Compound Interest Theory and other Delectable Debateable Concepts Applicable to Valuations and Feasibility Studies

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Having worked for ABSA in their valuations department for 15 years, spent 16 years as an academic, and the rest of the time as Quantity Surveyor it came as a bit of a culture shock to have to retire from ABSA due to the 63 years age restriction. However, I am back in valuations and still have much to offer. So when Karin van der Vyfer aproached me for an article for SA Valuer this was the area that was offered.

The time value of money is something we often work with in valuations and investment analysis and most of it is straight forward, yet after adjudicating aproximately 100 valuations from external valuations each month I realised that there are clearly differences of opinion and in cases misunderstandings.

One thing I have learnt is never to think that I know everything and I have often gone back to the top valuers in town and bounced my opinions off them, even at this age.

I therefore intend to cover some of the areas that many professionals have found difficulty with, or understand the concepts in different ways to their colleagues.

Economics is the basis of valuations

I have included some diagrams from T Collins and V Ghyoot “An introduction to Commercial Property Finance Development and investment below, of which has sold circa 5000 copies since July 2012. The first diagram covers the factors affecting the value of property. Some of these factors are controllable to a point and others we have no control over. The reason for this is when we start debating which methods are market related we need to stand back and say do the methods include the factors that affect supply and demand and are the willing buyers and sellers applying these inputs in the same way?

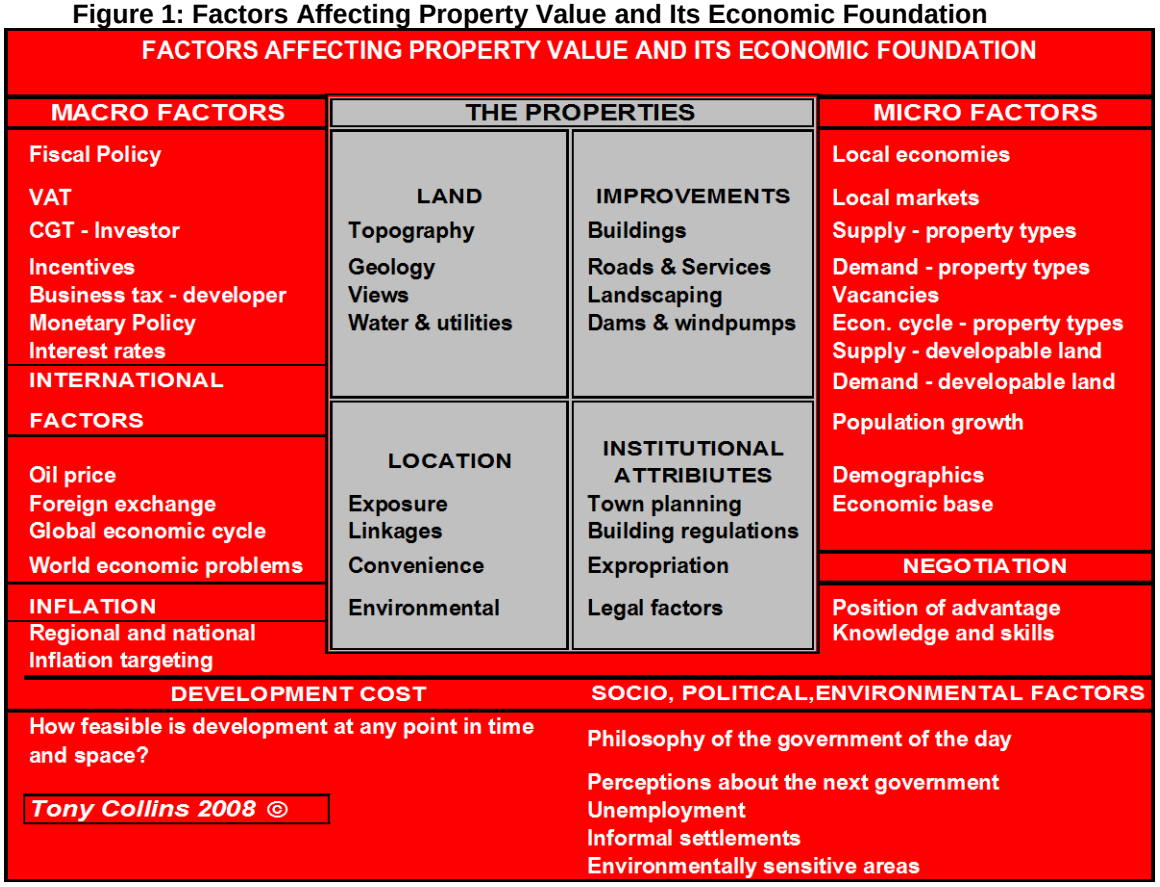
Looking at the diagram below we have some control / choice over:

- Land
- Improvements
- Location
- Institutional Attributes

The other factors in the diagram dictate to us the boundaries within which we have to work. In addition, there are factors that now affect the economy that were never considered important a few years ago. These are items such as foreign exchange levels and the oil price that can now because of their volatility, affect our inflation and the interest rates levels.

Factors Affecting Property Markets

Figure 1: Factors Affecting Property Value and Its Economic Foundation

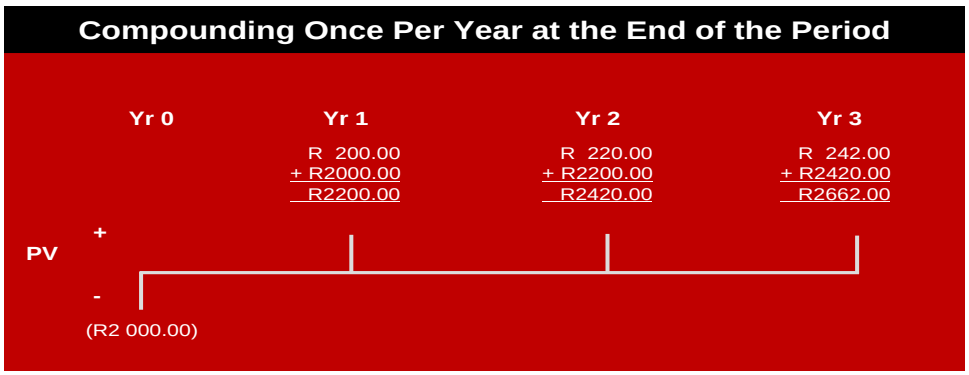


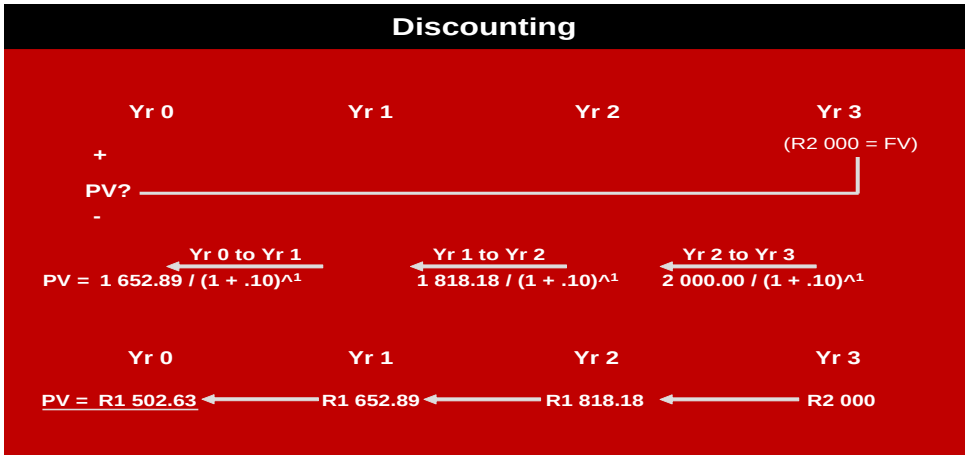
Compound Interest

With compound interest calculations the basic formula is:

$$FV = P(1+ i)^{\wedge n}$$

This formula forms the basis of most of our calculations whether it be compounding or discounting. The two diagrams below illustrate this.





Discounted Cash Flow Analysis

Is also just an application of our simple formula above but is now

PV = FV/ (1+i)^n

So why do we need interest rate tables when this formula is so simple to apply in Excel?

		Years	1	2	3	4	5	n
		Cash flow	R 200 000	R 220 000	R 242 000	R 266 200	R 292 820	FV
Discount rate	18%		R 169 492	R 158 001	R 147 289	R 137 303	R 127 994	
Present value	(NOT NPV)	sum D3 - H3	R 740 078					
The formula in D3 is therfore our formula above PV =D2/(1*18%)^D1								
NPV and IRR are measurements of return on equity which we do not have in the above calculation								

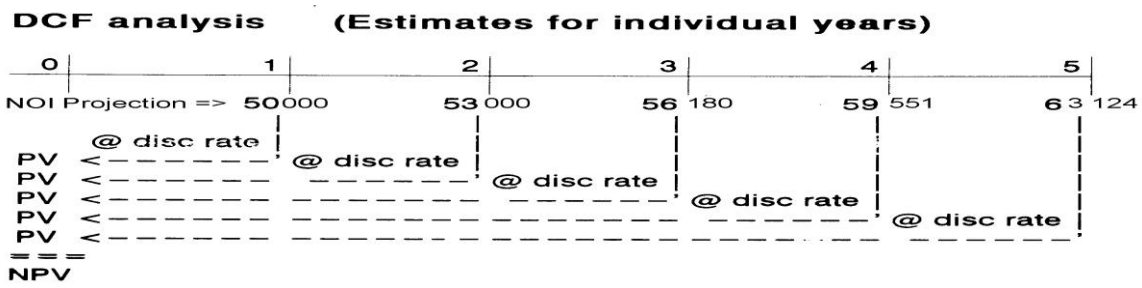
A further problem picked up amongst valuers is that some valuers when asked to give a discounted value of a 10 year lease and the discounted terminal value at the end of 10 years will;

1. Discount 9 years of cash flow and then
2. Give the Terminal value in year 10

However, I am of the opinion after talking to the late Mr Smal a few years ago and Erwin Rode agrees that we must

1. Discount 10 years of cash flow and the
2. Give the terminal value at the end of year 10

A further illustration of DCF is given below as applied to NPV



The above is of course incorrect as the answer is TPV (Total present Value) and not NPV as it ignores equity input

Since NPV = sum of the PVs – the equity input (or TPV-equity =NPV)

NPV is a measure of return on equity

What happens if you indicate the cash flow as above and then obtain an NPV of X. At the same time the QS has also submitted a feasibility study to the bank using NPV and deducting equity and he gets an NPV of Y and he is correct! What will the Bank credit officers think of the valuer?

Static DCF

Below is a static DCF model which is fine to use when we want to know why the developer paid R4,2 million for a house on Hermanus beach front and the valuer came up with R3,5 million on comparable sales. The answer lay in the under utilised bulk the developer intended using once the property was redeveloped.

The banks valuer took a trip to the local municipality and collected data on town planning and then simulated the proposed highest and best use for the site. The costs and projected incomes were then discounted.

The result is given below and the bank consultant was then able to explain were the “inflated sales price” came from.

RESIDUAL VALUE TO THE DEVELOPER				
Town Planning Allowances				
Site Size			**1464**	m2
Assumption The current double storey house will be demolished to make way for a block of apartments with retail shops at ground level				
Coverage				
Retail at ground floor level		**80%**	1171	m2
Residential at 1st floor level		**40%**	586	m2
Three floors allowed above retail		**3**	1757	m2
Components		**Gross**	**Net**	
Parking		586	539	m2
Retail		586	539	m2
Areas of all flats on 3 floors		1757	1493	m2
Areas of 3 Flats on one floor		586	498	m2
Flats each say 3 per floor		195	166	m2
SALES PRICES BASED ON CURRENT SALES IN THE AREA				
COMPONENTS				
Flats	166	M2 per Flat	**R3 500 000**	
Retail		R per m2	**R10 000**	
Parking		Price per Bay	**R60 000**	
PARKING				
50 % of ground floor is covered by parking				
50% of ground floor coverage is retail				
30 m2 per parking bay allowed				
9 flats / 3 per floor require 2 cover bays ea. = 18 bays required				
Allowance for bays	539	m2 per floor net	**18**	bays

BUILDING COSTS				
	Per m2	**gross m2**	**cost**	
Garage	**R1 800**	586	R1 054 080	
Shops	**R5 000**	586	R2 928 000	
Shopfronts / tenant allowance	**R500**	586	R292 800	
Flats	**R6 500**	1757	R11 419 200	
Paving	**R180**	293	R52 704	
Demolition house	**7.5%**	R 3 000 000	R225 000	% of cost
Building cost			**R15 971 784**	Demolition at
Interest		**15.5%**	R2 475 627	5 to 10%
Professionals		**12.5%**	R1 996 473	of cost of building
Vat	**ignore**	**14.0%**	R0	existing house
Total cost			**R20 443 884**	of 401 m2
INCOME FROM SALES				
	unit	**price**	**totals**	
Flats	**9**	R3 500 000	R31 500 000	
Retail in m2	538.75	R10 000	R5 387 520	
Parking undercover	**18**	R60 000	R1 080 000	
Total sales income			**R37 967 520**	
RESIDUAL CALCULATION				
Income			R37 967 520	
less vat		**14.00%**	R5 315 453	
less commission		**5.00%**	R1 898 376	
			R30 753 691	
less profit		**20.00%**	R6 150 738	
			R24 602 953	
less building cost			R20 443 884	
Residual value to developer		rounded to say	**R4 159 000**	

Now would you be happy receiving a straight line DCF for a million m2 of land in the Eastern Cape on the outlying areas of a city especially after receiving a guestimate at R 400 per m2?

Inferential DCF

A simple inferential DCF applied to residual land value is given below. Please note that in real life income and expenditure do not move in and out of the project in equal tranches.

Please e-mail me for more advanced Residual land value spreadsheets I use for teaching at the universities on the property studies courses at honours and masters levels.

	Total	01-Jul-12 1	01-Aug-12 2	01-Sep-12 3	01-Oct-12 4	01-Nov-12 5
Land actual cost	R -1 500 000					
Services	R -5 000 000	R -1 000 000	R -1 000 000	R -1 000 000	R -1 000 000	R -1 000 000
Professionals	R -900 000	R -180 000	R -180 000	R -180 000	R -180 000	R -180 000
Marketing	R -500 000	R -100 000	R -100 000	R -100 000	R -100 000	R -100 000
Other	R -300 000	R -60 000	R -60 000	R -60 000	R -60 000	R -60 000
Total costs (excl land cost)	R -6 700 000	**R -1 340 000**	**R -1 340 000**	**R -1 340 000**	**R -1 340 000**	**R -1 340 000**
Sales Income	R 12 000 000	R 2 400 000	R 2 400 000	R 2 400 000	R 2 400 000	R 2 400 000
Selling expenses		R -456 000	R -456 000	R -456 000	R -456 000	R -456 000
Total Income		**R 1 944 000**	**R 1 944 000**	**R 1 944 000**	**R 1 944 000**	**R 1 944 000**
Net cash flow		**R 604 000**	**R 604 000**	**R 604 000**	**R 604 000**	**R 604 000**
Total Accumulative (For Bank use)		R 604 000	R 1 208 000	R 1 812 000	R 2 416 000	R 3 020 000
Discounted net cash flow		R 594 586	R 585 318	R 576 195	R 567 214	R 558 373
Total PV @ 19%		**R 2 881 687**				
Less Developer's Profit	25%	R -720 422	(Selected discount rate does not include developer's profit)			
Residual Value (rounded)		**R 2 161 265**	The maximum the developer can pay for the land			

The problem says Prof Tom Whipple (Curtain University Perth) does not lie in the method but the application of the method:

1. How do we build up the discount rate?
2. If the DR is the investors MARR do we all agree on the magnitude of the components of:
    a. Cost of capital – savings @ 5% or RSA Bonds @ 10%?
    b. Growth or profit mark-up – we will all differ?
    c. Interpretation of risk – we have different propensities to take a risk?
3. What terminal cap rate do we use?
4. What operating cost escalation do we apply?
5. How long do we project the lease for?
6. Do we project leases beyond their termination dates?
7. What escalation amount is used after the lease is terminated if we project any further?
8. Do we allow for vacancies after termination dates?
9. Can the past figures be used to predict the future?

When is DCF best used:

1. As a back-up to capitalised value on large projects
2. Where the future income is of an uncertain nature
3. As a developers method to predict what could be earned by the developer based on his view of how the property should be developed
4. Beware with vacant land – it is not equal to Market Value
5. Where the area is a so called red area (dangerous to loan money in) and we value the cash flow only

Professor Richard Radcliff states that this is not a market related method as it ignores the main factors that affect supply and demand

Top slicing

Where we have a situation of a building earning R 40 per sqm on a triple net lease with a **blue chip tenant** and the market indicates R 30 per sqm is market related. It is practice to project the two incomes over the 10 year lease period, discount the difference and add up the opportunity cash flow. This opportunity cash flow is then added to the market value obtained from capitalising the first year and this creates a maximum price to pay for the property. This is acceptable to the banks.

The problem is where the discounted sum is then also capitalised and added to the market related market value based on the first year's income. This is not acceptable.

Net Present Value and Internal Rate of Return

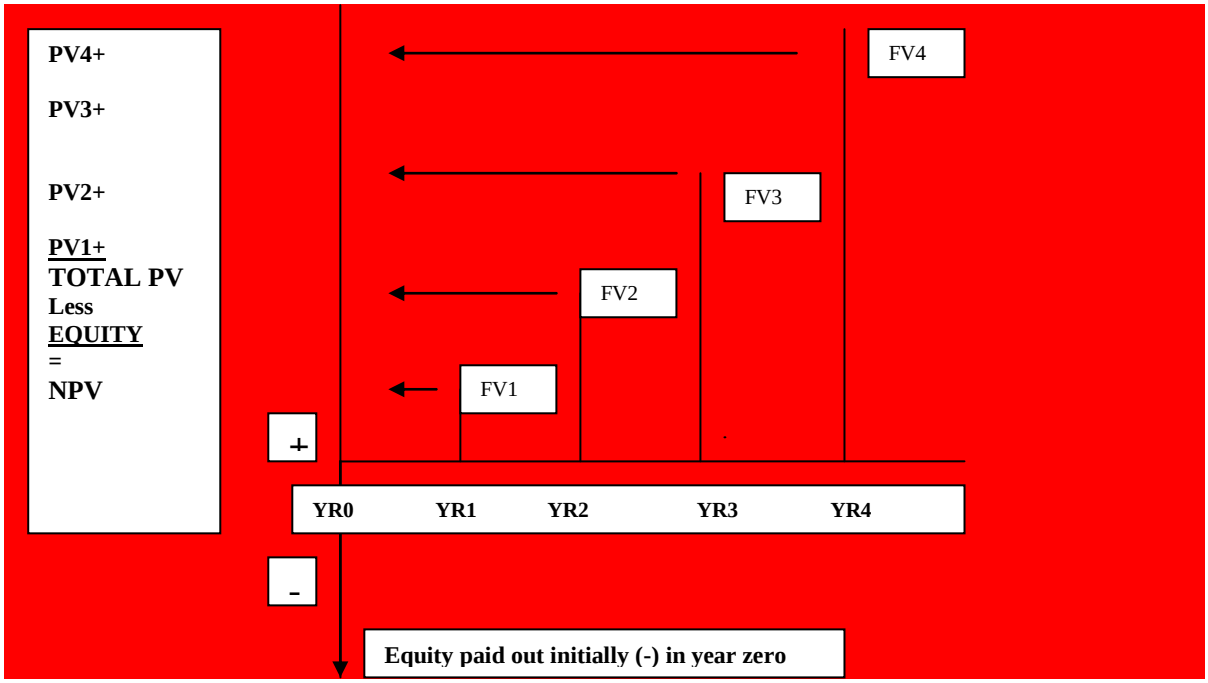
A building's FV in terms of after tax cash flows are discounted back to PV every year. All the PV's are then summed and the initial equity input is subtracted to give us the NPV. **The NPV is not equal to the Total PV for the project.**

The criterion required for a successful investment with NPV is that:

NPV ≥ 0 (in Rand)

From the diagram below we can see that the cash flow has been:

1. Discounted for 4 years
2. The four discounted amounts have been added up to get
3. Total Present Value
4. The Equity has been deducted and
5. The answer is NPV



The example in Table below indicates that we are making 12.5% as well as an extra bonus of R 4,513,941 since we have sliced 12.5% of future income off the top and we are left with the R 4,513,941 bonus. If we had an NPV of exactly 0 we would be making exactly 12.5%.

Example:

Year	Net Income p.a. (R)	Escalation	Tax Rate	Simplified After Tax Cash Flow (R)	Discount Rate	Discounted Simplified ATCF p.a.	Comments
0				-1,500,00		-1,500,00	Initial equity input
1	600,00	10%	28%	432,000	12.50%	384,000	
2	660,000	10%	28%	475,000	12.50%	375,467	
3	726,000	10%	28%	522,720	12.50%	367,123	
4	798,600	10%	28%	574,992	12.50%	358,965	
5	878,460	10%	28%	632,491	12.50%	350,988	
6	966,306	10%	28%	695,740	12.50%	343,188	
7	1,062,937	10%	28%	765,314	12.50%	335,562	
8	1,169,230	10%	28%	841,846	12.50%	328,105	
9	1,286,153	10%	28%	926,030	12.50%	320,183	
10	**1,414,769**	10%	28%	**9,253,993**	12.50%	**2.849.732**	Includes sale
ATN Reversion on Sale		10%	28%	**8,235,360**			

After tax net worth mad on sale of the building in year 10 is added to the after tax cash flow in year 10 to obtain the total cash flow in year 10

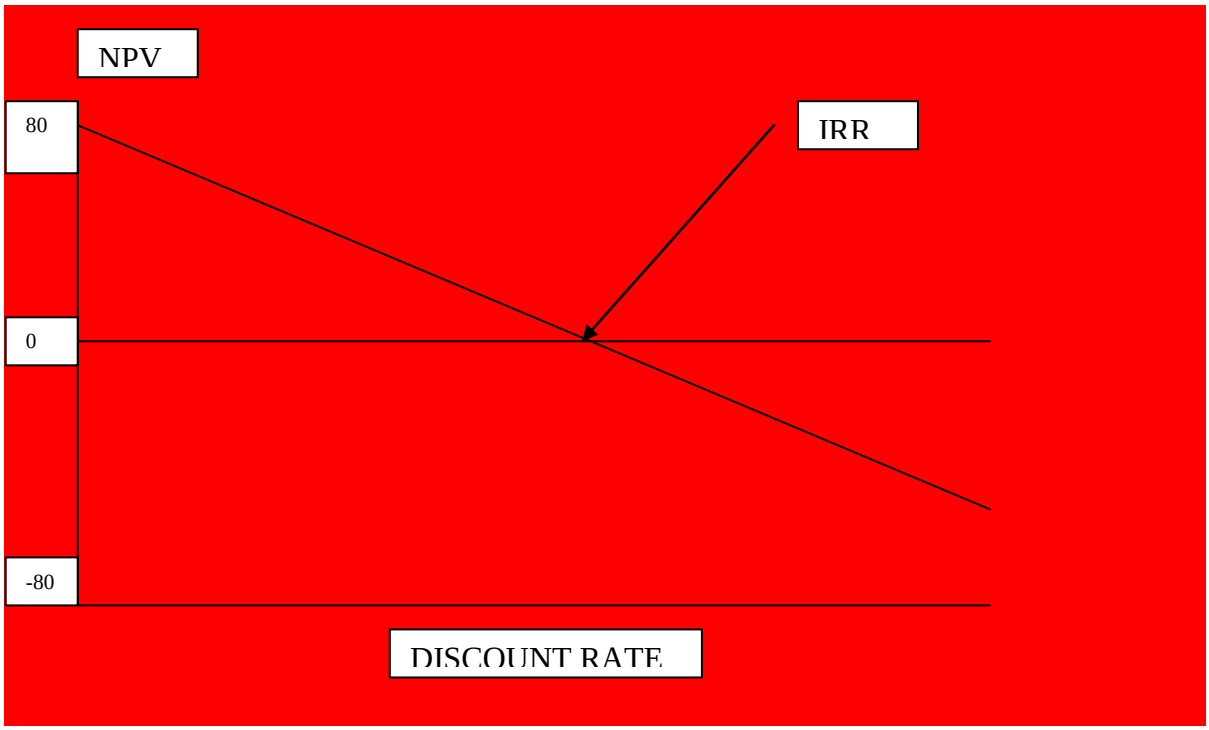
	NPV	4,513,941
	Equity	1,500,000
Total PV of income stream years 1 to 10	**Total PV**	6,013,941

Calculation of reversion to equity by building sale ***

Market value in year 10		14,000,000	**CROSS CHECK**	
Less costs of selling		700,000	**NPV**	4,513,941
		13,300,000	**IRR**	42%
Less capital gains tax	15%	1,928,500		
After tax reversion on sale		**11,438,000**		

The IRR is the discount rate that equates the projects NPV to Zero. It therefore determines the rate of interest that causes the present value of the net income of a building to equal the original capital, own equity input. A common technique used by financial calculators and spreadsheets is to make use of iterations, successive approximation which is a problem-solving or computational method in which a succession of approximations, each building on the one preceding, is used to achieve a desired degree of accuracy. This can be checked by using the goal seek facility on a spreadsheet which will accurately calculate IRR once you have worked out NPV. The use of successive approximation is a trial and error method.

Another method is to calculate IRR graphically by plotting NPV at various interest rates using a sloping straight line and then make use of a horizontal line using different discount rates to see where the two lines intersect. Where the two lines intersect the IRR is found and NPV is = 0. The vertical axis represents NPV (from say 80 to -80)



The horizontal axis represents the discount rate. The IRR is a horizontal line starting at 0 / zero on the NPV axis.

Since IRR is the return on the capital balance outstanding over the life of investment and it does not represent the rate of return on the total capital amount over the life of investment. It is actually similar to a mortgage loan calculation schedule when worked out year by year. (Capital + interest – cash inflow).

The formula for IRR is as follows: $\sum_{t=1}^{n} ATCF_t / (1+IRR)^t - Equity = 0$

The criterion is:

IRR ≥ the discount rate (12.5% in the case of the example above) *and it is **not** the same as the criterion for the NPV above (NPV ≥ 0 (in Rand).*
This also means that if the IRR = exactly 12.5% then NPV = 0

In the Table above IRR works out at 42% which is clearly more than the discount rate of 12.5%.

NPV versus IRR:

NPV is more reliable

- IRR can sometimes give no answer or two answers where cash-flows are unstable or have large positive and negative swings in some years
- NPV can be used to compare any size and type of building against each other as it will always return a Rand amount less, equal to, or greater than zero, which will indicate how well each project will perform.
- IRR can only be used to compare comparable buildings of type and size as it is ineffective as ranking measure when competing investments have
    - Different sizes
    - Different income patterns
    - Budget limits

Yield

Another much debated concept, which is incorrect in our book and was apparently altered by one of the editors without letting me know.

When we talk about yield we mostly refer to net yield in property and Net yield is equal to:

1. Net income from the property / the total development costs of a new project
2. Net income / the total purchase price including all costs of purchasing
3. Net income / market value. Only where the building is purchased as a going concern and the purchase price can be equated to market price and if the costs of transferring the company are not so high as to distort the market value concept.

Conclusion

Don't be afraid to ask your colleagues for help and always help where you can. Together we can become a better profession. In 2006 I was sitting in hospital after a cancer operation and I decided to put a stop to my PHD studies and write the book instead as I believed it would reach and assist more people in construction and real estate and generate more debate. I am fortunate to work in amazing profession where colleagues and friends have taught me so much. I hope that this article has been of interest. (tcollins@yebo.co.za) or (**tony@onyxvaluations.co.za**) Mobile: 071 412 0579

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