WORK – STUDY

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De Work-Factor Raad wil een platform bieden aan Work-Factor gebruikers, arbeidsanalisten, cost engineers en industrial engineers om problemen, oplossingen, ideeën en tips te bespreken. Daartoe zullen we regelmatig een WS Tip sturen aan "WF-leden" en geïnteresseerden. Mocht dit bericht niet op het juiste adres aankomen stuur het dan door naar geïnteresseerden en laat ons dat weten, svp.

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Het onderwerp van vorige WS Tips staat op de WF Website onder: WF en Management/Praktisch - Algemeen/WS Tips.

DECISION CALCULATION, Part 4

DISCOUNTING AND (NET) PRESENT VALUE (NPV)

Frequently, in businesses and economic problems, it is necessary to compare sums of money received or paid at different dates. Consider, for example, the purchase of a machine that costs ƒ 11,000.- (the money must be available before the actual purchase) and will yield a marginal revenue product of ƒ 14,520.- in about 2 years from today. If the machine can be financed by a three-year loan bearing 10 percent interest, it will cost the firm say ƒ 1,100.- on interest for each of the three years plus ƒ 11,000.- in principal repayment in the third year (see the table below).
Question: Is the machine a good investment?

Cost and benefits of investing in the machine

(	Year 1	Year 2	Year 3
Benefits			
Marginal revenue product of the machine	0	0	14,520
Costs			
Interest and principal on loan	1,100	1,100	12,100

The total costs of owing the machine over the three-year period are ƒ 1,100.- + ƒ 1,100.- + ƒ 12,100.- = ƒ 14,300.-, which is less than the benefits of ƒ 14,520.-. So, it looks OK.

But this is clearly an invalid comparison, because the ƒ 14,520.- in future benefits are not worth ƒ 14,520.- in terms of today's money. Adding up guilders or euro's received or paid at different dates is a bit like adding apples and oranges. The process that will be used for making these variables comparable is called discounting, or computing the present value of a future sum of money.
To illustrate the concept of present values, let us ask how much ƒ 1.- received a year from today is worth in terms of today's money. If the rate of interest is 10 percent, the answer is about 91 cts. Why? Because if we invest 91 cts today at 10 percent interest, it will grow up to 91 cts. plus 9.1 cts. in interest, is 100.1 cts. in a year. Similar considerations apply to any rate of interest.
In general:

If the rate of interest is i, the present value of ƒ 1.- to be received over one year is: $\frac{f\,1.-}{1+i}$

This is so, because in a year $\frac{f\,1.-}{1+i}$ will grow into $\frac{f\,1.-}{1+i}$ x (1 + i) = ƒ 1.-

What about money to be received two years from today? Using the same reasoning, ƒ 1.- invested today will grow to ƒ 1.- x 1.1 = ƒ 1.10 after one year and to ƒ 1.- x 1.1 x 1.1 = ƒ 1.- x 1.1^2 = ƒ 1.21 after two years. Consequently, the present value of ƒ 1.- to be received two years from today is:

$$\frac{f\,1.-}{(1.1)^2} = \frac{f\,1.-}{121} = 82.64 \text{ cts.}$$

A similar analysis applies to money received three years from today, four years from today and so on. The general formula for the present value of ƒ 1.- to be received N years from today when the rate of interest is i:

$$PV = \frac{f\,1.–}{(1+i)^N}$$

The present value formula highlights the two variables that determine the present value of any future flow of money, viz. the rate of interest (i) (over a certain period) and how many periods (N) you have to wait before you get it.

Let us now apply this analysis to our example.
The present value of the revenue is easy to calculate since it all comes two years from today.
Since the rate of interest is assumed to be 10 percent (i = 0.1) we have:

Present value of revenues $= \frac{f\,14{,}520.–}{(1.1)^2}$

$= f$ 12,000.-

The present value of the costs is a bit trickier in this example since costs occur at three different dates. The present value of the ƒ 1,100.- interest payment in year 1 is, of course, just ƒ 1,100.-. The present value of the next interest payment is,

ƒ 1,100.-/(1 + i) = ƒ 1,100.-/1.1 = ƒ 1,000.-.

And the present value of the final payment of interest plus principal is:

$$\frac{f\,12{,}100.–}{(1+i)^2} = \frac{f\,12{,}100.–}{11^2} = f\ 10{,}000.-$$

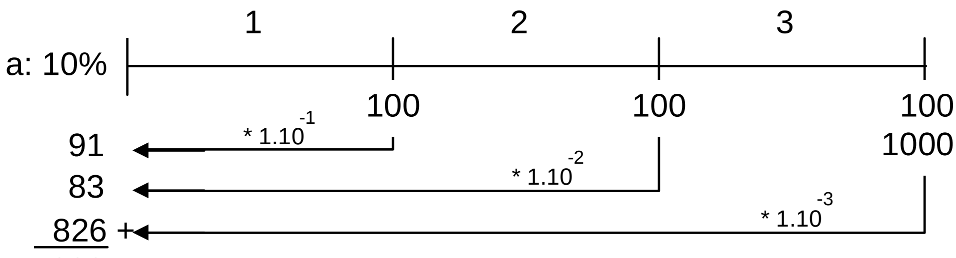
Now that we have expressed each sum in terms of its present value, it is permissible to add them up. So the present value of all costs is::

= ƒ 1,100.- + ƒ 1,000.- + ƒ 10,000.- = ƒ 12,100.-

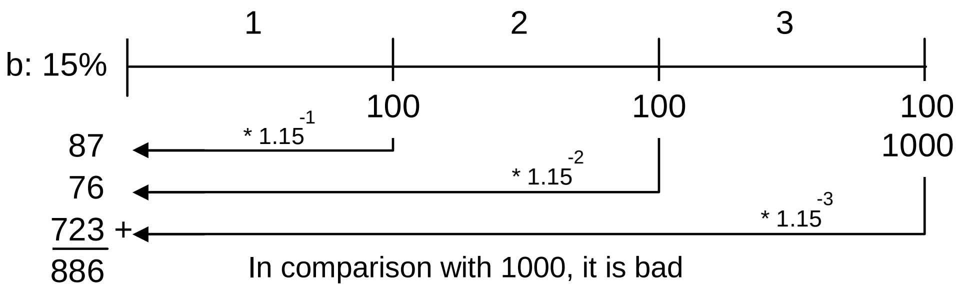
Comparing this to the ƒ 12,000.- present value of the revenues clearly shows that the machine is a poor investment after all. So, not OK.
This same calculation procedure is applicable to all investment decisions.

Questions for discussion
A government bond pays ƒ 100.- in interest each year for three years and also returns the principal of ƒ 1,000.- in the third year.
How much is it in terms of today's money if the rate of interest is 10 percent?
If the rate is 15 percent?

Answer:



In comparison with 1000, there is no difference.



In comparison with 1000, it is bad

Voor reacties naar

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