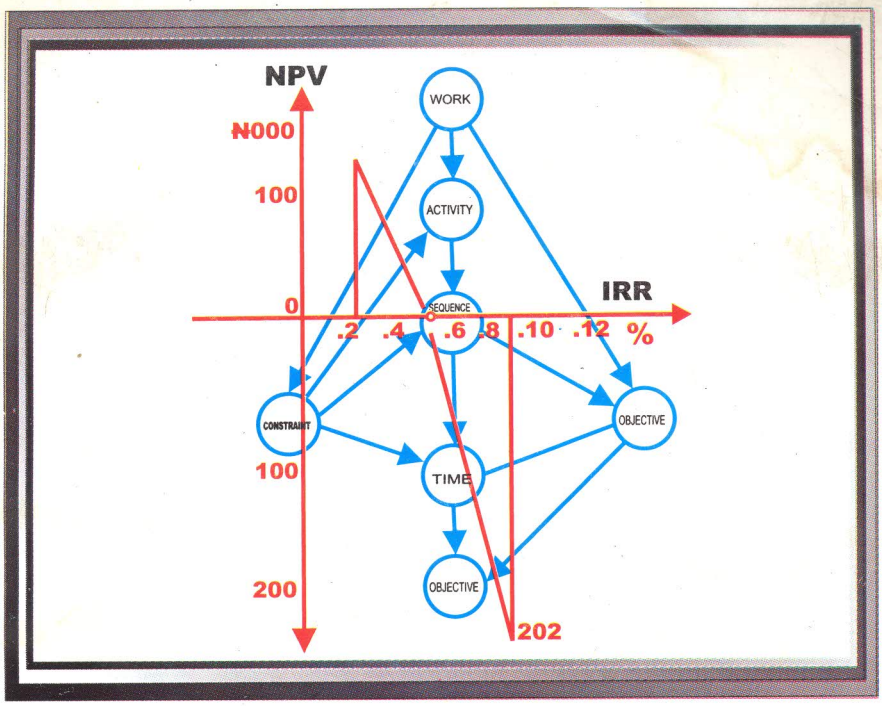

E. U. L. IMAGA

Project Management

Project Abandonment, Proposal and Feasibility Studies

CHAPTER 10

Investment Analysis

Investment can be defined as a firm commitment of scarce resources made in the hope of realizing benefits or returns that are expected to occur over a reasonably long period of time in the future. From the above, it can be seen that neither the resources nor the benefits need be in the form of explicit cash flows. For instance, a decision to have a Chemical Engineer spend a month studying the capabilities of various types of computer aided design devices would be an investment in the light of this definition.

Here the engineer's time is a scarce resource, because he would have spent the month in other activities that are valuable to the firm. In the first instance, the expected benefits will be increased knowledge by the management of a relatively new technology. Thus there is no explicit cash outlay or cash inflow but there is an investment.

Investment can also be seen as a firm's decision to invest its current funds most efficiently in long term activities over series of years. It therefore involves a sacrifice of present consumption in exchange of future benefits, hence people invest in the hope that the project cum investment will be able to deliver those expectations. It should be noted that if the investment is large, then the capital outlay is expected to be large. However, what might be deemed to be a large investment for a firm might turn out to be a minor investment for another firm. Whether the investment is large or small, considerations must be given on how to raise the capital

that is needed for the project. As a rule therefore, the return to be expected from any investment must exceed the cost of capital.

CLASSIFYING INVESTMENT

Any useful scheme of controlling investments must be based on a classification of types of investments. Different kinds of investments raise different problem, and are of different relative importance to the firm and therefore will require different persons to evaluate their significance. By classifying types of investments each investment proposal will receive attention from persons qualified to analyse them. Investments may therefore be classified as follows:

1. BY PROJECT SIZE

The amount of cash resources required to implement the project provides a useful way of differentiating three classes of investments namely as; Major projects, regular capital expenditures, and small proposals. For example, one firm affords separate treatment to "major projects" defined as initial expenditures of over ₦250,000, another applies formal capital budgeting procedures to expenditures in excess of ₦5,000; while smaller projects are exempted from formal approval. **Similarly,** projects can be classified by the type of scarce resources used namely; land, key management personnel, floor space and so on.

2. BY TYPES OF BENEFIT

Benefits can arise either from cost reductions, expansion of sales of existing products, expansion into new lines of activities, risk reduction of social overhead investments designed to improve general working conditions. Hot showers for workers, improved antipollution facilities and perhaps even a contribution to the community welfare fund are examples of the latter type of investment.

3. BY DEGREE OF DEPENDENCE

Interdependence between two investment projects can arise for several reasons:-

(a) It may be technically impossible to undertake both investment A and investment B. Such investments will be referred to as being **mutually exclusive** since the acceptance of one precludes the acceptance of the other. The early identification of mutually exclusive alternatives is crucial for a logical screening of investment; much effort, even more patience and often money are wasted when two divisions independently investigate, develop and initiate projects, which are recognized later as mutually exclusive. Numerous examples of such investments leap to mind: a basketball court and a swimming pool cannot be constructed on the same vacant lot; when a manufacturing plant is located near the sources of raw materials this may often mean that it cannot be close to the market; a power generating plant can be nuclear or coal fired – not both.

(b) If the decision to execute the first investment increases the expected benefits from the second project, the proposals are said to be complements. For example the rural electricity project may have a positive impact on the profitability of a number of other projects.

(c) If the acceptance of one project decreases the profitability of a second project they are said to be **substitutes.** Thus when a large razor blade manufacturer such as Gillette contemplated the introduction of stainless steel blades, the forecasted revenue from the sale of new blades was offset, in part, by a decline in the expected sales of its conventional blades. No such consideration hampered Wilkinson Ltd., the English firm that first introduced stainless steel blades. Presumably they assumed that the proceeds from razor blade sales were economically independent of the revenue from their other line of ceremonial swords. (They ignored the possibility that naval

officers who previously shaved with their Wilkinson sabers would not switch to Wilkinson blades, thereby decreasing the replacement demand for the former), e.g. The new close up-super whitening tooth paste and ordinary red brand close up toothpaste by Unilever Nig. PLC.

(d) Economic independence or dependence must be distinguished from another type of interrelationship, namely statistical independence when increases (decreases) in the benefits from the one are accompanied over time by an increase (decrease) in the benefits of the second. Thus, the revenue from two lines of luxury goods (for examples Lexus car and Lexus Jeep; Mercedes E-Class and S-Class cars).

4. BY TYPE OF CASH FLOW

Another type of classification is technical in nature but can prove useful when analyzing alternative measures of profitability. Here projects' forecasted cash flows are examined and classified either as "conventional" or "non conventional". **A conventional** investment project is defined as one in which the initial outlay is followed by a stream of net receipts of the form: -+++..., or if the outlay takes place over a number of years, the cash flow has the form: --++.... Some numerical examples will help to clarify the point. Consider the following investment project whose cash flows are all of the "conventional" type.

	Year					
Project A	-100	+100	-	-	-	-
Project B	-100	-	+	-	+150	-
Project C	-100	+40	+40	+40	+40	-40
Project D	-100	-100	+80	+100	+50	+75

As can be seen from these examples a conventional investment project is one whose cash flow has only one change in sign from a negative number to a positive number -/+++ or --/+++

or -/+. Hence projects with net terminal costs which have cash flows of the form -/+++/- are "non-conventional" since such projects have two changes in sign the first following the initial investment outlay and the second preceding the terminal years. An example of a non-conventional project is provided by the case of a strip mining or quarrying project in which the company is required to restore the physical appearance of the concession after the supply of ore (stone) has been exhausted.

Similarly projects with initial positive receipts of the form +/-/+++ also have non-conventional cash flows. Writing a textbook on project management provides an example of such a project; the initial receipt reflects the publisher's advance payment, which precedes both the author's investment outlay and (hopefully) the later stream of royalties.

THE ECONOMIC EVALUATION OF A PROJECT'S DESIRABILITY

Various methods have been identified for use in investment appraisal or analysis. In this section, we are going to group three various approaches, for convenience reasons, into two namely: non-discounting approach and discounting method.

Non-Discounting Approach

Here this approach simply evaluates a project based on the returns or benefits, but will be totally indifferent to the nature of the cash flow. For instance, this approach seeks to be indifferent to ₦10.00 received now and ₦10.00 received a year later. Examples of cases analysed include pay-back period, urgency method and average rate of return.

We are not going to dwell much on the above methods since they have their obvious short-comings, when projects which benefits accrue to the investor after a very long period of time in the unpredictable future.

Discounting Approach

The failures and demerits of the Non-Discounting Approach gave rise to the Discounting approach. This is because it allows the incorporation of the timing of cash flows. Two modern methods that are widely acceptable models are the Net Present Value. (NPV) and the Internal Rate of Return (IRR).

Net Present Value

Net Present Value (NPV) seeks to discount all the future cash inflows in an investment project to the present. This present value of all the inflows is subtracted from the outflow to obtain the Net Present Value. Assuming that there is a positive net inflow, it means that the project should be accepted and therefore it will be worth the while but if there is a negative net outflow, it shows a direct rejection of the proposed project.

Therefore the implication is that its obvious acceptance will not be in the interest of the prospective investor, and the firm will not maximize its consumption for us to discount the cash flow to the present, an appropriate discount rate should be sought. This rate could be equivalent to the cost of getting capital in the capital market. By cost of capital we mean that minimum rate, a project or an investment must earn in order to satisfy the expectations of its promoters.

The Net Present Value (NPV) approach of evaluating the desirability of a given project can be defined mathematically as follows:

$$NPV = \frac{S_1}{(1+k)^1} + \frac{S_2}{(1+k)^2} + \frac{S_3}{(1+k)^3} + \ldots\ldots + \frac{S_n}{(1+k)} - 1_o$$

Using summation

$$NPV = \sum_{t=1}^{n} \frac{St}{(1+k)t} - 1_o$$

Where;

St = The net cash receipt at the end of year.

K = The discount rate i.e. the required minimum rate of return on new project.

n = The project's duration in years.

1o = Initial investment out lay.

An investment proposal's NPV is derived by discounting the net cash receipts at a rate which reflects the value of the alternative use of the funds, adding them up over the life span of the proposed project and subtracting the initial investment outlay from it.

The actual calculation can easily be facilitated by the use of the present value tables.

Decision Rule

Before we can apply the NPV method of investment appraisal a decision rule must be established but this requires the stating of a goal for the enterprise. Assuming that the management of an enterprise desires more returns, rather than opting for less i.e. a situation where it wants to maximize consumption, the following decision criteria may be adopted:

If NPV is positive, accept the project.

If NPV is negative, reject the project.

The above decision rule holds where the present values are calculated using a discount rate which reflects the alternative return which the firm can earn on the capital in the market. Thus the firm should execute projects with a positive NPV and reject those proposals whose NPVs are negative. These decision rules follow from the assumption that firms operate so as to maximize the market value of their investments since under the assured conditions of certainty, the prices of all assets, including common stocks, are determined by their discounted present values. The above decision rules will ultimately result in an optimal choice of projects, because under the assumed conditions, no other group of

projects can be found which will increase the value of the enterprise.

Example: -

Given the following cash flow:

	Year				
0	1	2	3	4	5
-3,352	1000	1000	1000	1000	100

a. You are required to calculate the Net Present Value of the project using the following discount rates: 6, 10, 14, 15, 16, 20, and 24%.

b. Find the internal rate of return mathematically.

Solution:

The following steps are followed:

i. Set the above problem in a tabular form in an order shown below.

ii. Get the discount factor at the stated rate from the PV table, for the number of projects duration i.e. number of years above.

iii. Multiply the values got from the PV table by the different cash flows for each year respectively.

iv. Total up the various values so obtained in iii above.

v. Then subtract the initial outlay from the accumulated values in IV. and this gives the NPV.

Decision rules: If the value obtained from above is greater than the initial outlay, i.e. positive we accept the project at that prevailing discount factor but if negative we reject the proposed project accordingly.

i. Project at K = 6%

Year	0	1	2	3	4	5
Cash flow	-3,352	1000	1000	1000	1000	1000
Discount factor	.943	.890	.840	.792	.747	
PV		943	890	840	792	747
Total		4212				
NPV	=	4212 – 3,352				
	=	+ 860.				

Decision rule: We accept the project because it will be profitable at this discount rate i.e. 6%

Project at K = 10%

Year	0	1	2	3	4	5
Cash flow	-3,352	1000	1000	1000	1000	1000
D/F		.909	.826	.751	.683	.620
PV		909	826	751	683	620
Total	=	3789				
NPV	=	3789 – 3,352				
	=	+ 437.	So NPV is positive			

Project at K = 14%

Year	0	1	2	3	4	5
Cash flow	-3,352	1000	1000	1000	1000	1000
Discount facto		.877	.769	.675	.592	.519
PV		877	769	675	592	519
Total		3432				
NPV	=	3422 – 3,352				
	=	+ 80.				

Again NPV is positive.

	Project at K = 15%					
Year	0	1	2	3	4	5
Cash flow	-3,352	1000	1000	1000	1000	1000
Discount factor		.870	.756	.658	.571	.497
PV		870	756	658	571	497
Total		3352				
NPV	=	3352 – 3,352				
	=	0				

Here NPV = O and it is still positive. This is in agreement with the rule of NPV ≥ 0.

	Project at K = 16%					
Year	0	1	2	3	4	5
Cash flow	-3,352	1000	1000	1000	1000	1000
Discount factor		.862	.743	.640	.552	.476
PV		862	743	640	552	476
Total		3273				
NPV	=	3273 – 3,352				
	=	-79.				

Here the NPV is negative and therefore, our Decision rule states that it should be rejected. The project at this discount rate will not bring any financial return to the enterprise.

	Project at K = 20%					
Year	0	1	2	3	4	5
Cash flow	-3,352	1000	1000	1000	1000	1000
Discount factor		.833	.694	.578	.482	.401
PV		833	694	578	482	401
Total		2988				
NPV	=	2988 – 3,352				
	=	-364				

Decision rule: We reject the decision to embark on the project.

	Project at K = 24%					
Year	0	1	2	3	4	5
Cash flow	-3,352	1000	1000	1000	1000	1000
Discount factor		.807	.650	.525	.423	.341
PV		807	650	525	423	341
Total		2746				
NPV	=	2746 – 3,352				
	=	-606				

Decision rule: We reject the proposal of this discount factor, since the NPV is negative as well.

Likely Examination Questions

1. Define Investment as comprehensively as possible and justify your definition with some typical examples.

2.(a) State the various types into which one can logically classify investments.

(b) Discuss the peculiarities and implications of the various types of investments listed by you.

3. Given the following cash flow:

YEAR					
0	1	2	3	4	5
-3,341	1000	1000	1000	1000	1000

(a) Calculate the Net Present Value (NPV) of the above project using the following discount rates: 8, 14, 18, and 22% ages.

4.(a) Four each of the following projects calculate the NPV using a 15% discount rate.

(a) Find the IRR

CASH FLOW

Year	0	1	2	3	4	5	6	7
Project A	–4,564	1000	1000	1000	1000	1000	1000	1000
Project B	-2,000	524.7	524.7	524.7	524.7	524.7	524.7	524.7
Project C	-21,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000