project planning and management series

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The Project Planning and Management Series consists of a set of manuals and associated modules presenting practical approaches, tools and techniques for project planning and management. (See list on back cover). A product of the Government of Jamaica/USAID National Planning Project (1976-1980), the series was developed by the Project Development Resource Team (PDRT) of PAMCO for use in "action-training" workshops and reflects extensive experience in training and project development. All present PDRT members are contributing authors and have worked together in writing, revising and publishing the series. Special credits are due to Dr. Merlyn Kettering for design and development of the series; Dr. Bruce Brooks for writing final versions of many modules; Mrs. Marjorie Humphreys for assuming primary editing and production responsibility and for organizing draft papers into more useful materials; Mr. Lascelles Dixon, head of PDRT since 1979, for designing the cover and improving many of the illustrations; and Mrs. Christine Hinds and Miss Linette Johnson for typing the drafts and final manuscripts. Any comments on the series and its usefulness are welcome.

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DISCOUNTING

Bruce Brooks

PREREQUISITES: MODULE 20 - Cash Flow Analysis

MODULE 23 - Cost-Benefit Analysis

References: MODULE 22 - Net Present Worth

MODULE 24 - Benefit-Cost Ratio Analysis

MODULE 25 - Internal Rate of Return

B. *DISCUSSION:*

Discounting is another way to estimate a project's worth. It represents the time value of money as an opportunity cost and provides a basis for analysing and comparing future costs and benefit streams for a project and reducing them to their present worth. Once the costs and benefits are determined and annual cash flow is derived, the cash flows can then be discounted to arrive at the benefit-cost ratio, net present worth, and internal rate of return.

The loss of a higher rate of return figures prominently in judging the worth of a project when compared to alternative investments. Discounting places a greater weight on costs and benefits estimates that are in the more immediate future and if a discount rate of over 15% is used for an investment of 20 or more years the discount factors are negligible because of the risks involved relative to the payments that may be received at a time that far in the future. Distant estimates of return that are far in the future, therefore are not weighted as heavily in judging the worth of a project. The worth of the project is not judged directly by the discounted costs, benefits, and cash flows but this tool provides the inputs for deriving the measures (Present Net Worth, Cost-Benefit ratios, and Internal Rate of Return) that are useful in evaluating and comparing a project with other investment opportunities.

C. *PURPOSE:*

When projects last for more than one year, discounting offers a means of comparing projects that have differently shaped streams of costs and benefits.

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D. USES:

Uses of Discounting

1. To determine the present worth of future payments whether a single payment, a series of payments that are the same for each time period, or payments at irregular intervals. By application of a discount factor based on the selected discount rate to these payments, the future worth of payments can be determined.

2. To reduce future benefits to their present worth which can then be used to compare one project with another, even though they have dissimilar streams of costs and benefits over time. The steps in this comparison evolve from computation of each project's cash flows to benefit-cost ratios, a measure of net present worth, and computation of the internal rate of return for each project.

E. DEFINITIONS:

1. A *Discount Rate* is a percentage which equates the present and future worth of a payment.

2. A *Discount Factor* is a fraction between zero and one expressed in decimal form that is applied to a monetary unit to yield the present worth of a monetary unit that is spent or received.

3. *Opportunity Cost* is the cost of committing resources to a specific use compared to the return that could have been received from those same resources had they been committed to the most productive alternative use.

4. *Time Preference* for money is the desire of individuals to receive money now rather than receiving it at a future date.

5. *Present Worth* is the value now of a future payment of a monetary unit.

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F. *LIMITATIONS AND ADVANTAGES:*

Advantages of Discounting

1. Discounting puts more value on money received in the short term rather than the longer term. More distant receipts that are anticipated are less likely to be received than those which are close by, and therefore are more risky or less reliable. Discounting the future payments gives the analyst confidence in his valuation of future payments.

2. Discounting provides a logical basis for comparing payments and receipts at different times during the life of the project. It helps in the evaluation of a single project or the comparison of different projects.

Limitations of Discounting

1. Establishing the discount rate is often difficult for a number of reasons, e.g., there may be rapidly changing prices of inputs and outputs and a generally unstable economy and political situation.

   Establishment of a discount rate that is too low can result in an over-optimistic estimate of the future payments from a project. An estimated discount rate that appears to be high is often preferable to a low one because it is better to have the project turn out better than expected than worse than expected.

   One way of deriving an estimate to be used as the discount rate is to view the returns from similar kinds of ventures operating in the present economy and to use the highest internal rate of return as the discount rate. For example, if the highest internal rate of return on similar projects is 5% to 18%, then a discount rate of 18% should be used. Prevailing bank interest rates may be used, but these may not reflect subsidies that exist nor give sufficient attention to risk factors prevalent in the kind of project being considered.

2. When a discount rate is chosen it is usually held constant during the life of the project. This is an inherent weakness and can be corrected by changing the discount rate for future periods. Care should be taken if this is done because the errors may be compounded rather than reduced.

   Also, if the worth of several projects is being compared, the same discount rate must be used in the analysis of each unless they are mutually exclusive. This simply means that they have different risk levels and opportunity costs and should not be compared. This is also done when judging single projects.

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Discount rates like other rates should be expected to vary over time, but the recommended approach is to choose the rate to be used carefully and use it over the life of the project. Establishing the appropriate discount rate requires a knowledge of the returns that similar efforts are generating, and subjective judgment. The opportunity cost of capital must be estimated which does require knowledge about the best return from the best alternative investments.

G. *ASSUMPTIONS:*

There is a preference for immediate benefits rather than receipt of benefits at some later date. The logic of this is embodied in the judgement that there are opportunities which will be foregone during the waiting period before benefits are received. The opportunity to invest in a project that yields a greater return on the amount invested is no longer available and is therefore a cost. Another cost is the risk associated with the receipt of future payments and the longer the period the greater is the risk. For example, the value of a dollar that could be invested in a project today but not repaid for 10 years is worth much less than a dollar today. Even at prevailing interest rates of 10% compounded annually, the present value of the dollar is only 38.59 cents. If this amount were, invested at 10% interest compounded annually you would get back $1.00 in 10 years. Another way of looking at this investment is in terms of how much the one dollar investment has to increase to realize 10% interest compounded annually. The answer is $2.59. So if the project is expected to earn 10% on the investment it must pay back $2.59 for every dollar invested. But, suppose there is an alternative investment which gives promise of yielding a 14% return on investment, investment of a dollar in this project will yield $3.71. Obviously the latter project would and should be favoured based solely on the criteria of internal rate of return.

H. *OUTPUT:*

Outputs of Discounting

The present worth of any payment or stream of payments can be determined by discounting. The discounted values or present worth of payments can then be used to determine the financial criteria for evaluating a project.

The financial criteria as computed from discounted values of payments (costs, benefits, and cash flows) are:

Net Present Worth	-	(SEE MODULE 22)
Benefit-Cost Ratio	-	(SEE MODULE 24)
Internal Rate of Return	-	(SEE MODULE 25)

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Any or all of the above measures can be used to evaluate single projects or compare several projects.

I. *STEPS FOR PROCEDURES FOR DOING DISCOUNTING*

There are four different time schedules in which receipts (payments) are received. These are discussed separately and examples given for each. The three different time modes for discounting payments are:

(a) A single future payment

(b) A series of non-uniform payments

(c) An annuity

(a) *Steps in Discounting a Single Future Payment*

STEP 1. Determine the discount rate which will be used to compute the discount factor.

STEP 2. Compute the discount factor (DF)

$$DF\ [r/n] = 1/[1 + (r/100)]^n$$

where n = number of years in the future that the payment will be received

r = discount rate in percent, i.e., 10%, 12% .....

NOTE: To save computation time, the discount factors for discount rates of 1 to 50% are shown in the APPENDIX at the end of this Module.

(b) *Steps in Discounting a Series of Payments that are not uniform*

STEP 1. Determine the discount rate, r.

STEP 2. Show in tabular form the years of payments or receipts and amount of payments.

STEP 3. Determine the discount factor, at the chosen discount rate, for each payment.

STEP 4. Compute the present worth of the annual payments.

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STEP 5. Sum the present worth to arrive at a single value. Figures in parenthesis are subtracted from the total. It is possible to have a negative present worth.

The information above is tabulated as shown in TABLE 1 below

TABLE 1

PRESENT WORTH OF A SERIES OF
NON-UNIFORM PAYMENTS

Years	Payments or Receipts	15% Discount Factor	Present Worth
1	(50)	.870	(43.50)
2	100	.756	75.60
3	150	.658	98.70
4	200	.572	114.40
TOTAL	400	2.856	245.20

NOTE: The benefit flow or annual payments from the project illustrated above are not equal and some may be negative. Negative figures are shown in parentheses, e.g., (100).

Each year's payments or receipts were discounted separately to arrive at a present worth for each year and then these were summed. The discount factors for each year were determined by using the same formula as was used for a single future payment, i.e., DF $[r/n] = 1/[1 + (r + 100)]^n$. Using the formula to calculate the discount factor the annual factors are:

DF First year $= 1/[1 + (15/100)] = 1/1.15 = .870$

DF Second year $= 1/[1 + (15/100)]^2 = 1/1.3225 = .756$

DF Third year $= 1/[1 + (15/100)]^3 = 1/1.5209 = .658$

DF Fourth year $= 1/[1 + (15/100)]^4 = 1/1.7490 = .572$

The annual payments or receipts are then multiplied by the discount factors, i.e., the first year's discount factor times the first year's

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payment or receipts, the second year's discount factor times the second year's payments or receipt, etc., to arrive at the present worth of annual payments or receipts as noted in the table above. The sum of the discounted payments is $245.20 instead of $400.00 and this amount would be further reduced by using a higher discount rate.

(c) *Steps in Discounting an Annuity* (An amount paid or received annaully over a period of years).

STEP 1. Setting a discount rate, r.

STEP 2. Computing a discount factor for each year.

$$ADF\ [r/n] = \overset{n}{E}\ 1/[1 + (r/100)]^{i}$$

i = the year, ranging from 1 to n.

E = the sum of the terms of index i,

n = the number of years that the annuity is to be paid with each payment made at the end of the year.

r = the discount rate in percent.

An example of a computation using the formula requires that the discount factor for each year be computed, i.e., $1/[1 + (r/100)]^{n}$ which are the single year's present value discount factors. These then are summed to arrive at the discount factor for each year. For example, if the previous example is used for a 20% discount rate for a four year period it would appear as follows with an annual annuity of $1,000.00.

TABLE 2

Year	Amount Received at end of each year	Discount Factors at 20%	Present Worth of Amount Received
1	1,000	.870	870
2	1,000	1.626	1.626
3	1,000	2.284	2,284
4	1,000	2.856	2,856

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Note that the discount factor for each year that follows is the sum of that year's discount factor plus the discount factors of all previous years. For example, the discount factor for year three is the sum of the single year's discount factors for years, 1, 2, and 3. (SEE SINGLE YEAR'S DISCOUNT FACTORS IN PREVIOUS TABLE).

STEP 3. Multiply the annual discount factors by the uniform payments. The present worth of a series of four $1,000 year and payments discounted at 20% rates is $2,856, and the present value of three $1,000 year end payments is $2,284, as shown in the Table above.

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EXERCISE ON DISCOUNTING

(Use discount factor tables in Appendix 21.1) to determine discount factors)

A project is proposed that has the following estimated costs and revenues over a ten (10) year period:

Year	Receipts	Costs
1	(000)	(620)
2	130	240
3	270	180
4	275	180
5	300	180
6	300	190
7	300	190
8	300	190
9	270	190
10	230	190

1. Compute the project benefits (SEE MODULE 23 - COST BENEFIT ANALYSIS).

2. Discount the benefits to their Net Present Worth.

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APPENDIX 21.1

DISCOUNTING TABLES

TABLE 1

Present Worth of $1 Received at Future Date

$$DF\ [r/n] = 1/[1 + (r/100)]$$

Year (n)	1%	2%	3%	4%	5%	6%	7%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346
2	0.9803	0.9612	0.9426	0.9246	0.9070	0.8900	0.8734
3	0.9706	0.9423	0.9151	0.8890	0.8638	0.8396	0.8163
4	0.9610	0.9238	0.8885	0.8548	0.8227	0.7921	0.7629
5	0.9515	0.9057	0.8626	0.8219	0.7835	0.7473	0.7130
6	0.9420	0.8880	0.8375	0.7903	0.7462	0.7050	0.6663
7	0.9327	0.8706	0.8131	0.7599	0.7107	0.6651	0.6228
8	0.9235	0.8535	0.7894	0.7307	0.6768	0.6274	0.5820
9	0.9143	0.8368	0.7664	0.7026	0.6446	0.5919	0.5439
10	0.9053	0.8203	0.7441	0.6756	0.6139	0.5584	0.5083
11	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751
12	0.8874	0.7885	0.7014	0.6246	0.5568	0.4970	0.4440
13	0.8787	0.7730	0.6810	0.6006	0.5303	0.4688	0.4150
14	0.8700	0.7579	0.6611	0.5775	0.5051	0.4423	0.3878
15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624
16	0.8528	0.7284	0.6232	0.5339	0.4581	0.3936	0.3387
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166
18	0.8360	0.7002	0.5874	0.4936	0.4155	0.3503	0.2959
19	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584
21	0.8114	0.6598	0.5375	0.4388	0.3589	0.2942	0.2415
22	0.8034	0.6468	0.5219	0.4220	0.3418	0.2775	0.2257
23	0.7954	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109
24	0.7876	0.6217	0.4919	0.3901	0.3101	0.2470	0.1971
25	0.7798	0.6095	04776	0.3751	0.2953	0.2330	0.1842
26	0.7720	0.5976	0.4637	0.3607	0.2813	0.2198	0.1722
27	0.7644	0.5859	0.4502	0.3468	0.2678	0.2074	0.1609
28	0.7568	0.5744	0.4371	0.3335	0.2551	0.1956	0.1504
29	0.7493	0.5631	0.4243	0.3207	0.2429	0.1846	0.1406
30	0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314
35	0.7059	0.5000	0.3554	0.2534	0.1813	0.1301	0.0937
40	0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668
45	0.6391	0.4102	0.2644	0.1712	0.1113	0.0727	0.0476
50	0.6080	0.3715	0.2281	0.1407	0.0872	0.0543	0.0339

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Year (n)	8%	9%	10%	11%	12%	13%	14%
1	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772
2	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695
3	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750
4	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921
5	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194
6	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556
7	0.5835	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996
8	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506
9	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075
10	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697
11	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366
12	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076
13	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821
14	0.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597
15	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401
16	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229
17	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078
18	0.2502	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946
19	0.2317	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829
20	0.2145	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728
21	0.1987	0.1637	0.1351	0.1117	0.0926	0.0768	0.0638
22	0.1839	0.1502	0.1228	0.1007	0.0826	0.0680	0.0560
23	0.1703	0.1378	0.1117	0.0907	0.0738	0.0601	0.0491
24	0.1577	0.1264	0.1015	0.0817	0.0659	0.0532	0.0431
25	0.1460	0.1160	0.0923	0.0736	0.0588	0.0471	0.0378
26	0.1352	0.1064	0.0839	0.0663	0.0525	0.0417	0.0331
27	0.1252	0.0976	0.0763	0.0597	0.0469	0.0369	0.0291
28	0.1159	0.0895	0.0693	0.0538	0.0419	0.0326	0.0255
29	0.1073	0.0822	0.0630	0.0485	0.0374	0.0289	0.0224
30	0.0994	0.0754	0.0573	0.0437	0.0334	0.0256	0.0196
35	0.0676	0.0490	0.0356	0.0259	0.0189	0.0139	0.0102
40	0.0460	0.0318	0.0221	0.0154	0.0107	0.0075	0.0053
45	0.0313	0.0207	0.0137	0.0091	0.0061	0.0041	0.0027
50	0.0213	0.0134	0.0085	0.0054	0.0035	0.0022	0.0014

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Year (n)	15%	16%	17%	18%	19%	20%	21%
1	0.8696	0.8621	0.8547	0.8475	0.8403	0.8333	0.8264
2	0.7561	0.7432	0.7305	0.7182	0.7062	0.6944	0.6830
3	0.6575	0.6407	0.6244	0.6086	0.5934	0.5787	0.5645
4	0.5718	0.5523	0.5337	0.5158	0.4987	0.4823	0.4665
5	0.4972	0.4761	0.4561	0.4371	0.4190	0.4019	0.3855
6	0.4323	0.4104	0.3898	0.3704	0.3521	0.3349	0.3186
7	0.3759	0.3538	0.3332	0.3139	0.2959	0.2791	0.2633
8	0.3269	0.3050	0.2848	0.2660	0.2487	0.2326	0.2176
9	0.2843	0.2630	0.2434	0.2255	0.2090	0.1938	0.1799
10	0.2472	0.2267	0.2080	0.1911	0.1756	0.1615	0.1486
11	0.2149	0.1954	0.1778	0.1619	0.1476	0.1346	0.1228
12	0.1869	0.1685	0.1520	0.1372	0.1240	0.1122	0.1015
13	0.1625	0.1452	0.1299	0.1163	0.1042	0.0935	0.0839
14	0.1413	0.1252	0.1110	0.0985	0.0876	0.0779	0.0693
15	0.1229	0.1079	0.0949	0.0835	0.0736	0.0649	0.0573
16	0.1069	0.0930	0.0811	0.0708	0.0618	0.0541	0.0474
17	0.0929	0.0802	0.0693	0.0600	0.0520	0.0451	0.0391
18	0.0808	0.0691	0.0592	0.0508	0.0437	0.0376	0.0323
19	0.0703	0.0596	0.0506	0.0431	0.0367	0.0313	0.0267
20	0.0611	0.0514	0.0433	0.0365	0.0308	0.0261	0.0221
21	0.0531	0.0443	0.0370	0.0309	0.0259	0.0217	0.0183
22	0.0462	0.0382	0.0316	0.0262	0.0218	0.0181	0.0151
23	0.0402	0.0329	0.0270	0.0222	0.0183	0.0151	0.0125
24	0.0349	0.0284	0.0231	0.0188	0.0154	0.0126	0.0103
25	0.0304	0.0245	0.0197	0.0160	0.0129	0.0105	0.0085
26	0.0264	0.0211	0.0169	0.0135	0.0109	0.0087	0.0070
27	0.0230	0.0182	0.0144	0.0115	0.0091	0.0073	0.0058
28	0.0200	0.0157	0.0123	0.0097	0.0077	0.0061	0.0048
29	0.0174	0.0135	0.0105	0.0082	0.0064	0.0051	0.0040
30.	0.0151	0.0116	0.0090	0.0070	0.0054	0.0042	0.0033
35	0.0075	0.0055	0.0041	0.0030	0.0023	0.0017	0.0013
40	0.0037	0.0026	0.0019	0 0013	0.0010	0.0007	0.0005
45	0.0019	0.0013	0.0009	0.0006	0.0004	0.0003	0.0002
50	0.0009	0.0006	0.0004	0.0003	0.0002	0.0001	0.0001

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Year (n)	22%	23%	24%	25%	26%	27%	28%
1	0.8197	0.8130	0.8065	0.8000	0.7937	0.7874	0.7813
2	0.6719	0.6610	0.6504	0.6400	0.6299	0.6200	0.6104
3	0.5507	0.5374	0.5245	0.5120	0.4999	0.4882	0.4768
4	0.4514	0.4369	0.4230	0.4096	0.3968	0.3844	0.3725
5	0.3700	0.3552	0.3411	0.3277	0.3149	0.3027	0.2910
6	0.3033	0.2888	0.2751	0.2621	0.2499	0.2383	0.2274
7	0.2486	0.2348	0.2218	0.2097	0.1983	0.1877	0.1776
8	0.2038	0.1909	0.1789	0.1678	0.1574	0.1478	0.1388
9	0.1670	0.1552	0.1443	0.1342	0.1249	0.1164	0.1084
10	0.1369	0.1262	0.1164	0.1074	0.0992	0.0916	0.0847
11	0.1122	0.1026	0.0938	0.0859	0.0787	0.0721	0.0662
12	0.0920	0.0834	0.0757	0.0687	0.0625	0.0568	0.0517
13	0.0754	0.0678	0.0610	0.0550	0.0496	0.0447	0.0404
14	0.0618	0.0551	0.0492	0.0440	0.0393	0.0352	0.0316
15	0.0507	0.0448	0.0397	0.0352	0.0312	0.0277	0.0247
16	0.0415	0.0364	0.0320	0.0281	0.0248	0.0218	0.0193
17	0.0340	0.0296	0.0258	0.0225	0.0197	0.0172	0.0150
18	0.0279	0.0241	0.0208	0.0180	0.0156	0.0135	0.0118
19	0.0229	0.0196	0.0168	0.0144	0.0124	0.0107	0.0092
20	0.0187	0.0159	0.0135	0.0115	0.0098	0.0084	0.0072
21	0.0154	0.0129	0.0109	0.0092	0.0078	0.0066	0.0056
22	0.0126	0.0105	0.0083	0.0074	0.0062	0.0052	0.0044
23	0.0103	0.0086	0.0071	0.0059	0.0049	0.0041	0.0034
24	0.0085	0.0070	0.0057	0.0047	0.0039	0.0032	0.0027
25	0.0069	0.0057	0.0046	0.0038	0.0031	0.0025	0.0021
26	0.0057	0.0046	0.0037	0.0030	0.0025	0.0020	0.0016
27	0.0047	0.0037	0.0030	0.0024	0.0019	0.0016	0.0013
28	0.0038	0.0030	0.0024	0.0019	0.0015	0.0012	0.0010
29	0.0031	0.0025	0.0020	0.0015	0.0012	0.0010	0.0008
30	0.0026	0.0020	0.0016	0.0012	0.0012	0.0010	0.0006
35	0.0009	0.0007	0.0005	0.0004	0.0003	0.0002	0.0002
40	0.0004	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
45	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
50	0.0000	0.0000	0.0000				

DO NOT DUPLICATE WITHOUT PERMISSION

Year (n)	29%	30%	35%	40%	45%	50%
1	0.7752	0.7692	0.7407	0.7143	0.6897	0.6667
2	0.6009	0.5917	0.5487	0.5102	0.4756	0.4444
3	0.4658	0.4552	0.4064	0.3644	0.3280	0.2963
4	0.3611	0.3501	0.3011	0.2603	0.2262	0.1975
5	0.2799	0.2693	0.2230	0.1859	0.1560	0.1317
6	0.2170	0.2072	0.1652	0.1328	0.1076	0.0878
7	0.1682	0.1594	0.1224	0.0949	0.0742	0 0585
8	0.1304	0.1226	0.0906	0.0678	0.0512	0.0390
9	0.1011	0.0943	0.0671	0.0484	0.0353	0.0260
10	0.0784	0.0725	0.0497	0.0346	0.0243	0.0173
11	0.0607	0.0558	0.0368	0.0247	0.0168	0.0116
12	0.0471	0.0429	0.0273	0.0176	0.0116	0.0077
13	0.0365	0.0330	0.0202	0.0126	0.0080	0.0051
14	0.0283	0.0253	0.0150	0.0090	0.0055	0.0034
15	0.0219	0.0195	0.0111	0.0064	0.0038	0.0023
16	0.0170	0.0150	0.0082	0.0046	0.0026	0.0015
17	0.0132	0.0116	0.0061	0.0033	0.0018	0.0010
18	0.0102	0.0089	0.0045	0.0023	0.0012	0.0007
19	0.0079	0.0068	0.0033	0.0017	0.0009	0.0005
20	0.0061	0.0053	0.0025	0.0012	0.0006	0.0003
21	0.0048	0.0040	0.0018	0.0009	0.0004	0.0002
22	0.0037	0.0031	0.0014	0.0006	0.0003	0.0001
23	0.0029	0.0024	0.0010	0.0004	0.0002	0.0001
24	0.0022	0.0018	0.0007	0.0003	0.0001	0.0001
25	0.0017	0.0014	0.0006	0.0002	0.0001	0.0000
26	0.0013	0.0011	0.0004	0.0002	0.0001	0.0000
27	0.0010	0.0008	0.0003	0.0001	0.0000	
28	0.0008	0.0006	0.0002	0.0001		
29	0.0006	0.0005	0.0002	0.0001		
30	0.0005	0.0004	0.0001	0.0000		
35	0.0001	0.0001	0.0000			
40	0.0000	0.0000				
45						
50						

DO NOT DUPLICATE WITHOUT PERMISSION

TABLE 11

PRESENT WORTH OF $1 RECEIVED ANNUALLY
AT THE END OF EACH YEAR FOR n YEARS

$$ADF\,[r/n] = \sum_{i=1}^{n} 1/[1 + (r/100)]^{i}$$

Year (n)	1%	2%	3%	4%	5%	6%	7%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236
11	10.3676	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987
12	11.2551	10.5753	0.9540	9.3851	8.8633	8.3838	7.9427
13	12.1337	11.3484	10.6350	9.9856	9.3936	8.8527	8.3576
14	13.0037	12.1062	11.2961	10.5631	9.8986	9.2950	8.7455
15	13.8651	12.8493	11.9379	11.1184	10.3797	9.7122	9.1079
16	14.7179	13.5777	12.5611	11.6523	10.8378	10.1059	9.4466
17	15.5623	14.2919	13.1661	12.1657	11.2741	10.4773	9.7632
18	16.3983	14.9920	13.7535	12.6593	11.6396	10.8276	10.0591
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356
20	18.0456	16.3514	14.8775	13.5903	12.4622	11.4699	10.5940
21	18.8570	17.0112	15.4150	14.0292	12.8212	11.7641	10.8355
22	19.6604	17.6580	15.9369	14.4511	13.1630	12.0416	11.0612
23	20.4558	18.2922	16.4436	14.8568	13.4886	12.3034	11.2722
24	21.2434	18.9139	16.9355	15.2470	13.7986	12.5504	11.4693
25	22.0232	19.5235	17.4131	15.6221	14.0939	12.7834	11.6536
26	22.7952	20.1210	17.8768	15.9828	14.3752	13.0032	11.8258
27	23.5596	20.7069	18.3270	16.3296	14.6430	13.2105	11.9867
28	24.3164	21.2813	18.7641	16.6631	14.8981	13.4062	12.1371
29	25.0658	21.8444	19.1885	16.9837	15.1411	13.5907	12.2777
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7648	12.4090

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Year (n)	1%	2%	3%	4%	5%	6%	7%
31	26.5423	22.9377	20.0004	17.5885	15.5928	13.9291	12.5318
32	27.2696	23.4683	20.3888	17.8736	15.8027	14.0840	12.6466
33	27.9897	23.9886	20.7658	18.1476	16.0025	14.2302	12.7538
34	28.7027	24.4986	21.1318	18.4112	16.1929	14.3681	12.8540
35	29.4086	24.9986	21.4872	18.6646	16.3742	14.4982	12.9477
40	32.8347	27.3555	23.1148	19.7928	17.1591	15.0463	13.3317
45	36.0945	29.4902	24.5187	20.7200	17.7741	15.4558	13.6055
50	39.1961	31.4236	25.7298	21.4822	18.2559	15.7619	13.8007

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Year (n)	8%	9%	10%	11%	12%	13%	14%
1	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772
2	1.7833	1.7591	1.7355	1.7125	1.6901	1.6681	1.6467
3	2.5771	2.5313	2.4869	2.4437	2.4018	2.3612	2.3216
4	3.3121	3.2397	3.1699	3.1024	3.0374	2.9745	2.9137
5	3.9927	3.8897	3.7908	3.6959	3.6048	3.5172	3.4331
6	4.6229	4.4859	4.3553	4.2305	4.1114	3.9976	3.8887
7	5.2064	5.0330	4.8684	4.7122	4.5638	4.4226	4.2883
8	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389
9	6.2469	5.9952	5.7590	5.5370	5.3282	5.1317	4.9464
10	6.7101	6.4177	6.1446	5.8892	5.6502	5.4262	5.2161
11	7.1390	6.8052	6.4951	6.2065	5.9377	5.6869	5.4527
12	7.5361	7.1607	6.8137	6.4924	6.1944	5.9176	5.6603
13	7.9038	7.4869	7.1034	6.7499	6.4236	6.1218	5.8424
14	8.2442	7.7862	7.3667	6.9819	6.6282	6.3025	6.0021
15	8.5595	8.0607	7.6061	7.1909	6.8109	6.4624	6.1422
16	8.8514	8.3126	7.8237	7.3792	6.9740	6.6039	6.2651
17	9.1216	8.5436	8.0216	7.5488	7.1196	6.7291	6.3729
18	9.3719	8.7556	8.2014	7.7016	7.2497	6.8399	6.4674
19	9.6036	8.9501	8.3649	7.8393	7.3658	6.9380	6.5504
20	9.8181	9.1286	8.5136	7.9633	7.4694	7.0248	6.6231
21	10.0168	9.2922	8.6487	8.0751	7.5620	7.1016	6.6870
22	10.2007	9.4424	8.7715	8.1757	7.6446	7.1695	6.7429
23	10.3711	9.5802	8.8832	8.2664	7.7184	7.2297	6.7921
24	10.5288	8.7066	8.9847	8.3481	7.7843	7.2829	6.8351
25	10.6748	9.8226	9.0770	8.4217	7.8431	7.3300	6.8729
26	10.8100	9.9290	9.1610	8.4881	7.8957	7.3717	6.9061
27	10.9352	10.0266	9.2372	8.5478	7.9426	7.4086	6.9352
28	11.0511	10.1161	9.3066	8.6016	7.9844	7.4412	6.9607
29	11.1584	10.1983	9.3696	8.6501	8.0218	7.4701	6.9830
30	11.2578	10.2737	9.4269	8.6938	8.0552	7.4957	7.0027
31	11.3498	10.3428	9.4790	8.7332	8.0850	7.5183	7.0199
32	11.4350	10.4062	9.5264	8.7686	8.1116	7.5383	7.0350
33	11.5139	10.4644	9.5694	8.8005	8.1354	7.5560	7.0482
34	11.5869	10.5178	9.6086	8.8293	8.1566	7.5717	7.0599
35	11.6546	10.5668	9.6442	8.8552	8.1755	7.5856	7.0700
40	11.9246	10.7574	9.7791	8.9511	8.2438	7.6344	7.1050
45	12.1084	10.8812	9.8628	9.0079	8.2825	7.6609	7.1232
50	12.2335	10.9617	9.9148	9.0417	8.3045	7.6752	7.1327

DO NOT DUPLICATE WITHOUT PERMISSION

Year (n)	15%	16%	17%	18%	19%	20%	21%
1	0.8696	0.8621	0.8547	0.8475	0.8403	0.8333	0.8264
2	1.6257	1.6052	1.5852	1.5656	1.5465	1.5278	1.5095
3	2.2832	2.2459	2.2096	2.1743	2.1399	2.1065	2.0739
4	2.8550	2.7982	2.7432	2.6901	2.6386	2.5887	2.5404
5	3.3522	3.2743	3.1993	3.1272	3.0576	2.9906	2.9260
6	3.7845	3.6847	3.5892	3.4976	3.4098	3.3255	3.2446
7	4.1604	4.0386	3.9224	3.8115	3.7057	3.6046	3.5080
8	4.4873	4.3436	4.2072	4.0776	3.9544	3.8372	3.7256
9	4.7716	4.6065	4.4506	4.3030	4.1633	4.0310	3.9054
10	5.0188	4.8332	4.6586	4.4941	4.3389	4.1925	4.0541
11	5.2337	5.0286	4.8364	4.6560	4.4865	4.3271	4.1769
12	5.4206	5.1971	4.9884	4.7932	4.6105	4.4392	4.2784
13	5.5831	5.3423	5.1183	4.9095	4.7147	4.5327	4.3624
14	5.7245	5.4675	5.2293	5.0081	4.8023	4.6106	4.4317
15	5.8474	5.5755	5.3242	5.0916	4.8759	4.6755	4.4890
16	5.9542	5.6685	5.4053	5.1624	4.9377	4.7296	4.5364
17	6.0472	5.7487	5.4746	5.2223	4.9897	4.7746	4.5755
18	6.1280	5.8178	5.5339	5.2732	5.0333	4.8122	4.6079
19	6.1982	5.8775	5.5845	5.3162	5.0700	4.8435	4.6346
20	6.2593	5.9288	5.6278	5.3528	5.1009	4.8696	4.6567
21	6.3125	5.9731	5.6648	5.3837	5.1268	4.8913	4.6750
22	6.3587	6.0113	5.6964	5.4099	5.1486	4.9094	4.6900
23	6.3988	6.0442	5.7234	5.4321	5.1668	4.9245	4.7025
24	6.4338	6.0726	5.7465	5.4510	5.1822	4.9371	4.7128
25	6.4642	6.0971	5.7662	5.4669	5.1952	4.9476	4.7213
26	6.4906	6.1182	5.7831	5.4804	5.2060	4.9563	4.7284
27	6.5135	6.1364	5.7975	5.4919	5.2151	4.9636	4.7342
28	6.5335	6.1520	5.8099	5.5016	5.2228	4.9697	4.7390
29	6.5509	6.1656	5.8204	5.5098	5.2292	4.9747	4.7430
30	6.5660	6.1772	5.8294	5.5168	5.2347	4.9789	4.7463
31	6.5791	6.1872	5.8371	5.5227	5.2392	4.9824	4.7490
32	6.5905	6.1959	5.8437	5.5277	5.2430	4.9854	4.7512
33	6.6005	6.2034	5.8493	5.5320	5.2462	4.9878	4.7531
34	6.6091	6.2098	5.8541	5.5356	5.2490	4.9898	4.7546
35	6.6166	6.2153	5.8582	5.5386	5.2512	4.9915	4.7559
40	6.6418	6.2335	5.8713	5.5482	5.2582	4.9966	4.7596
45	6.6543	6.2421	5.8773	5.5523	5.2611	4.9986	4.7610
50	6.6605	6.2463	5.8801	5.5541	5.2623	4.9995	4.7616

DO NOT DUPLICATE WITHOUT PERMISSION

Year (n)	22%	23%	24%	25%	26%	27%	28%
1	0.8197	0.8130	0.8065	0.8000	0.7937	0.7874	0.7813
2	1.4915	1.4740	1.4568	1.4400	1.4235	1.4074	1.3916
3	2.0422	2.0114	1.9813	1.9520	1.9234	1.8956	1.8684
4	2.4936	2.4483	2.4043	2.3616	2.3202	2.2800	2.2410
5	2.8636	2.8035	2.7454	2.6893	2.6351	2.5827	2.5320
6	3.1669	3.0923	3.0205	2.9514	2.8850	2.8210	2.7594
7	3.4155	3.3270	3.2423	3.1611	3.0833	3.0087	2.9370
8	3.6193	3.5179	3.4212	3.3289	3.2407	3.1564	3.0758
9	3.7863	3.6731	3.5655	3.4631	3.3657	3.2728	3.1842
10	3.9232	3.7993	3.6819	3.5705	3.4648	3.3644	3.2689
11	4.0354	3.9018	3.7757	3.6564	3.5435	3.4365	3.3351
12	4.1274	3.9852	3.8514	3.7251	3.6060	3.4933	3.3868
13	4.2028	4.0530	3.9124	3.7801	3.6555	3.5381	3.4272
14	4.2646	4.1082	3.9616	3.8241	3.6949	3.5733	3.4587
15	4.3152	4.1530	4.0013	3.8593	3.7261	3.6010	3.4834
16	4.3567	4.1894	4.0333	3.8874	3.7509	3.6228	3.5026
17	4.3908	4.2190	4.0591	3.9099	3.7705	3.6400	3.5177
18	4.4187	4.2431	4.0799	3.9279	3.7861	3.6536	3.5294
19	4.4415	4.2627	4.0967	3.9424	3.7985	3.6642	3.5386
20	4.4603	4.2786	4.1103	3.9539	3.8083	3.6726	3.5458
21	4.4756	4.2916	4.1212	3.9631	3.8162	3.6792	3.5514
22	4.4882	4.3021	4.1300	3.9705	3.8223	3.6844	3.5558
23	4.4985	4.3106	4.1371	3.9764	3.8273	3.6885	3.5592
24	4.5070	4.3176	4.1428	3.9811	3.8312	3.6918	3.5619
25	4.5139	4.3232	4.1474	3.9849	3.8342	3.6943	3.5640
26	4.5196	4.3278	4.1512	3.9879	3.8367	3.6963	3.5656
27	4.5243	4.3316	4.1542	3.9903	3.8387	3.6979	3.5669
28	4.5281	4.3346	4.1566	3.9923	4.8402	3.6991	3.5679
29	4.5312	4.3371	4.1585	3.9938	3.8414	3.7001	3.5687
30	4.5338	4.3391	4.1601	3.9950	3.8424	3.7009	3.5693
31	4.5359	4.3407	4.1614	3.9960	3.8432	3.7015	3.5697
32	4.5376	4.3421	4.1624	3.9968	3.8438	3.7019	3.5701
33	4.5390	4.3431	3.1632	3.9975	3.8443	3.7023	3.5704
34	4.5402	4.3440	4.1639	3.9980	3.8447	3.7026	3.5706
35	4.5411	4.3447	4.1644	3.9984	3.8450	3.7028	3.5708
40	4.5439	4.3467	4.1659	3.9995	3.8458	3.7034	3.5712
45	4.5449	4.3474	4.1664	3.9998	3.8460	3.7036	3.5714
50	4.5452	4.3477	4.1666	3.9999	3.8461	3.7037	3.5714

DO NOT DUPLICATE WITHOUT PERMISSION

Year (n)	29%	30%	35%	40%	45%	50%
1	0.7752	0.7692	0.7407	0.7143	0.6897	0.6667
2	1.3761	1.3610	1.2894	1.2245	1.1653	1.1111
3	1.8420	1.8161	1.6959	1.5889	1.4933	1.4074
4	2.2031	2.1662	1.9970	1.8492	1.7195	1.6049
5	2.4830	2.4356	2.2200	2.0352	1.8755	1.7366
6	2.7000	2.6428	2.3852	2.1680	1.9831	1.8244
7	2.8682	2.8021	2.5075	2.2628	2.0573	1.8829
8	2.9986	2.9247	2.5982	2.3306	2.1085	1.9220
9	3.0997	3.0190	2.6653	2.3790	2.1438	1.9480
10	3.1781	3.0915	2.7150	2.4136	2.1681	1.9653
11	3.2388	3.1473	2.7519	2.4383	2.1849	1.9769
12	3.2859	3.1903	2.7792	2.4559	2.1965	1.9846
13	3.3224	3.2233	2.7994	2.4685	2.2045	1.9897
14	3.3507	3.2487	2.8144	2.4775	2.2100	1.9932
15	3.3726	3.2682	2.8255	2.4839	2.2138	1.9954
16	3.3896	3.2832	2.8337	2.4885	2.2164	1.9970
17	3.4028	3.2948	2.8398	2.4918	2.2182	1.9980
18	3.4130	3.3037	2.8443	2.4941	2.2195	1.9986
19	3.4210	3.3105	2.8476	2.4958	2.2203	1.9991
20	3.4271	3.3158	2.8501	2.4970	2.2209	1.9994
21	3.4319	3.3198	2.8519	2.4979	2.2213	1.9996
22	3.4356	3.3230	2.8533	2.4985	2.2216	1.9997
23	3.4384	3.3254	2.8543	2.4989	2.2218	1.9998
24	3.4406	3.3272	2.8550	2.4992	2.2219	1.9999
25	3.4424	3.3286	2.8556	2.4994	2.2220	1.9999
26	3.4437	3.3297	2.8560	2.4996	2.2221	2.0000
27	3.4447	3.3305	2.8563	2.4997	2.2221	2.0000
28	3.4455	3.3312	2.8565	2.4998	2.2222	2.0000
29	3.4461	3.3316	2.8567	2.4999	2.2222	2.0000
30	3.4466	3.3321	2.8568	2.4999	2.2222	2.0000
31	3.4470	3.3324	2.8569	2.4999	2.2222	2.0000
32	3.4473	3.3326	2.8570	2.5000	2.2222	2.0000
33	3.4475	3.3328	2.8570	2.5000	2.2222	2.0000
34	3.4477	3.3329	2.8570	2.5000	2.2222	2.0000
35	3.4478	3.3330	2.8571	2.5000	2.2222	2.0000
40	3.4482	3.3332	2.8571	2.5000	2.2222	2.0000
45	3.4482	3.3333	2.8571	2.5000	2.2222	2.0000
50	3.4483	3.3333	2.8571	2.5000	2.2222	2.0000

DO NOT DUPLICATE WITHOUT PERMISSION

Project Planning and Management Series.

MANUAL - I Planning for Project Implementation
MANUAL - P Project Planning
MANUAL - M Project Management
MANUAL - PF Pioneer Farm Implementation Planning

MODULES

1. Defining Project Objectives (Objective Trees)
2. The Logical Framework
3. Work Breakdown Structure
4. Activity Description Sheets
5. Project Organization
6. Linear Responsibility Charts
7. Project Scheduling - Bar Charts
8. Bar Charting for Project Control/Scheduling
9. Project Scheduling - Network Analysis
10. Milestones Description Charts
11. Resource Planning & Budgeting
12. The Role of PAMCO
13. Project Technology Analysis
14. Demand Analysis
15. Market Strategy Analysis
16. Project Area Analysis
17. Project Costs & Benefits
18. Project Profile
19. Financial Analysis
20. Cash Flow Analysis
21. Discounting
22. Net Present Worth Analysis
23. Cost-Benefit Analysis
24. Benefit-Cost Ratio Analysis
25. Internal Rate of Return
26. Social Analysis of a Project
27. Economic Analysis of Projects (including Border Pricing)
28. Financial Statements & Ratios
29. Project Selection & Ratios Analysis
30. Brainstorming
31. Decision-making System for Projects
32. Project Institutional Environmental Analysis
33. Ecological Analysis for Projects
34. Introduction to Contracts, Jamaican Contract Documents & Tendering Procedures
35. Selection & Use of Consultants
36. Project Documents for Planning & Implementation
37. Report Writing for Projects
38. Project Files
39. Formats for Pre-Feasibility & Feasibility Studies
40. Motivation of Employees and Personnel Evaluation
41. Design of a Project Management Control System
42. Evaluating & Forecasting Project Progress & Performance
43. Project Termination
44. Introduction to Lending Agencies
45. Organizing and Conducting Conference Meetings
46. Withdrawal of and Accounting for Loan Funds in the Financing of Projects