

CHAPTER - 4

Methods of Financial Appraisal in Capital Budgeting

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4.1: Introduction

Financial Appraisal is necessary to assess the desirability of an investment proposal. If a project has the potentials of creating wealth for the shareholders, it is said have satisfied financial criterion. On the other hand, if the project carries the risk of causing loss to shareholders' existing stock of wealth, the project is required to be dropped or scrapped. Hence, it demands that managers should use appropriate methods of financial appraisal and choose the project that offers the highest prospect of value addition.

Different methods are there for financial appraisal of long-term investments. These are categorized as traditional non-DCF methods and DCF methods. Sophisticated methods that also recognizes the worth of real options linked with every capital investment is extended version of DCF methods. This chapter will cover the discussion and survey of traditional non-DCF methods and modern DCF methods. In this chapter a brief description of the methods of the financial appraisal has been made and subsequently the survey findings in this regard have been presented. Though this chapter is almost repetition of previous studies done in Indian by almost all the scholars, it has been again produced here as a part of convention. However, an additional effort has been done here to examine the inter-relationship between 'choice of methods' with variable like size of investment, the methods of financing the investments.

4.2: Quantitative Methods of Investment Appraisal

There are a number of methods for quantitative appraisal of investment proposals. Depending on the methodologies involved with them, the methods have been broadly classified into two categories, viz., DCF (Discounted Cash Flow) methods and Non-DCF methods. Methods like Internal Rate of Return (IRR), Modified Internal Rate of Return (MIRR), Net Present Value (NPV) and Net Terminal Value (NTV) belong to DCF category. On the other hand, Payback Period and Accounting Rate of Return (ARR) fall

under Non-DCF category. The use of more advanced versions like MIRR and NTV is almost negligible (Patel B. M., 2000). Very recent research findings [i.e., Graham and Harvey (2002); George Kester and Geraldine Robbins (2011)] show that Financial Executives in the practical field use four methods such as IRR, NPV, Payback Period and ARR. Focus of Payback Period is early recovery of invested sum, which results in strengthening the liquidity position of the firm. IRR represents the highest return an investment can generate and NPV gives the quantum of absolute value addition. It shows each of the methods is designed to measure a specific feature of an investment, not all features together. These methods have been briefly discussed below:

4.2.1: Payback Period: Payback Period is defined as the time that a project takes to recover the fund invested in the project. It is usually computed in terms of years, over which cumulative cash inflow from the operations of the project becomes equal with initial investment cost. As a rule of thumb, a shorter Payback Period is recognized as a decision yardstick to ensure better results; hence, the conventional rule is to select the project with shorter Payback Period.

4.2.2: Accounting Rate of Return: ‘Accounting Rate of Return’ is a measure of a project’s average profitability over the entire life of the project. ARR is calculated as below:

$$\text{ARR} = \frac{\text{Average Profit resulting from the Investment}}{\text{Average Investment}}$$

That is, when average profit resulting from the investment over its useful life is divided by average investment cost, ARR is obtained. ARR can alternatively be termed as Return on Investment, ROI. When the computed ARR is higher than a predetermined target rate, the project is accepted.

4.2.3: Net Present Value: NPV is one of the DCF methods. This method assumes that cash flows occurring in future have lower time value; hence, the future cash flows are reduced to present value equivalents by the process of discounting, which is done at the rate of the opportunity cost of capital so that *costs incurred today and benefits to be*

received in future can be logically compared. The excess present value of future cash inflows (benefits) over the initial investment cost is referred to as Net Present Value. Mathematically it can be expressed by the expression as below:

$$NPV = \sum_{t=1}^n \frac{C_t}{(1+k)^t} - C_0$$

Where, C_t stands for cash inflow of t^{th} year, C_0 stands for initial investment cost, k is the opportunity cost of capital and n is life of the project. Project having a positive figure of NPV qualifies for acceptance. A Project with higher NPV implies a better value addition to shareholders' wealth, so projects with higher NPV values are given priority.

4.2.4: Internal Rate of Return: The rate at which invested sum generates return is defined as the Internal Rate of Return (Roy Dipen, 2008). In practice it is computed as the discounting rate, which equates the present value of cash inflows with initial investment cost (or cash outflows). Say, in a hypothetical project, the figures of net cash inflows in successive years are given as $C_1, C_2, C_3, C_4, \dots, C_n$. The project has life of n years and initial investment cost of C_0 . Then, the Internal Rate of Return may be defined as the discounting rate denoted normally by r , which makes present value of cash inflows equal to the present value of investment cost. By definition-

$$\frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \dots \frac{C_n}{(1+r)^n} = C_0$$

For finding IRR an accountant is to solve the above equation for the value of r , when values of all other variables are assumed to be known to him. IRR is alternatively known as discounted rate of return. It indicates the break-even rate of borrowing that an organisation can use to finance the investment and stay as well off as it was before financing the investment. If computed IRR from a project is higher than cost of capital, the project is economically gainful. Otherwise, it is rejected.

4.2.5: Modified Internal Rate of Return: MIRR is similar to IRR except the rate at which cash inflows are reinvested. IRR embodies the option of reinvesting cash inflows back into project at project

rate of return r . The assumption of MIRR is that cash inflows are not reinvested back into the same project, but put back into the general money fund. Thus in the calculation of MIRR cash inflows are compounded at common rate of return, k (i.e. WACC). The steps in calculating MIRR:

- i) Estimate terminal value of net cash inflows, $TV = \sum_{t=1}^n C_t (1+k)^{n-t}$
- ii) MIRR is a rate at which compounded value of initial cost will be equal to TV, terminal value computed at step i).

Say, unknown MIRR is r^* .

At a specific rate r^* , compounded value of initial cost = $Co (1+r^*)^n$

- iii) Equate the results obtained at step i) and step ii)

$$Co (1+r^*)^n = TV$$

$$Co (1+r^*)^n = \sum_{t=1}^n C_t (1+k)^{n-t}$$

Solve the above equation for the value of r^* . The result gives the value of MIRR

4.2.6: Net Terminal Value: Net Terminal Value of an investment is the difference between the compounded value of all net cash inflows and the compounded value of the capital cost of the project. Symbolically, it is defined as

$$NTV = \sum_{t=1}^T C_t (1+r^*)^{T-t} - Co(1+i^*)^T$$

Where r^* is the reinvestment rate, T is the life of the project. Normal interest rate is i^*

4.3: Trend in the use of Capital Budgeting Evaluation Techniques in India

In India the credit of first published study in the area of capital budgeting decision-making in corporate sector goes to Porwal L S (1976). In early seventies of last century he noticed prevalence of traditional appraisal methods in quantitative evaluation of investment proposals. He observed the largest number of firms to rely on Payback Period

method, which is not theoretically recognised to be a sound method for project evaluation. From a study of a small sample of fourteen large Indian firms, Pandey I M (1989) arrived at almost similar results. His findings confirmed that the majority of the companies were still using Payback Period as the primary method for evaluation of projects. In addition to this, he also reported that about two-thirds of the companies using Payback Period method were simultaneously using Internal Rate of Return (IRR) as the secondary method. From a study of 64 firms of different sizes Shivaswamy M (1996) obtained almost same results once again.

However, very recent studies report a better trend consistent with modern theories of quantitative appraisal. In India the use of IRR has increased steadily. Anand Manoj (2002) found 85 % of the firms using IRR. In addition to using IRR, 67% of these companies were found to use Payback Period as a supporting second method. To the practicing managers popularity of Payback Period is still very high. Presently instead of relying on a single method, firms have developed the trend of using multiple methods to be assured about the merit of an investment proposal (Patel B M, 2000).

It is interesting to observe that the sum of percentages, as shown in the column marked for Porwal’s (1976) findings, is equal to 100%. But no ‘column total’ is 100% in respect of other studies. Due to simultaneous use of multiple methods, the sum of the percentage of popularity of various methods appears more than 100% in the studies of Prabhakar (1995) and Manoj Anand (2002).

Table 4.3: Trend in the use of Capital Budgeting Evaluation Techniques in India

Methods of evaluation	Porwal L S (1976)	Shivaswami (1995)	Manoj Anand (2002)	Shah Kamini (2008)
ARR	38%	33%	34.0%	--
Payback	23%	69%	67.5%	66.7%
NPV	4%	31%	66.3%	55.6%
IRR	27%	54%	85.0%	74.1%
Other	8%	14%	35.0%	7.4%

Chadwell-Hatfield *et al* (1997) from a study reported that 67% firms insisted that acceptable projects should have a shorter Payback Period in addition to passing NPV or IRR criterion. Table A reflects that for evaluation of capital projects, today the firms

don't rely on using a single evaluation method. Patel B M (2000) observes that some of the Indian firms even use four to five methods before arriving at the final decision regarding acceptance or rejection of an investment proposal. The findings reflect that today the firms tend to be more careful in choosing an investment proposal.

Table 4.3 given above reveals that since 1976 IRR has emerged as the most used technique in India. Its use is still increasing every day. Payback Period is the next favoured technique. However, NPV is **not** so popularly used as IRR and Payback Period are used.

Gupta Sanjeev *et al.* (2007) conducted a study on 32 companies in Punjab and found that majority of the sample companies using non-discounted cash flow techniques like PBP and ARR. Only a few companies were found to use DCF; of them very negligible number of companies were found to use NPV technique to evaluate a new project. The most preferred discount rate is WACC.

Shah Kamini (2008) found that almost all the companies are using now multiple techniques for evaluating their capital budgeting proposals. The researcher also observed that the companies prefer 'IRR and NPV' to Payback period method. Interestingly she observed two different trends in choosing evaluation tools. She noted that for investing in new projects firms use IRR, PBP and NPV, while for expansion, replacement, modernization, etc., firms largely rely on Payback period method. She also found Sensitivity analysis as the most important technique for risk analysis and scenario analysis as the second most important technique for this purpose.

Yadav Vinod Kumar (2013) finds that in small-scale industries firms mainly use traditional payback period and Accounting Rate of Return instead of scientific evaluation methods like IRR and NPV.

4.4: Methods of Financial Appraisal: a Survey Industry Practice

Data collection has been made during last five years, from 2010 to 2015. The data regarding use of appraisal methods by 30 companies have been initially compiled in Table 4.4. It shows that out of 30 companies surveyed 9 companies use IRR and Payback

Period simultaneously. Another eight companies, in addition to using IRR and Payback period simultaneously, use NPV method too as an additional method to be more secured in arriving at the correct decision. That is, these latter 8 companies use three methods, viz., NPV, IRR and Payback Period simultaneously. Number of companies using only DCF method alone is just three; two of them are using IRR and one is using NPV. Therefore, though the Table 4.4 reflects that **in aggregate 28 companies** use sophisticated DCF methods; but it does not confirm that the corporate houses substituted DCF method for non-DCF traditional methods. Use of non-DCF methods is still prevalent. The corporate houses use DCF and non-DCF methods simultaneously to cover appraisal of the maximum number of parameters of an investment, as possible.

Only two companies report that they use only non-DCF Payback Period method alone. Data reveals that the firms place greater reliance on combined use of DCF and non-DCF methods to avoid the risk of taking a wrong decision.

Table 4.4: Number of Companies and Appraisal Methods Used

Appraisal Methods Used	Number of firms
IRR, Payback Period	9
IRR, NPV, Payback	8
IRR, NPV	2
IRR, NPV, Payback, ARR	3
IRR	3
NPV, Payback period	2
NPV	1
Payback period	2
ARR	0
Total Number of Firms	30

4.5: Simultaneous Use of Multiple Methods

Out of the 30 firms surveyed, only six firms have been found to use a single method for project appraisal. Remaining 24 companies use multiple methods for appraisal of their project proposals. Three companies have been found to use four methods simultaneously to arrive at their final decision. Thirteen companies have been found to use 2 methods, while eight companies have been found to use three methods. The data regarding use of multiple methods have been shown in Fig. 4.5 with the help of histogram as shown below:

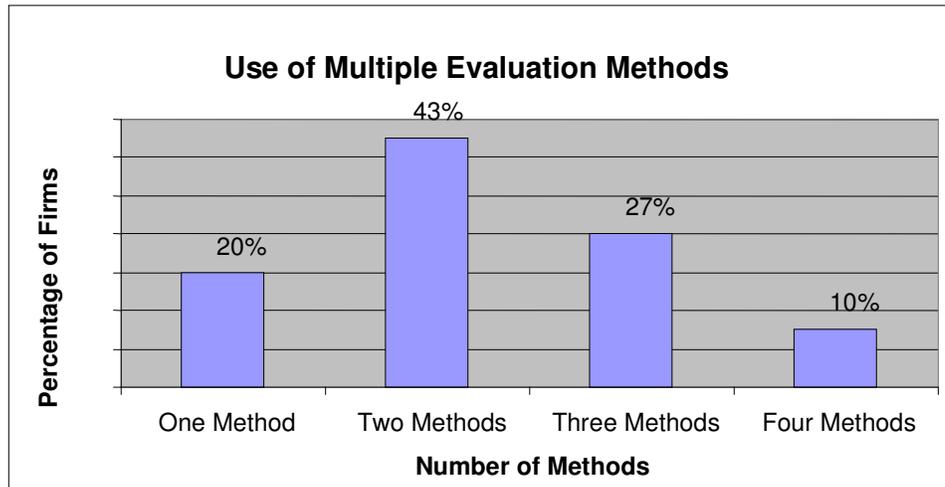


Fig. 4.5: The Trend of Using Multiple Evaluation Methods

Use of multiple methods can be explained as an attempt to taking into account the different attributes of an investment. From Table 1 it is observed that vast majority of the companies use Payback Period method in addition to DCF methods like IRR and NPV. It indicates that majority of the companies insist on liquidity in addition to profitability. Since 80% companies use multiple methods, the alternative hypothesis that Indian Companies use multiple methods for investment appraisal is accepted. Statistical validity of the inference has been established through a non-parametric *sign test* as given below. Firms using multiple methods are assigned plus sign and those using single method are assigned negative sign.

Number of Plus (+) sign, $X = 24$

Number of Minus (-) sign = 6

Sample size, $n = 30$

H_0 : Probability of + sign is equal to 0.5, Symbolically, $H_0: P(+) = 0.50$

H_1 : Probability of + sign is greater than 0.5, Symbolically, $H_1: P(+) > 0.50$

$$Z = \frac{X - np}{\sqrt{npq}} \quad \text{-----} \quad (I)$$

$$Z = \frac{24 - 30(0.5)}{\sqrt{30 \times 0.5 \times 0.5}} = 3.28 > 1.645$$

For right-tailed test 5% Critical Value of $Z = 1.645$

Since computed Z is greater than critical value (1.645), the alternative hypothesis that *the firms depend on the use of multiple methods for evaluation of projects* has been accepted.

4.6: Shifting Trends towards Scientific Methods

Data reveal that the highest percentage of companies uses IRR. The vast majority of the companies have been found to use IRR. The second equally important method is Payback Period. With different combinations of other methods, 24 companies have been found to use Payback Period. In percentage terms popularity of both IRR and Payback are 83% and 80% respectively. Compared to IRR, popularity of NPV to Indian companies is as low as 53% only.

Table 4.6: Percentage of Firms using Various Appraisal Method

Methods	Number of Firms Using	Percentage of Users
IRR	25	83%
Payback	24	80%
NPV	16	53%
ARR	3	10%
DCF = NPV + IRR	28	93%

Only 16 companies indicate that they use NPV method. The data regarding popularity of various methods have been shown in Table 4.6. Popularity of the methods in percentage terms have also been shown by a histogram as shown in Fig. 4.6.

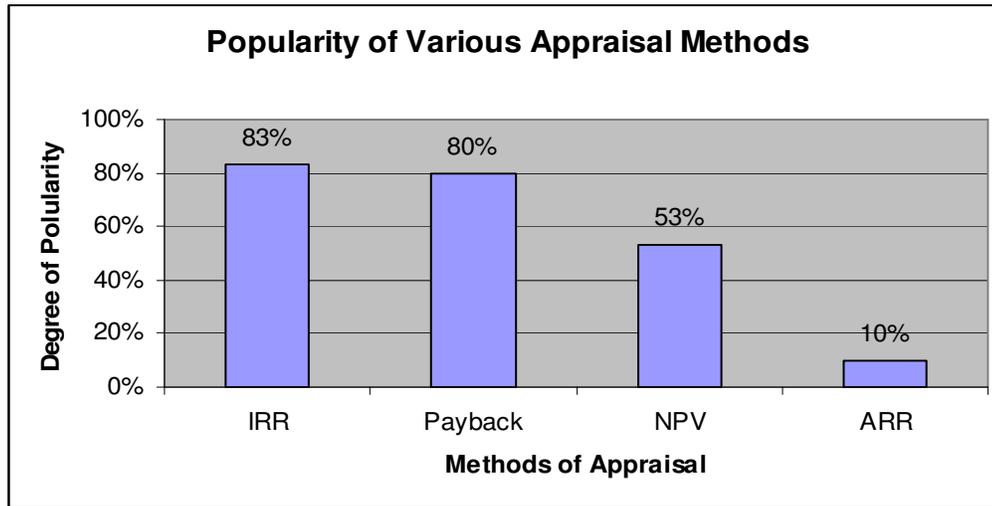


Fig. 4.6: Popularity of Various Appraisal Methods

If we classify the data given in Table 1 in terms users of DCF and non-DCF methods, we find that only 2 companies do not use any DCF method. That is, out of 30 companies, 28 companies use DCF methods, alone or in combination with other DCF and/or non-DCF methods. That is, overall 93% companies use sophisticated DCF methods. If this outcome is compared with the findings of Porwal (1976), which **was just 31%**, the difference appears highly significant. It can be confidently concluded that significant shift has taken place in respect of the use of DCF methods. Data gathered are quite enough to arrive at the conclusion. Following statistical test has been made to make the inference statistically valid.

$$p_1 = \text{proportion of DCF users as per Porwal's study} = 0.31$$

$$n_1 = \text{sample size in Porwal's study} = 45$$

$$p_2 = \text{proportion of DCF users as per present study} = 0.93$$

$$n_2 = \text{sample size in the present study} = 30$$

$$H_0: P_2 = P_1$$

$$H_1: P_2 > P_1$$

$$Z = \frac{p_2 - p_1}{SE(p_2 - p_1)} \quad \text{----- (II)}$$

$$= \frac{0.93 - 0.31}{.116} = 5.34 > 1.645$$

The test result supports alternative hypothesis. It can be safely concluded that since 1976 a significant shift has taken place in favour of using sophisticated DCF methods in capital budgeting. Compared to findings of Anand Manoj (2002), the difference is not significant. It leads to a conclusion that the major shift towards use of scientific methods has taken place in the 90s of the last century, when major liberalization programmes were launched. However, the trend of using scientific methods what was set in 1990s is still being carried on in 21st century with some marginal improvements.

4.7: Relationship between Method of Financing and Choice of Appraisal Method

In the questionnaire an effort was made for obtaining input regarding means of financing the investment proposals. Equity capital mobilised from new issue can be good source of financing new projects. However, following sub-prime crisis in 2008, as condition of capital market appeared unattractive, initial public offer in the primary market was almost negligible. The companies surveyed had no history of raising equity capital from primary market during the period of survey. The financing alternatives that were available to them were confined to borrowing and retained earnings only. Data so obtained from the companies in respect of their mode of financing has been tabulated below:

Table 4.7: Modes of Financing

Modes of Financing	Number of Companies
100% Loan Financing	2
Internal Fund Plus Loan Financing	23
100% Internal Fund	5

Table 4.7 shows that 25 firms (83%) finance the project proposals through loan financing. Of them 7% of the companies use 100% loan financing and remaining 76% companies combine internal fund with borrowing to finance the investments. These 25 firms taking loan, in part or fully, use multiple methods for economic evaluation of project proposals. 22 out of 25 borrowing firms report that they use IRR, alone or in

combination with other methods, while only 12 firms report that they use NPV, alone or in combination with other methods.:

Table.4.7A: Appraisal Method Used by Firms Financing Investment through Borrowing

	IRR	NPV	Total
Number of Firms	22	12	25
Percentage (%)	88%	48%	

It reflects that in the present industrial scenario, majority of the companies use loan capital for financing their investment proposals. While a firm is going to borrow, it is essential on the part of the companies to know at what highest rate they can make a fresh borrowing. In other words, to them it is essential to know if the project return will be more than the rate of borrowing. To meet this requirement IRR acts as a good yardstick. It appears from the above table that there is a relationship between the selection of evaluation method and mode of financing the investment. Firms taking loan from market have reason to use IRR instead of NPV. This is statistically confirmed through Chi-square test at 5% level of significance.

Computed $\chi^2 = 7.24 > \text{Critical Value}, 3.84$ with 1 *d. f.*

In the backdrop of liberalization our findings appear relevant in the light of Leverage Aggressive Hypothesis (Brander and Lewis, 1986; Maksimovic, 1986), which states that as competitive situation and rivalry become dominant in market, firms use cheaper loan financing to fight product-market competition.

The statistical result informs that choice of appraisal method is not independent of method of financing. According to opinion of finance executives, IRR gives more transparent idea about the outcome of a financial decision. IRR is the most popular method of investment evaluation because of its clarity. Ross, Westerfield and Jordan (2002) correctly highlight this with a simple instance. According to them, a finance executive may simply report to the board of directors that new investment will fetch 20% return (given, IRR = 20%). This may somehow seem simpler than telling that at 10% discount rate the investment has the potential of producing NPV of certain amount, viz., \$250 million.

Theoretically neither IRR is better than NPV, nor NPV is better than 'IRR'. There is no rational reason behind identifying one of them as better, because both the measures are obtained from the same valuation equation. However, in the light of practical usefulness, IRR can be treated to be better than NPV. Very recent findings reflect this truth. See Table 4.7B as given below:

Table 4.7B: The Recent Trend Showing Popularity of IRR

Serial No.	Author	Year	Most preferred Method
1	Porwal L S (1976)	1976	ARR
2	Wong, Farragher and Leung (1987)	1987	PBP , ARR
3	Prabhakara Babu & Sharma A (1996)	1996	IRR
4	Colin Drury and Mike Tayles (1996)	1996	IRR
5	Kester, George W & Chong Tsui Kai (1996)	1996	IRR, PBP
6	Graham and Harvey (2001)	2001	IRR, NPV
7	Cooper William D., Morgan Robert G., Regman Alonzo, Smith Margart (2001)	2001	IRR
8	Ryan Patricia A and Ryan Glenn P. 2002	2002	NPV
9	Anand Manoj (2002)	2002	IRR
10	Hogaboam, Liliya S. and Shook S R. (2004)	2004	IRR
11	Truong G., Partington and Peat M. 2006	2006	NPV, PBP
12	Shah Kamini (2008)	2008	IRR, NPV

Source: Shah Kamini (2008), edited partly to accommodate the recent findings only.

Note; PBP = Payback Period, IRR = Internal Rate of Return, NPV = Net Present Value

4.8: Relationship between Selection of Appraisal Method and Size of Investment

In this paragraph the relationship between selection of Appraisal Method and Size of Investment has been examined. In the questionnaire a question asking information regarding size of investment was listed. Companies were asked to give data on the sizes of their capital budgets in the last three years (2010 – 2015). Five companies out of 30 companies surveyed abstain from giving input on this issue. On the basis of the responses received from remaining 25 companies, size of average investment of each company was determined. Then on the basis of size of investments the companies have

been grouped into two categories, one group having average investment below Rs 500 crores and another group having investment above Rs 500 crores. Use of various methods by these two groups of companies has been enlisted in the table below:

Table 4.8: Size of Investment and Method of Appraisal

Appraisal Method	X < Rs 500 cr	X > Rs 500 cr	Total
IRR	12	11	23
NPV	5	10	15
PBP	11	10	21
Total	<u>28</u>	<u>31</u>	59

Note: Figures indicate number of companies using respective methods

To test existence of association between size of investment and choice of appraisal method chi-square test has been conducted. This test corresponds to 4th Hypothesis. Computed chi-square is less than corresponding critical value 5.99 at 5% level of significance with 2 'd. f.'. It leads us to infer that there is no association between sizes of investment and choice of appraisal method.

$$\chi^2 = 1.60 < 5.99$$

Findings of this test lead us to draw an inference that combined use of scientific DCF methods with traditional Payback method has become the industry norm. Almost all firms, except one or two cases, use combination of methods to be sure that selected project satisfies both the parameters of profitability and liquidity simultaneously. Firms use scientific methods regardless of the size of investment. This leads us to infer that firms always act wisely without bothering for size of investment.

4.9: Conclusion

Corporate houses today reflect more maturity in their capital budgeting decision-making than what they were in the last century. Instead of relying on a single theoretically sound DCF method, corporate houses today use multiple methods and combine theory with practical considerations of everyday business. IRR has been found to be the most preferred method for financial appraisal of project proposals. This finding is similar to recent findings reported in various research

papers. The companies use theoretically sophisticated DCF methods in conjunction with traditional Payback Period. They want to be sure about liquidity as well as profitability before committing any fund to an investment plan. These findings reflect that CFOs of Indian corporate houses today are more practical and matured in combining theory with practice.

Findings reveal that there exists a relationship between sources of finance and methods of appraisal. Firms depending on loan make greater use of IRR method than NPV. These findings are in conformity with the propositions of Leverage Aggressive Hypothesis. However, no relationship exists between size of investment and choice of appraisal method. It leads to drawing conclusion that the firms are equally serious even when fund involved with an investment plan is low.

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