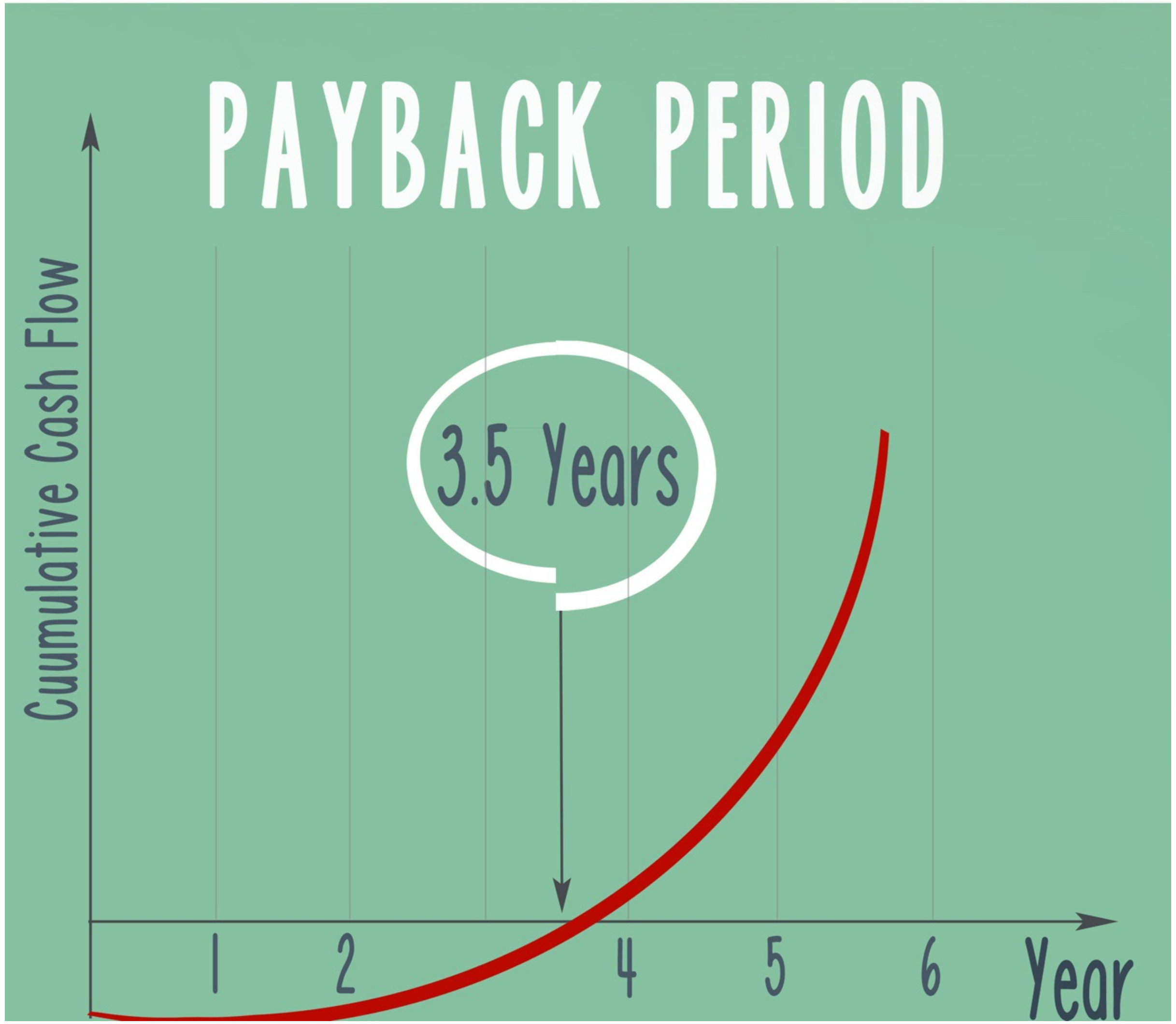
Payback Period Analysis



How long does it take to payback our original investment?

The Payback Period Analysis- PBP

- Simple Payback Period
- Discounted Payback Period

Payback Period Analysis

The Payback Period, PBP, is the time necessary for an investment to be fully "recovered".

- PBP is related to risk: short PBP's = low risk, long PBP's = high risk

- Simple Payback Period Analysis
  - More commonly used in business
  - TVM is not considered
  - Payback Period is determined when the cumulative cash flows = 0.

- Discounted Payback Period Analysis
  - TVM <u>is</u> considered
  - Payback Period is determined when the cumulative ***discounted*** cash flows = 0.

The Shorter the Payback Period, the Better!

Simple Payback Period

Example: A company invests $48,000 in a new machine with a salvage value of $5,000 after 6 years. The machine will generate $12,000 per year throughout its lifetime. Assuming a Discount Rate = 8%, what is the Simple Payback Period?

Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
-$48,000	$12,000	$12,000	$12,000	$12,000	$12,000	$17,000

Investment = $48,000

Without much calculation, you can see it takes 4 years to recover the initial investment: **PBP = 4 years**.

Note:

- We don't worry about the Discount Rate because Simple PBP does not involve TVM.
- We also don't consider any cash flows after the PBP; the salvage value has no impact.

Simple Payback Period – A More Complex Example

A company invests $48,000 in a new machine. The machine is expected to generate the cash flows in the table below. What is the Simple Payback Period?

Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
-$48,000	$20,000	$18,000	$15,000	$12,000	$10,000	$10,000

PBP: the time when sum of the cash inflows = the sum of the cash outflows

A convenient and quick approach to this is to evaluate the ***cumulative cash flows*** *over the project lifetime:*

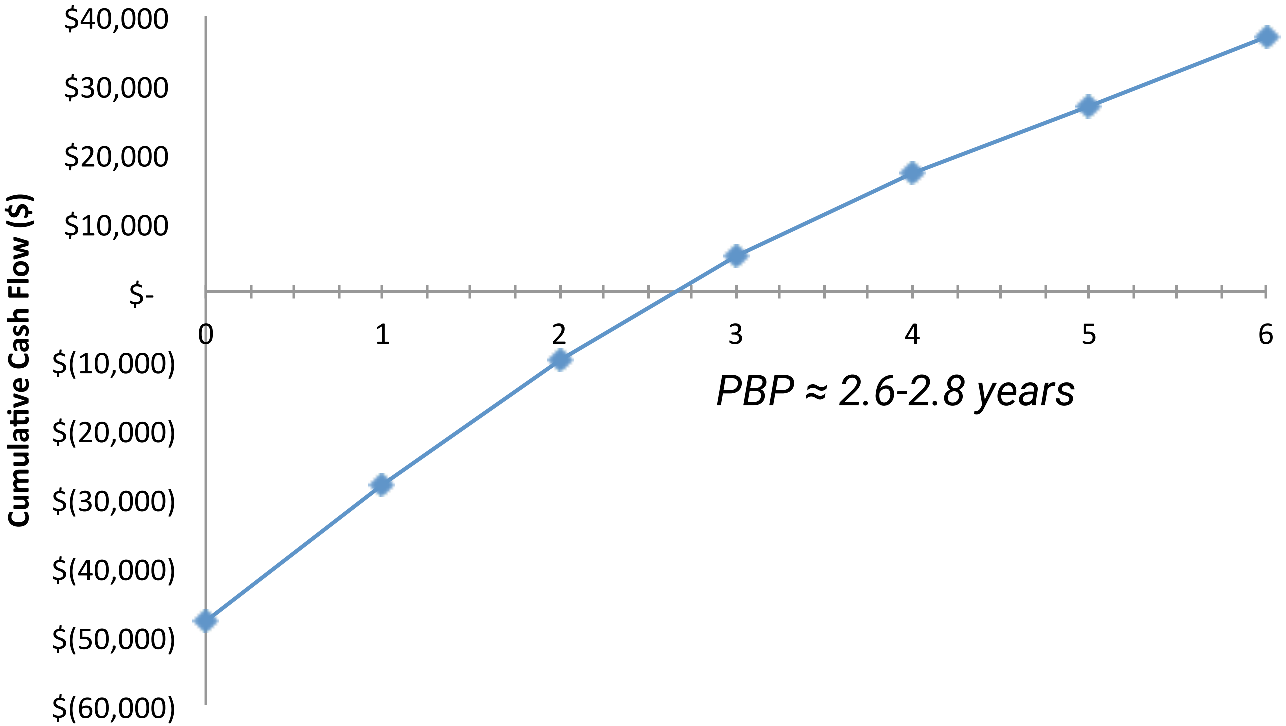
Cumulative Cash Flows

Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
-$48,000	-$28,000	-$10,000	$5,000	$17,000	$27,000	$37,000

The Payback Period is between 2 and 3 years.

Simple Payback Period

	A	B	C	D	E	F	G	H
1	**PAYBACK PERIOD EXAMPLE**							
2								
3		Year						
4		0	1	2	3	4	5	6
5	Cash Flow	$ (48,000)	$ 20,000	$ 18,000	$ 15,000	$ 12,000	$ 10,000	$ 10,000
6	Cumulative Cash Flow:	$ (48,000)	$ (28,000)	$ (10,000)	$ 5,000	$ 17,000	$ 27,000	$ 37,000
7								



- At the end of Year 2, we have -$10,000.
- We estimate receiving $15,000 in Year 3
- To get the fractional time period:
  $10,000 / $15,000 = 0.67
- The exact PBP = 2.67 years

Discounted Payback Period

Still the time necessary to recover your investment, only now incorporating TVM.

Discounted Payback Period

A company invests $48,000 in a new machine. The machine will generate the cash flow in the table below. What is the Payback Period, assuming a discount rate of 15%?

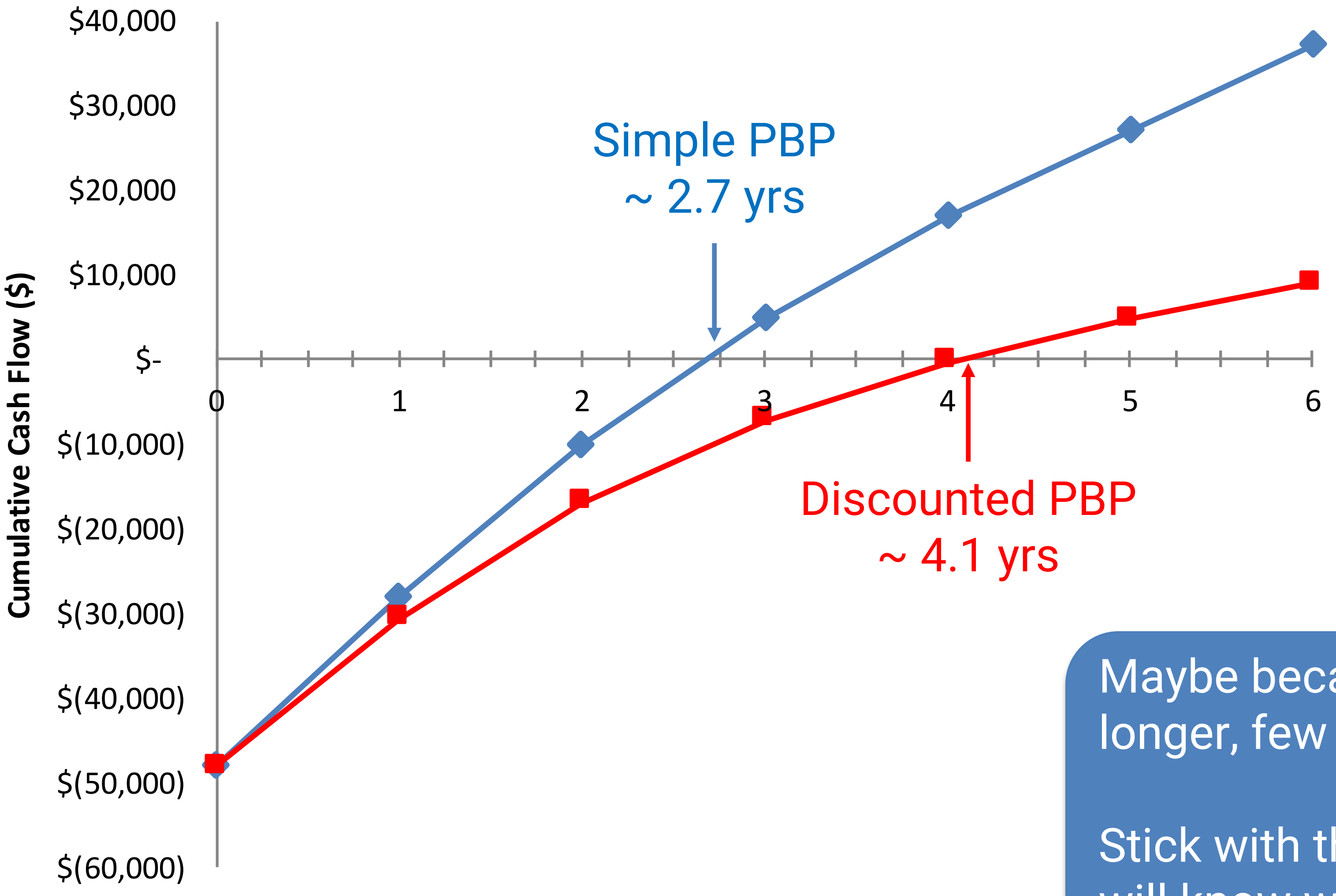
You do the same thing, this time using the discounted cash flows…

	Year (N)						
	0	1	2	3	4	5	6
Cash Flow	$ (48,000)	$ 20,000	$ 18,000	$ 15,000	$ 12,000	$ 10,000	$ 10,000
PV Factor: $1/(1+i)^N$	1.0000	0.8696	0.7561	0.6575	0.5718	0.4972	0.4323
PV (Cash Flow)	$ (48,000)	$ 17,392	$ 13,610	$ 9,863	$ 6,862	$ 4,972	$ 4,323
Cumulative Cash Flow:	$ (48,000)	$ (30,608)	$ (16,998)	$ (7,136)	$ (274)	$ 4,698	$ 9,021

- At the end of Year 4, we have -$274
- We get $4,972 in Year 5 (on a discounted cash flow basis)
- To get the fractional period: $274 / $4972 = 0.06
- The exact Discounted PBP = 4.06 years

Discounted PBP is between 4-5 years

Simple & Discounted Payback Period



Maybe because Discounted PBP is always longer, few people actually use it.

Stick with the Simple PBP and everyone will know what you're talking about.

The Payback Period: Back to Palisade, Colorado

Rabbit Ridge Winery
Palisade, Colorado

What is the Payback Period for Investing in the new Grape Crushing Machine?

Rabbit Ridge Winery Revisited…

Simple Payback Period Analysis

	A	B	C	D	E	F	G
1	**Rabbit Ridge Grape Crusher**						
2							
3	**Initial Investment:**	**$52,000**					
4	**Net Benefits:**	**$23,000**					
5	**Salvage Value:**	**$10,400**					
6	**Time (years):**	**5**					
7	**Discount Rate:**	**12%**					
8							
9	**Simple Payback Period**			**End of Year Cash Flows**			
10	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
11	Cash Flow	-$52,000	$23,000	$23,000	$23,000	$23,000	$33,400
12	**Cumulative Cash Flow**	**-$52,000**	**-$29,000**	**-$6,000**	**$17,000**	**$40,000**	**$73,400**
13							
14	**Simple Payback Period:**	**2.26**	*= 2 + ($6,000 / $23,000)*				

Rabbit Ridge Winery Revisited…

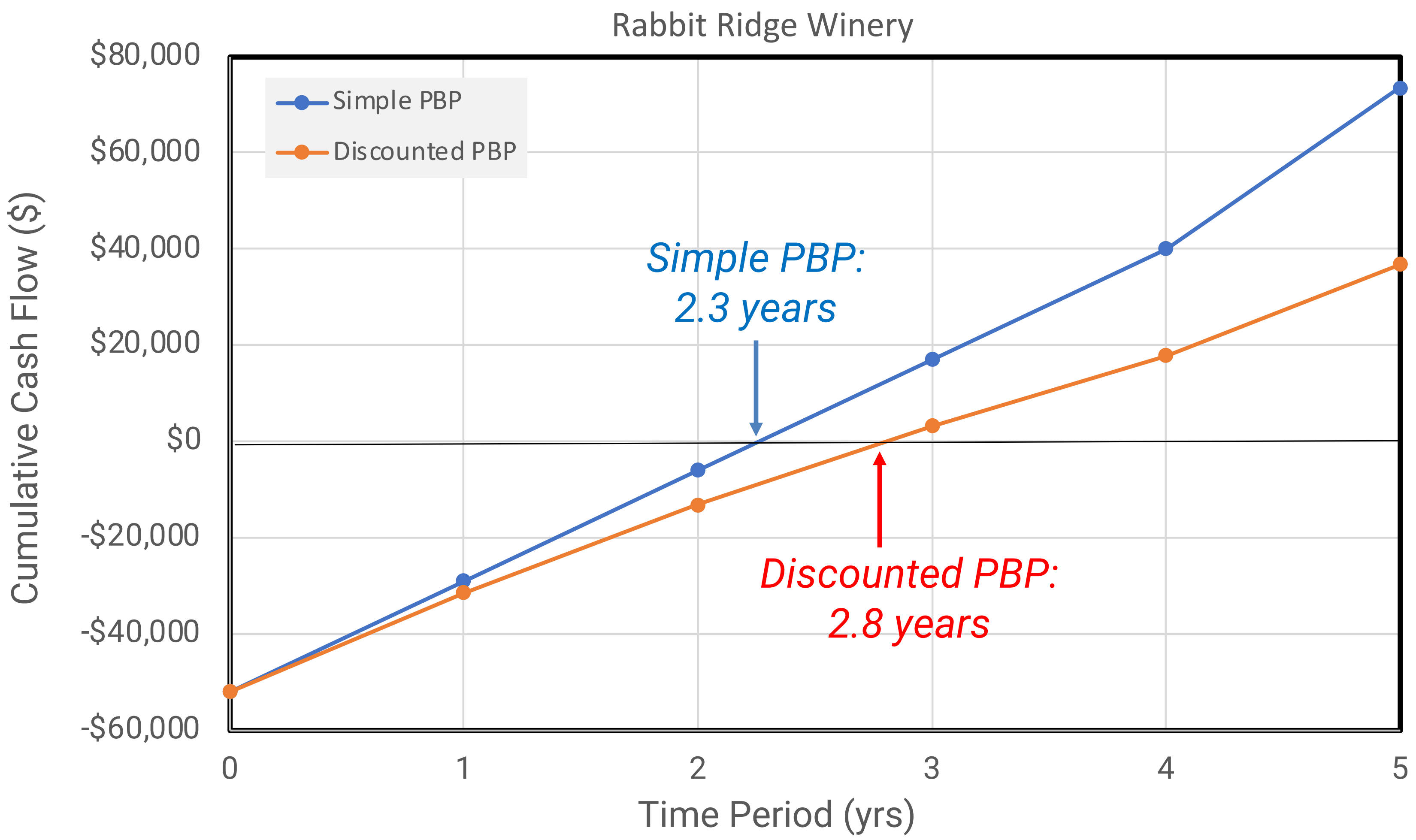
Discounted Payback Period Analysis

	A	B	C	D	E	F	G
1	**Rabbit Ridge Grape Crusher**						
2							
3	**Initial Investment:**	**$52,000**					
4	**Net Benefits:**	**$23,000**					
5	**Salvage Value:**	**$10,400**					
6	**Time (years):**	**5**					
7	**Discount Rate:**	**12%**					
8							
9	**Discounted Payback Period:**			**End of Year Cash Flows**			
10	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
11	Cash Flow	-$52,000	$23,000	$23,000	$23,000	$23,000	$33,400
12	$1/(1+i)^N$ Factor	1.000	0.893	0.797	0.712	0.636	0.567
13	PV of Cash Flow	-$52,000	$20,536	$18,335	$16,371	$14,617	$18,952
14	**Cum. PV Cash Flow**	**-$52,000**	**-$31,464**	**-$13,129**	**$3,242**	**$17,859**	**$36,811**
15							
16	**Discounted Payback Period:**	**2.80**	*= 2 + ($13,129 / $16,371)*				

Rabbit Ridge Winery Revisited…

The fact that the payback periods are less then 3 years is a good sign!

Simple & Discounted Payback Period Analysis



How to get noticed at work…

"Say, I just completed the chemical process flow calculations for the new equipment, and we should be able to improve throughput by 60%.

Now I want to examine the financial payback of the equipment. Do we use the Simple Payback Method or the Discounted Payback Method?

And if the Discounted Payback Method, what is our company's Hurdle Rate?"

And this is what separates great engineers from great engineers that become leaders in their company.

Main Takeaways…

The Payback Period, PBP, represents the amount of time necessary to recoup the initial investment.

PBP can be determined two ways: The Simple Payback Period and the Discounted Payback Period.

The Simple PBP is determined when the cumulative cash flows = 0.

The Discounted PBP is determined when the cumulative discounted cash flows = 0.

The Simple Payback Period is far more common in business, but be ready to know the discounted payback period just in case!

Next Time…

The Internal Rate of Return, The IRR

Credits & References

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