Chapter 3

METHODOLOGY

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   I. For Data Collection
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3.1. THE STUDY
Review of various types of mutual funds prevalent in India as on March 16, 2007 was done and accordingly classified. Inventory of available mutual funds was prepared. Study of various Mutual Fund evaluation methodologies in India and abroad was carried out and documented. Performance of open-ended growth (Non-Dividend) select equity mutual funds in India was evaluated for a period of five years starting from May 1, 2001 to April 30, 2006.

Comprehensive Scientific Framework for analysis of the performance of existing equity mutual fund portfolios in the Indian context was evolved and developed after studying various techniques of performance evaluation and testing of number of related hypotheses based on risk and return characteristics of the select existing funds.

Qualitative framework (Pre-commissioning due diligence) was developed for evaluating the performance of New Funds Offerings (N.F.O). This refers to a prescriptive checklist that can be used to assess NFO and mutual Funds without a sufficiently long track record. This checklist serves as the initial impressions of what the Portfolio is intended to look like and accomplish in the future. This framework did not involve and include any hypothesis testing.

3.2. THE DESIGN
The research used a combination of quantitative and qualitative techniques. An exploration of the various tools and techniques used in India and abroad was conducted. Research used exploratory design techniques and referred to standard concepts from Modern Portfolio Theory, Return Measurement, Risk Measurement, Risk Adjusted Performance Ratios (Sharpe, Treynor, Fund Alpha, Information and Sortino) and portfolio performance techniques of Morningstar, Standard & Poor’s, Lipper, Euro Performance and Edhee, CRISIL, Value Research and ICRA.

After studying and researching the related literature, following framework for performance evaluation was evolved and constructed:
3.2.1. Framework for analysis of existing Indian equity mutual funds:
The framework for analysis of existing Indian equity funds was evolved and constructed based on the results of following analytical methodologies:

I. Analysis of absolute fund performance
The absolute returns of select funds were calculated based on daily, weekly and monthly returns for a period of five years (May 1, 2001-April 30, 2006)

II. Analysis of distribution of returns of Mutual Funds and their related Bench Marks
To determine whether Indian equity indices and portfolio return are normally distributed or not, properties of skewness & kurtosis of distributions were considered and calculated. Following hypotheses were considered for testing:

Hypothesis 01
Indian Equity Indices are perfectly normally distributed.

Hypothesis 02
Indian Equity portfolio returns are perfectly normally distributed.

III. Analysis of relative fund performance
The fund pricing time-series was compared to its benchmark pricing time-series. The benchmarks chosen were the benchmarks as stated by the funds, collected from Bloomberg. Fund excess return was calculated over their benchmarks.

Hypothesis 03
Indian equity mutual funds do not perform better than their benchmarks i.e. active returns are not positive.

Fund Active return = Fund Return - Benchmark return
Funds returns were regressed to their benchmarks and \( \alpha \) and \( \beta \) calculated by computing the coefficients from the regression equation \( R \) (fund) = \( \beta \) * Return (benchmark) + \( \alpha \) + error. The coefficients were tested for statistical significance by the t-test.
Hypothesis 04
Active Returns do not allow the identification of relative performance of the fund in a stable and predictive manner.

IV. Analysis of Risk of Funds
Methodology was evolved based on:
Study and analysis of daily, weekly, monthly volatility of returns of select Mutual Funds and their related benchmarks for five years (May 1, 2001 to April 30, 2006).
Volatility of returns was calculated using the following metrics:
a. Standard Deviation,
b. Beta
c. Semi-Standard Deviation
d. Worst monthly draw down in percentage terms

V. Stability of Metrics across time
The next step was to identify the metrics that would be stable across time. This was to help build the framework for Funds performance analysis.
The following metrics were included in analysis:

- Geometric total return
- Mean daily total return
- Median daily total return
- Geometric active return
- Mean daily active return
- Median daily active return
- Sharpe ratio
- Treynor ratio
- Information ratio
- Sortino ratio
- Fund Alpha

A. Methodology for Identifying Metrics
The metrics were calculated on a daily, weekly, monthly basis and yearly basis, going back five years from the date of the analysis. For each of the 47 funds, each of the
above ratios was calculated for the last 5 years. To get a perspective of relative performance in a peer-group sense, each of the funds was ranked within the universe on each of the above metrics. Further, quintiles of ranks were created to reduce the dispersion as also to make the rankings independent of the number of funds covered in the analysis.

B. Testing Stability of the Metrics
After building Matrix there is one question in mind, is there any stable pattern for Metric over period of time, or it follows a random walk pattern?

Hypothesis 05
Metric X does not have a stable pattern over time, and follows a random walk pattern.

All above eleven metrics were tested for the above hypothesis. To test the hypothesis, the ranks of all funds were calculated across all above metrics. They were then split into quintiles – once each for 2, 4, 5, 8 and 10 quintiles.

Quintiles (statistics) a value, which divide a set of data into, equal proportions; examples are quartile and deciles.

Further, the quintile rank of every fund on one metric in one year was compared to the quintile rank of the same fund on the same metric in the next year. Hence, there was a time-series of quintile ranks, which had (=47x4) pairs of data for each metric. The rank correlation was calculated for this pair of time-series for each data. Based on the results of correlation, conclusions were drawn.

C. Stability of Metrics – Probability Approach
Following risk adjusted performance metrics were considered for testing of hypotheses:

- Sharpe Ratio
- Treynor Ratio
• Information Ratio
• Sortino Ratio
• Fund Alpha

Further analysis on the stability of the metrics that showed higher stability was conducted in a probabilistic framework. This means, the probability of that fund to be in the same quintile was calculated and tabulated.

D. Predicting Future performance
The next step was to check whether the metrics could meaningfully predict future performance.

The following metrics were included in analysis-
• Geometric total return
• Mean daily total return
• Median daily total return
• Geometric active return
• Mean daily active return
• Median daily active return
• Sharpe ratio
• Treynor ratio
• Information ratio
• Sortino ratio
• Fund Alpha

Hypothesis 06
Metric X in one time period has no ability to predict active returns (with respect to benchmark) in the next time period.

All above eleven performance metrics were tested for above mentioned hypothesis.

To test the hypothesis, the ranks of all funds were calculated across all above metrics. They were then split into quintiles – once each for 2, 4, 5, 8 and 10 quintiles.
Further, the quintile rank of every fund on one metric in one year was compared to the quintile rank of the same fund on active returns (with respect to the benchmark) in the next year. Hence, there was a time-series of quintile ranks that had \((47 \times 4)\) pairs of data for each metric. The correlation was calculated for this pair of time-series for each data. Based on the correlations, conclusions were drawn.

A composite performance metric
Question is whether single measure (performance metric) is robust to satisfy and meet stability and predictability requirements.

**Hypothesis 07**
Composite Performance Metric exhibits better predictability than single measure.

A composite ranking mechanism was tested to find a more effective predictive measure.

### 3.2.2. New Funds Offerings (N.F.Os)

**International Best Practices:**
In this section, best practices from international markets have been gathered and they have formed a good starting point for further studies. Prescriptive Checklist is prepared to analyze the domestic NFOs.

**Domestic NFOs:**
Recent NFOs were downloaded from www.sebi.gov.in. These were then studied for business practices, transparency and disclosure based on the prospectus.

### 3.3. THE SAMPLE

#### 3.3.1. Sample size and data collection
Methodology of Collection of sample data for this research is based on the following

i. Secondary data was used in this research.

ii. Data was collected from Bloomberg web site. (www.bloomberg.com)

iii. List of funds that were domiciled in India and invest in Indian securities was downloaded from Bloomberg website. Bloomberg is a provider (like Reuters) of
financial data services for global markets that collects and disseminates data on Indian mutual funds, including basic descriptive information, the historical time series of mutual fund net asset values (NAVs), their stated Index benchmarks and the historical time series of benchmark levels.

iv. Funds that invest only in equities and that have at least 5 years of investment history have been included in this analysis.

v. For consistency of analysis and performance comparison, only the accumulation (Non-dividend paying) options (also called share classes in international parlance) of the collected funds were included in the analysis as dividend distributions could make data non-comparable.

Classification of funds on above criterion resulted in sixty funds.

3.3.2. Data Cleaning
To make the data usable for analysis purposes, the data was cleaned by
1. Eliminating dates from analysis for which NAV values were unavailable for the Sensex 30 index (a total of four days for the 5 year period).
2. Forward-filling historical time series on days for which values were missing from either the NAV or the benchmark level series.
3. Restricting analysis to a continuous period for which all series had valid values
4. Some funds with no specified benchmarks were excluded, as the analysis requires extensive analysis of active returns
5. Funds were filtered on the basis of their investment objectives and investment history.

The final sample included a total of 47 mutual funds with a data set consisting of the reported daily NAVs close to 60,000 shown in table 3.1.
Table No.3.1: Funds and their Benchmarks in Sample

<table>
<thead>
<tr>
<th>MUTUAL FUND</th>
<th>BENCH MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRANKLIN INDIA PRIMA-G</td>
<td>NSE S&amp;P CNX 500 EQTY IDX</td>
</tr>
<tr>
<td>FRANKLIN INDIA BLUECHIP-G</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
<tr>
<td>HDFC INDIA CAPITAL BLDER-G</td>
<td>NSE S&amp;P CNX 500 EQTY IDX</td>
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<tr>
<td>CANGROWTH PLUS</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
<tr>
<td>FRANKLIN INDIA PRIMA PLUS-G</td>
<td>NSE S&amp;P CNX 500 EQTY IDX</td>
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<tr>
<td>BIRLA INDIA OPPORTUNITIES-G</td>
<td>NSE S&amp;P CNX 500 EQTY IDX</td>
</tr>
<tr>
<td>JM EQUITY FUND-G</td>
<td>INDIA BSE SENSEX VALUE</td>
</tr>
<tr>
<td>RELIANCE GROWTH FUND-G</td>
<td>BOMBAY STOCK EX 100 IDX</td>
</tr>
<tr>
<td>RELIANCE VISION FUND-G</td>
<td>BOMBAY STOCK EX 100 IDX</td>
</tr>
<tr>
<td>HDFC INDIA TAX SAVER-G</td>
<td>NSE S&amp;P CNX 500 EQTY IDX</td>
</tr>
<tr>
<td>HDFC INDIA TOP 200 FUND-G</td>
<td>BOMBAY STOCK EX 200 IDX</td>
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<tr>
<td>TEMPLETON INDIA GROWT FUND-G</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
<tr>
<td>SUNDARAM BNP PAR GROWTH-G</td>
<td>BOMBAY STOCK EX 200 IDX</td>
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<td>DBS CHOLA OPPORTUNITIES-G</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
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<td>TATA PURE EQUITY FUND</td>
<td>BSE SENSEX 30 INDEX</td>
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<tr>
<td>PRUDENTIAL ICICI GROWTH-G</td>
<td>NSE S&amp;P CNX NIFTY INDEX</td>
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<td>FRANKLIN INFOTECH-G</td>
<td>BOMBAY STOCK EX TECK IDX</td>
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<tr>
<td>BIRLA SUN LIFE EQUITY FUND-G</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
<tr>
<td>FRANKLIN INDIA TAXSHIELD-G</td>
<td>NSE S&amp;P CNX 500 EQTY IDX</td>
</tr>
<tr>
<td>ING VYSYA SELECT STOCKS-G</td>
<td>BOMBAY STOCK EX 100 IDX</td>
</tr>
<tr>
<td>TATA LIFE SCIENCES &amp; TECHNOL</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
<tr>
<td>PRINCIPAL INDEX I-NIT '99</td>
<td>NSE S&amp;P CNX NIFTY INDEX</td>
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<tr>
<td>PRUDENTIAL ICICI TAX PLAN-G</td>
<td>NSE S&amp;P CNX NIFTY INDEX</td>
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<tr>
<td>BIRLA BASIC INDUSTRIES-GRTTH</td>
<td>BOMBAY STOCK EX 200 IDX</td>
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<th>Fund Name</th>
<th>Index Name</th>
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<tbody>
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<td>KOTAK MAHINDRA K TECHNOLOGY</td>
<td>BOMBAY STOCK EX IT IDX</td>
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<td>NSE S&amp;P CNX 500 EQTY IDX</td>
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<td>BOMBAY STOCK EX TECK IDX</td>
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<td>TAURUS DISCOVERY STOCK FUND</td>
<td>BOMBAY STOCK EX 200 IDX</td>
</tr>
<tr>
<td>PRINCIPAL RESURGENT INDIA-G</td>
<td>NSE S&amp;P CNX 500 EQTY IDX</td>
</tr>
<tr>
<td>TEMPLETON INDI INDEX NIFTY-G</td>
<td>NSE S&amp;P CNX NIFTY INDEX</td>
</tr>
<tr>
<td>HDFC GROWTH FUND-G</td>
<td>BSE SENSEX 30 INDEX</td>
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<td>PRINCIPAL GROWTH FUND-G</td>
<td>NSE S&amp;P CNX NIFTY INDEX</td>
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<td>LICMF DHANVIKAS (1)</td>
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<td>SBI MAGNUM MULTIPLIER PLUS20</td>
<td>BSE SENSEX 30 INDEX</td>
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<tr>
<td>LICMF DHANSAMRIDDHI</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
<tr>
<td>LICMF TAX PLAN-G</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
<tr>
<td>SBI MAGNUM SECTOR-IT FUND</td>
<td>BOMBAY STOCK EX IT IDX</td>
</tr>
<tr>
<td>CAN D'MAT</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
<tr>
<td>UTI GROWTH &amp; VALUE FUND-G</td>
<td>BSE SENSEX 30 INDEX</td>
</tr>
<tr>
<td>ESCORTS TAX PLAN-G</td>
<td>NSE S&amp;P CNX NIFTY INDEX</td>
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<td>FRANKLIN INDIA INDEX TAX</td>
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3.4. THE TOOLS

3.4.1. For Data Collection:
Collection of sample data for this research was based on the following –
a. Secondary data has been used in this research
b. Data was downloaded from Bloomberg web site

3.4.2. For Data Analysis:

3.4.2.1. Statistical Tools:
   a. t- test for significance
   b. Chi Square test
   c. Coefficient of Correlation
      The fund’s rate of return should be correlated with the rates of return of the benchmark during the period under consideration. For analysis of how funds’ return move together with those of the market, the correlation coefficient has been used. Coefficient of Correlation shows covariance between benchmark return and fund return.
   d. Rank Correlation
      In statistics, rank correlation is the study of relationships between different rankings on the same set of items. It deals with measuring relationship between two rankings, and assessing the significance of this relationship. For the persistence of measures, rank correlation has been used.

3.4.2.2. Financial Tools:

A. Fund Absolute Return Measurement:
Return is defined to include changes in the value of the fund over the performance period plus any income earned over that period.

Mutual funds use the unit-value method so that cash flows result in changes in units, but not net asset value. As a result, evaluation of mutual fund performance can directly use beginning-and ending-period net asset values when calculating returns.
As the research is restricted to open ended non-dividend funds, rate of return of mutual fund will be calculated as under-

\[
Rp = \frac{NAV_t - NAV_{t-1}}{NAV_{t-1}}
\]

There is confusion in mind of investor that whether he/she should calculate return of fund on daily basis, weakly basis, or annual basis? In this research, daily, weakly and annual return has been calculated to determine further the appropriate method to measure the return of fund.

Further there is also confusion in mind of investor that whether he should consider Arithmetic Mean, Geometric Mean or Median or any other metric as measure of central tendency.

In this research Arithmetic Mean, Geometric Mean and Median have been calculated to determine further the appropriate method to measure the return of fund.

**B. Characteristics of the Normal Probability Distribution**

To determine whether Indian equity indices and portfolio return are normally distributed or not, properties of skewness & kurtosis of distributions have been considered and calculated.

**C. Active Return Measurement**

Every fund has its own benchmark and fund manager needs to measure the performance of fund with respect of benchmark. If it is positive, the fund has given higher return than benchmark. If it is negative, fund has given return lower than benchmark.

Active return = Portfolio’s return - Benchmark’s return

To determine, significance of active return  ‘t’ test has been applied
D. Fund Risk Measurement

i. **Standard Deviation (Total Risk)**
It is used to measure the variation in individual return from the average expected return over a certain period. Lower the investor risk tolerance, less likely it is that he or she will hold the riskier fund long enough to achieve its ultimate return. The factors which affect the variability of the performance of an investment are: the kind of stocks in the portfolio, the degree to which a fund diversifies the degree to which a manager uses leverage of borrowing in an effort to enhance performance, and the extent to which the manager tries to time the market.

ii. **Beta**
Beta coefficients compare the variability of fund return to its benchmark.

iii. **Semi-standard Deviation**
Semi Standard Deviation is calculated in the same way as the Standard deviation, except only the downside deviations (negative returns) are considered. Positive side return deviations are not considered while computing standard deviation.

iv. **Worst monthly draw down in percentage terms**
Worst monthly draw down represents the largest negative monthly rate of return experienced during the time period considered. A draw down is measured on the basis of month end NAV only and does not reflect intra-month figure. And as a percentage it is calculated as worst monthly draw down NAV figures divided by the base NAV figure. In our study we have considered periods as one year, three years cumulative and five years cumulative.

E. **Risk -Adjusted Performance Ratios**
The Research uses following methods of assessing risk –adjusted performance:

i. **Sharpe Ratio** = \( \frac{\text{Portfolio Return - Risk free Return}}{\text{Standard Deviation of Portfolio}} \)
ii. Treynor Ratio

\[
\text{Treynor ratio} = \frac{R_p - R_f}{\beta_p}
\]

\(R_p=\text{Portfolio Return, } R_f=\text{Risk free rate, } \sigma_p=\text{Standard Deviation of Returns, } \beta_p=\text{Portfolio Beta}\)

iii Fund Alpha

\[
\text{Fund Alpha} = \text{Realized Return} - \beta \times R_m
\]

Where, \(\beta\) is the beta of the portfolio, and the \(R_m\) is the benchmark return

\[
\text{Fund Alpha} = \text{Portfolio Return} - [\text{Portfolio Beta (Market Return)}]
\]

iv. Information Ratio

\[
\text{Information Ratio} = \frac{\text{Portfolio (Fund) Alpha}}{\text{Portfolio (Fund) Risk}}
\]

\[
= \frac{\text{Portfolio Return} - \text{Benchmark Return}}{\text{Standard Deviation (Portfolio Return-Benchmark Return)}}
\]
v. Sortino ratio

The Sortino ratio is a measure of a risk-adjusted return of an investment asset. It is an extension of the Sharpe ratio. While the Sharpe ratio takes into account any volatility in return of an asset, Sortino ratio differentiates volatility due to up and down movements. The up movements are considered desirable and not accounted in the volatility. That is, the Sortino ratio does not penalize a fund for its upside volatility.

\[
\text{Sortino Ratio} = \frac{\text{Portfolio Return} - \text{Risk free Return}}{\text{Semi Standard Deviation of Portfolio}}
\]

\[
\text{Sortino ratio} = \frac{R_p - R_f}{\sigma_d}
\]

Where as \( \sigma_d \) is the downside volatility. The downside volatility is computed using the standard deviation formula, keeping only the contribution of negative excess returns.