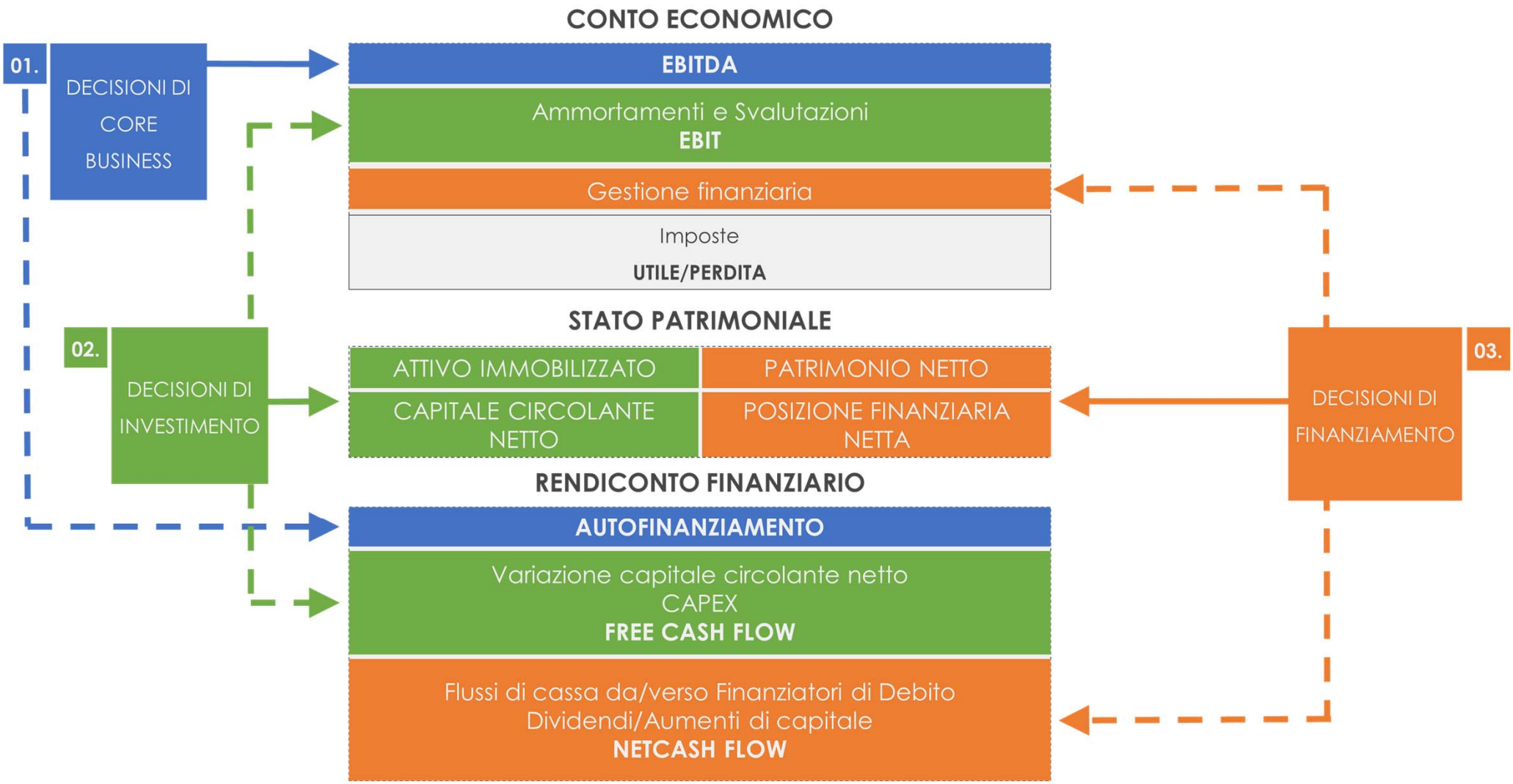
Bilanciare gli obiettivi su 3 orizzonti temporali

+1

Guidare la Capacità di Esecuzione

Source: Sola (2012)

…e ricordando l'ordine con cui un imprenditore deve prendere le decisioni



"The optimal amount raised is the maximal amount which, in a given period, allows the last dollar raised to be more useful to the company than it is harmful to the entrepreneur"
Pierre Entremont – Otium Capital

Back-Up

The Venture Capital Method is a simple net present value method that takes the perspective of the investor instead of the firm

Approach

- The Basic Venture Capital Method is sometimes explained in the language of internal rates of return (IRR) and sometimes in term of NPV. To illustrate the method we use a financial start-up company called "SpiffyCalc" that is seeking financing from a Venture Capital* fund by the name of "Vulture Venture"

SpittyCalc contest

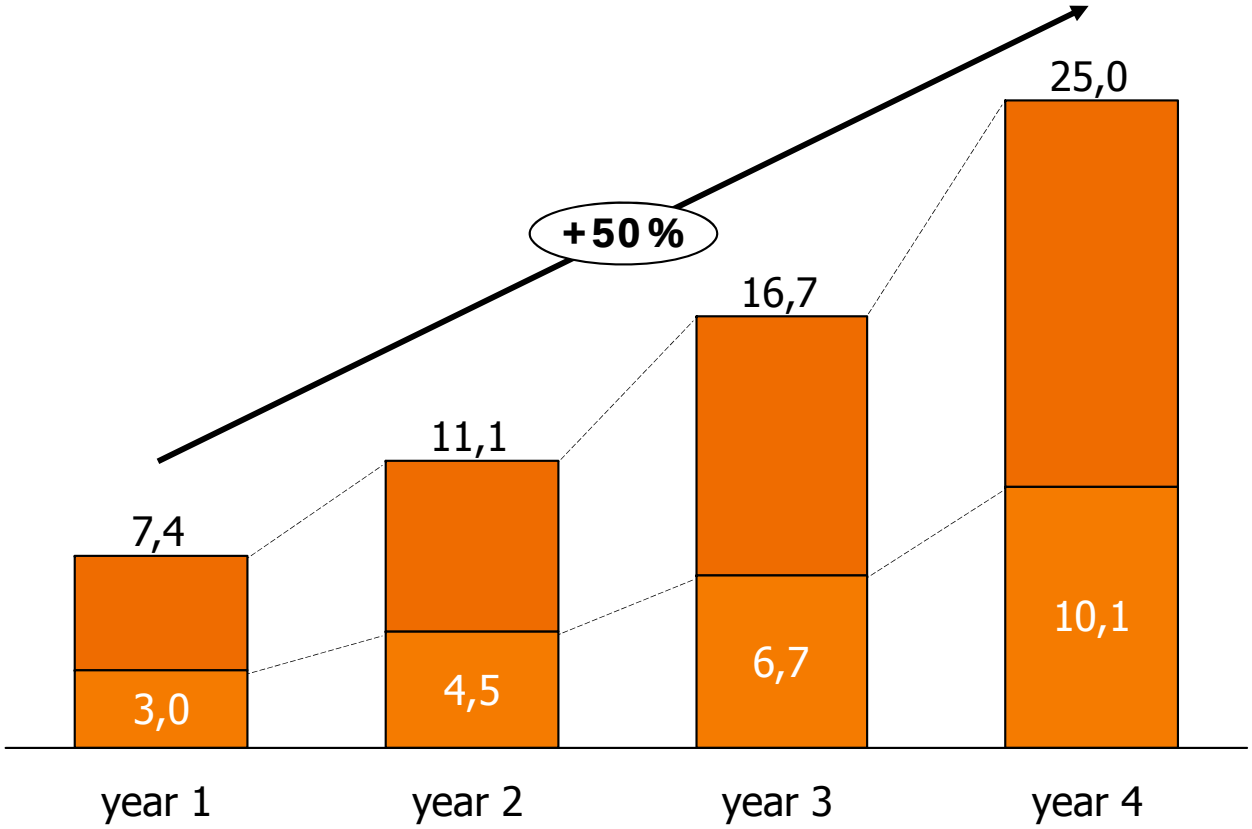
"The founders of SpiffyCalc" expect to be able to sell the company for $25 million in four years. At this point they need to raise $3 million. Vulture Ventures considers this a risky business and wants to apply a discount rate of 50 percent to be adequately compensated for the risk they will bear. The entrepreneurs also decided that whatever valuation they would get, they wanted to own 1 million shares, e.i a majority interest, which they thought would be a cool number to brag about"

* Venture Capital or everyone who invests in the early stage

Case datas

SpiffyCalc situation

- V = terminal value (at time of exit) = $25 million (in four years)
- t = time to exit event = 4 years
- I = amount of investment = $3 million
- r = discount return used by investors = 50 percent
- x = number of existing shares (owned by entrepreneurs) = 1 million (majority)



The VC Method can be approach with simple five step procedure….

Step	Description	Example
1 **Determine the post-money valuation**	• $POST = V/ (1+r)^{t}$	• $POST = 25/ (1+0.5)^{4} = 4.938$ Ml
2 **Determine the pre-money valuation**	• PRE = POST - I	• PRE = 4.938 - 3 = 1,938 Ml
3 **Determine the investor ownership fraction**	• F* = I/POST	• F* = 3/ 4.938 = 0.6075
4 **Obtain the number of shares**	• y = x [F/(1-F)]	• y = 1,000,000* [0.6075/(1-0.6075)] = 1,547,771
5 **Obtain the price of shares**	• $p_1 = I/y$	• $p_1 = I/y$ = \$3 Ml/1,547,771 = \$ 1.94

* F is the required ownership fraction for the investor

Solution VC Method (1/2)

Step 1: Determine the post-money valuation

The only positive cash flow in this model occurs at the time of exit (typically an IPO or an acquisition), where we measure the terminal value of the company, denoted by V = $ 25 million. This means that after receiving the required $3 milion, the initial value of the company is simply the discounted terminal value in 4 years`time.

If Vulture Venture is using a discount rate of 50 percent, the NPV of the terminal value in four years is:

- $V/ (1+r)^{t}$ =$25 milion / $(1+0,5)^{4}$ = $ 4,938,272 = POST

This is called the post money valuation, i.e., the value of the company once the initial investment has been made.

Step 2: Determine the pre-money valuation

Subtracting the cost of the investment of $3 million from the post-money valuation yields:

- PRE = $ 1,938,272 = POST - I

This is called the pre money valuation

Solution VC Method (2/2)

Step 3: Determine the ownership fraction

Vulture Ventures is investing $3 million in a venture valued at $ 4,938, 272. In order to get back its money it therefore needs to own a sufficient fraction of the company. If they own a fraction:

- F = $3 milion / $ 4,938,272 = 60.75 percent, they get their required rate of return on their investment.

Step 4: Obtain the number of shares

The actual outstanding shares are of 1 million. When Vulture Venture makes its investment it needs to calculate the number of shares required to achieve its desired ownership fraction. In order to obtain a 60.75 percent owned by the founders (x=1 million) and y be the number of shares that Vulture Venture requires:

- Y = x * (F/1-F) and so:
- Y = 1,000,000 * [0,6075/(1-0,6075)]= 1,547,771

Vulture Venture thus needs 1,547,771 shares to obtain their desired 60.75 percent of the company

Step 5: Obtain the price of shares

The price of shares is thus given by :

- $3 million / 1,547,771 = $1.94

This give a Value of the entrepreneur's shares ⇨ **1,000,000 * 1.94 = 1,938,272 $**

Analysis: Sensitivity Analysis with the Basic Venture Capital Method

It is interesting to do some sensitivity analysis. So we will examine the effect of changing five assumptions:

¶ Variation 1: reduce the terminal value by 10 percent

¶ Variation 2: increase IRR by 10 percent

¶ Variation 3: increase investment by 10 percent

¶ Variation 4: increase time by 10 percent

¶ Variation 5: increase the number of exiting shares: this has no effect on any real values

Single period NPV method		Base Model	Variatio 1	Variation 2
Exit value	V	$ 25.000.000,00	**$ 22.500.000,00**	$ 25.000.000,00
Time to exit	t	4	4	4
Discount rate	r	50,00%	50,00%	**60,00%**
Investment amount	I	$ 3.000.000,00	$ 3.000.000,00	$ 3.000.000,00
Numeber of existing shares	x	1.000.000	1.000.000	1.000.000
Post-Money	POST	$ 4.938.272	$ 4.444.444	$ 3.814.697
Pre-Money	PRE	$ 1.938.272	$ 1.444.444	$ 814.697
Ownnership fraction of investors	F	60,75%	67,50%	78,64%
Ownnership fraction of entrepreneurs	1-F	39,25%	32,50%	21,36%
Number of new shares	y	1.547.771	2.076.923	3.682.349
Price per share	p	$ 1,94	$ 1,44	$ 0,81
Final wealth of investors		$ 15.187.500,00	$ 15.187.500,00	$ 19.660.800,00
Final wealth of entrepreneurs		$ 9.812.500,00	$ 7.312.500,00	$ 5.339.200,00
NPV of investors` wealth		$ 3.000.000,00	$ 3.000.000,00	$ 3.000.000,00
NPV of entrepreneurs` wealth		$ 1.938.272	$ 1.444.444	$ 814.697

Single period NPV method		Variation 3	Variation 4	Variation 5
Exit value	V	$ 25.000.000,00	$ 25.000.000,00	$ 25.000.000,00
Time to exit	t	4	**4,4**	4
Discount rate	r	50,00%	50,00%	50,00%
Investment amount	I	**$ 3.300.000,00**	$ 3.000.000,00	$ 3.000.000,00
Numeber of existing shares	x	1.000.000	1.000.000	2.000.000
Post-Money	POST	$ 4.938.272	$ 4.198.928	$ 4.938.272
Pre-Money	PRE	$ 1.638.272	$ 1.198.928	$ 1.938.272
Ownnership fraction of investors	F	66,83%	71,45%	60,75%
Ownnership fraction of entrepreneurs	1-F	33,18%	28,55%	39,25%
Number of new shares	y	2.014.318	2.502.235	3.095.541
Price per share	p	$ 1,64	$ 1,20	$ 0,97
Final wealth of investors		$ 16.706.250,00	$ 17.861.700,15	$ 15.187.500,00
Final wealth of entrepreneurs		$ 8.293.750,00	$ 7.138.299,85	$ 9.812.500,00
NPV of investors` wealth		$ 3.300.000,00	$ 3.000.000,00	$ 3.000.000,00
NPV of entrepreneurs` wealth		$ 1.638.272	$ 1.198.928	$ 1.938.272

The treatment of Option Pools

One subtle point in this calculation is the treatment of an employee option pool. Most venture capital deals include a non trivial amount of shares for the option pool.

This option pool will be depleted over times as the company hires executives and other employees.

Usually the entrepreneurs` shares and the option pool are lumped into one.

Consider this example:

	BASE	OPT PULL
PRE	• 1.938 Ml	• 1.938 Ml + 1
POST	• 4.938 Ml	• 5.938 Ml
Investment amount	• 3 Ml	• 3 Ml

With two option pool we can have:

1. VC buy less shares
2. Post money value increase

Step by step all the formulas…

Step	Description
1	• $W = I\,(1+r)^{t}$ • con W the amount of wealth investors expect to accumulate
2	• $F = W/V$ • con F the fraction of shares ownership require by investors
3	• $y = x[F/(1-F)]$ • y is the number of shares the investors require to achieve their desired ownership fraction
4	• $p_1 = I/y$ • p_1 is the price for share
5	• $POST = I/F$ or $POST = p_1 * (x+y)$ • POST is the post-money valuation
6	• $PRE = POST - I$ or $PRE = p_1 * x$ • PRE is the pre-money valuation

* F is the required ownership fraction for the investor

IRR: an alternative phrasing of the Venture Capital Method of IRR

The so called venture capital method is often explained in the language of IRRs. While the IRR is often a problematic method in finance, our venture capital method is sufficiently simple that the IRR and the NPV method give exactly the same answer.

Step by step all the formula…

Step	Description	Example
1	• $W = I (1+r)^t$ • con W the amount of wealth investors expect to accumulate	• $W = I (1+r)^t = 3$ Ml $(1+0.5)^4 = 15.2$ Ml
2	• $F = W/V$ (V=the value of the end of the period) • con F the fraction of shares ownership require by investors	• $F = W/V = 15.2/25$ Ml $= 0.6075$
3	• $y = x[F/(1-F)]$ • y is the number of shares the investors require to achieve their desired ownership fraction	• $y = x[F/(1-F)] = 1{,}000{,}000\ [0.6075/(1-0.6075)] = 1{,}547{,}771$
4	• $p_1 = I/y$ • p_1 is the price for share	• $p_1 = I/y = 3$ Ml / 1,547,771 = \$1.94
5	• $POST = I/F$ or $POST = p_1 * (x+y)$ • POST is the post-money valuation	• POST = 3 Ml/0.6075 = \$1.94 * (1,000,000+1,547,771) = \$ 4.94 Ml
6	• $PRE = POST - I$ or $PRE = p_1 * x$ • PRE is the pre-money valuation	• PRE = \$4.94 Ml - \$3 Ml = \$1.94 * 1,000,000 = \$ 1.94 Ml

Step 1: Determine the future wealth that Vulture Ventures needs to obtain in order to achieve their desired IRR

When Vulture Venture decides to invest in a company, it formulates a "desired rate of return". Suppose that Vulture Ventures is asking for 50 percent IRR. Also SpittyCalc needs to accumulate in order to achieve its desired return.

Vulture Ventures would want to make:

- $3 million x (1,5)^4 = $ 15,187,500 in three years

Step 2: Determine the of shares that Vulture needs to hold in order to achieve the desired IRR

To find out the required percentage of shares that Vulture Ventures need to achieve 50 percent IRR, we simply divide its required wealth by the estimated value of company, i.e.:

- $ 15,187,500/ $ 25 million = 0.6075.

Vulture Ventures would thus need 60.75 percent of the shares

Step 3: Determine the number of shares

When Vulture Ventures makes its investment it needs to calculate the number of shares required to achieve its desired ownership fraction. We assume that the founders of SpittyCalc issued themselves 1,000,000 shares, and nobody else owns any other shares. We the calculate how many shares Vulture Ventures needs ti obtain a 60.75 percent ownership share the company.

Using the same reasoning as before let x be the number of shares owned by the founders (x=1,000,000) and y be the number of shares of Vulture Ventures requires, then y/(1,000,000+y)= 0.6075).
After some algebric transformation we have:

- y= 1,000,000 [0.6075 / (1-0.6075)] = 1,547,771.

Vulture Ventures thus need 1,547,771 shares to obtain their desired 60.75 percent of the company

Step 4: Determine the price of shares

Given that Vulture Ventures is investing $3 million, the price of share is:

- $ 3 million/ 1,547,771 = $ 1.94.

Step 5: Determine post-money valuation

The post-money valuation can actually be calculate in a number of ways.

1. If investment of $3 million buys 60.75 percent of the company:
   - 60.75 percent * post-money valuation = $3 million

   And so:
   - Post-money valuation = $3 million / 0.6075 = $ 4,938,272
2. To note that there are 2,547,771 shares in the company that are valuated at $ 1.94, so:
   - Post-money valuation = 2,547,771 * 1.94 ~ $ 4,94 million (allowing for rounding error)

Step 6: Determine pre-money valuation

The pre-money valuation we simply substract the value of the VC`s investment from the post-money valuation:

• $ 4,938,272 - $ 3 million = 1,938,272.

Another way of calculating the pre-money valuation is to evaluate the existing shares at the new price:

• 1,000,000 x $1.94 ~ $ 1.94 million (again allowing for rounding error)

We note that all the value are exactly the same for the NPV method. The only difference is that one additional step was need in the IRR method, namely to calculate yhe required wealth of the investors at a future point time.

Estimating the terminal value

"The terminal value represents the value of the company at the time of an exit event, be it an IPO or acquisition"

How to determine it

The most frequently used method to determine the terminal value is to take a multiple of earnings at the time of exit.

An estimate is taken of what the earnings are before tax, and then an industry multiple is taken

The most difficulty

The difficulty, in particular for highly innovative ventures that operate in new or emerging industries are:

- to come up with a good estimate of the earnings
- to find an appropriate industry multiple

Considerations

- The common methodology of all these multiples calculations is to look at comparable firms in the industry. One problem is that often difficult to found truly comparable companies. Another problem is that one typically looks at recent comparable deals. If a company is financed at a time when the stock market peaks and it uses recent iPOs as a basis of comparison, it will obtain a large multiples. But these multiples may not reflect the multiples that il will be able to obtain when it plans to go public several years later.
- In principle, better methods of estimating terminal value would be to use: NPV, CAPM, APT we think fits the data best. The problem is that it is exceedingly difficult to come up with reasonable cash flow projections

Accounting for risk…

In the venture capital method the estimate of terminal value is typically based on some kind of success scenario.
There is a considerable risk involved in a typical venture capital deal, venture capitalists usually apply a very high discount risk to compensate for the risk.

Scenario

Venture capitalist are negotiating with entrepreneurs who are often overconfident and have a strong tendency to overstate the prospects of their new ventures.
Venture capitalist can argue with them for some time, but rather than having a long and aggravating debate about these estimates, the VCs can simply deflate them by applying a higher discount rate.

The method is rather confusing, as it combines two distinct reasons for discounting:

1. VCs need to be compensated for holding significant risk
2. VCs do not believe that venture will necessarily succeed

…there are two closely related ways of dealing with…

Method 1

This method is to simply recognize the fact that the discount rate incorporate a "risk of failiure" component, as well as a true risk-diversification component. Since VCs are not diversified, they may use a high discount rate to account for the variability of returns implies an approximate risk-adjusted discount rate of 20 percent. If it was certain that this company would succeed, then the post-money valuation would simply be given by:

- \$25 million / $(1.2)^4$ =\$ 12,056,327

Suppose now that the investors actually believe that the company might simply falter (with no value left) and that the probability of that event happen is 20 percent each year. The probability of getting the terminal valuation is only:

- $(80 \text{ percent})^4$ = 40.96 percent

so the expected post-money valuation is only:

- 0,4096 * \$ 12,056,327 = \$ 4,938,272

This can be see from the following: let π be the probability of failiture in any one year, then:

$$POST = \frac{(1-\pi)^t X}{(1-r)^t} = \left(\frac{1-\pi}{1+r}\right)^t X$$

In our case $POST = \left(\frac{1-0.2}{1+0.2}\right)^4 25 = \$4.94Ml$

…there are two closely related ways of dealing with…

Method 2

This method consist in to allow for a variety of scenarios to generate a less biased estimate of expected returns. Typically we would try to adjust the terminal value to better reflect our true expectations. For example, SplittyCalc`s estimate of $25 million may have been based on an estimated earnings of $2.5 million and a multiple of 10.
Suppose now that there is a possibility that SpittyCalc`s product won't work, in which case the company will have no earnings. Or it may work, but the opportunity is smaller than originally hoped for, so that earnings in year three are only $1 million and the multiple is only 5, reflecting a lower growth potential.

Suppose now that each of these three scenarios are equally likely. The expected terminal value is not $25 million but only:

- 1/3 * $0 + 1/3 * $ 5 * 1 + 1/3*10*$2.5 million = $ 10 million

When valuing the company, the VC now use a lower discount rate that reflects only the true amount of risk in the venture. Using the corrected estimate of $ 10 million and applying a 20 percent discount rate for as before leads to a post-money valuation of $ 4,822,531. The VC would need to own 62.21 percent of the company

Investment amounts and multiple rounds of finance…

There are a variety of methods to determine the amount of money.
A simple and powerful method is to go to entrepreneurs` financial projections, and look at their cash flow statement, which tracks to expected cash balances of the company over time.

An important insight that comes out of this method is that is often better to raise money in several rounds.

Example: the SpittyCalc case

Starting with a cash balance of $0, the company project the following cash balances:

End of year 1	End of year 2	End of year 3	End of year 4	End of year 5
$(1,600,000)*	$(2,700,000)	$(4,600,000)	$(2,600,000)	$(1,200,000)

The VC method…

We show the formulas for the case where there are two rounds of financing. All variables pertaining to round 1 (2) will have the subscript $_{1\ (2)}$.

Step	Description
1 **Define interest rates**	• Suppose that the terminal value is expected to occur on date T_3 , the second round at some date T_2 and the first round is happening at date T_1 . Define $(1+R_2)$ as the component discount rate between time T_2 and T_3 ,i.e, there are three years between the second round and the exit time, and if the discount rate for these three years is 40 percent, 35 percent, and 30 percent respectively, then $(1+R_2)$= 1.4*1.35*1.3…
2 **$POST_2$**	• $POST_2 = V/ (1+R_2)$ Where $POST_2$ is the post-money valuation at the time of the second round, V is the terminal value and R_2 is the compound discount rate between the time of the second round and the time of exit
3 **PRE_2**	• $PRE_2 = POST_2 - I_2$ Where PRE_2 is the pret-money valuation at the time of the second round of financing and I_2 is the amount raised in the second round
4 **$POST_1$**	• $POST_1 = PRE_2/(1+R_1)$ $POST_1$ is the post-money valuation at the time of the first round and R_1 is the compound discount rate between the time of the first and the second round
5 **PRE_1**	• $PRE_1 = POST_1 – I_1$ Where PRE_1 is the pret-money valuation at the time of the first round of financing and I_1 is the amount raised in the first round
6 **F_2**	• $F_2 = I_2/POST_2$ F_2 is the required ownership fraction for the investors in the second round

The VC method…

Step	Description
7 **F_1**	• $F_1 = I_1/POST_1$ F_1 is the required ownership fraction for the investors in the first round (this is not their final ownership share, as they will get diluited by factor of $(1- F_2)$ in the second round
8 **y_1**	• $y_1 = x_1 [F_1/(1-F_1)]$ y_1 is the number of new shares that the investors in the first round require to achieve their desired ownership fraction, and x_1 is the numeber of existing shares
9 **p_1**	• $p_1 = I_1/y_1$ p_1 is the price per share in the first round
10 **x_2**	• $x_2 = x_1 + y_1$ x_2 is the number of existing shares at the time of the second round
11 **y_2**	• $y_2 = x_2 [F_2/(1-F_2)]$ y_2 is the number of new shares that the investors in thesecond round require to achieve their desired ownership fraction
12 **p_2**	• $p_2 = I_2/y_2$ p_2 is the price per share in the first round

Investment amounts and multiple rounds of finance…

Looking at these numbers, SpittyCalc realized that raising $3 million would get the company through its first two years.
But after two years the company would need some additional money to survive. Indeed, SpittyCalc estimated that the lowest cash balance would occur at the end of year three, that it would generate positive cash flows thereafter. The company therefore recognized that it needed to raise a total $4.6 million. It also thought that it was more prudent to leave itself with some safety cushion, so it decided to raise a total of $5 million dollars.
When it put those numbers into its spreadsheet, however, the numbers demonstrated that investors needed to receive 101.25 percent of the company and that its pre-money valuation was -$61,728. This obviously means that a $5 million, the project was a negative NPV project!

But SpittyCalc also noticed that it didn't need to raise the entire $5 million right from the start. For example, it could initially raise $ 3 million and then raise the remaining $ 2 million after two years. In this case, the valuation method needs to take into account that the equity that first round investors put into the business will be diluted in future rounds.
This is a difficult problem, as it requires that we make assumptions about the terms of financing of these future rounds. While these assumptions may be difficult to get by, ignoring them will almost certainly lead to an inaccurate valuation. Indeed, ignoring future dilution will lead the venture capitalists to pay too much. The NPV framework is the most flexible and powerful method to account for future dilution.
•Suppose now that SpittyCAlc has already identified "Slowtrain Investors" as a potential investor for that second round.

Investment amounts and multiple rounds of finance…

- Suppose also that all investors apply a 50 percent discount rate through the four years before Spitty Calc expects to be acquired. At the end of the second year, when "Slowtrain" makes to second round investment, it would be doing the same calculation as we did above. It would use:
  - $POST_2$ = \$25 million / $(1.5)^2$ = \$11,111,111

It would ask for a 2,000,00/ 11,111,111 = 18.00 percent ownership stake.

This means that the existing owners of the firm (the founders) and the first round investors (Vulture Venture) would jointly only retain 82 percent of the company, or:

–0.82 * \$11,111,111 = \$ 9,111,111

This is also the pre-money valuation at the time of this second round of financing, and no coincidence, since the pre-money valuation measures precisely the value for the existing owners of the firm.

For the first round investment, Vulture Ventures can then expect the company to be worth \$9,111,11 at the time of the second round, i.e., in two years' time. If they used the same method as above to calculate the post money valuationat the time of the first round, i.e. :

- $POST_1$ = \$9,111,111 / $(1.5)^2$ = \$4,040,383

This implies that it will ask for:

- 3,000,000 / \$ 4,040,383 = 74.09 percent of the shares of the company.

Note that Vulture Ventures will not own 74.09 percent after four years. Instead it expects a future diluition that will brings its ownership down to:

- f_1 = 0.82 * 0.7409 = 0.6075

Investment amounts and multiple rounds of finance…

We cannot calculate the price and the number of shares for the second round before we calculate the price and the number of shares for the first round.
For the first round we use the usual method:

- $y_1 = x_1 * F_1 / (1 - F_1) = 1{,}000{,}000 * 0.7409 / (1-0.7409) = 2{,}858{,}824$

and thus:

- $p_1 = 3{,}000{,}000 / 2{,}858{,}824 = \$1.05$

For the second round we repeat the exercise.
The important step , however, is to use the correct numbers of shares, namely the total number of existing shares (irrespective of whether they owned by the entrepreneur or the investor). We have:

- $x_2 = (x_1 + y_1) = 1{,}000{,}000 + 2{,}858{,}824 = 3{,}858{,}824$ as the number of existing shares at the end of the second round.

The number of shares required is thus:

- $y_2 = x_2 * F_2 (1- F_2) = 0.18 / (1-0.18) = 847{,}059$

The price of the second round shares are then given by:

- $2{,}000{,}000 / 847{,}059 = \$ 2.36$

This table summarizes these assumptions and results…

NPV method with two round of financing	Time of exit	Second Round	First Round
Exit value	$ 25.000.000,00		
Compound discont rate		2,25	2,25
Investment amount		$ 2.000.000,00	$ 3.000.000,00
Number of existing shares		3.858.824	1.000.000
Post-Money		$ 11.111.111	$ 4.049.383
Pre-Money		$ 9.111.111	$ 1.049.383
Ownnership fraction		18,00%	74,09%
Number of new shares		847.059	2.858.824
Price per share		$ 2,36	$ 1,05
Ownership shares of entrepreneurs	21,25%		
Wealth of entrepreneurs	$ 5.312.500,00	$ 2.361.111,11	$ 1.049.382,72
Ownership shares of first round investors	60,75%		
Wealth of first round investors	$ 15.187.500,00	$ 6.750.000,00	$ 3.000.000,00
Ownership shares of second round investors	18,00%		
Wealth of second round investors	$ 4.500.000	$ 2.000.000	

Further Examples

1. Consider a first variation of the model. Suppose that the discount rate is highest in the early years and becomes lower after a while.

   Assume that the discount rate is 60 percent in the first year, stay at 50 percent in years two and three, and fall to 40 percent in the fourth year.

   This change our compound discount rates, we have infact:

   - $(1+R_2) = 1.5*1.4 = 2.1$

   and

   - $(1+R_2) = 1.6*1.5 = 2.4$

Example 1	Time of exit	Second Round	First Round
Exit value	$ 25.000.000,00		
Compound discont rate		2,1	2,4
Investment amount		$ 2.000.000,00	$ 3.000.000,00
Number of existing shares		3.661.972	1.000.000
Post-Money		$ 11.904.762	$ 4.126.984
Pre-Money		$ 9.904.762	$ 1.126.984
Ownnership fraction		16,80%	72,69%
Number of new shares		739.437	2.661.972
Price per share		$ 2,70	$ 1,13
Ownership shares of entrepreneurs	22,72%		
Wealth of entrepreneurs	$ 5.680.000,00	$ 2.704.761,90	$ 1.126.984,13
Ownership shares of first round investors	60,48%		
Wealth of first round investors	$ 15.120.000,00	$ 7.200.000,00	$ 3.000.000,00
Ownership shares of second round investors	16,80%		
Wealth of second round investors	$ 4.200.000	$ 2.000.000	

Further Examples

2. Examine the role of timing of second round.

Suppose, for example, tha t SpittyCAlc might be able to delay the timing of second round y one year. In this case the compound disconut rates are giben by:

- $(1+R_2) = 1.4$

and

- $(1+R_2) = 1.6*1.5*1.5 = 3.6$

Delaying the second round of financing would imprve the valuation of the company

Example2	Time of exit	Second Round	First Round
Exit value	$ 25.000.000,00		
Compound discont rate		1,4	3,6
Investment amount		$ 2.000.000,00	$ 3.000.000,00
Number of existing shares		3.135.593	1.000.000
Post-Money		$ 17.857.143	$ 4.404.762
Pre-Money		$ 15.857.143	$ 1.404.762
Ownnership fraction		11,20%	68,11%
Number of new shares		395.480	2.135.593
Price per share		$ 5,06	$ 1,40
Ownership shares of entrepreneurs	28,32%		
Wealth of entrepreneurs	$ 7.080.000,00	$ 5.057.142,86	$ 1.404.761,90
Ownership shares of first round investors	60,48%		
Wealth of first round investors	$ 15.120.000,00	$ 10.800.000,00	$ 3.000.000,00
Ownership shares of second round investors	11,20%		
Wealth of second round investors	$ 2.800.000	$ 2.000.000	

The determinant of valuation: looking beyond the numbers

¶ Any valuation number can be justified by an appropriate choice of 2 components:

- Discount rates
- Terminal value

¶ A valuation method is a sophisticated tool for determining how entrepreneurs and venture capitalists should split the returns of the new venture

¶ The actual spit is not really driven by the valuation method, but rather by the outcome of the bargaining between the entrepreneurs and the venture capitalists

The valuation method is an important tool to master for all parties involved, as it often provides the quantitative basis for the negotiation

2. Berkus Method

The Berkus Method

Given a max. value of $2M for a similar box

1.	Sound idea (basic value)	**$300k**/$400k
2.	Prototype (technology)	**$100k**/$400k
3.	Quality management team (execution)	**$300k**/$400k
4.	Strategic relationships (go-to-market)	**$200k**/$400k
5.	Product rollout or Sales (production)	**$100k**/$400k
BOX VALUATION		**$1,000,000**

Descrizione

Il calcolo della valutazione pre-money viene elaborato su una serie di valutazioni predeterminate assegnate ad alcune caratteristiche fondamentali della startup, quali: la presenza o meno di un prototipo, di partnership strategiche, della capacità di gestione del team.

The Berkus Method is a simple and convenient rule of thumb to estimate the value of your box. First, you have to know how much a similar box is worth. Then, you assess how you perform in the 5 key criteria for building boxes.

3. Scorecard Valuation Method

The Scorecard Valuation method

		Weight	vs. average project
1.	TEAM CAPACITY	*40%*	125%
2.	PRODUCT/TECHNOLOGY READINESS	*30%*	100%
3.	MARKET SIZE	20%	15%
4.	COMPETITION	10%	75%

***

INITIAL VALUE	$1,500,000
MULTIPLIER	117,5%
BOX VALUATION	**$1,760,250**

Your box is 17,5% better than an average similar box

Descrizione

Si basa su un'iniziale comparazione della media delle valutazioni pre-money di altre startup attive nello stesso settore e nella stessa area geografica e di alcune variabili specifiche, quali caratteristiche del Management Team, del prodotto e della tecnologia utilizzata, dimensione e competitività del mercato in cui si opera, necessità di ulteriori investimenti, partnership e canali di vendita etc.
This method can also be found under the name of Bill Payne Method, considering 6 criteria: Management (30%), Size of opportunity (25%), Product or Service (10%), Sales channels (10%), Stage of business (10%) and Other factors (15%).

4. Risk Factor Summation Method

The Risk Factor Summation Method

INITIAL VALUE				**$1,500,000**
1.	MANAGEMENT RISK	*Very low*	*+$500,000*	$2,000,000
2.	STAGE OF THE BUSINESS	*Normal*		
3.	LEGISLATION/POLITICAL RISK	*Normal*		
4.	MANUFACTURING RISK	*Normal*		
5.	SALES AND MANUFACTURING RISK	*Normal*		
6.	FUNDING/CAPITAL RAISING RISK	*Normal*		
7.	COMPETITION RISK	*Very high*	*-$500,000*	$1,500,000
8.	TECHNOLOGY RISK	*Low*	*+$250,000*	$1,750,000
9.	LITIGATION RISK	*Very low*	*+$500,000*	$2,250,000
10.	INTERNATIONAL RISK	*Normal*		
11.	REPUTATION RISK	Very low	+$500,000	$2,750,000
12.	POTENTIAL LUCRATIVE EXIT	Normal		
BOX VALUATION				**$2,750,000**

Descrizione

First, you determine an initial value for your box. Then you adjust said value for 12 risk factors inherent to box-building.
Initial value is determined as the average value for a similar box in your area, and risk factors are modelled as multiples of $250k, ranging from $500k for a very low risk, to -$500k for a very high risk. The most difficult part here, and in most valuation methods, is actualy finding data about similar boxes.
The Risk Factor Summation Method is meant for pre-revenue startups.

4. Risk Factor Summation Method

The Risk Factor Summation Method

INITIAL VALUE				**$1,500,000**
1.	MANAGEMENT RISK	*Very low*	*+$500,000*	$2,000,000
2.	STAGE OF THE BUSINESS	*Normal*		
3.	LEGISLATION/POLITICAL RISK	*Normal*		
4.	MANUFACTURING RISK	*Normal*		
5.	SALES AND MANUFACTURING RISK	*Normal*		
6.	FUNDING/CAPITAL RAISING RISK	*Normal*		
7.	COMPETITION RISK	*Very high*	*-$500,000*	$1,500,000
8.	TECHNOLOGY RISK	*Low*	*+$250,000*	$1,750,000
9.	LITIGATION RISK	*Very low*	*+$500,000*	$2,250,000
10.	INTERNATIONAL RISK	*Normal*		
11.	REPUTATION RISK	Very low	+$500,000	$2,750,000
12.	POTENTIAL LUCRATIVE EXIT	Normal		
BOX VALUATION				**$2,750,000**

Descrizione

First, you determine an initial value for your box. Then you adjust said value for 12 risk factors inherent to box-building.
Initial value is determined as the average value for a similar box in your area, and risk factors are modelled as multiples of $250k, ranging from $500k for a very low risk, to -$500k for a very high risk. The most difficult part here, and in most valuation methods, is actualy finding data about similar boxes.
The Risk Factor Summation Method is meant for pre-revenue startups.