Evaluation Alternatives
Present Worth Analysis

Companies constantly evaluate whether or not to pursue projects.

Mutually Exclusive Projects – several projects proposed to address the same need. Only one of the projects can be selected.

Independent Projects – projects that do not compete, and are selected merely on their economic value.

Do Nothing (*DN*) Option – projects are often compared to the option of taking no action.

Present Worth Analysis

Project Types:

Revenue – each alternative project being evaluated generate costs and revenues. These alternatives usually involve the purchase of new systems and equipment in order to increase revenue. Both the cost streams and revenue streams vary by alternative.

Service – Each alternative has only cost cash flow estimates. These projects are typically for safety, or are government mandated projects.

Present Worth Analysis –
Equal Life Alternatives

One alternative – Calculate the present worth (*PW*) at the MARR. If PW $\geq$ 0, the requested MARR is met or exceeded and the alternative is financially viable.

Two or more alternatives – calculate the PW of each alternative at the MARR. Select the alternative with the PW value that is numerically largest. (If all PW are negative, and do nothing is an alternative, then do nothing.)

Present Worth Analysis – Equal Life Alternatives

Revenue Example: You are evaluating the purchase of a two income properties. You expect a MARR of 15%. You have enough funds for both purchases.

	$75K Home	$37.5K Home
Purchase Price	$15,000	$ 7,500
Annual Maint.	$ 6,000	$ 4,000
Annual Income	$ 7,500	$ 5,000
Resale (after Expenses)	$90,000	$40,000
Life, years	15	15

Present Worth Analysis – Equal Life Alternatives

$75K Home

PW = $-\$15{,}000 + 1500(P/A,15\%,15) + \$90{,}000(P/F,15\%,15)$
$= \$4832$

$37.5K Home

PW = $-\$7{,}500 + \$1000(P/A, 15\%,15) + \$40{,}000(P/F,15\%,15)$
$\$3263$

What if 8% MARR was used?
PW ($75K Home) = $26,207
PW ($37.5K Home) = $13,667

Present Worth Analysis – Equal Life Alternatives

Service Example: You are evaluating the purchase of a new or used car that needs to last you for only 5 years.

	New Car	Used Car
Purchase Price	$20,000	$10,000
Annual Maint.	$ 500	$ 1,000
Resale Value	$ 8,000	$ 4,000
Life, years	5	5

Present Worth Analysis – Equal Life Alternatives

Use 8% for *i* since 8% is the expected rate of return if money invested in stock market rather than purchasing a vehicle.

New Car

PW = -$20,000 - $500(P/A,8%,5) + $8000(P/F,8%,5)
= -$16,552

Used Car

PW = -$10,000 -$1000(P/A,8%,5) + $4,000(P/F,8%,5)
= -$11,270

Present Worth Analysis – Different Life Alternatives

The **Present Worth** of alternatives **must** be compared over the same number of years.

If project alternative have different service lives, the equal service requirement can be satisfied by:

1) Compare the alternative over a period of time equal to the *least common multiple (LCM)* of their lives.
2) Compare the alternative using a *study period of length n*, which does not necessarily take into consideration the useful lives of the alternatives. This period *n* is called the planning horizon.

Present Worth Analysis – Different Life Alternatives

Revenue Example: You are evaluating the upgrade of some production equipment to increase productivity. You are considering two alternatives. Company policy dictates a MARR of 20%.

	Alternative 1	Alternative 2
Purchase Price	$ 200,000	$100,000
Annual Maint.	$ 5,000	$ 2,000
Productivity Imp. (per year)	$ 40,000	$ 20,000
Life, years	10	12

Present Worth Analysis – Different Life Alternatives

Revenue Example: Because life alternatives are different, you decide to use a 10 year planning horizon and estimate a resale value of alternative of $5000 for the remaining 2 year of life.

Alternative 1

PW = -$200,000 + $35,000(P/A,20%,10)

PW = -$53,262

Alternative 2

PW = -$100,000 + $18,000(P/A,20%,10) + 5000(P/F,20%,10)

PW = -$23,727

Which alternative should you choose? Do nothing

Present Worth Analysis – Different Life Alternatives

Service Example: You are evaluating the purchase of a new or used cars that needs to last you for 10 years.

	New Car	Used Car
Purchase Price	$20,000	$10,000
Annual Maint.	$ 750	$ 1,000
Resale Value	$ 4,000	$ 4,000
Life, years	10	5

Present Worth Analysis – Different Life Alternatives

Use 8% for *i* since 8% is the expected rate of return if money invested in stock market rather than purchasing a vehicle.

New Car

PW = -$20,000 - $750(P/A,8%,10) + $4000(P/F,8%,10)

PW = -$23,180

Used Car

Buy used car in year 0 ↓ Sell car in year 5 ↓ Buy used car in year 5

PW = -$10,000 + $4,000(P/F,8%,5) -$10,000(P/F,8%,5) + $4000(P/F,8%,10) -$1000(P/A,8%,10)

PW = -$18,941

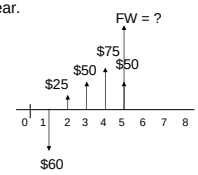
Future Worth Analysis

Future worth analysis is similar to present worth analysis, expect that all cash flows are normalized to some future point in time.

Future worth is often used if an asset is to be sold at some future point in time, but before its expected life is reached. The future worth would be an indicator of how much the asset could be sold for at that future point in time (of course this assumes the buyer expects the same cash flows you anticipate).

Future Worth Analysis

Example: A company is considering selling off its power generation plants in 5 years. The cash flow projection over the next 5 years for this power generation operation unit is depicted below. What sales price in year 5 (future worth)must be received to achieve the company's ROR of 5% per year.



FW = -$60(F/P,5%,4) + $25(F/P,5%,3) + $50(F/P,5%,2) + $75(F/P,5%,1) + $50

Capitalized Cost

Capitalized cost (CC) is the present worth of an alternative that will last "forever". Examples include University endowments, and large public sector projects (dams, bridges, tollroads, etc.).

CC is related to P/A formula, $P = A(P/A,i\%,\infty)$

As n approaches infinity, CC = A/i

For example, if an endowment was invested at 10% interest, and $1000 was to be withdrawn every year indefinitely, then

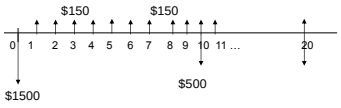
$1000/.1 = $10,000

must be the present amount in the endowment.

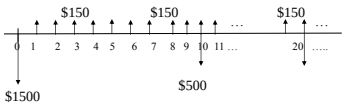
Capitalized Cost

The following examples demonstrates how to obtain the capitalized cost of an asset which contains both recurrent and non-recurrent cash flows.

A toll-road was just completed at a cost of $1.5 billion, with major maintenance expenditures of $500 million forecast every 10 years. Annual receipts minus maintenance results in a positive cash flow of $150 million. What is the present worth, assuming i = 5%?



Capitalized Cost



1) Convert the $500 million every 10 years to an annual cost.

   A_1 = -$500(A/F, 5%,10) = **-$500(A/F, 5%,10) = -$39.75M**

   Therefore A_T = **$110.25 million**

2) CC = -$1,500 + 110.25/.05 = $705 million