

# Intangible Assets Valuation

Dr. Daniel Sava  
Dr. Brian More

Mathys & Squire Consulting



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# Dr. Daniel Sava

IP commercialization professional

PhD in Chemistry (Materials Science, Life Sciences)

Financial Modelling Valuation Analyst (FMVA<sup>®</sup>)



# Dr. Brian More

IP commercialization professional

PhD in nuclear physics (nuclear structure)

MBA in Technology Transfer and Innovation



# Introduction

Objective – Clear and key considerations for valuation of IP in an academic/technology development environment;

Broad audience – different levels of IP valuation understanding

Discussion! – Always interrupt for questions

# Fundamentals of Intangible Assets Valuation

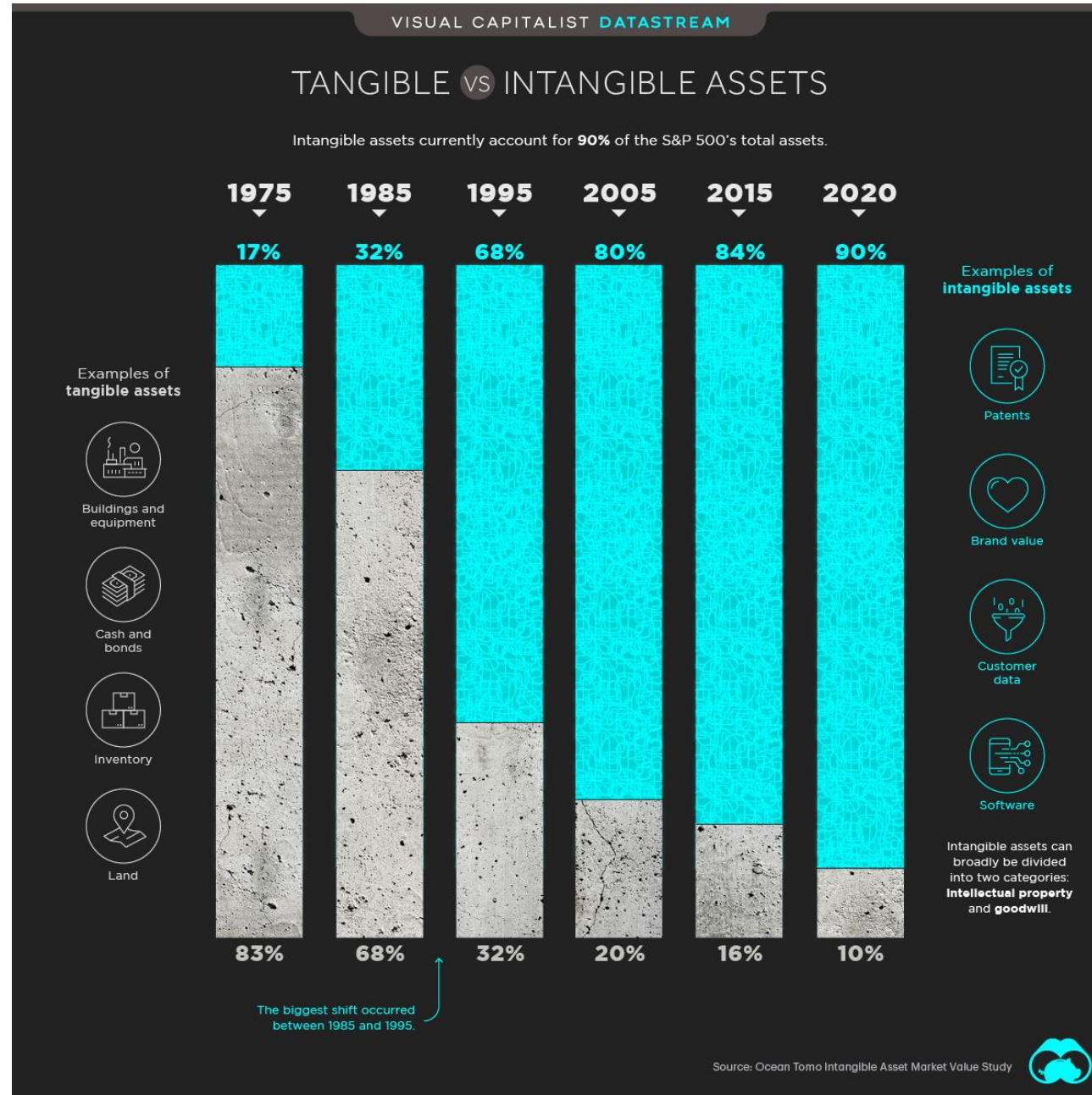
Dr. Daniel Sava

# Why?

Understanding the monetary value of the intangible asset (intellectual property) at a specific time.



# Why?





# When?

When do you want  
your IP/IA valued?



# When?

## Transactional



- Transaction pricing – license, sale, purchase
- Financing – fundraising, collateral based
- Tax requirements
- Liquidation/Re-organisation
- Litigation

## Notational



- Strategic planning
- Insurance purposes
- Management information purposes
- Identification of commercialisation opportunities

# What?

Accounting standards - International Financial Reporting Standards (IFRS) & Generally Accepted Accounting Principles (GAAP)

**Intangible assets** – IFRS – International Accounting Standards (IAS) 38 – *“An intangible asset is an identifiable non-monetary asset without physical substance. Such an asset is identifiable when it is separable, or when it arises from contractual or other legal rights. Separable assets can be sold, transferred, licensed, etc.”*

**Intangible assets** – US GAAP – Accounting Standards Codification (ASC) 350 – *“Intangible assets are assets (not including financial assets) that lack physical substance.”*

# What?

What are the usual types of assets you want valued?



# What?

## Registered/unregistered IP

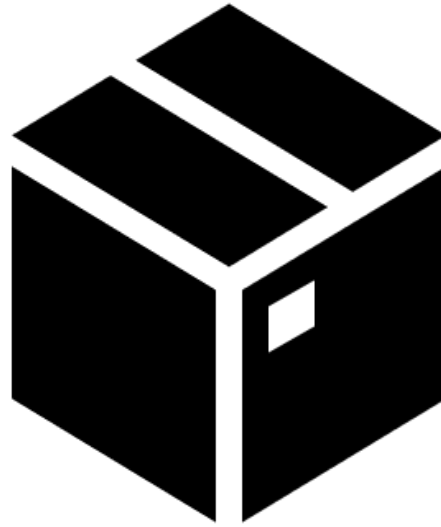
- Patents
- Trademarks
- Designs
- Copyright
- Trade secrets/know-how

## Other intangibles

- Contract intangibles
- Customer intangibles
- Data processing intangibles
- Human capital intangibles
- Marketing intangibles
- Goodwill

# Valuation process – Data & Results

Inputs (Why, When, what, financials, etc.)



\$1.42m (\$1.1m – \$1.74m)

# Valuation process – Data & Results



- License/Spin-out
- Strategic decision
- IP transfer
- IP based financing

# Valuation process – Data & Results



- IP ownership
- IP related agreements (NDAs, MTAs, Collaboration Agreements, etc.)
- Cross check IP information – databases – legal status; fees, remaining life-time
- IP prosecution and litigation (if any) history
- IP protection and respective products; Competitors & IP landscape



# Valuation process – Data & Results



- What is the Unique Selling Point (USP)/Value proposition of the IP?
- What is the competitive advantage?
- What is the size of the market?
- What is the regulatory landscape?
- Pricing, adoption, etc.

# Valuation process – Data & Results



- Analyse all available financial reports
- Revenue modelling (adoption, pricing, growth rates, etc.)
- Discount rate, royalty rate, financial margins (EBIT,  $\Delta$ WC, etc.), tax rate.
- Timing of Cash Flows and valuation
- Scenarios and sensitivity

# Valuation process – Data & Results



- Integrate all information
- Check for cohesive story and assumptions
- Check calculations – especially units

# Due diligence

Check all information as close as possible to the source!

- Interviews with clients/academics
- Interviews with people within the industry of the IP
- IP checks – read through agreements; information public databases, etc.
- Habit to challenge the information (devil's advocate role) – ask for sources

# Valuation approaches

## Business valuation techniques

- Asset Approach (fair market value of net assets) – cost approach
- Intrinsic Value (Income Approach) – Discounted Cash Flows (DCF)
- Relative Value (Market Approach) – Public company comparable/Precedent transactions



# Valuation methods

## Cost approach (asset approach)

- Cost to reproduce
- Cost to replace

## Market approach (sales comparison approach)

- Use comparable IP transactions

## Income approach

- Future potential income

# Methodologies and their limits

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# Cost approach methods

## Cost to reproduce (Cost to develop)

- Estimated cost to make an exact duplicate or replica of the IP **at current prices** (date of the valuation)

## Cost to replace (Cost of reasonable alternatives)

- Estimated cost to make an equivalent utility asset of the IP **at current prices** (date of the valuation)



# Cost to reproduce

Minimum value of patent right = Cost of developing technology + Patenting legal costs

Price of patent right = Minimum value of patent right + Reasonable profit margin + Entrepreneur's/Owner's incentive (opportunity cost)

# Cost to replace

Maximum price an acquirer would pay for the IP asset = cost of obtaining a reasonable IP right alternative

# Cost approaches – key considerations

Data available for analysis – components of cost (Material, Labor, Overhead, Developer's profit, Opportunity Cost/Entrepreneurial incentive)

At current prices – bringing everything to valuation date's prices

- Adjust for inflation
- Adjust for obsolescence
  - Physical obsolescence
  - Functional obsolescence
  - Technological obsolescence
  - Economic obsolescence

# Cost approaches – limitations

- Disregards the creativity/innovation of the IP
- Hard to properly quantify all the time and advancement effects
- Does not take into account the future (earning) potential of the IP

# Cost approach - example

## Totals of historical costs

Inflation rate	6%	Tax rate	25%
Obsolescence	15%	Discount rate	15%
Profit	10%	Tax amortisation period	15
Opportunity cost	10%	Annuity	5.8473701
		TAB factor	0.10797943

	2018	2019	2020	2021	2022	2023
Materials(Prototypes)	\$0	\$0	\$20,000	\$75,000	\$0	
Labor	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	
Overhead	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	
Other costs	\$10,000	\$15,000	\$5,000	\$30,000	\$30,000	
Total costs	\$177,018	\$182,019	\$192,020	\$272,021	\$197,022	

## Adjustments

Total costs	\$177,018	\$182,019	\$192,020	\$272,021	\$197,022	\$0
Profit & Opp. Cost adj.	1.20	1.20	1.20	1.20	1.20	1.20
Inflation adj.	1.34	1.26	1.19	1.12	1.06	1.00
Obsolescence adj.	0.50	0.57	0.66	0.76	0.87	1.00
Adjusted costs	\$141,331.45	\$157,663.10	\$180,447.88	\$277,331.84	\$217,923.46	\$0.00
Total reproduction costs	\$974,697.73					
Tax	\$243,674.43					
After tax reproduction costs	\$731,023.30					
Tax Amortisation Benefit	\$78,935.48					
Fair value	\$809,958.78					

# Market approach methods

Value of IP – derived – comparable IP transactions (same industry, same IP characteristics (size of portfolio, geography, IP landscape), market and competitor dynamics, etc.)

Sales transaction method – Multiple approach (similar to business valuation)

Licensing transaction – Royalty rate comparables – used in Relief from Royalty method (a mixture of market approach with income approach)

# Market approach limitations

- No “liquid” market for IP transaction (no equivalent of stock market for IP)
- Each piece of IP is unique – remaining life and stage of IP, size, competitive market and IP landscape
- Portfolio effect (rarely does a piece of IP transact on its own)
- Survivorship bias

# Market approach methods – Royalty rate benchmark

Advanced Agreement Search <span style="float: right;">×</span>				
#	FILTER		STEP COUNT	RESULT COUNT
1	<b>Full Text</b> carbon capt* OR carbon dioxide OR sequestr* OR carbon util*	<a href="#">Edit</a> <a href="#">Remove</a>	683	683
<b>AND</b> 2	<b>IP Type</b> PATENT TECHNOLOGY	KNOW HOW TRADE SECRET	9,700	357
<b>AND NOT</b> 3	<b>IP Type</b> BRAND CONTENT LOGO SLOGAN TRADEMARK	CUSTOMER LIST DOMAIN NAME SYMBOL WORKS OF AUTHORSHIP	18,851	244
<b>AND</b> 4	<b>Effective Date</b> AFTER 01/01/2010	<a href="#">Edit</a> <a href="#">Remove</a>	5,329	39
<input type="checkbox"/> Use Boolean Logic Use boolean logic when you need to use more complicated logic than what is available in the linear logical operators.				TOTAL COUNT
				39

Carbon capture technology (patent portfolio) – with no patents yet granted



# Market approach methods – Royalty rate benchmark

Year	Licensor	Licensee	IP right	Territory	Base	Royalty	Restrictions
15/04/2021	Euacentrix LLC	Boon Industries Inc.	IP covering proprietary technology – Proprietary formula (ClO <sub>2</sub> + water) & make use Proprietary Equipment	Worldwide	Net Sales	5%	Exclusive; For all application and uses
19/11/2020	Digital Research Solutions Inc.	JANGIT Enterprises Inc.	Patent (US 10572726 (digital media document summarizer) + associated know-how	Worldwide	Net Sales	6%	Exclusive, Solely for field of Summarization, Consolidation and educational software
04/12/2019	Tortec Forschungsinstitut gmbh	Tortec Titan+	Exploit the technology (List of 8 patents (Ukraine, Russia) + technologies, patents, designs, processes, formulas, know-how, technical data, etc.) to produce TORtec products.	Worldwide	Net Income	10%	Exclusive, Perpetual, Irrevocable
21/04/2015	SG Blocks Inc	Red Cardinal Holdings	Proprietary method and technology for construction of buildings	Worldwide	Net Sales	10%	Non-exclusive USA, EU Exclusive – The world – (USA+EU)
01/08/2011	Temple University	Save the world air, inc.	Patent rights (Patent portfolio – Method for Reduction of Crude oil viscosity – USA, Brazil, Canada, UK, China, Indonesia, Mexico, Nigeria, Norway, Russia, Arab Emirates- granted only in UK and Nigeria) and technical information for making, selling, using, importing Licensed product	Worldwide	Net Sales	7% for (first \$20m sales, sliding scale to 4% for >\$100m	Exclusive
12/07/2010	CEFCO Global Clean Energy, llc/CEFCO LLC	Peerless, LLC	CEFCO Process (Patent US20080250715+ know-how) in the field of “air quality control systems for post-combustion gases, including air filtration, air emissions control, carbon emission and capture and air pollutants recovery, and the production of end-products, including chemicals, fertilizers, fuels, and metals and minerals, from the products of such filtration, control, capture or recovery process.”	USA	Gross Revenue Sales	5%	Exclusive, 10 years
09/12/2014	Rice University	Tubz, LLC	Patent family (USA, Europe, Israel, South Korea) - Graphene-CNT Hybrid Material and Use as a Supercapacitor Electrode	Worldwide	Adjusted Gross Sales	3% +other payments	Exclusive, Field of use (consumer electronics (including without limitation mobile electronics, mobile telephones/smartphones, tablets, and wearable electronics), nano electronic technologies, electric vehicles, energy storage, and medical devices.)

# Income approach methods

Determine the value of the IP – present value of the future income (cash flow, cost saving)

## Direct methods

- Discounted cash flow – (cost savings/price premium (product vs generic))
- Relief from Royalty (Royalty Savings)
- Premium profit/With or without (Comparative Income differential; Incremental Cashflow)
- Others – Greenfield,

## Indirect methods

- Residual – Multi-period excess earnings
- Residual – Profit split method

# Income approach methods - example

Example DCF - cost saving or premium profit. – Trade secret (process) – indefinite lifetime

Example for relief from royalty – Patent portfolio – with remaining lifetime 15 years

Example for multi period excess earnings – Creative work (Game) – with remaining lifetime (life of author + 70 years)

# Income approach methods – DCF – cost savings

## Cost savings

Average Competitor COGS	35%	Average saving for technology	10%
Average COGS with efficient technology	25%	Terminal growth rate	1%
Industry growth rate	5%	Tax rate	25%
Discount rate	20%	Financial Year End	31/12/2023
Tax amortisation period	25	Valuation Date	29/08/2023
Annuity	4.947587	First cashflow	31/12/2023
TAB factor	0.0520511		

	2023	2024	2025	2026	2027	2028	Terminal
Revenues	\$15,000	\$15,750	\$16,538	\$17,364	\$18,233	\$19,144	\$19,335.67
Saved costs	\$1,500	\$1,575	\$1,654	\$1,736	\$1,823	\$1,914	\$1,934

## Net Present Value

Saved costs	\$1,500	\$1,575	\$1,654	\$1,736	\$1,823	\$1,914	\$1,934
Taxes	-\$375	-\$394	-\$413	-\$434	-\$456	-\$479	-\$483
After tax saved costs	\$1,125	\$1,181	\$1,240	\$1,302	\$1,367	\$1,436	\$1,450
Partial period adjustment	0.34	1	1	1	1	1	
Terminal value	\$381	\$1,181	\$1,240	\$1,302	\$1,367	\$1,436	\$7,632
	\$381	\$1,181	\$1,240	\$1,302	\$1,367	\$1,436	\$9,068
Years for discounting	0.34	1.34	2.34	3.34	4.34	5.34	
Discount factor	94%	78%	65%	54%	45%	38%	
Present value of saved costs	\$358	\$925	\$810	\$709	\$620	\$3,426	
<b>Net present value</b>	<b>\$6,848</b>						
Tax amortization benefit	\$356						
<b>Fair value</b>	<b>\$7,204</b>						

# Income approach methods – Relief from Royalty

## Saved Royalties

		Royalty Rate	3%					
		Terminal growth rate	-10%					
		Tax rate	25%					
Discount rate	20%	Financial Year End	31/12/2023					
Tax amortisation period	15	Valuation Date	29/08/2023					
Annuity	4.6754726	First cashflow	31/12/2023					
TAB factor	0.0845099							
		<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>Terminal</b>
Revenues		\$1,500	\$2,750	\$4,000	\$5,000	\$6,750	\$7,250	\$6,525.00
Royalties		\$45	\$83	\$120	\$150	\$203	\$218	\$196

## Net Present Value

Royalties		\$45	\$83	\$120	\$150	\$203	\$218	\$196
Taxes		-\$11	-\$21	-\$30	-\$38	-\$51	-\$54	-\$49
After tax royalties		\$34	\$62	\$90	\$113	\$152	\$163	\$147
Partial period adjustment		0.34	1	1	1	1	1	
		\$11	\$62	\$90	\$113	\$152	\$163	
Terminal value								\$489
		\$11	\$62	\$90	\$113	\$152	\$163	\$653
Years for discounting		0.34	1.34	2.34	3.34	4.34	5.34	
Discount factor		94%	78%	65%	54%	45%	38%	
Present value of saved costs		\$11	\$48	\$59	\$61	\$69	\$247	
<b>Net present value</b>		<b>\$495</b>						
Tax amortization benefit		\$42						
<b>Fair value</b>		<b>\$536</b>						

# Income approach methods – Multi period excess earnings

## Multi period excess earnings

CACs	3.5%	EBIT margin	15%				
		Terminal growth rate	4%				
		Tax rate	25%				
Discount rate	20%	Financial Year End	31/12/2023				
Tax amortisation period	25	Valuation Date	29/08/2023				
Annuity	4.947587	First cashflow	31/12/2023				
TAB factor	0.0520511						
		<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028 Terminal</b>
Revenues		\$1,500	\$2,750	\$4,000	\$5,000	\$6,750	\$7,250 \$7,540.00
EBIT		\$225	\$413	\$600	\$750	\$1,013	\$1,088 \$1,131

## Net Present Value of excess earnings

EBIT	\$225	\$413	\$600	\$750	\$1,013	\$1,088	\$1,131
Taxes	-\$56	-\$103	-\$150	-\$188	-\$253	-\$272	-\$283
<b>Contributory asset charges</b>	-\$53	-\$96	-\$140	-\$175	-\$236	-\$254	-\$264
Net excess earnings	\$116	\$213	\$310	\$388	\$523	\$562	\$584
Partial period adjustment	0.34	1	1	1	1	1	1
	\$39	\$213	\$310	\$388	\$523	\$562	\$3,652
Terminal value	\$39	\$213	\$310	\$388	\$523	\$4,214	
Years for discounting	0.34	1.34	2.34	3.34	4.34	5.34	
Discount factor	94%	78%	65%	54%	45%	38%	
Present value of saved costs	\$37	\$167	\$202	\$211	\$237	\$1,592	
<b>Net present value</b>	<b>\$2,446</b>						
Tax amortization benefit	\$127						
<b>Fair value</b>	<b>\$2,574</b>						

# Which method should I choose?

	Relief from Royalty	MPEE	With or without	Greenfield	DCF (cost saving/price premium)	Cost method
Brand/ Trademark	✓		✓		✓	
Trade secret/ Know-how	✓	✓			✓	
Patents/ Technology/Database/ Mask works	✓	✓			✓	
Software	✓	✓			✓	✓
Copyright (teaching material/ artistic work /procedures) Designs	✓	✓		✓		✓
License/Contract			✓	✓		

# Not an exact science – Scenarios & Sensitivity analysis

## DCF cost savings

		Discount rate				
		15.0%	17.5%	20.0%	22.5%	25.0%
Technology saving	5.0%	\$5,021	\$4,198	\$3,602	\$3,151	\$2,799
	7.5%	\$7,531	\$6,297	\$5,403	\$4,727	\$4,199
	10.0%	\$10,042	\$8,396	\$7,204	\$6,303	\$5,598
	12.5%	\$12,552	\$10,496	\$9,006	\$7,879	\$6,998
	15.0%	\$15,063	\$12,595	\$10,807	\$9,454	\$8,397

## Relief from Royalty

		Discount rate				
		15.0%	17.5%	20.0%	22.5%	25.0%
Royalty rate	2.0%	\$470	\$407	\$358	\$317	\$284
	2.5%	\$588	\$509	\$447	\$396	\$354
	3.0%	\$705	\$611	\$536	\$476	\$425
	3.5%	\$823	\$713	\$626	\$555	\$496
	4.0%	\$940	\$815	\$715	\$634	\$567

## MPEE

		Discount rate				
		15.0%	17.5%	20.0%	22.5%	25.0%
EBIT	10.0%	\$2,070	\$1,627	\$1,328	\$1,115	\$955
	12.5%	\$3,040	\$2,389	\$1,951	\$1,638	\$1,403
	15.0%	\$4,011	\$3,152	\$2,574	\$2,160	\$1,851
	17.5%	\$4,981	\$3,914	\$3,196	\$2,683	\$2,299
	20.0%	\$5,952	\$4,677	\$3,819	\$3,205	\$2,747

## MPEE

		Discount rate				
		15.0%	17.5%	20.0%	22.5%	25.0%
CAC	2.5%	\$4,528	\$3,559	\$2,906	\$2,439	\$2,090
	3.0%	\$4,270	\$3,355	\$2,740	\$2,300	\$1,970
	3.5%	\$4,011	\$3,152	\$2,574	\$2,160	\$1,851
	4.0%	\$3,752	\$2,949	\$2,408	\$2,021	\$1,732
	4.5%	\$3,493	\$2,745	\$2,242	\$1,881	\$1,612



# Advanced Income Approach methods & Key parameters

Dr. Daniel Sava; Dr. Brian More

# Advanced Income Methods

## Standard income methods

- do not take into account market flexibility/uncertainty

## Purpose of advanced methods

- does take into account market uncertainty
- helps with strategic decisions

# rNPV

rNPV – risk adjusted Net Present Value

Extension of the DCF method – accounting for risk/probability of success

# rNPV – simple example

Project – InvenTech

Still in development – requires \$50k investment today

1 year – 50% success rate; further \$300k required to launch on market

After launch Revenues are Y2 - \$150k Y3 \$250k Y4 - \$450k Y5 - \$250k Y6 – \$200k; Cash flow is 40% of Revenues.

Discount rate 15%

# rNPV – simple example

Year	0	1	2	3	4	5	6
Revenue	\$0	\$0	\$150,000	\$250,000	\$450,000	\$250,000	\$200,000
Net CF	-\$50,000	-\$300,000	\$60,000	\$100,000	\$180,000	\$100,000	\$80,000
Success factor	100%	50%	50%	50%	50%	50%	50%
Risk adjusted CF	-\$50,000	-\$150,000	\$30,000	\$50,000	\$90,000	\$50,000	\$40,000
Discount	100%	87%	76%	66%	57%	50%	43%
Risk adjusted present CF	-\$50,000	-\$130,435	\$22,684	\$32,876	\$51,458	\$24,859	\$17,293
<b>rNPV</b>	<b>-\$31,265</b>						

# rNPV – decision tree

Development of technology – not pre-defined

In reality - many decision points in taking a project to market

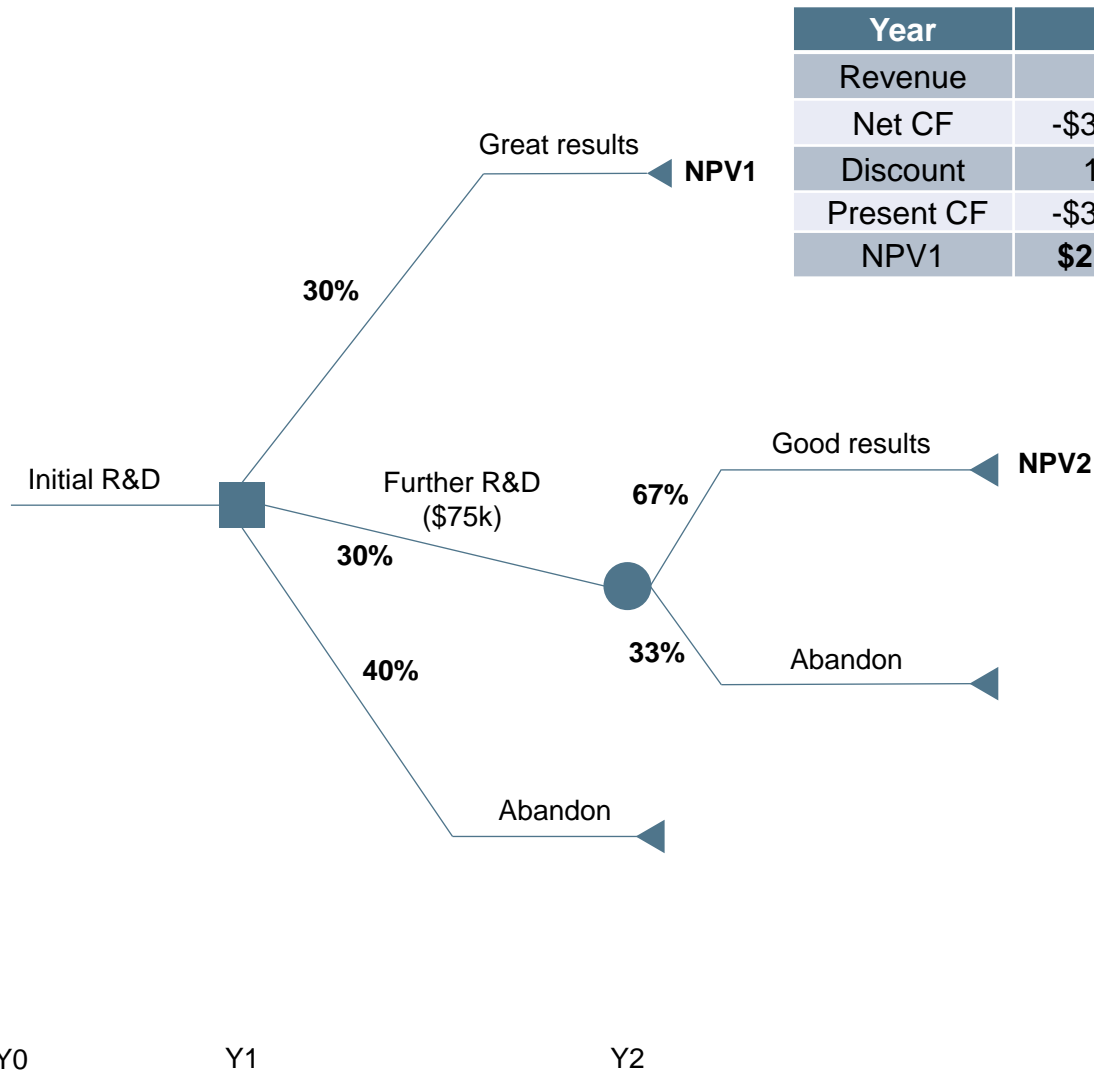
InvenTech – instead of the 50% chance of success;

30% chance – great results; (better revenues by 50%)

40% - abandon

30% - more development (another \$75k required) – which results 67% - good results, 33% abandon

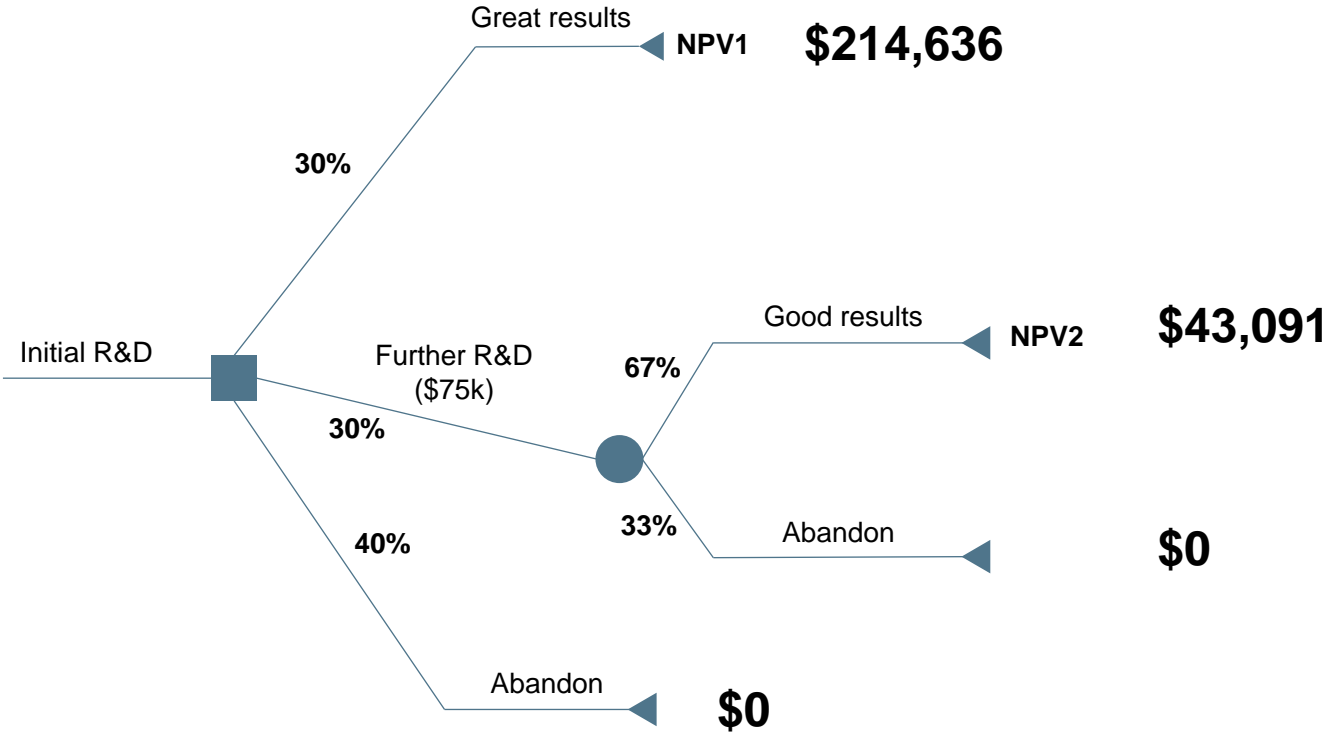
# rNPV – decision tree



Year	1	2	3	4	5	6
Revenue	\$0	\$225,000	\$375,000	\$675,000	\$375,000	\$300,000
Net CF	-\$300,000	\$90,000	\$150,000	\$270,000	\$150,000	\$120,000
Discount	100%	87%	76%	66%	57%	50%
Present CF	-\$300,000	\$78,261	\$113,422	\$177,529	\$85,763	\$59,661
NPV1	<b>\$214,636</b>					

Year	2	3	4	5	6	7
Revenue	\$0	\$150,000	\$250,000	\$450,000	\$250,000	\$200,000
Net CF	-\$300,000	\$60,000	\$100,000	\$180,000	\$100,000	\$80,000
Discount	100%	87%	76%	66%	57%	50%
Present CF	-\$300,000	\$52,174	\$75,614	\$118,353	\$57,175	\$39,774
NPV2	<b>\$43,091</b>					

# rNPV – decision tree

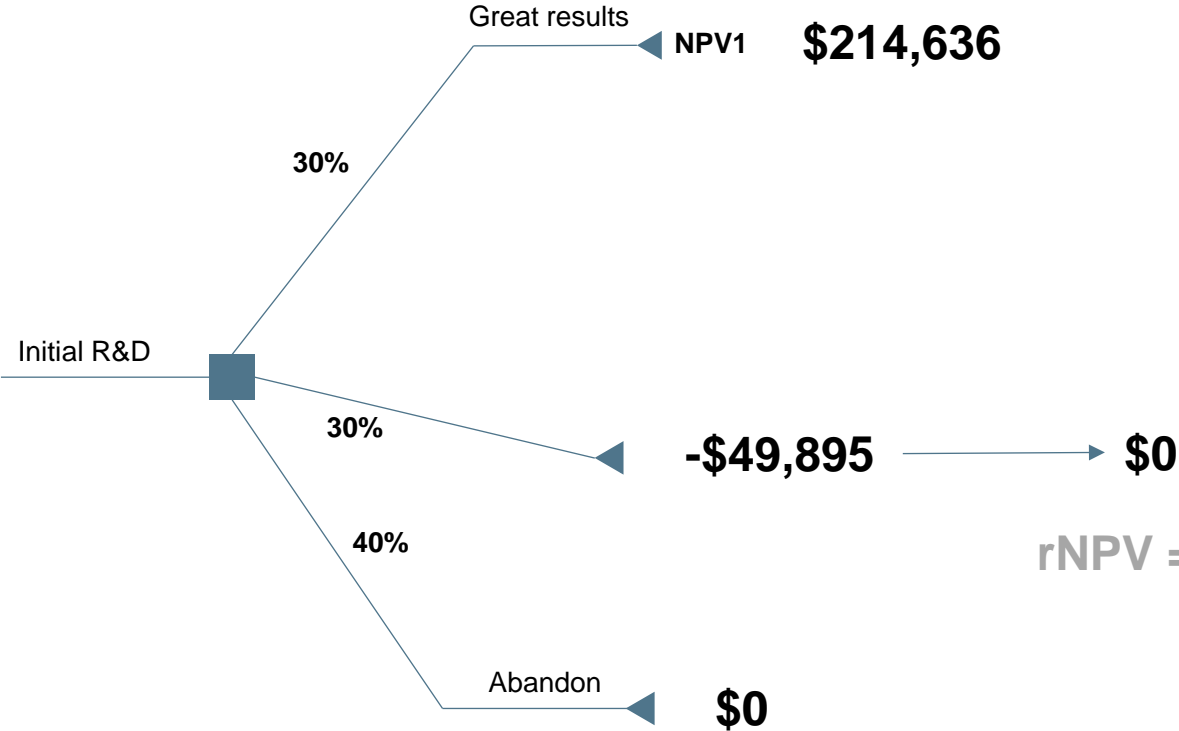


Year	1	2
Revenue	\$0	\$0
Net CF	-\$75,000	\$43,091
Success factor	100%	67%
Risk adjusted CF	-\$75,000	\$28,871
Discount	100%	87%
Risk adjusted present CF	-\$75,000	\$25,105
NPV	-\$49,895	

Y0                      Y1                      Y2



# rNPV – decision tree



$$rNPV = -\$50,000 + (30\% \times \$214,636) \times 0.87 = \underline{\underline{\$5922}}$$

$$rNPV = -\$50,000 + (30\% \times (\$214,636 - 49,895)) \times 0.87 = \underline{\underline{-\$7,024}}$$

Y0                      Y1                      Y2

---

# rNPV – decision tree vs simple risk adjustment

Year	0	1	2	3	4	5	6
Revenue	\$0	\$0	\$225,000	\$375,000	\$675,000	\$375,000	\$300,000
Net CF	-\$50,000	-\$300,000	\$90,000	\$150,000	\$270,000	\$150,000	\$120,000
Success factor	100%	30%	30%	30%	30%	30%	30%
Risk adjusted CF	-\$50,000	-\$90,000	\$27,000	\$45,000	\$81,000	\$45,000	\$36,000
Discount	100%	87%	76%	66%	57%	50%	43%
Risk adjusted present CF	-\$50,000	-\$78,261	\$20,416	\$29,588	\$46,312	\$22,373	\$15,564
NPV1	<b>\$5,992</b>						

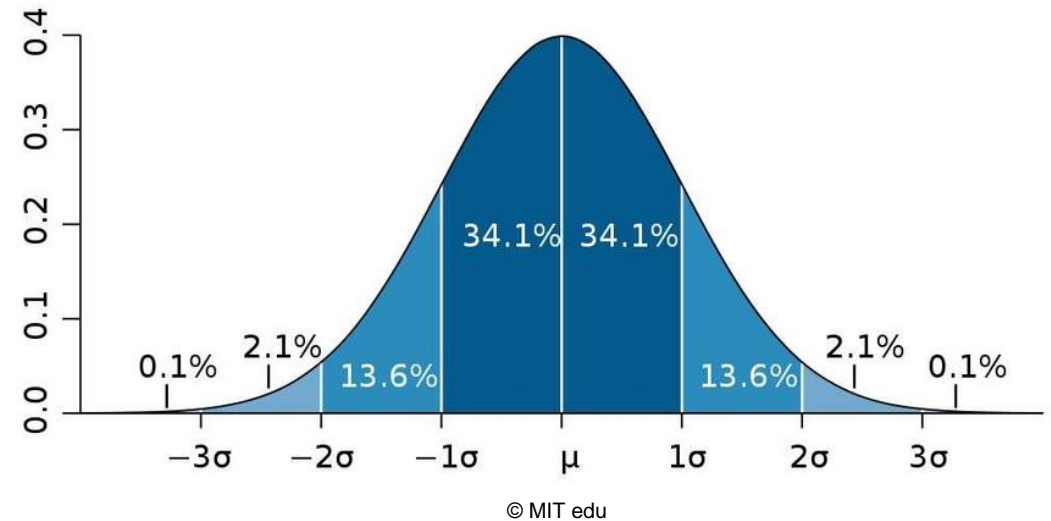
$$\mathbf{rNPV = -\$50,000 + (30\% \times \$214,636) \times 0.87 = \underline{\underline{\$5992}}}$$

# Monte Carlo

For traditional DCFs – people use scenarios – worst case, average case, best case (assumptions for each case)

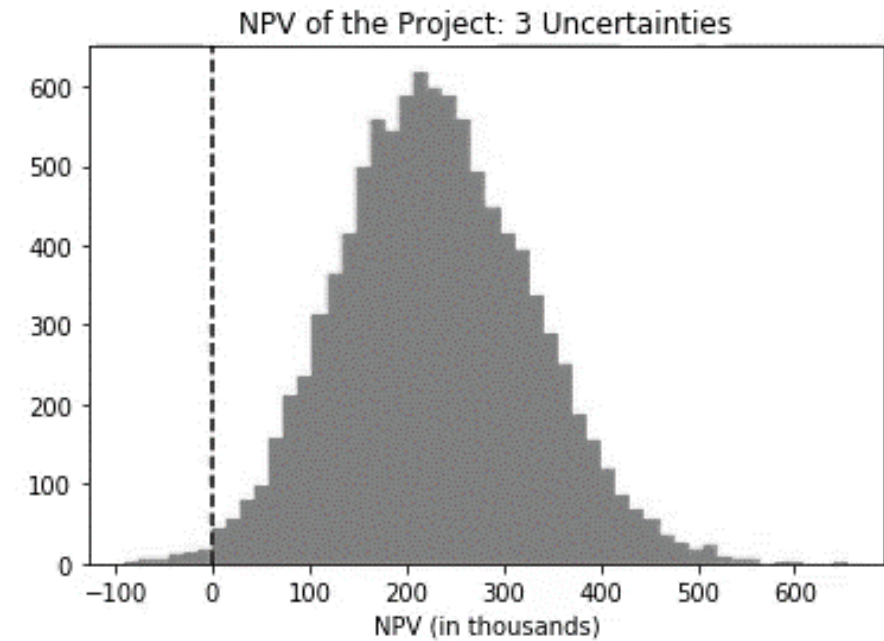
Monte Carlo – simulate the probability of a range of case

Example – Simulate a normal distribution for number of units sold, price of product, discount rate and royalty rate (based on mean & std. deviation)



# Monte Carlo

Result a distribution of NPV (or Fair Values) for the IP.



# Real options

A real option gives the owner the right, but not the obligation to do something;

From finance – Call option (Option to buy asset at an agreed price); Put option (Option to sell an asset at an agreed price)

Different options – option to defer, option to expand or contract, option to abandon or licence, option to switch, option to stage investments, options to grow.

For IP valuation – option to abandon once a project is not profitable anymore is the most used.

# Real options

From a mathematical point of view – 4 methods to value an option:

- Formula
- Trees
- Simulations
- Finite differences

IP valuation – Trees (binomial) and Formula (Black Scholes) – the most used.

# Real options – binomial tree

Similar to decision trees – Binomial tree

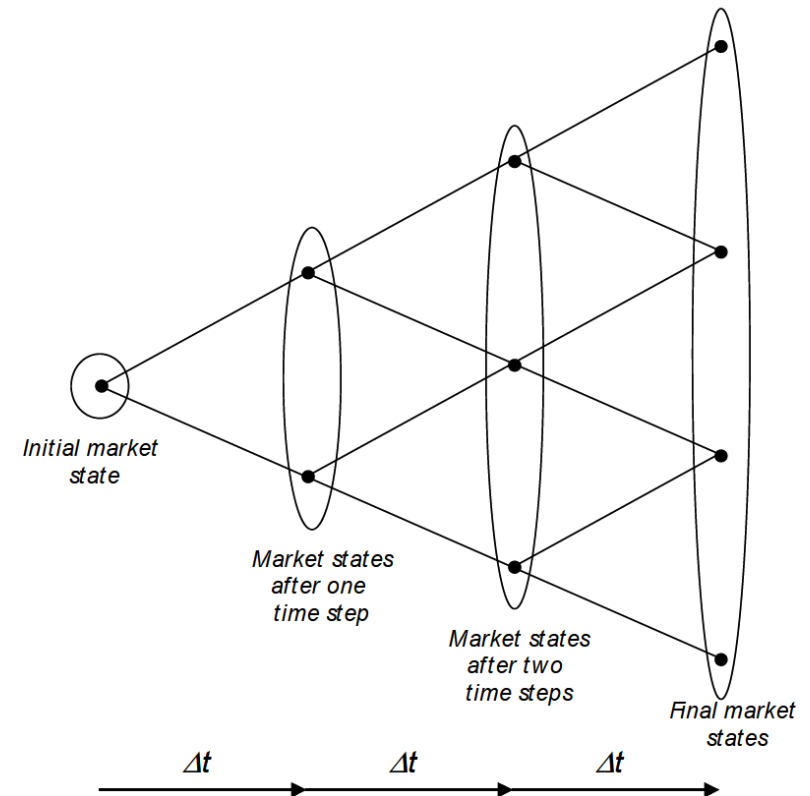
Main use – valuation of Life Sciences Projects

Changes of Revenues(Cashflows)

Each node – 2 possibilities

Main assumption – Volatility

Steps up down – calculate based on volatility  
and time interval



Valuation in Life Sciences – A Practical Guide -Boris Bogdan, Ralph Villiger

# Real options – Black Scholes formula

Black Scholes formula

$$C = N(d_1)S_t - N(d_2)Ke^{-rt}$$

$$\text{where } d_1 = \frac{\ln \frac{S_t}{K} + (r + \frac{\sigma^2}{2})t}{\sigma\sqrt{t}}$$

$$\text{and } d_2 = d_1 - \sigma\sqrt{t}$$

C = call option price

N = Cumulative distribution functions of the normal distribution (Area under the curve)

$S_t$  = spot price of an asset (Current underlying price asset – Present value of cashflows)

K = strike price (exercise price – Cost of development)

r = risk-free interest rate

t = time to maturity (how long to get to market)

$\sigma$  = volatility of the asset



# Key parameters

Revenue modelling

Discount rate

Royalty rate

Success rates

Others

# Revenue modelling

One of the greatest impact on the final valuation results – Starting base

- Market/Industry analysis
- Corresponding product & geography – IP
- Competitive landscape – market share
- Value proposition/Unique selling point (USP) - Pricing

# Revenue modelling

## Basic modelling – linear growth rate

Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Revenue	\$1,000,000	\$1,100,000	\$1,210,000	\$1,331,000	\$1,464,100	\$1,610,510	\$1,771,561	\$1,948,717	\$2,143,589	\$2,357,948
Total addressable market	\$10,000,000									
Market share	10%									
Growth rate	10%									

# Revenue modelling

## Basic modelling – comparable growth rates

Growth rates		55%	48%	41%	37%	33%	25%	20%	15%	10%
Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Revenue	\$200,000	\$310,000	\$458,800	\$646,908	\$886,264	\$1,178,731	\$1,473,414	\$1,768,097	\$2,033,311	\$2,236,642
Total addressable market	\$10,000,000									
Market share	2%									

# Revenue modelling

More realistic approach – Fisher – Pry model – diffusion of new technologies

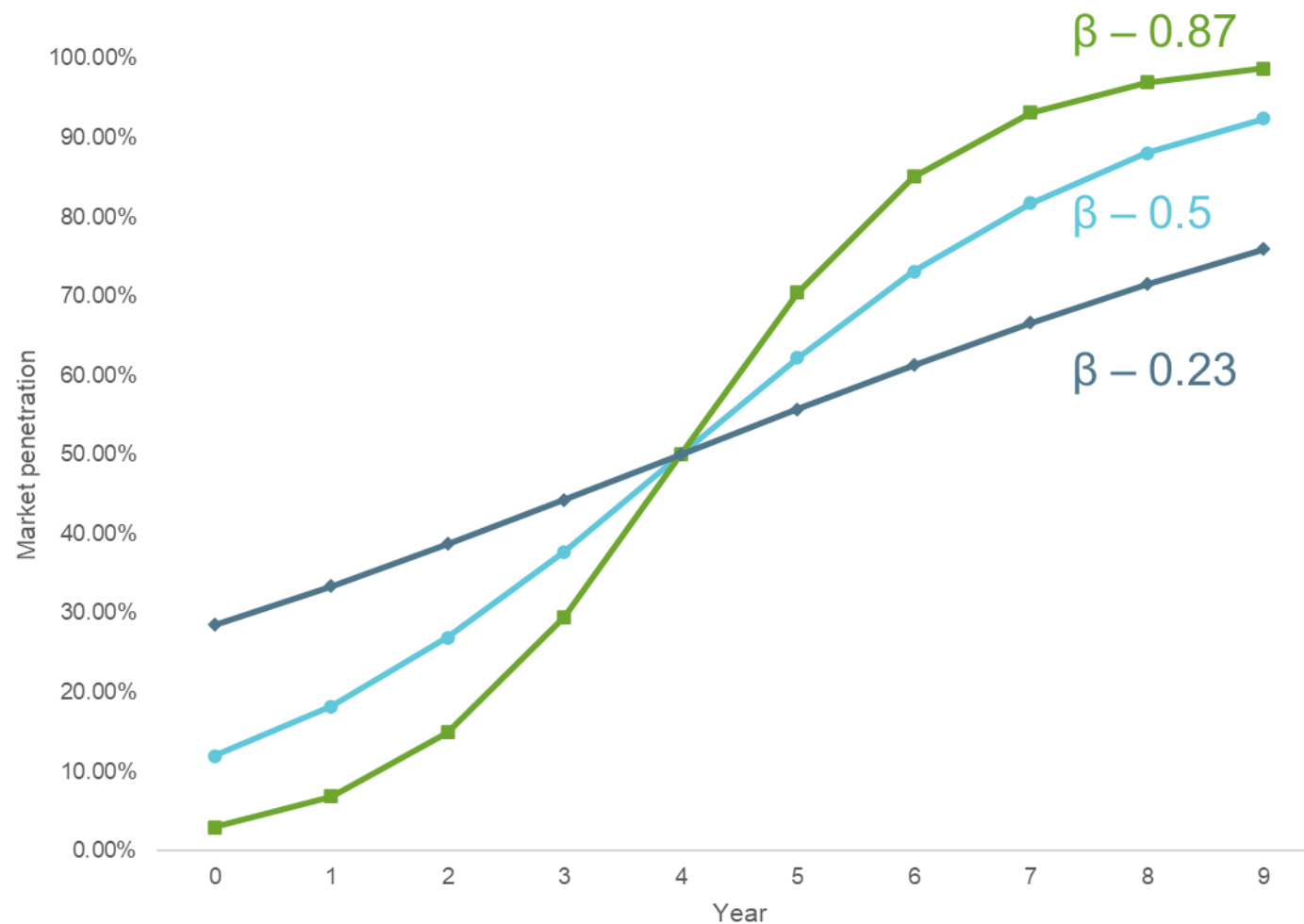
Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Time (t)	0	1	2	3	4	5	6	7	8	9
Market Penetration (MP)	11.92%	18.24%	26.89%	37.75%	50.00%	62.25%	73.11%	81.76%	88.08%	92.41%
Revenue	\$1,192,029	\$1,824,255	\$2,689,414	\$3,775,407	\$5,000,000	\$6,224,593	\$7,310,586	\$8,175,745	\$8,807,971	\$9,241,418
Target market size (SOM)	\$10,000,000									
Shape parameter ( $\beta$ )	0.50									
Time to 50% (T)	4									

$$MP = \frac{1}{1 + e^{-\beta(t-T)}} \quad \text{Logistic curve}$$

# Revenue modelling

The larger  $\beta$  – the steeper the curve.

Ideally – model  $\beta$  and  $T$  – based on numbers within the industry



# Discount rate

Discount rate – rate factor with which future cash flows are discounted to a present value.

\$100 today > \$100 in one year > \$100 in two years, etc. (Time value of money)

# Discount rate

Companies can raise money through debt (borrowing)  
or through equity (selling shares)

Investors – want a return for their money

Return for debt < return for equity - Debt is paid first &  
the remainder goes to shareholders

Weighted average cost of capital (WACC)

## Weighted average cost of capital formula

$$WACC = \left( \frac{E}{V} \times Re \right) + \left( \frac{D}{V} \times Rd \times (1 - Tc) \right)$$

**E** = market value of the firm's equity

**D** = market value of the firm's debt

**Tc** = corporate tax rate

**Re** = cost of equity

**Rd** = cost of debt

**V** = E + D

INSIDER

<https://www.businessinsider.com/personal-finance/weighted-average-cost-of-capital>



# Discount rate

For IP assets – Investment – shareholders or potential shareholders

What is their required return? What is the cost of equity?

Risk vs Reward

The riskier the IP – the higher the Reward required



# Discount rate – theoretical models

Capital Asset Pricing Model (CAPM) –  $R_e = r_f + \beta (r_m - r_f) = r_f + \beta r_p$

$R_e$  – cost of equity;  $r_f$  – risk free rate (US treasuries, UK gilts rates)

$r_m$  – market required rate of return;  $r_p$  – market risk premium

$\beta$  – measure of volatility – movement of a stock compared to the stock market as a whole

Advantageous – databases with all parameters

Better suited for bigger companies with diversified IP assets

# Discount rate – theoretical models

Build up method –  $R_e = r_f + r_p + r_i + r_s + r_c + r_{cp}$

$r_i$  – industry premium,  $r_s$  – size premium,  $r_c$  – country premium,  $r_{cp}$  – company risk

Advantageous – databases with all parameters

Better suited for bigger companies with diversified IP assets

# Discount rate – IP – early stage

## IP valuations discount rate

- Not a diversified portfolio (single asset/product - more risk)
- High likelihood of failure
- Market/Industry/Regulatory landscapes matter

Investment in IP – very similar to early-stage Venture Capital Investment

# Discount rate – IP

## Venture Capital Rates of Return

Stage of development	Required rate of return (%)
Startup	50 - 70
First stage (early development)	40 - 60
Second Stage (expansion)	30 - 50
Third Stage	20 - 35

Intellectual property – Valuation, Exploitation, and Infringement Damages – Russell L. Parr – 5<sup>th</sup> edition 2018

Startup – companies less than 1 year old;      First stage – Prototypes developed, scaling up risk high;

Second stage – Product finalised and company growing;      Third stage – Companies approaching maturity

# Discount rate – IP

Venture Capital Rates of Return -  $(1+TR)^T = (1+r)^T/(1-p)$

$TR = [(1+r)^T/(1-p)]^{(1/T)} - 1$ ; TR – target return; r- required return; p – probability of failure; T- time to exit

For r = 25%

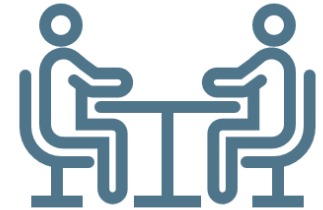
	10%	20.0%	30.0%	40.0%	50.0%	60.0%	70.0%	80.0%	90.0%
1	39%	56%	79%	108%	150%	213%	317%	525%	1150%
2	32%	40%	49%	61%	77%	98%	128%	180%	295%
3	29%	35%	41%	48%	57%	70%	87%	114%	169%
4	28%	32%	37%	42%	49%	57%	69%	87%	122%
5	28%	31%	34%	38%	44%	50%	59%	72%	98%
6	27%	30%	33%	36%	40%	46%	53%	63%	83%
7	27%	29%	32%	34%	38%	42%	48%	57%	74%
8	27%	29%	31%	33%	36%	40%	45%	53%	67%
9	26%	28%	30%	32%	35%	38%	43%	49%	61%

# Royalty rate

Royalty rate – Licensor (owner of IP) – granting rights to Licensee (using the IP)

Licensing agreement – many considerations

- Licensed rights (details of IP)
- Scope of licence (geographies, markets, field of use)
- Exclusivity (exclusive, sole, non-exclusive)
- Financial terms (up-front payments, milestone payments, running royalties, royalty base, equity compensation, audit clauses, etc.)



# Royalty rate

<b>Non-exclusive license</b>	<b>Non-exclusive license</b>	<b>Sole license</b>	<b>Sole License</b>	<b>Exclusive license</b>	<b>Exclusive license</b>	<b>Exclusive license</b>	<b>Exclusive license</b>
<b>Geography</b>	<b>Geography</b>	<b>Geography</b>	<b>Geography</b>	<b>Restricted geography</b>	<b>Worldwide</b>	<b>Restricted geography</b>	<b>Worldwide</b>
<b>Restricted field of use</b>	<b>Fields of use</b>	<b>Fields of use</b>	<b>Fields of use</b>	<b>Restricted field of use</b>	<b>Restricted field of use</b>	<b>For all fields of use</b>	<b>For all fields of use</b>





# Royalty rate determination

- Rule of thumb – 25% of profit (or 5% Net Sales for businesses with 20% profit margin)
- Benchmarking – similar transactions or industry averages
- Profit differential analysis (profit with and without access to the IP)
- Profit split - Analysis of contributions for allocation of profit – royalty rate (ideal)

# Royalty rate

- Agreements need to be analysed in detail (very time consuming)
  - Granted rights
  - Geography; Field of Use
  - Royalty Base (Gross sales, Net sales, EBITDA, Net Profit, etc.)
  - Related parties vs. Arm's length negotiation
  - Industry, types of companies, etc.

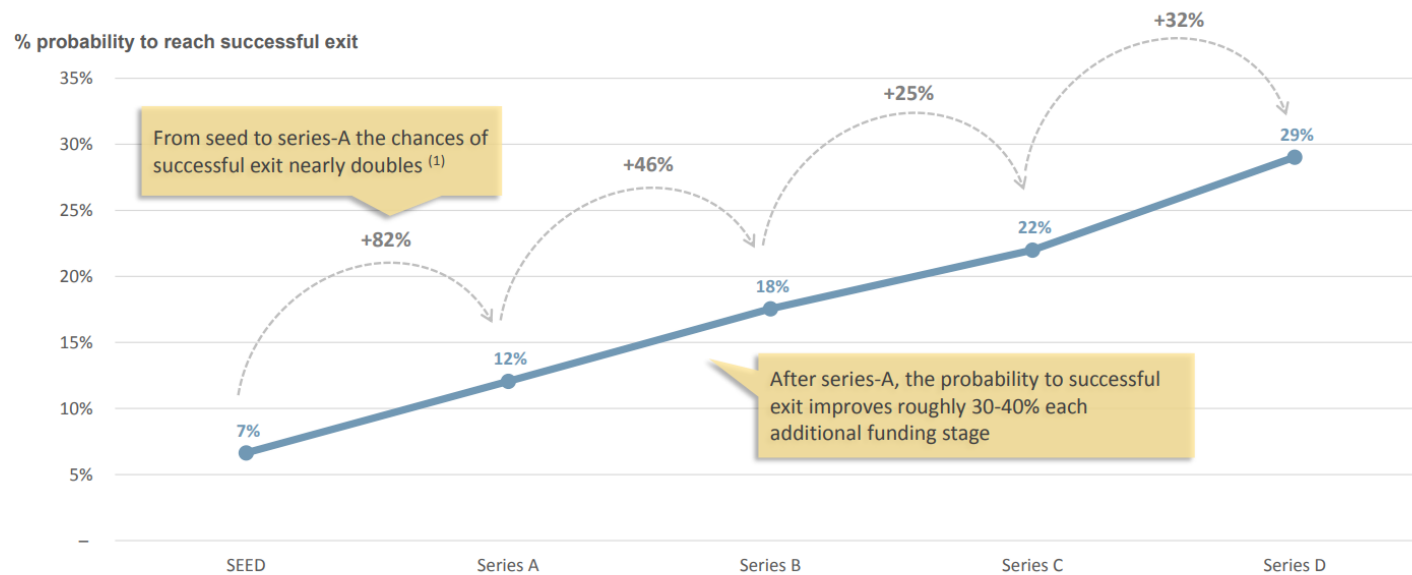
# Royalty rate determination

Industry	Average	Median	Max	Min	Count
Chemicals	4.7%	4.3%	25.0%	0.1%	78
Internet (incl software)	11.8%	8.8%	50.0%	0.3%	88
Telecom (excl Media)	4.9%	4.5%	15.5%	0.4%	73
Consumer Goods, Retail & Leisure	5.5%	5.0%	28.0%	0.1%	98
Media & Entertainment	9.1%	5.0%	50.0%	2.0%	25
Food Processing	3.2%	2.8%	10.0%	0.3%	38
Medical/Health Products	6.1%	5.0%	77.0%	0.1%	376
Pharma & Biotech	7.0%	5.0%	50.0%	0.0%	458
Energy & Environment	5.0%	5.0%	20.0%	1.0%	107
Machines/Tools	5.2%	4.5%	25.0%	0.5%	90
Automotive	4.3%	3.5%	15.0%	0.5%	59
Electrical & Electronics	4.2%	4.0%	15.0%	0.5%	139
Semiconductors	4.3%	3.0%	30.0%	0.0%	75
Computers & Office Equip	5.3%	4.0%	25.0%	0.2%	73
Software	11.5%	6.8%	70.0%	0.0%	147
<b>Industry Summary</b>	<b>6.40%</b>	<b>4.80%</b>			<b>1,924</b>

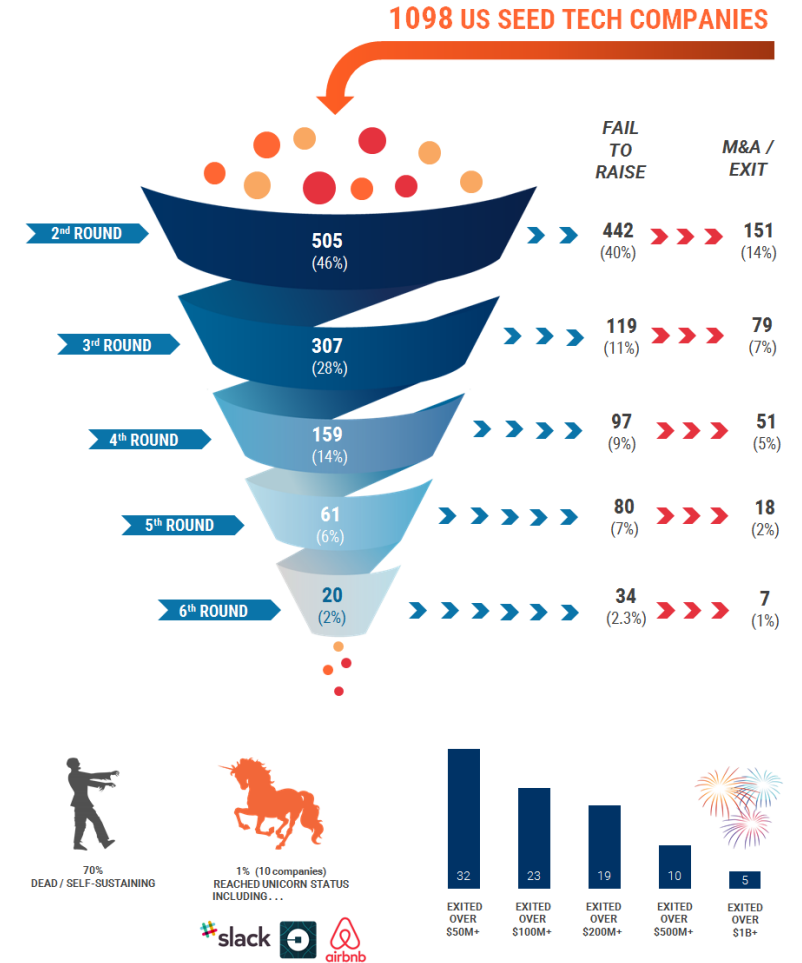
derived from RoyaltySource

# Success rate

## Seed stage – low probability of success



Note: cohorts between 2010-2013. Several companies from these cohorts may still reach exit, which would increase % success.  
 1. Data is also affected by survival bias: there are many unknown seeded companies that failed and never announced their seed round. Correcting for this would reduce the % success.



Note: All numbers based on cohort of companies that raised seed in 2008, 2009 or 2010 and disclosed valuations only.



# Success rate

Pharma/  
Biotech  
Success  
rates

Disease Group	Stage 1	Stage 2	Stage 3	Approval	Cumulative
Arthritis/Pain	76.90%	38.10%	78.10%	89.10%	20.40%
CNS	66.20%	45.60%	61.80%	77.90%	14.50%
CV	62.70%	43.30%	76.30%	84.40%	17.50%
GIT	66.80%	49.10%	71.00%	85.90%	20.00%
Immunology	64.80%	44.60%	65.20%	81.60%	15.40%
Infections	70.80%	51.20%	79.90%	96.90%	28.10%
Metabolism	47.80%	52.00%	78.90%	92.80%	18.20%
Oncology	64.40%	41.80%	65.40%	89.70%	15.80%
Ophthalmology	66.00%	39.00%	64.00%	92.00%	15.20%
Respiratory	63.40%	41.10%	59.90%	76.90%	12.00%
Urology	50.00%	38.00%	67.00%	79.00%	10.10%
Women's Health	39.00%	42.00%	48.00%	59.00%	4.60%

Valuation in Life Sciences – A Practical Guide -Boris Bogdan, Ralph Villiger

# Other factors

Valuation date & End of financial year – Adjustments for partial period and cashflows – informs the assumptions;

Tax rate & Tax amortisation benefit

Contributory Asset Charges

EBIT margin

Changes in WC margin

# Work through academic specific examples

Dr. Brian More

# Case study 1 – Valuation of technology (patents + know how)

Carbon capture technology – patent at PCT stage (priority date – Jan 2022) + know-how

ISR report – quite clean + different types of claims

There are a few strong competitors

The team is very experienced and can deliver scale-up; done so with previous technology

No projections, not easy to get the costs of development as was done alongside other things.



# Case study 1 – Valuation methods

What method would you choose?

Relief from Royalty – easiest to obtain data for

DCF/Greenfield can also work – more data required about EBIT, changes in working capital, investment requirements, depreciation & amortisation.

# Case study 1 – Revenue modelling

Carbon market – a few established players

<https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage>

Around – 125Mt per year by 2030 (125 million tonnes)

For our example – the technology aims for **1Mt** by 2033 – Fisher Pry to model the diffusion of the technology.

Price per tonne – PwC – forecasts future carbon offset prices (graph) – assume a \$60



<https://www.pwc.co.uk/services/sustainability-climate-change/insights/bullish-sentiment-expected-over-next-decade-for-carbon-markets-globally-latest-trends-and-developments-in-2022.html#:~:text=The%20EU%20and%20UK%20ETS,2026%2D30%20for%20both%20schemes>

# Case study 1 – Revenue modelling

Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Time	0	1	2	3	4	5	6	7	8	9	10
Penetration	3.23%	7.24%	15.45%	29.94%	50.00%	70.06%	84.55%	92.76%	96.77%	98.59%	99.39%
Removal Capacity	32	72	154	299	500	701	846	928	968	986	994
Target removal capacity	1,000										
Shape parameter	0.85										
Timeto50%	4										

## Revenue in thousands)

Penetration	3.23%	7.24%	15.45%	29.94%	50.00%	70.06%	84.55%	92.76%	96.77%	98.59%	99.39%
Carbon removal capacity (kilotonnes)	<b>32.00</b>	<b>72.00</b>	<b>154.00</b>	<b>299.00</b>	<b>500.00</b>	<b>701.00</b>	<b>846.00</b>	<b>928.00</b>	<b>968.00</b>	<b>986.00</b>	<b>994.00</b>
Revenue	\$1,920	\$4,320	\$9,240	\$17,940	\$30,000	\$42,060	\$50,760	\$55,680	\$58,080	\$59,160	\$59,640

# Case study 1 – Royalty rate

Year	Licensor	Licensee	IP right	Territory	Base	Royalty	Restrictions
15/04/2021	Euacentrix LLC	Boon Industries Inc.	IP covering proprietary technology – Proprietary formula (ClO <sub>2</sub> + water) & make use Proprietary Equipment	Worldwide	Net Sales	5%	Exclusive; For all application and uses
19/11/2020	Digital Research Solutions Inc.	JANGIT Enterprises Inc.	Patent (US 10572726 (digital media document summarizer) + associated know-how	Worldwide	Net Sales	6%	Exclusive, Solely for field of Summarization, Consolidation and educational software
04/12/2019	Tortec Forschungsinstitut gmbh	Tortec Titan+	Exploit the technology (List of 8 patents (Ukraine, Russia) + technologies, patents, designs, processes, formulas, know-how, technical data, etc.) to produce TORtec products.	Worldwide	Net Income	10%	Exclusive, Perpetual, Irrevocable
21/04/2015	SG Blocks Inc	Red Cardinal Holdings	Proprietary method and technology for construction of buildings	Worldwide	Net Sales	10%	Non-exclusive USA, EU Exclusive – The world – (USA+EU)
01/08/2011	Temple University	Save the world air, inc.	Patent rights (Patent portfolio – Method for Reduction of Crude oil viscosity – USA, Brazil, Canada, UK, China, Indonesia, Mexico, Nigeria, Norway, Russia, Arab Emirates- granted only in UK and Nigeria) and technical information for making, selling, using, importing Licensed product	Worldwide	Net Sales	7% for (first \$20m sales, sliding scale to 4% for >\$100m	Exclusive
12/07/2010	CEFCO Global Clean Energy, llc/CEFCO LLC	Peerless, LLC	CEFCO Process (Patent US20080250715+ know-how) in the field of “air quality control systems for post-combustion gases, including air filtration, air emissions control, carbon emission and capture and air pollutants recovery, and the production of end-products, including chemicals, fertilizers, fuels, and metals and minerals, from the products of such filtration, control, capture or recovery process.”	USA	Gross Revenue Sales	5%	Exclusive, 10 years
09/12/2014	Rice University	Tubz, LLC	Patent family (USA, Europe, Israel, South Korea) - Graphene-CNT Hybrid Material and Use as a Supercapacitor Electrode	Worldwide	Adjusted Gross Sales	3% +other payments	Exclusive, Field of use (consumer electronics (including without limitation mobile electronics, mobile telephones/smartphones, tablets, and wearable electronics), nano electronic technologies, electric vehicles, energy storage, and medical devices.)

# Case study 1 – Royalty rate

What royalty rate should we use for this valuation?

Which do you think is the closest comparable?

In my view – 5<sup>th</sup> agreement is the closest – start from 5% - consider geography, exclusivity, any other existing licences.

How would you adjust if you discover there is already a contract that gives a companies a free non-exclusive world-wide licence?

3.25% - 3.75%

# Case study 1 – Discount rate and risk adjustment

What are the risks for this technology to reach the market?

What are the risks associated with the IP?

How can we account for the risk in the IP valuation?

Either high VC discount rate; or Rate of return of startup (20%) + risk adjustment of revenues (10% success rate)

# Case study 1 – Other parameters

Tax rate – 25% - usually a good assumption if no information

Terminal growth rate - -7% - the patent expires in 2043

Tax amortisation period – Remaining patent lifetime

Valuation data

End of financial year

# Case study 1 – Revenues & Inputs

## Revenues & Inputs

Target Capacity for removal (kilotonnes)	<b>1,000</b>	Royalty Rate	3.5%	Success factor	10%								
Price per kilotonne	\$60	Terminal growth rate	-7%										
Discount rate	20%	Tax rate	25%										
Tax amortisation period	19	Financial Year End	31/12/2023										
Annuity	4.8434957	Valuation Date	29/08/2023										
TAB factor	0.0680682	First cashflow	31/12/2023										
		<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>	<b>2031</b>	<b>2032</b>	<b>2033</b>	Terminal
Penetration		3.23%	7.24%	15.45%	29.94%	50.00%	70.06%	84.55%	92.76%	96.77%	98.59%	99.39%	
Carbon removal capacity (kilotonnes)		<b>32.00</b>	<b>72.00</b>	<b>154.00</b>	<b>299.00</b>	<b>500.00</b>	<b>701.00</b>	<b>846.00</b>	<b>928.00</b>	<b>968.00</b>	<b>986.00</b>	<b>994.00</b>	<b>924.00</b>
Revenue		\$1,920	\$4,320	\$9,240	\$17,940	\$30,000	\$42,060	\$50,760	\$55,680	\$58,080	\$59,160	\$59,640	\$55,440



# Case study 1 – Fair value

## Net Present Value

Revenues	\$1,920	\$4,320	\$9,240	\$17,940	\$30,000	\$42,060	\$50,760	\$55,680	\$58,080	\$59,160	\$59,640	\$55,440
risk adjusted revenues	\$192	\$432	\$924	\$1,794	\$3,000	\$4,206	\$5,076	\$5,568	\$5,808	\$5,916	\$5,964	\$5,544
Pre tax royalties	\$7	\$15	\$32	\$63	\$105	\$147	\$178	\$195	\$203	\$207	\$209	\$194
Taxes	-\$2	-\$4	-\$8	-\$16	-\$26	-\$37	-\$44	-\$49	-\$51	-\$52	-\$52	-\$49
After tax saved costs	\$5	\$11	\$24	\$47	\$79	\$110	\$133	\$146	\$152	\$155	\$157	\$146
Partial period adjustment	0.34	1	1	1	1	1	1	1	1	1	1	1
	\$2	\$11	\$24	\$47	\$79	\$110	\$133	\$146	\$152	\$155	\$157	\$146
Terminal value												\$539
	\$2	\$11	\$24	\$47	\$79	\$110	\$133	\$146	\$152	\$155	\$157	\$685
Years for discounting	0.34	1.34	2.34	3.34	4.34	5.34	6.34	7.34	8.34	9.34	10.34	11.34
Discount factor	94%	78%	65%	54%	45%	38%	31%	26%	22%	18%	15%	13%
Present value of saved costs	\$2	\$9	\$16	\$26	\$36	\$42	\$42	\$38	\$33	\$28	\$24	\$87
<b>Net present value</b>	<b>\$382</b>											
Tax amortization benefit	\$26											
<b>Fair value</b>	<b>\$408</b>											

# Case study 1 – Sensitivity Analysis

		Discount rate				
		15.0%	17.5%	20.0%	22.5%	25.0%
Royalty rate	2.5%	\$430	\$351	\$291	\$245	\$209
	3.0%	\$516	\$421	\$349	\$294	\$251
	3.5%	\$602	\$491	\$408	\$343	\$293
	4.0%	\$688	\$561	\$466	\$392	\$334
	4.5%	\$774	\$631	\$524	\$441	\$376

		Discount rate				
		15.0%	17.5%	20.0%	22.5%	25.0%
Success rate	7.5%	\$451	\$368	\$306	\$257	\$219
	10.0%	\$602	\$491	\$408	\$343	\$293
	12.5%	\$752	\$614	\$510	\$429	\$366
	15.0%	\$903	\$737	\$611	\$515	\$439
	17.5%	\$1,053	\$859	\$713	\$601	\$512

# Case study 2 – Software valuation (copyright)

Scientific software for selling to pharma and chemical industry companies

Accounts for cost of development

IP copyright – not patented; no open-source code used

The software comprises 5 modules developed in collaboration between the biotechnology department and the computing department

Use the cost to reproduce at today's prices

# Financial Data Verified by Accounts

Year	2018	2019	2020	2021	2022	2023
	Inception	Coding	Elaboration	Transition	Transition	Delpoyment
Systems Architect	25,000	5,000	54,000	10,000	5,400	14,000
Sprint Manager	2,000	35,000	46,300	0	0	0
Designer	36,700	10,000	23,670	2,600	0	3,000
Coder	0	176,320	83,250	20,000	12,300	4,320
Penetration testing	0	0	28,900	32,800	25,890	6,000
Overheads	12,740	45,264	47,224	13,080	8,718	5,464
Capital expenditure	28,500			4,630		
Consultancy	20,000	20,000	20,000	20,000	20,000	20,000
<b>Totals</b>	<b>124,940</b>	<b>291,584</b>	<b>303,344</b>	<b>103,110</b>	<b>72,308</b>	<b>52,784</b>
<b>Total Historic Cost</b>	<b>948,070</b>					

Accounting year end the 30th of June

# Input Parameters for Valuation

## Adjustments

Inflation rate	5% pa
Obsolescence	10% pa
Profit	10%
Opportunity cost	10%
Discount rate	15%
Valuation date	30/08/2023

## Tax

Corporation Tax	25%
Tax Amortization period	15 years
Annuity	5.8473
TAB factor	0.10797943

# Step by Step Calculations

Multiply the annual costs by the profit and opportunity cost to enhance the value = 120%

<b>Totals</b>	<b>124,940</b>	<b>291,584</b>	<b>303,344</b>	<b>103,110</b>	<b>72,308</b>	<b>32,784</b>
<b>Profit + Opportunity</b>	<b>149,928</b>	<b>349,901</b>	<b>364,013</b>	<b>123,732</b>	<b>86,770</b>	<b>39,341</b>

Multiply the new costs by the inflation factor

Number of days from the accounting period end to the valuation date = 61 days

Enhancement factor = 0.167 to increase the costs from June to August

For 2023 multiply by  $(1 + 0.05)^{0.167} = 1.008$

For 2022 multiply by  $(1 + 0.05)^{1.167} = 1.059$

Then continue back to 2018

<b>Totals</b>	<b>124,940</b>	<b>291,584</b>	<b>303,344</b>	<b>103,110</b>	<b>72,308</b>	<b>32,784</b>
<b>Profit + Opportunity</b>	<b>149,928</b>	<b>349,901</b>	<b>364,013</b>	<b>123,732</b>	<b>86,770</b>	<b>39,341</b>
<b>Inflation Factor</b>	<b>5.167</b>	<b>4.167</b>	<b>3.167</b>	<b>2.167</b>	<b>1.167</b>	<b>0.167</b>
<b>Inflated costs</b>	<b>192,916</b>	<b>428,786</b>	<b>424,838</b>	<b>137,531</b>	<b>91,853</b>	<b>39,663</b>

# Step by Step Calculations

Divide the new costs by the obsolescence factor

Number of days from the accounting period end to the valuation date = 61 days

Enhancement factor = 0.167 to increase the costs from June to August

For 2023 divide by  $(1 + 0.10)^{0.167} = 1.016$

For 2022 divide by  $(1 + 0.10)^{1.167} = 1.118$

Then continue back to 2018

<b>Totals</b>	<b>124,940</b>	<b>291,584</b>	<b>303,344</b>	<b>103,110</b>	<b>72,308</b>	<b>32,784</b>
<b>Profit + Opportunity</b>	<b>149,928</b>	<b>349,901</b>	<b>364,013</b>	<b>123,732</b>	<b>86,770</b>	<b>39,341</b>
<b>Inflation Factor</b>	<b>5.167</b>	<b>4.167</b>	<b>3.167</b>	<b>2.167</b>	<b>1.167</b>	<b>0.167</b>
<b>Inflated costs</b>	<b>192,916</b>	<b>428,786</b>	<b>424,838</b>	<b>137,531</b>	<b>91,853</b>	<b>39,663</b>
<b>Obsolescence</b>	<b>117,894</b>	<b>288,242</b>	<b>314,147</b>	<b>111,867</b>	<b>82,185</b>	<b>39,036</b>

Reproduction cost then equals the sum of the bottom line = **€ 953,371**

# Accounting for tax and tax amortization benefit (TAB)

Reproduction cost then equals = € 953,371

Corporation tax = 25%

Tax deducted = € 238 343

After tax reproduction cost = € 715,028

Tax amortization benefit = € 77,208

**Fair Market Value of Software = € 792,236**



# Commentary on Calculations

The inflation rate is taken at 5% per annum, more accurately you would apply the inflation rate at the known yearly rate.

Obsolescence is taken at 10% per annum, this varies dependent upon the complexity of the algorithms.

The fair market value is very sensitive to the obsolescence  
For an obsolescence of 20% the fair value becomes **€539,752**

# Case study 3 – Teaching material (copyright)

Teaching material – new way of teaching medical students – saves Medical universities cost;

Your university medical school has developed a blended teaching software package along with online real time assessment for medical students. The software is a gamification of traditional lecture theatre training with cost savings as shown on the next slide:

# Medical School Cost Savings 2023-2028



Lecture theatre time saved = 200 hours per annum



Marking and assessment time saved = 500 hours per annum



Blended cost of teaching staff = \$ 250 per hour (includes overheads)



Blended cost of marking staff = \$ 50 per hour (includes overheads)



Total cost saving = \$ (200 x 250) + \$ (500 x 50) = \$ 75,000 per annum

# Input Parameters for Valuation

Adjustments		Tax	
Growth rate	5% pa	Corporation Tax	25%
Terminal growth rate	1%	Tax Amortization period	25 years
Discount rate	20%	Annuity	4.947587
Valuation date	29/08/2023	TAB factor	0.0520511
Financial year end	31/12/2023		
First cash flow	31/12/2023		

# Step by Step Calculations

Year	2023	2024	2025	2026	2027	2028	Terminal
Saved costs	75,000	78,750	82,688	86,822	91,163	95,721	96,678
Taxes	18,750	19,688	20,672	21,705	22,791	23,930	24,170
After tax saved costs	56,250	59,063	62,016	65,116	68,372	71,791	72,509
Partial Period Adjustment	0.34	1	1	1	1	1	
	19,125	59,063	62,016	65,116	68,372	71,791	
Terminal Value						381,625	
	19,125	59,063	62,016	65,116	68,372	453,416	
Years for discounting	0.34	1.34	2.34	3.34	4.34	5.34	
Discount factor	0.94	0.78	0.65	0.54	0.45	0.38	
<b>Present Value of saved costs</b>	<b>17,975</b>	<b>46,260</b>	<b>40,478</b>	<b>35,418</b>	<b>30,991</b>	<b>171,265</b>	
Net Present Value	<b>342,388</b>						
TAB	<b>17,822</b>						
Fair Value	<b>360,209</b>						

# Commentary on Calculations

The discount rate is taken at 20%, this is high for a public university where the cost of capital is debt only, this figure is more like a small private university value.

For sensitivity calculations take the discount rate to 10%, then recalculate.

## Result

Net Present Value		<b>485,246</b>
TAB		<b>48,525</b>
Fair Value		<b>533,771</b>

A 48% increase in the expected lifetime value

# Licensing Considerations

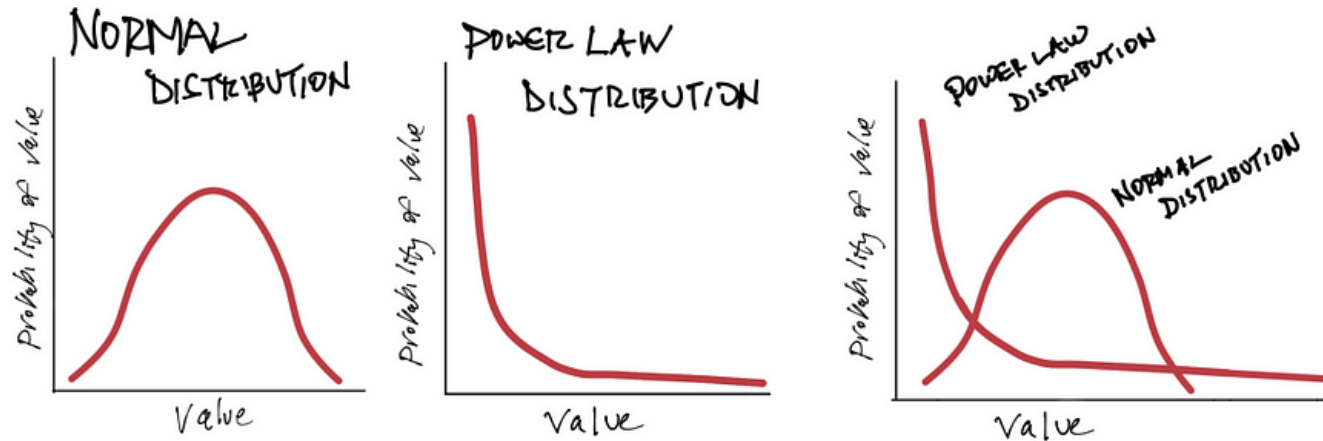


The total value of the NPV of the cost savings using the gamified teaching material = \$360,000.

The licensing university would expect 25% of this as a royalty = \$90,000

Or \$9,000 per annum over 10 years.

# Spinouts and VC funding



Source: <https://dougshapiro.medium.com/power-laws-in-culture-27ab6461c693>

Venture capital works on a Power Law model

VCs – each investment is made with the potential of returning 10-20x (the whole fund or more)

Most of the investments will fail

A few will return the invested capital or a bit more

Outliers will return most of the fund



*“A healthy intellectual property position may not guarantee a start-up technology company is going to be successful, but it is going to find it a whole lot harder to succeed if it does not have one. And crucially, it is not just the ownership of intellectual property that is important, it is the understanding that intellectual property is a key.”*

Joff Wild

# Spinouts and VC funding – due diligence

<p><b>COMMERCIAL</b></p> <p><i>From startup Int. research References</i></p>	<p><b>PRODUCT</b></p> <p><i>Exact purpose and actual use-case of the product or service</i></p>	<p><b>MARKET</b></p> <p><i>Size, competition, customers and associated growth</i></p>	<p><b>ECONOMICS</b></p> <p><i>Revenue and cost economics, delivery, upselling potential</i></p>	<p><b>EXIT</b></p> <p><i>Exit channels, strategic partners, captable structure</i></p>
<p><b>TECHNICAL</b></p> <p><i>From startup Int. research References + int./ext. experts</i></p>	<p><b>ASSETS</b></p> <p><i>Intellectual property of hardware, software, licenses et cetera</i></p>	<p><b>SCALABILITY</b></p> <p><i>Full/partial ability of technology to scale and remain robust</i></p>	<p><b>DEFENSE</b></p> <p><i>Speed of replication or adoption by competition</i></p>	<p><b>QUALITY</b></p> <p><i>Development quality, evaluation of tech-roadmap</i></p>
<p><b>FINANCIAL</b></p> <p><i>From startup + int./ext. experts</i></p>	<p><b>BOOKS</b></p> <p><i>Quality and correctness of financial accounting, activation of assets</i></p>	<p><b>PLANNING</b></p> <p><i>Financial controlling and tracking of key performance indicators</i></p>	<p><b>CASH</b></p> <p><i>Payment cycles, defaults, general cash flow management</i></p>	<p><b>AUDIT/TAX</b></p> <p><i>Audit and taxation reports, national &amp; international</i></p>
<p><b>LEGAL</b></p> <p><i>From startup + int./ext. experts + law firm</i></p>	<p><b>BASE</b></p> <p><i>Investor-, shareholder agreements, fundamental contracts</i></p>	<p><b>REPORTS</b></p> <p><i>Past legal reports on the company, cases w/ business impact</i></p>	<p><b>CONTRACTS</b></p> <p><i>Supplier-, customer-, partner-, employment contracts</i></p>	<p><b>NEGOTIATE</b></p> <p><i>Terms and conditions for future events regarding exit etc.</i></p>

# Spinouts and VC funding – valuation approaches

Early stages- VCs value company/not IP individually

- IP is included in the company value (main driver of value)

Pre & Post money valuation

The Art

- How much money one needs to raise? – VCs usually want 20-30% equity
- Interest from other investors (FOMO) – more leverage
- *“We laugh at [venture] firms that use spreadsheets for seed and Series A deals for valuations. There’s just not enough data.”* says Mendelson, co-author of the book, *Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist*.

Early stage – lack of historical financial data

Premoney valuation =  
Postmoney valuation –  
Invested Capital

Premoney valuation - €4m | 80%  
Postmoney valuation - €5m | 100%  
Invested capital - €1m | 20%



# Spinouts and VC funding – valuation approaches

3 semi-quantitative method (high degree of subjectivity) – Payne Scorecard, Berkus method, and Risk factor summation method.

- Example of Payne Scorecard

2 quantitative methods – VC method; First Chicago method.

- VC method

# Spinouts and VC funding – Payne scorecard

COMPARISON FACTOR	WEIGHT IN VALUATION
Strength of entrepreneur & Team	0-30%
Size of the opportunity	0-25%
Product/Technology	0-15%
Competitive environment	0-10%
Marketing/Sales/Partnerships	0-10%
Need for additional investment	0-5%
Other factors	0-5%

Develop for seed companies in the range of \$1m - \$2.5m – Premoney valuation.

Decide on comparison factor for potential company

Compare the factors with a benchmark company for which the Premoney valuation is known

Add factors and multiply with benchmark pre-money valuation

Source: William Payne, The Definitive Guide to Raising Money from Angels; Antonella Puca, Early Stage Valuation: A Fair Value Perspective

# Spinouts and VC funding – Payne scorecard

COMPARISON FACTOR	TARGET COMPANY	BENCHMARK	COMPARISON	FACTOR
Strength of entrepreneur & Team	30%	25%	120%	0.36
Size of the opportunity	25%	25%	100%	0.25
Product/Technology	15%	20%	75%	0.1125
Competitive environment	10%	10%	100%	0.1
Marketing/Sales/Partnerships	10%	12.5%	80%	0.08
Need for additional investment	5%	5%	100%	0.05
Other factors (great traction)	5%	2.5%	200%	0.1

Total factor – 1.0525; Benchmark Premoney valuation - \$2m

Target Premoney valuation - \$ 2.105m

# Spinouts and VC funding – VC method

Estimating – Postmoney valuation & ownership % - as a function of desired risk adjusted return & capital to invest

Postmoney valuation = Valuation at exit /  $(1 + \text{Target Return})^{\text{Time to exit}}$

Example

€1m to invest; Required return 40%

Value at exit - €30m; Time to exit – 6 years

Target Total value to paid in capital (TVPI or Investment multiple) -  $(1 + \text{Target Return})^{\text{Time to exit}} = 7.53$

Postmoney valuation -  $€30\text{m} / 7.53 = \text{approx. } €4\text{m}$



Thank you for your attention!

[DSava@mathys-squire.com](mailto:DSava@mathys-squire.com)  
[BMore@mathys-squire.com](mailto:BMore@mathys-squire.com)

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