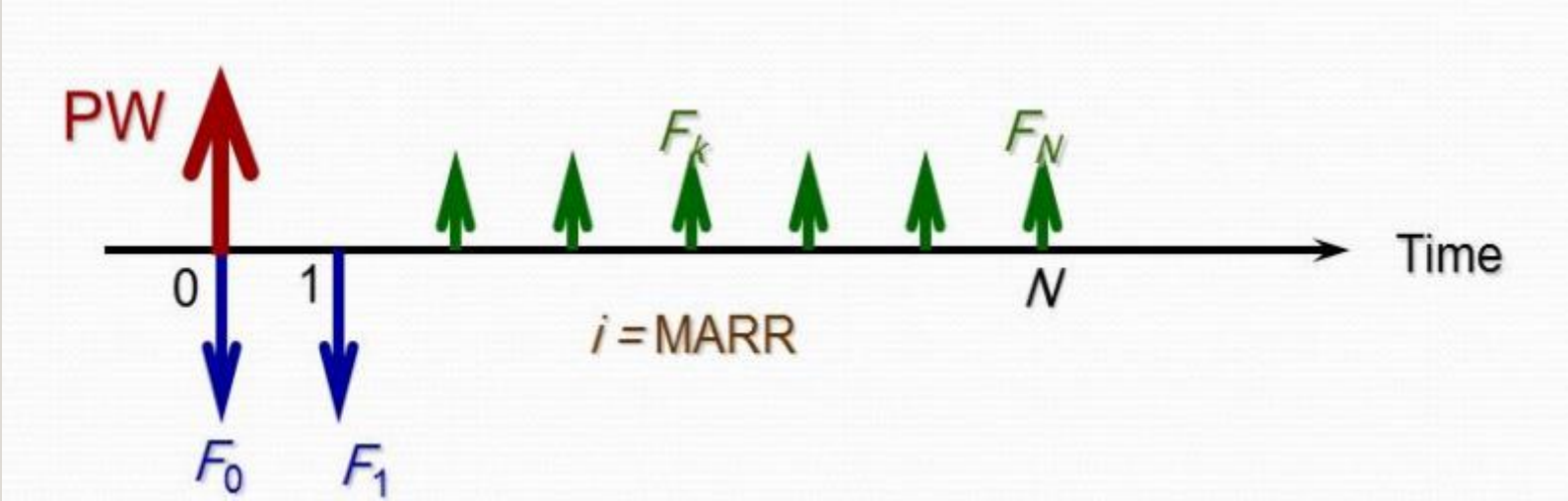
مقارنة البدائل
COMPARISION ANALYSIS

- طريقة القيمة الحالية Present Worth (PW)
- طريقة القيمة المستقبلية Future Worth (FW)
- طريقة القيمة السنوية Annual Worth (AW)

طريقة القيمة الحالية
PRESENT WORTH METHOD(PW)

- ✓ تقوم هذه الطريقة على اساس مفهوم القيمة المكافئة لكل التدفقات النقدية لنقطة اساس الحاضر وبمعدل فائدة MARR
- ✓ يكون المشروع مجدي اقتصاديا إذا كانت قيمة PW أكبر من الصفر



مثال 1

يقترح فريق المهندسين آلة جديدة ستزيد الإنتاجية لأعمال اللحام. تبلغ تكلفة الاستثمار في الآلة 2,500,000 ليرة سورية، وتبلغ قيمتها السوقية 500,000 في نهاية فترة الدراسة البالغة خمس سنوات. ستؤدي زيادة الإنتاج بسبب الآلة إلى تحقيق إيرادات سنوية تبلغ 800,000 ليرة بعد طرح تكاليف التشغيل، يبلغ معدل العائد المقبول الأدنى للشركة MARR = 20% سنوياً. هل يعد هذا الاقتراح مجدياً وفق طريقة القيمة الحالية PW؟

الحل

$$PW = -2{,}500{,}000 + 800{,}000\,(P/A, 20\%, 5) + 500{,}000\,(P/F, 20\%, 5)$$

$$PW = -2{,}500{,}000 + 800{,}000\,(2.9906) + 500{,}000\,(0.4019)$$

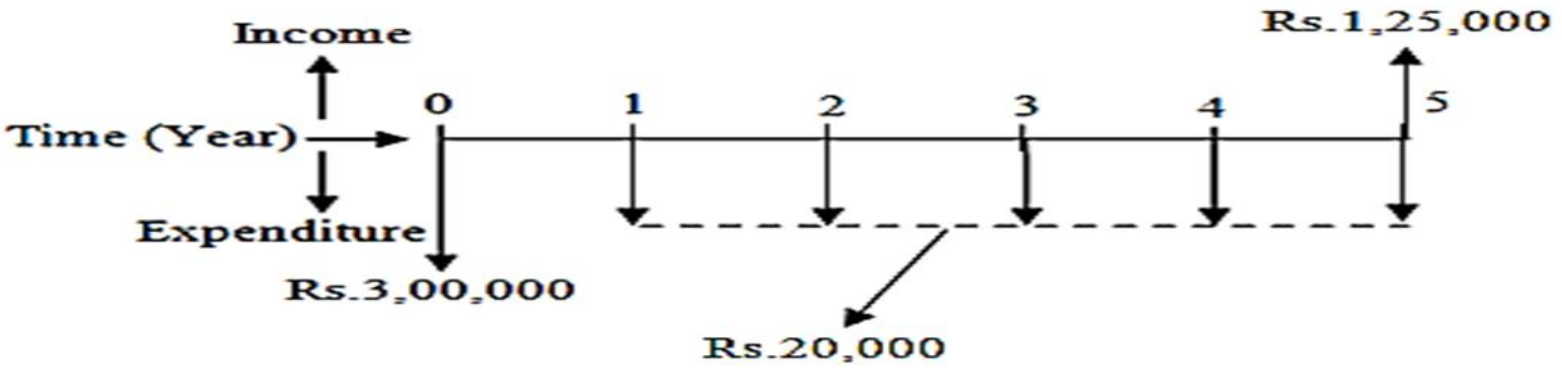
$PW = 93{,}430 > 0$ المشروع مقبول

مثال 2

هناك بديلين لشراء جبالة بيتون، يملك كلا البديلين نفس العمر المفيد، التدفق النقدي للبديلين كما يلي:
البديل الأول: سعر الشراء الأولي 300000، كلفة التشغيل والصيانة السنوية 20000، كلفة الاسترداد المتوقعة 125000، العمر المفيد 5 سنوات.
البديل الثاني: سعر الشراء الأولي 200000، كلفة التشغيل والصيانة السنوية 350000، كلفة الاسترداد المتوقعة 70000، العمر المفيد 5 سنوات.
باستخدام طريقة القيمة الحالية أوجد البديل الأفضل إذا كان معدل الفائدة 10%.

الحل

البديل الأول:



PW1 = - 3,00,000 - 20,000(P/A, i, n) + 1,25,000(P/F, i, n)

PW1 = - 3,00,000 - 20,000(P/A, 10%, 5) + 1,25,000(P/F, 10%, 5)

$$PW_1 = -3,00,000 - 20,000 \times \frac{(1+i)^n - 1}{i(1+i)^n} + 1,25,000 \times \frac{1}{(1+i)^n}$$

$$PW_1 = -3,00,000 - 20,000 \times \frac{(1+0.1)^5 - 1}{0.1(1+0.1)^5} + 1,25,000 \times \frac{1}{(1+0.1)^5}$$

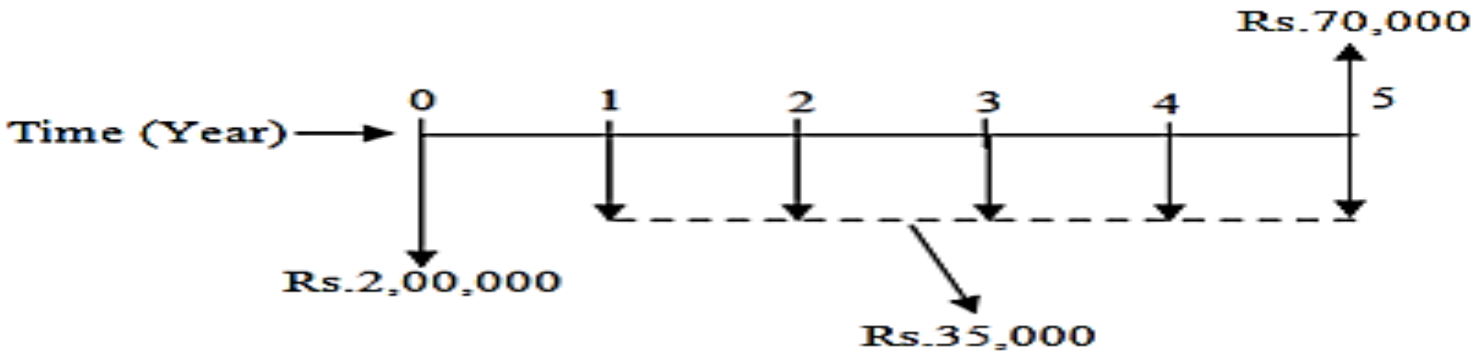
$$PW_1 = -3,00,000 - 20,000 \times 3.7908 + 1,25,000 \times 0.6209$$

$$PW_1 = -3,00,000 - 75,816 + 77,613$$

$PW_1 = -3,00,000 - 75,816 + 77,613$

PW_1 = - Rs.2,98,203

البديل الثاني:



$PW_2 = -2,00,000 - 35,000(P/A, i, n) + 70,000(P/F, i, n)$

$PW_2 = -2,00,000 - 35,000(P/A, 10\%, 5) + 70,000(P/F, 10\%, 5)$

$$PW_2 = -2,00,000 - 35,000 \times \frac{(1+i)^n - 1}{i(1+i)^n} + 70,000 \times \frac{1}{(1+i)^n}$$

$$PW_2 = -2,00,000 - 35,000 \times \frac{(1+0.1)^5 - 1}{0.1(1+0.1)^5} + 70,000 \times \frac{1}{(1+0.1)^5}$$

$PW_2 = -2,00,000 - 35,000 \times 3.7908 + 70,000 \times 0.6209$

$PW_2 = -2,00,000 - 13,2678 + 43,463$

$PW_2 =$ **- Rs.2,89,215**

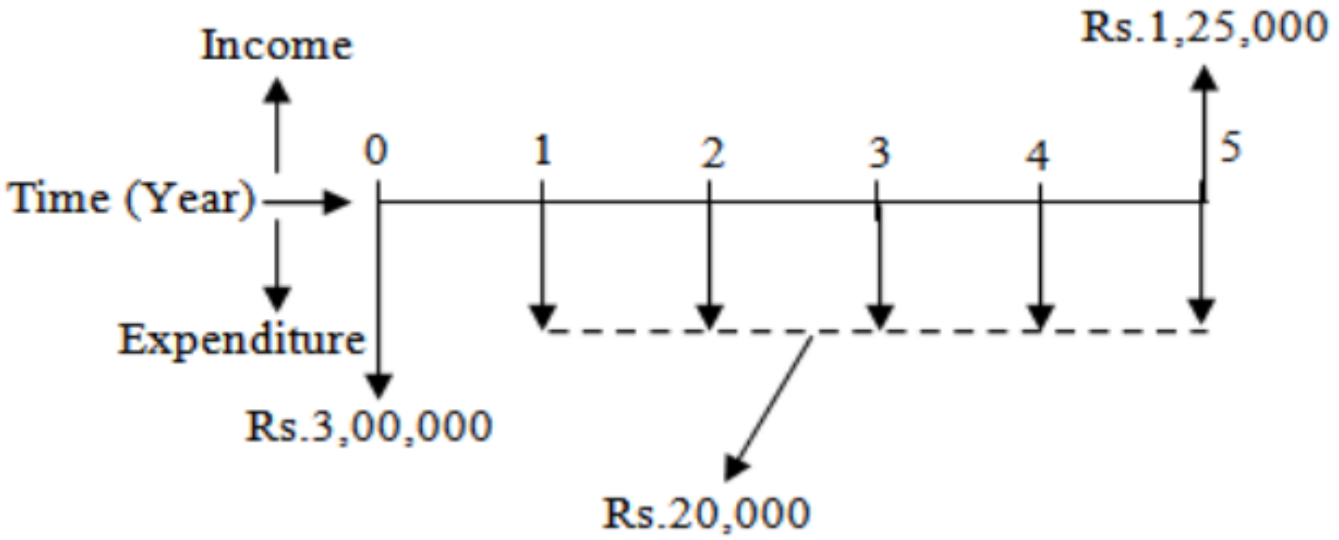
-298203 < -289215

البديل الثاني هو الأفضل

طريقة القيمة المستقبلية
FUTURE WORTH METHOD(PW)

- ✓ تقوم هذه الطريقة على اساس مفهوم القيمة المكافئة لكل التدفقات النقدية لنقطة اساس المستقبل وبمعدل فائدة MARR
- ✓ يكون المشروع مجدي اقتصاديا إذا كانت قيمة FW أكبر من الصفر

- أعد حل المثال 2 بطريقة القيمة المستقبلية:

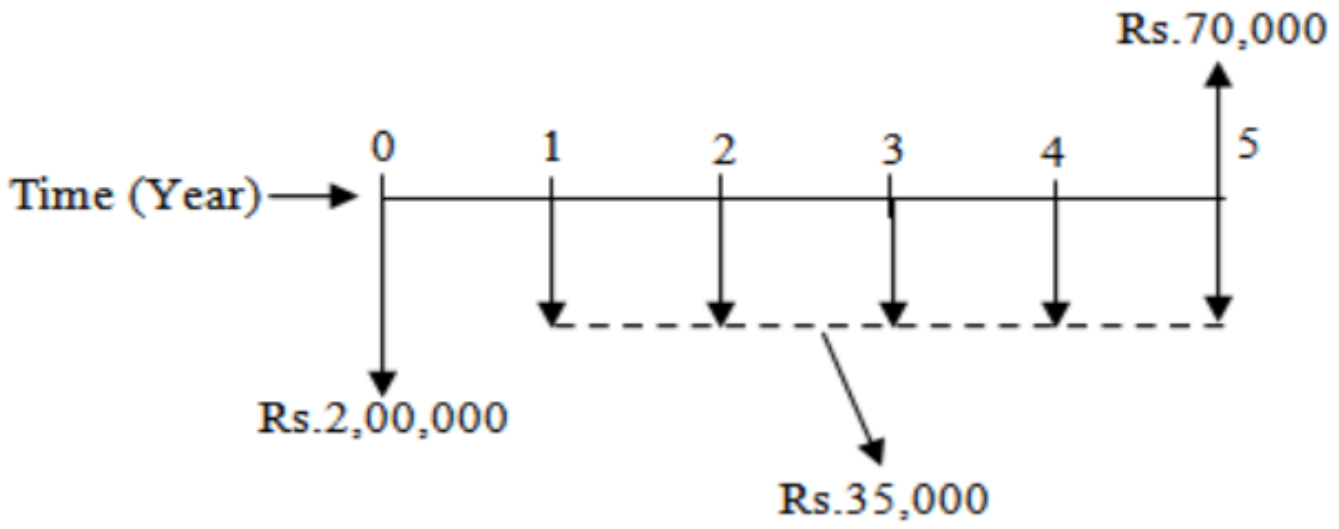


$$FW_1 = -300000(F/P,10\%,5) - 20000(F/A,10\%,5) + 125000$$

$$FW_1 = -300000 \times 1.6105 - 20000 \times 6.1051 + 125000$$

$$FW_1 = -483150 - 122102 + 125000$$

FW_1 = -Rs.480252



$$FW_2 = -200000(F/P,10\%,5) - 35000(F/A,10\%,5) + 70000$$

$$FW_2 = -200000 \times 1.6105 - 35000 \times 6.1051 + 70000$$

$$FW_2 = -322100 - 213679 + 70000$$

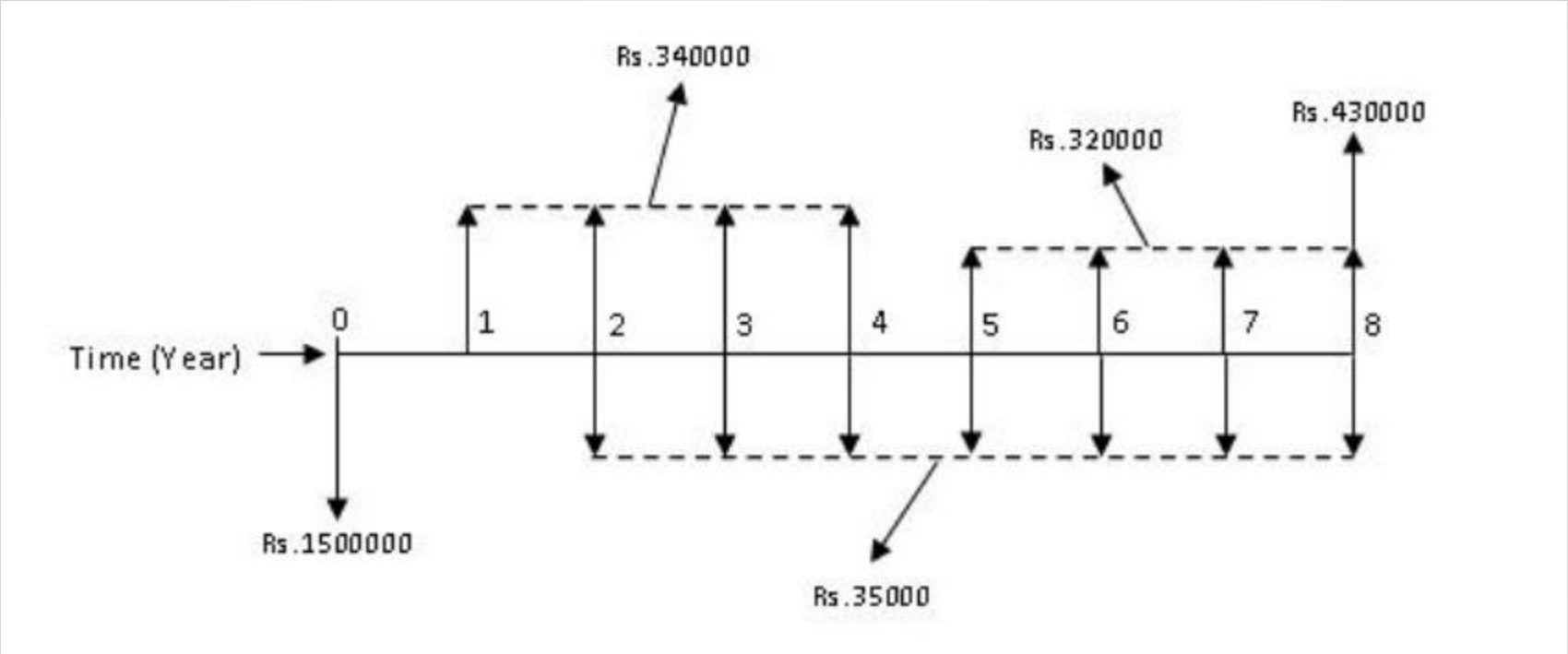
$$FW_2 = \text{-Rs.}465779$$

There are two alternatives for a construction firm to purchase a road roller which will be used for the construction of a highway section. The cash flow details of the alternatives are as follows;

Alternative-1: Initial purchase cost = Rs.1500000, Annual operating cost = Rs.35000 starting from the end of year '2' (negligible in the first year) till the end of useful life, Annual revenue to be generated = Rs.340000 for first 4 years and then Rs.320000 afterwards till the end of useful life, Expected salvage value = Rs.430000, Useful life = 8 years.

Alternative-2: Initial purchase cost = Rs.1800000, Annual operating cost = Rs.25000, Annual revenue to be generated = Rs.365000, Expected salvage value = Rs.550000, Useful life = 8 years.

Find out the most economical alternative on the basis of equivalent future worth at the interest rate of 9.5% per year.

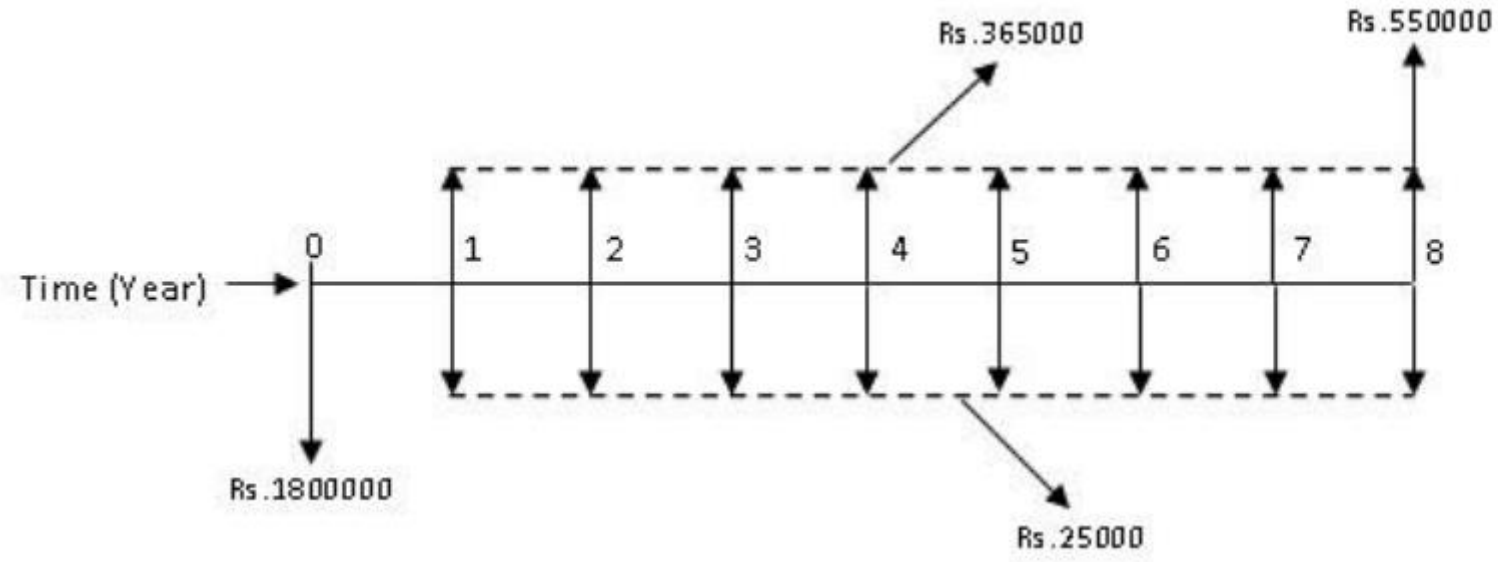

Rs.340000
Rs.320000
Rs.430000
Time (Year)
0
1
2
3
4
5
6
7
8
Rs.1500000
Rs.35000

$$FW_1 = -1500000(F/P, 9.5\%, 8) - 35000(F/A, 9.5\%, 7) + 340000(P/A, 9.5\%, 4)(F/P, 9.5\%, 8) + 320000(F/A, 9.5\%, 4) + 430000$$

$$FW_1 = -1500000 \times 2.0669 - 35000 \times 9.3426 + 340000 \times 3.2045 \times 2.0669 + 320000 \times 4.6070 + 430000$$

$$FW_1 = -3100350 - 326991 + 2251950 + 1474240 + 430000$$

FW_1 = Rs.728849



$$FW_2 = -1800000(F/P, 9.5\%, 8) - 25000(F/A, 9.5\%, 8) + 365000(F/A, 9.5\%, 8) + 550000$$

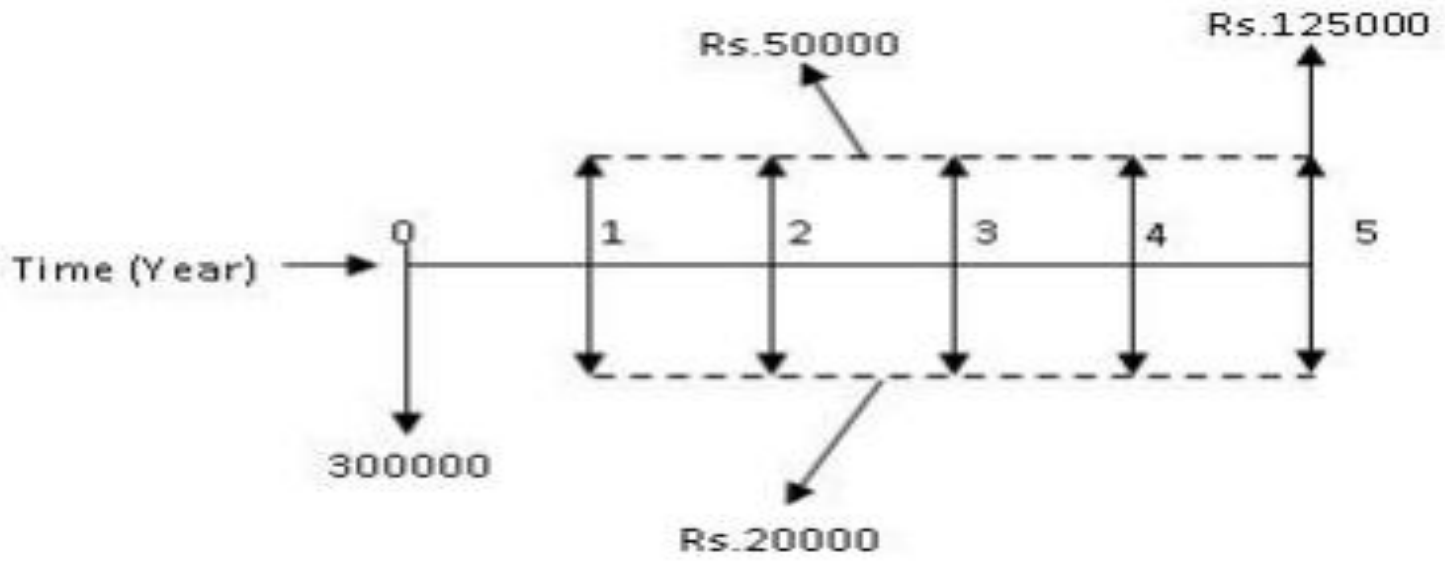
$$FW_2 = -1800000 \times 2.0669 + (365000 - 25000) \times 11.2302 + 550000$$

$$FW_2 = -3720420 + 3818268 + 550000$$

FW_2 = Rs.647848

طريقة القيمة السنوية
ANNUAL WORTH METHOD(PW)

- ✓ تقوم هذه الطريقة على اساس مفهوم القيمة المكافئة السنوية لكل التدفقات النقدية وبمعدل فائدة MARR
- ✓ يكون المشروع مجدي اقتصاديا إذا كانت قيمة AW أكبر من الصفر



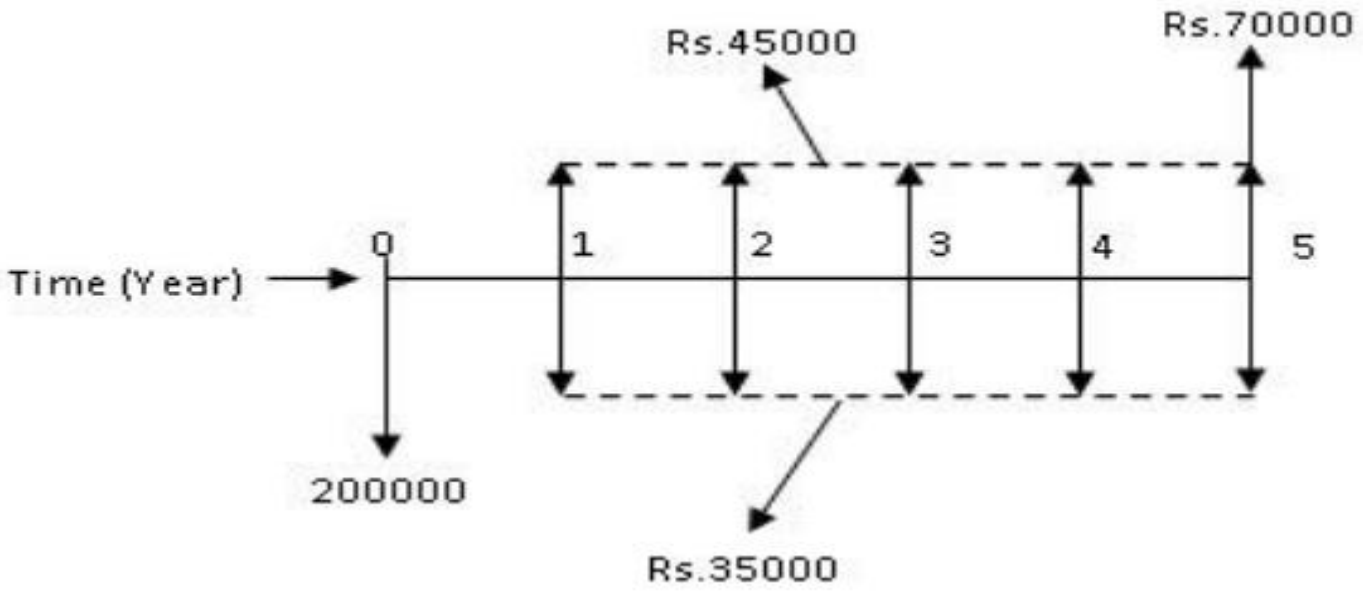
$$AW_1 = -300000(A/P,i,n) - 20000 + 50000 + 125000(A/F,i,n)$$

$$AW_1 = -300000(A/P,10\%,5) - 20000 + 50000 + 125000(A/F,10\%,5)$$

$$AW_1 = -300000 \times 0.2638 + (50000 - 20000) + 125000 \times 0.1638$$

$$AW_1 = -79140 + 30000 + 20475$$

AW_1= - Rs.28665



$$AW_2 = -200000(A/P,i,n) - 35000 + 45000 + 70000(A/F,i,n)$$

$$AW_2 = -200000(A/P,10\%,5) - 35000 + 45000 + 70000(A/F,10\%,5)$$

$$AW_2 = -200000 \times 0.2638 + (45000 - 35000) + 70000 \times 0.1638$$

$$AW_2 = -52760 + 10000 + 11466$$

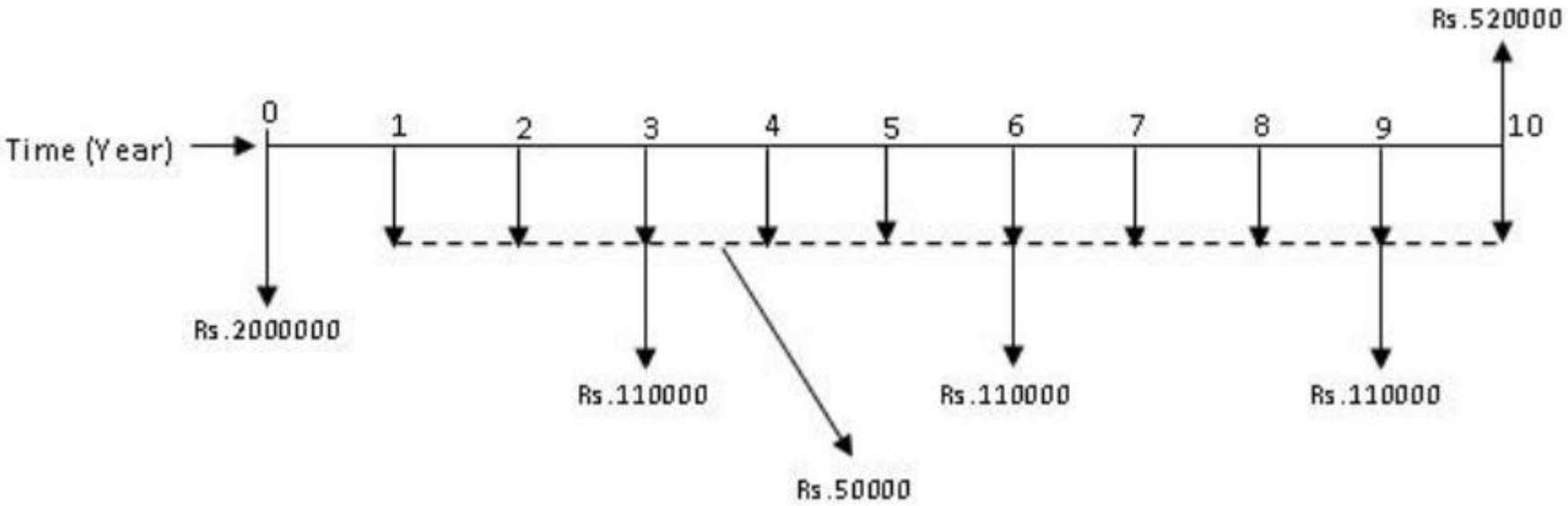
AW_2= - Rs.31294

A material supply contractor has two options (i.e. from two different manufacturing companies, Company-1 and Company-2) to purchase a tractor for supply of construction materials. The details of cash flow of the two options are given below;

Company-1 Tractor: Initial purchase cost = Rs.2000000, Annual operating cost including labor and maintenance = Rs.50000, Cost of new set of tires to be replaced at the end of year '3', year '6'and year '9' = Rs.110000 each, Expected salvage value = Rs.520000, Useful life = 10 years.

Company-2 Tractor: Initial purchase cost = Rs.2200000, Annual operating cost including labor and maintenance = Rs.27000, Cost of new set of tires to be replaced at the end of year '4' and year '8' = Rs.120000 each, Expected salvage value = Rs.700000, Useful life = 10 years.

Determine which company tractor should be selected on the basis of equivalent uniform annual worth at the interest rate of 12% per year.

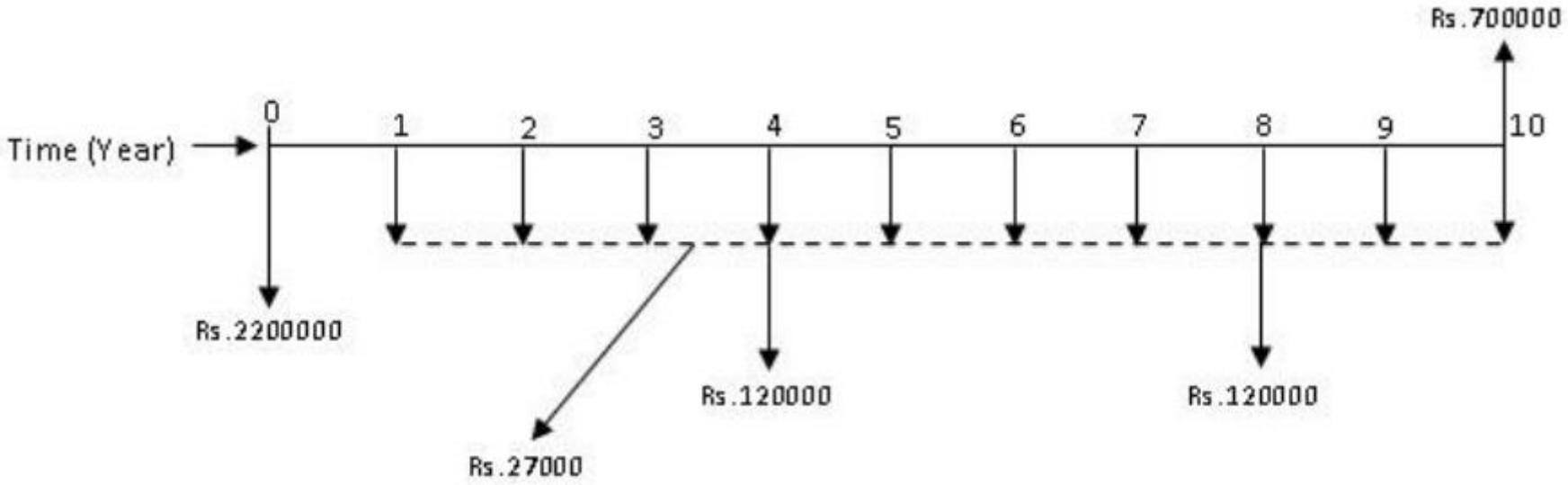


$$AW_1 = -2000000(A/P,12\%,10) - 50000 - 110000(P/F,12\%,3)(A/P,12\%,10) - 110000(P/F,12\%,6)(A/P,12\%,10) - 110000(P/F,12\%,9)(A/P,12\%,10) + 520000(A/F,12\%,10)$$

$$AW_1 = -2000000 \times 0.1770 - 50000 - 110000 \times 0.7118 \times 0.1770 - 110000 \times 0.5066 \times 0.1770 - 110000 \times 0.3606 \times 0.1770 + 520000 \times 0.0570$$

$$AW_1 = -354000 - 50000 - 13859 - 9864 - 7021 + 29640$$

$$\boldsymbol{AW_1 = -405104}$$



$$AW_2 = -2200000(A/P,12\%,10) - 27000 - 120000(P/F,12\%,4)(A/P,12\%,10) - 120000(P/F,12\%,8)(A/P,12\%,10) + 700000(A/F,12\%,10)$$

$$AW_2 = -2200000 \times 0.1770 - 27000 - 120000 \times 0.6355 \times 0.1770 - 120000 \times 0.4039 \times 0.1770 + 700000 \times 0.0570$$

$$AW_2 = -389400 - 27000 - 13498 - 8579 + 39900$$

$$\boldsymbol{AW_2 = -398577}$$

Using the annual worth method, compare the following machines having different life spans at an interest rate of 11.5% per year.

Machine-1

Cash flow details:

Initial purchase price = Rs.1200000

Annual operating cost = Rs.38000

Annual revenue = Rs.210000 for first 6 years and then Rs.225000 afterwards till the end of useful life.

Expected salvage value = Rs.320000

Useful life = 14 years

Machine-2

Cash flow details:

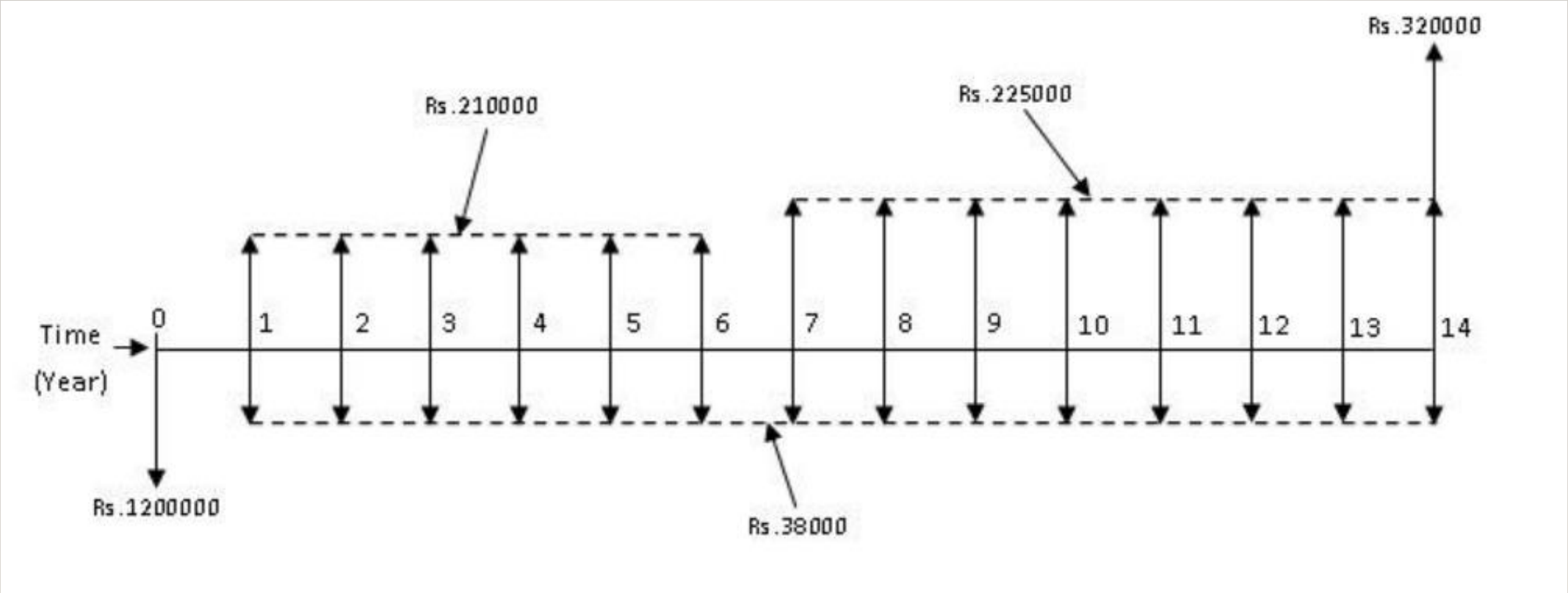
Initial purchase price = Rs.1400000

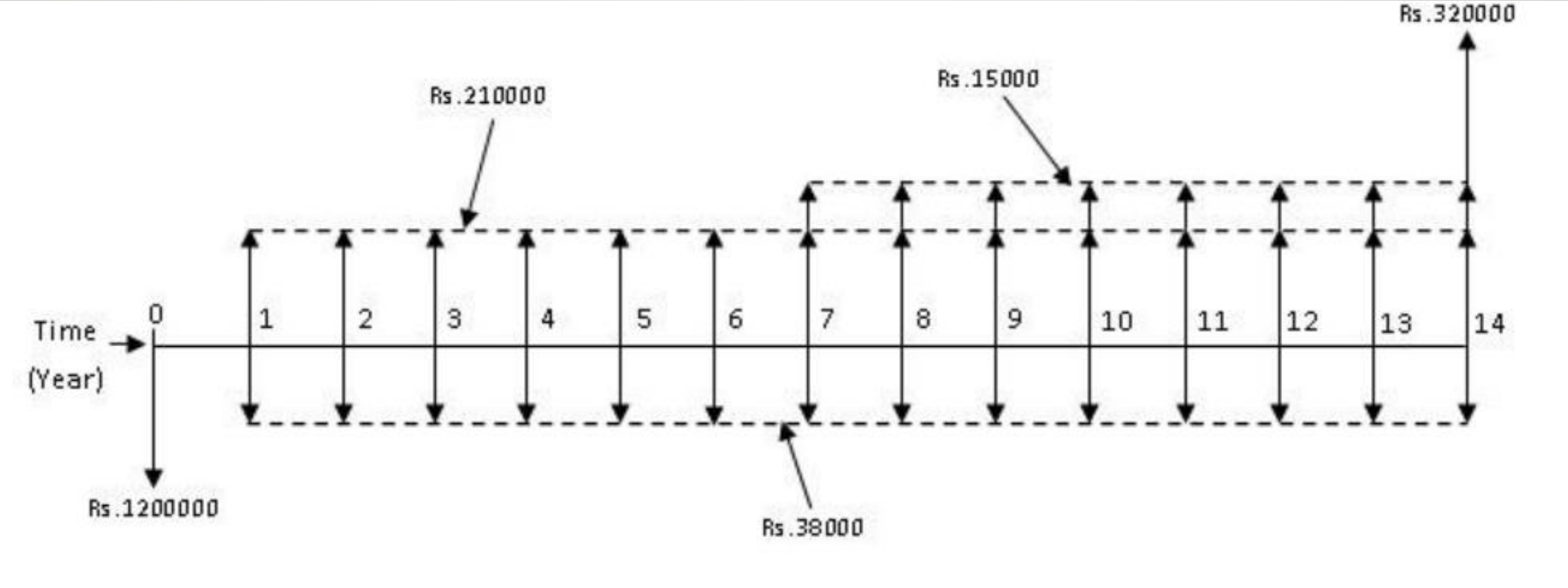
Annual operating cost = Rs.26000

Annual revenue = Rs.290000

Expected salvage value = Rs.450000

Useful life = 7 years


Rs.320000
Rs.210000
Rs.225000
Time
(Year)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Rs.1200000
Rs.38000

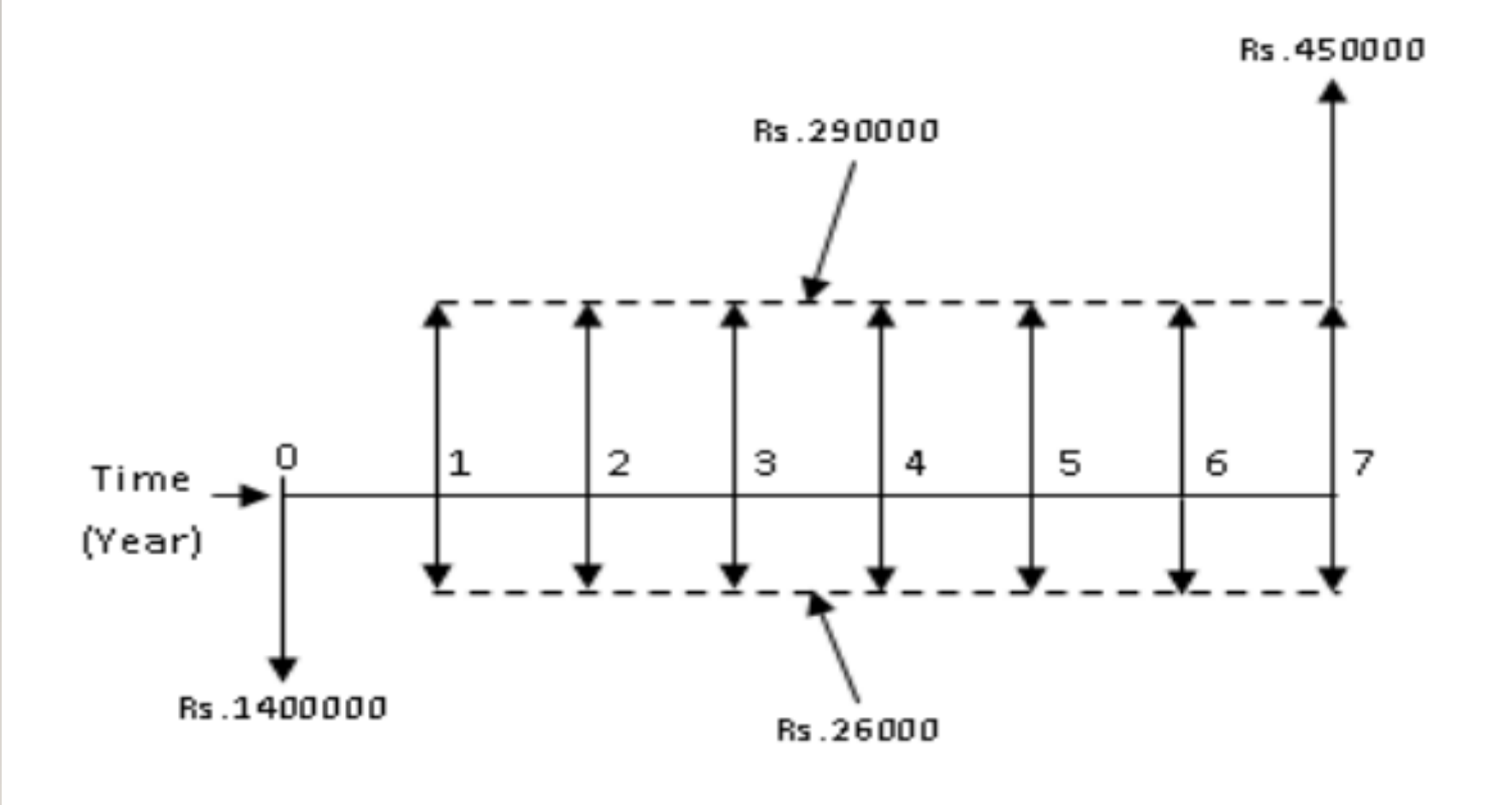

Rs.320000
Rs.210000
Rs.15000
Time
(Year)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Rs.1200000
Rs.38000

$$AW_1 = -1200000(A/P,11.5\%,14) - 38000 + 210000 + 15000(F/A,11.5\%,8)(A/F,11.5\%,14) + \\ +320000(A/F,11.5\%,14)$$

$$AW_1 = -1200000 \times 0.14703 - 38000 + 210000 + 15000 \times 12.07744 \times 0.03203 + 320000 \times 0.03203$$

$$AW_1 = -176436 - 38000 + 210000 + 5803 + 10250$$

$$\boldsymbol{AW_1 = \text{Rs.}11617}$$


Rs.450000
Rs.290000
Time
(Year)
0
1
2
3
4
5
6
7
Rs.1400000
Rs.26000

$$AW_2 = -1400000(A/P, 11.5\%, 7) - 26000 + 290000 + 450000(A/F, 11.5\%, 7)$$

$$AW_2 = -1400000 \times 0.21566 - 26000 + 290000 + 450000 \times 0.10066$$

$$AW_2 = -301924 - 26000 + 290000 + 45297$$

AW_2= Rs.7373

طريقة معدل العائد الداخلي لتقييم البديل
INTERNAL RATE OF RETURN (IRR)

نقوم بإيجاد معدل العائد الداخلي IRR وهو يحقق:

$$PW = 0 \; [PW(\text{الإيرادات}) = PW(\text{النفقات})]$$

$$FW = 0 \; [FW(receipts) = FW(expenditures)]$$

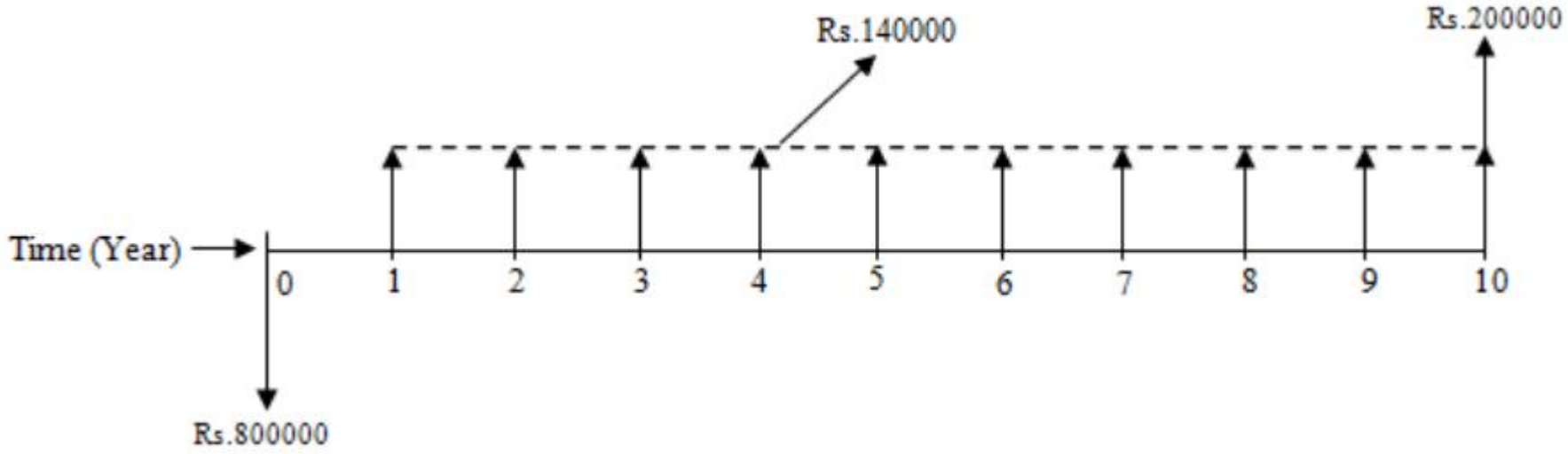
$$AW = 0 \; [AW(receipts) = AW(expenditures)]$$

يتم حساب IRR بطريقة التجربة والخطأ.

يكون المشروع (البديل) مقبولاً للاستثمار عندما يتحقق:

$$IRR \geq MARR$$

A construction firm is planning to invest Rs.800000 for the purchase of a construction equipment which will generate a net profit of Rs.140000 per year after deducting the annual operating and maintenance cost. The useful life of the equipment is 10 years and the expected salvage value of the equipment at the end of 10 years is Rs.200000. Compute the rate of return using trial and error method based on present worth, if the construction firm's minimum attractive rate of return (MARR) is 10% per year.



$$PW = -800000 + 140000(P/A, i_r, 10) + 200000(P/F, i_r, 10)$$

For determining the value of 'i_r' the net present worth is equated to zero.

$$0 = -800000 + 140000(P/A, i_r, 10) + 200000(P/F, i_r, 10)$$

$$PW = -800000 + 140000(P/A, 8\%, 10) + 200000(P/F, 8\%, 10)$$

$$PW = -800000 + 140000 \times 6.7101 + 200000 \times 0.4632$$

***PW* = Rs.232054**

$$PW = -800000 + 140000(P/A, 12\%, 10) + 200000(P/F, 12\%, 10)$$

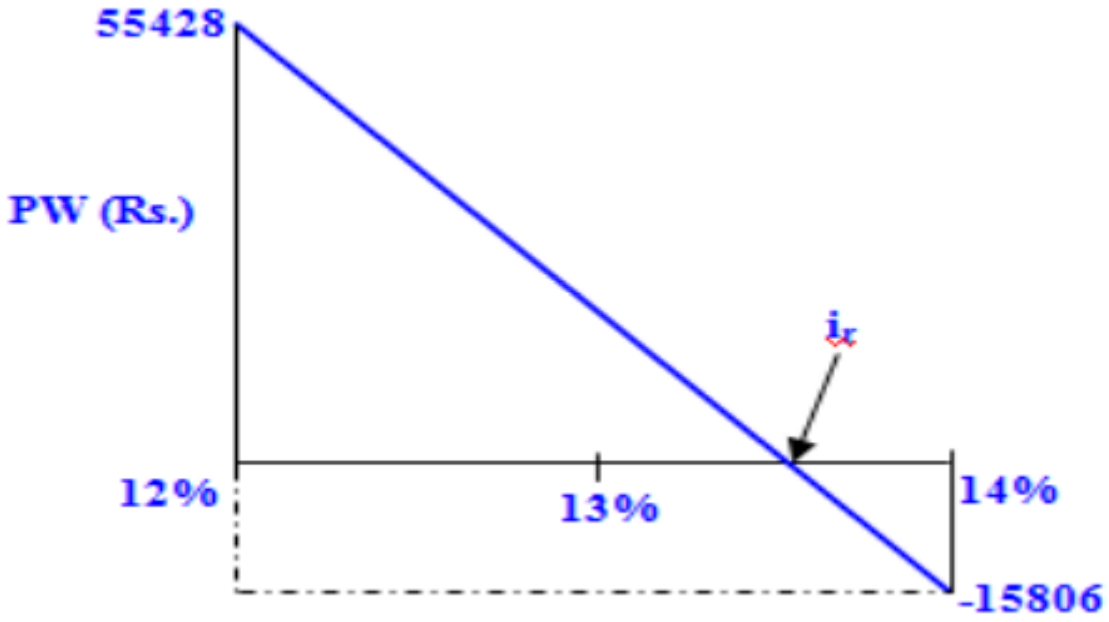
$$PW = -800000 + 140000 \times 5.6502 + 200000 \times 0.3220$$

***PW* = Rs.55428**

$$PW = -800000 + 140000(P/A, 14\%, 10) + 200000(P/F, 14\%, 10)$$

$$PW = -800000 + 140000 \times 5.2161 + 200000 \times 0.2697$$

***PW* = -Rs.15806**



$$PW = Rs.55428 \text{ at } i_r = 12\%$$

$$PW = -Rs.15806 \text{ at } i_r = 14\%$$

$$\frac{55428-(-15806)}{14\%-12\%} = \frac{55428-0}{i_r - 12\%}$$

i_r is found to be 13.55% per year

المشروع مجدي اقتصاديا لأن

i_r > MARR