Abstract

1. Introduction:-
Ever rising frauds, equipped fraud perpetrators, volatile business atmosphere, development of technology are exerting pressure on finance executives as far as handling the business risk is concerned. The business organizations today, have to continuously deal with frauds, financial misrepresentation etc. The nature, volume, severity and type of fraud can be different for different industries; depending upon the effectiveness of internal controls, efficiency of audit procedures, work culture of an organization, opportunities for frauds etc. But none the less, fraud is all pervading. Growth in volume and value of business organizations obviously denotes enormous challenges for risk management. Management has to react and adapt to this ever challenging situation when it comes to fraud fighting.

Companies are increasingly feeling the need to manage fraud risk more efficiently than ever before. The attitude of regulatory authorities has also changed towards stringent norms to punish fraudsters and monitor frauds. Establishment of Serious Fraud Investigation Office (SFIO) under Ministry of Corporate Affairs, introduction of Companies Act 2013 are a few to name.

The thought process for the present study was triggered with the Satyam Software saga in 2009 and the turmoil thereafter. It was then that the audit procedures were questioned just the way the corporate governance was distrusted. Corporate India became increasingly cautious about fraud risk management since then and it was felt that there has to be some way of curbing this problem at its inception. A need to go little beyond the traditional audit procedures and become investigative prompted the present study.

The need of the present study is also underlined by the responsibilities that the Indian law has entrusted on the management and the auditors of companies. Law mentions that auditors are expected to express their opinion about ‘true and fairness’ of the financial position of an entity at the end of a statutory audit. Auditor is looked upon as the guardian of shareholders’ interest. However, it is equally important to note that the management of an entity has the primary responsibility of preparation and communication of authentic and true financial statements to all stakeholders. Thus
finally, any fraud which takes place in an organization is the result of defaults by auditors as well as management. Internal auditors, external auditors, board of directors and executive management are said to be the cornerstones of corporate governance. They all need to work hand-in-hand for the success of an entity. However various accounting scandals and frauds have time and again proven that the governance systems today are not really capable of preventing businesses from the risk of financial statements being misrepresented.

The present study gave indicators which prompt the need of forensic accounting as a mechanism to control fraud risk. Organizations always strive to optimize returns by way of efficient utilization of economic resources and avoiding leakages in revenue. But, frauds create hindrance in this goal. (KPMG, 2012) survey stated there is a greater awareness about frauds in corporate India. However, that there is a need to consider the fraud risks at a strategic level and adopt comprehensive fraud mitigation frameworks in view of long term sustainability. This would automatically result in reduction of fraud incidences, thereby maintaining an ethical atmosphere in the organization.

2. Literature Review:-
The researcher has conducted an exhaustive review of literature in the time frame of year 1967 to year 2014. Details are as follows:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Nature of literature</th>
<th>Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Research Papers</td>
<td>55</td>
</tr>
<tr>
<td>2</td>
<td>Doctoral Thesis</td>
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<tr>
<td>3</td>
<td>Books</td>
<td>20</td>
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<td>4</td>
<td>Reports</td>
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<tr>
<td>5</td>
<td>ACFE Fraud Manuals</td>
<td>2</td>
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</table>

Review of few important research papers/ other literature has been given below:-
(Beaver W. H., 1967) was one of the early inventors of the use of financial ratios to detect corporate financial difficulties. He anticipated the potential power of prediction inbuilt in the financial ratios. He has noted Univariate analysis, Multivariate analysis, Probit and Logit models have been the most commonly used models of financial fraud prediction as stated in the study.
Author found out that all the ratios cannot have the predictive ability of equal level. Ex- Cash flows to total debt is a better predictor as compared to liquid ratio. He further stated that predicting non-failed companies was possible more than predicting the failed companies. Scope for further research lies in the area of ‘Multi-ratio analysis’, where many ratios should be used at the same time. Researcher has picked up this thought for the present study and has used it in data processing.

(Courtis, 1978) cited that it is not possible to conduct financial analysis unless it is transferred into financial ratios as stated by Horrigan in 1965. Author mentioned that very little work has been done on inter-links between different ratios and their analysis to map the profile of a firm. Highly correlated ratios can be removed after ensuring that all relevant aspects of a firm’s complexion are covered.

This research helped the researcher in crystalizing the thought process as regards the statistical tools that can be used for present study.

(Hunt & Stefan, 1997) mentioned that forensic accounting could be extremely useful in prevention of fraudulent activities in business organizations. Forensic accountants prove to be very useful for any business. But their services are very costly and as such small businessmen may not use forensic services for their business.

(Koornhof & Plessis, 2000) defined red flagging as an early warning that can be used to determine the probability of financial statement frauds. Survey of 46 lenders and investors in South Africa reveled that investors there knew about red flags and use the same in decision making. A total of 65 qualitative red flags were incorporated in the questionnaire and were analyzed using a Likert scale. Authors indicate that behavioral predictive models, corporate failure predictions, ratio analysis when combined with qualitative red flags would give strength and more relevance to red flagging.

(Spathis, Doumpos, & Zopounidis, 2002) explored an innovative method to find out firms issuing falsified financial statements (FFS) and to identify factors associated with such statements. Falsification comes mainly in the form of showing more assets, profits and sales than actual or understatement of liabilities, losses and expenses.
Prior research has put forth few variables like sales, account receivables, reserve for bad debts and inventory as more prone to frauds than others (Schilit 1993; Loebbecke et al 1989). Spathis et al. studied 76 Greek firms; half of them were fraudulent and half were non-fraudulent. Ten financial ratios were applied to detect factors associated with FFS. Statistical tools namely UTADIS classification method and factor analysis were used. Finally two most important ratios that surfaced both from original set of ratios and from the reduced set were Total Debt to Total Assets and Inventory to Sales ratio.

(Renick, June 2007) wrote that a phased engagement is effective because the scope and timeframe of each phase is controlled. That permits the client to decide whether to expand or limit the scope of each phase or the scope of the entire engagement. Accordingly, each phase stands on its own and has its own parameters and deliverables. As a result, costs for each phase and, therefore, the cost of the entire engagement, can be controlled. A phased engagement also allows faster response and completion times because all the time and energy is devoted to the completion of each phase before the next phase is commenced. The author speaks about vertical phasing.

(Owojori, 2009) explained the concept, need and role of forensic accounting in solving vexed problems of corporate world. Inability on the part of internal as also statutory auditors further promotes the need of forensic accounting in the interest of shareholders and protection of their interest.

(Hogan, Rezaee, Riley, & Velury, 2007) were the authors of one of the articles published for Public Company Accounting Oversight Board (PCAOB) in USA and have gathered the academic research on fraudulent financial reporting. It has been observed by (Kaminski et al., 2004) that ratio analysis has yielded limited success in fraud detection due to instability of ratios over time and subjectivity of ratios. However, this research mentioned that advanced tools like cluster models, simple logistic models, Benford’s law etc. have worked very well while comparing fraud and non-fraud companies. Researcher thus, decided to use financial ratios in conjunction with strong statistical tools in the present study.
(Unegbu & Tasie, 2011) conducted a study to suggest a CPT model for detecting the ‘intent’ in published financial statements, thereby differentiating frauds from genuine errors. A Cash flow statement and Percentage trend analyses model had been proposed in the study. Authors claimed that an investor has access to and uses only the published financial statements and as such they have used only those for the analysis. Study found out that CPT model has very high ability to differentiate between falsified and non-falsified financial statements. This led the researcher to pick up publicly available financial data for the present study.

(Rothberg, 2012) claims that calculating and monitoring key financial ratios is the best way to measure the financial performance of a business and can spot problems before they get worse. He says “if you can measure it, you can manage it.” Current ratio, debt-to-equity ratio, days sales outstanding (or DSO), accounts receivable (A/R) days, accounts payable (A/P) days, inventory turnover are the key ratios in this regard.

(Sharma & Panigrahi, 2012) studied the literature on use of various data mining techniques specifically used for financial fraud detection between financial years 1992-2011. They mentioned four key classes of techniques as useful for fraud detection namely Neural Network, Regression models, Fuzzy logic and Expert System and Genetic Algorithm. It was stated that outlier analysis is highly suitable in financial accounting fraud detection. It was useful in differentiating fraudulent data from authentic data. Research concluded by showing the urgency to bridge the gap between researchers and practitioners so that more practical models could be invented with the help of researchers. (Hawkins, 1980) explained an outlier as an observation that deviates so much from the other observations in a given data set that, it arouses suspicions that it was generated by a different mechanism. Outliers thus, point out the threats existing in the financial statements of companies. This research paper was instrumental in establishing the thought process of the research towards data processing and analysis.

(Mehta, Patel, & Purohit, 2012) developed a model for detecting factors associated with fraudulent financial statements (FFS). Research gave a total of ten variables as potential indicators of fraudulent financial statements like debt to equity, sales to total
It was further found that companies with high inventories with respect to sales, high debt to total assets, low net profit to total assets and low Z scores are more likely to misrepresent financial statements.

(Radziah, Dickson, Sembilan, & Wan, 2013) studied financial ratios to see if they could differentiate fraudulent financial statements (FFS) and non-fraudulent ones. Analysis was performed using Paired sample t-test and logistic regression was used. Ratios like debt equity ratio, Sales to total assets showed negative correlation with FFS. Many other ratios like inventory to total assets, gross profit to assets etc. showed strong positive relation.

2.1 ‘Gap Analysis’

After an extensive survey of literature, it was found that there are some gaps in the present body of knowledge. This prompted the researcher to take up this topic for study. Brief findings from the review of literature and consequent “Gap Analysis” has been presented here-

1) Majority of the reviewed literature has focused on fraud detection.

**Gap Identified**-It was observed that there is a lot of scope for research in the fraud prevention area. Research on early detection of frauds and on preventive measures of fraud has been limited. Early detection is the need of the hour and as such must be tackled on priority by companies.

2) A lot of previous research work has followed the method of comparing Fraud and Non-fraud firms (Spathis 2002). But such method of research cannot be adopted in India due to the opaque disclosures about frauds.

**Gap Identified**- Research on Indian economy by taking a wider cross section of companies operating in India was not observed by the researcher. This gap was filled during the research at hand.

3) More research in the field of forensic accounting has been conducted by those entities that have access to financial data.
**Gap Identified**- Frauds and Finances are the most crucial aspects of a firm and thus the information relating to those will not be accessible to all. The research will be of some use to common man only if it is done with the help of financial data easily available to him. As such, researcher used financial statements as the input for research.

4) It was observed that lot of study has been done on **qualitative red flags as compared to quantitative red flags**. Quantitative red flags are easy to understand and interpret as compared to the qualitative red flags.

**Gap Identified**- There was a need to state numbers, which are relatively easy to understand. Researcher found that concentrating more on numbers was essential.

5) **Ratio Analysis** has been identified and used as a powerful financial measurement in finding out the financial difficulties as also frauds and errors in the existing literature.

**Gap Identified**- However, ratio analysis has not been used as much for early detection or prevention of frauds. In Indian context, such research has not been done. Whatever research exists is on selected companies with a very small sample. Thus, researcher used ratios to identify indications of vulnerability to fraud risk.

6) Looking at the expectations of stakeholders and management from the auditors, it is absolutely essential that forensic accounting principles be applied to accounting systems. Lot of time and efforts are required to be spent on forensic activities but the people are still a bit reluctant to accept it. As a result, only giant organizations are availing these services as of now. The major problem is that forensic services are **very costly in general and more specifically in India**.

**Gap Identified**- Pinpointing sensitive areas will enable all entities to use the expertise for areas most vulnerable to frauds. Also the cost of using forensic expertise for smaller areas will be much lesser and thus affordable to all.

7) **Stronger internal controls** are a good way to minimize frauds.

**Gap Identified**- There is a need to ensure that internal controls incorporate elements of forensic accounting and fraud risk mitigation techniques.
8) Various sectors have their own set of problems and prospects that should be studied one by one in order to formulate a regime for fraud prevention and early detection for each of them.

**Gap Identified** - There was a need to study sector-specific warning signals of possibilities of frauds. The present study included it as one of the objectives of study.

9) Ratio analysis when coupled with data mining techniques give better results as far as fraud detection is concerned.

**Gap Identified** - Researcher has used the said combination for identifying indicators showing the need of forensic accounting. This in turn would help in fraud prevention.

3. Statement of Problem

Literature review conducted shows that there is a need to dig further in the area of early detection of frauds. Warning signals about possibilities of frauds can give an insight into the vulnerable areas of a financial system. These signals can guide managers on fraud risk mitigation before a fraud takes massive form.

In case of India, frauds are increasing in size and severity in last few years. Lot of research work has been done in detection of frauds. However, the researcher felt that identifying and installing fraud risk controls as part of management control system would go a long way in prevention of frauds.

Forensic accounting techniques have the ability to detect and even prevent frauds to a large extent. The present study thus, aimed at identifying fraud risk indicators which in turn would highlight the need of forensic accounting services and tools.

4. Significance of the study

Review of literature showed that no much work has been done in the area of fraud indicators as a tool of fraud prevention in Indian context.

The present study will be more significant now in the light of provisions of Companies Act 2013. The Act contains explicit about fraud risk and has given greater responsibility and accountability to independent directors, auditors and employees as far as frauds are concerned. Thus, identification of possible fraud risk will certainly help senior level officials in companies who would now come under the purview of the provisions of companies act.
Thus, researcher decided to venture into the identification of indicators from published financial statements. This would promote the need of digging to the roots of a transaction, with the help of forensic accounting techniques.

5. Research Problem

Literature review conducted shows a dire need to research further in the area of early detection of frauds. Specially talking about Indian scenario, it is seen that frauds are on the rise and yet not much is being done to strategically prevent them. Qualitative indicators are relatively subjective in nature. For example, an employee living beyond his means is an important qualitative indicator that speaks about possibility of that employee being a fraudster. Or Profit figures are too good to be true is another such qualitative indicator. But these do not quantify the fraud risk. Numbers enable a person understand the situation better than just words. Thus, quantitative indications, whether in financial terms or in statistical terms, should be used for this purpose.

It was found from the literature that red flags or fraud indicators do not mean that fraud necessarily exists in an organization. However they work as “Fraud Risk Identifiers” and speak about the susceptibility of an organization to frauds. These signals can guide managers on fraud risk mitigation before any fraud takes a massive form. They also would help management in installing sufficient and appropriate internal controls, both operational and financial.

A fraud survey report by ACFE in 2012 stated that each year a median loss of 5% of the annual revenue is faced by organizations across the globe including India. The problem of misstatement, whether due to frauds or errors, is huge with no formal solution.

Deliotte India Fraud Survey report of 2014 based on a sample of 400 executives mentioned that, only 38% respondents’ organize trainings of fraud risk assessment. This speaks about the laid back attitude towards fraud risk assessment in particular and fraud prevention in general. Report says that companies need to invest in fraud control mechanisms for long term sustainability.
Thus, identifying indicators of fraud risk that companies face and ensuring proactive approach of managers and directors towards fraud risk control was the prime research problem that researcher observed in the review of literature. It was seen that concept of red flags in forensic accounting shows a path towards fraud risk assessment and control. Forensic accounting in this sense is the way as well as the means of fraud risk mitigation.

6. Objectives

1) To study the published financial statements of various companies in different sectors in order to identify the need of forensic accounting.
2) To identify sector-specific red flags which would bring forth the fraud symptoms at an early stage.
3) To develop a statistical model to study the need of forensic accounting with the help of ratio analysis.
4) To facilitate investors to understand the elements of accounting they should study more closely before investing in a company or sector.

7. Scope of the research

1) There are many frauds which cannot be directly traced to financial statements but affect the organization. They are called as ‘Off the books’ frauds. Frauds like kickbacks from vendors, frauds using information technology, stealing cash before it is recognized by an accounting entry, unrecorded sales etc. fall in this category.
   The research under consideration is restricted to only those financial frauds which have a reflection in the books of accounts and affect the financial statements adversely. ‘Off the books’ frauds form part of the present study, to the extent they impact the financial statements.

2) The research was restricted to only the financial and quantitative indicators of frauds, which can be shown in terms of numbers. There exist many qualitative indicators of possibilities of frauds such as pressure to meet debt covenants or analysts' earnings expectations, weak internal controls, changes in auditors over accounting or auditing disagreements, meeting earnings targets consistently over an extended time frame projecting high growth rates etc. However these indicators have not been considered for this study.
3) The researcher has categorically excluded few other sectors like banks and other financial institutions, agriculture etc. from the research. Banks and financial institutions have a different financial and reporting framework and as such comparing them with other non-financial sectors would not have been appropriate. Agricultural sector is relatively unorganized in terms of record keeping, financial reporting etc.

4) This research was restricted to public companies as defined by the companies act only. Private companies and other forms of commercial organizations were out of the orbit of this study.

8. Limitations of the study
1) The research was restricted to possibilities of financial statement frauds only. Other types of frauds like cyber-crimes, identity theft, payroll frauds etc. outside the purview of this study.

2) The researcher faced inherent limitation in the study of forensic accounting as no much research exists in this area in Indian context.

3) The researcher has used averaging technique to attain a measure of central tendency for all the ratios of all companies across the time span under consideration. Due to this, the year on year trends of each company could not be observed.

4) The researcher was more interested in observing the behavior of the indicator ratios of an entire sector. As such, year-on-year study of individual companies could not be taken up in this research.

5) The secondary data used for analysis was not available for an entire span of ten years in case of 5-10% companies due to either closure of such companies or limitations of the database. However, to avoid the aberrations in data, all the variables were averaged and then utilized for data analysis to arrive at rational findings.
9. Hypotheses

1) Properly identified red flags or fraud indicators based on financial data leads to early diagnosis of fraud symptoms.

2) Properly identified red flags or fraud indicators based on financial data pinpoint the need of forensic accounting as a management control system for selected areas of transactions instead of implementation of full-fledged forensic accounting system.

10. Pilot Study

A pilot study was conducted over the financial data of ten companies from three sectors namely Trading, Shipping and Diversified. Data for ten years from 2004 and 2013 were picked up for the purpose of pilot study. Eighteen ratios were calculated. Then they were averaged and processed further with the help of ‘Descriptive Analysis using Mean and Standard Deviation’ and Correlation analysis. Descriptive analysis gave broader ratios whereas correlation gave more pointed ratios as red flags. The findings showed that using mean and standard deviation as tools to detect indicators showing fraud possibilities, were very effective. As such, these tools could be used for the entire dataset also.

Results of pilot study showed that when worked with bigger data, findings can be more fruitful. As such, the researcher decided to take 17 major sectors representing a wider section of the Indian economy on the whole. It was felt that more advanced techniques were required to be used in order to device a statistical model for identify fraud indicators in order to help in fraud prevention as also early detection of frauds. Researcher found out from the literature review that, ‘Z scores’ are superior in identifying fraud indicators as compared to using only mean and standard deviation. Thus, final data analysis has been performed using ‘Z Scores’ and subsequently logistic regression and chi square test of contingency were performed on the secondary data, as deemed fit.

11. Data Processing

Processing of Secondary Data

The secondary data gathered by the researcher was processed in five steps as follows-

i) The secondary data collected and duly sorted, was further processed by sorting company wise and then chronologically. The data for the time period between 2004
and 2013 was collected. It has been observed that taking data for a longer duration gives better results.

This data was now ready for being used for calculation of financial ratios.

ii) Microsoft Excel was used to calculate all 18 financial ratios across 17 sectors for all the years between financial years 2004-2013. Non divisible or redundant figures were eliminated at this stage in order to ensure accuracy and precision in calculation of averages, which was the next step in the data processing. Elimination of redundant figures removed the variations in data and helped in getting more informative and relevant figures. The “yearly” financial ratios so calculated, were further averaged to get one figure of each of the 18 ratios for every company. Average is said to be the measure of central tendency and as such is effective when inter-firm comparison within a sector is performed.

iii) Statistical Package for Social Sciences (IBM-SPSS) 21.0 was used for advanced data analysis. The averaged ratios as arrived at in the step (i) above, were used to generate Z scores for each sector. Z scores enabled the comparison between various firms by creating a common base for the same.

All the ratios beyond a threshold of ‘Plus or Minus 2’, written in statistical terms as ‘± 2’ were treated as outliers. In financial statements, an outlier arouses suspicion about possibilities of some irregularities or anomalies in accounting data leading to risks of frauds or errors.

A company has been classified as a “Red Flag” company if it has one or more outliers in the set of 18 ratios calculated. Red Flag Company has been denoted by ‘1’. A company which does not have even one outlier ratio has been termed as a “Green Flag” company and has been denoted by ‘0’.

iv) These Z Scores and the classification as red and green flag companies, was used for the advanced data processing performed by the researcher with the help of statistical technique named as “Logistic Regression”. A regression equation has been formulated for 12 sectors.

v) Logistic Regression could not be used for the remaining 5 sectors out of 17 sectors, due to redundancies. Researcher performed ‘Chi Square Test of Contingency’ for those five sectors instead of ‘Logistic Regression’.
Data of five sectors namely Automobiles, Construction Materials, Diversified, Hotels and Resorts and Shipping was processed with the help chi square test which studied the relationship between an individual financial ratio and vulnerability to fraud risk. For Chi Square test, an additional working had to be done. All the variables must be translated into nominal scale for the chi square test to function effectively. (Zikmund, 2003) stated that nominal scale is best suitable for those cases where the numbers or letters allotted to objects act as tags for categorizing data.

All the z scores were further converted in the format of ‘0’ and ‘1’ depending upon whether a score indicated outlier or not. Companies falling beyond the ‘± 2’ for a particular ratio were called as outliers for that ratio and others were called as inliers for that ratio. All the outlier ratios of all companies were termed as “1” and all the inliers were called as “0”. These inliers and outliers were studied with red flag and green flag companies identified at the time of outlier detection, already mentioned in (ii) above.

**Processing of Primary Data**

The primary data was processed and further analyzed using Friedman’s chi square test and percentage pie charts, depending on the type of questions asked and the format in which the answers were expected. The semi-structured questionnaire could be decomposed as follows-

1) Friedman’s test was used when the questions asked were closed ended and answers were expected in the form of rating or ranking.

2) In case of other closed ended questions, percentage pie diagram was used.

3) There were three open ended questions in the questionnaire. The data processing in their case was initiated by deciphering the answers. The responses were noted and coded and classified. Further analysis was performed using percentage pie chart.
12. Research Methodology

12.1 Data Collection Methods-
Data collected was a mix of primary and secondary data.

(I) Collection of Primary Data
Primary data was important since it meant getting the first hand opinions from industry practitioners about their ways of coping with the fraud risk and about the perceived need of forensic accounting. Researcher was keen on checking if identification of fraud symptoms is useful to managers of corporate world. Researcher was also curious to check if any formal structure of fraud risk assessment exists in organizations. 18 middle and senior level finance executives from companies across various sectors under study were approached and a semi-structured questionnaire was executed to seek information from them. Same questions were asked to all respondents. The semi structured questionnaire was designed with the help of subject matter experts. The reliability and face validity was tested for the said questionnaire before circulating it.

Distribution of questionnaire was done on the basis of suitability; mostly by personal contacts, emails. In some cases, telephonic conversations were used. Questions asked were a mix of open ended and closed ended questions. Semi-structured questionnaire gave enough flexibility to respondents to share their views without being bound by multiple choice answers for all the questions. At the same time, it ensured that the discussions are kept on track.

Fraud is a very sensitive topic and hence, it was absolutely essential that no questions relating to respondent’s employer or his work be asked. Hence, the researcher categorically ensured that all the questions are generic in nature, allowing the respondents to answer without any hesitation or apprehensions about disclosure of sensitive information.

(II) Collection of Secondary Data

a) Professional Database-

1) The Secondary Data required for the present study was collected through a professionally managed database called “Capitaline TP”. Raw data was downloaded with appropriate query posed to the database in order to extract a wide dataset. The data
was wide in terms of time frame and also in terms of number of companies and sectors involved in this study.

2) Private companies were removed from this data since the scope of the research is restricted to published financial statements only, thereby restricting the study to public companies only. A sample of 2595 companies across 17 different sectors was finalized as the input for the present study.

b) Other Sources of Information-
Apart from this, secondary data was also collected from many sources like websites; ACFE reports, survey documents published by chartered accountancy firms; reports from regulatory authorities like revenue department, SFIO etc.; books on forensic accounting like forensic accounting for dummies, publication by Bombay chartered accountants association; doctoral theses on related topics etc.
All these sources helped the researcher in understanding the subject more intensely and way ahead was then relatively easier.

12.2 Sample size for the study
The sample size for the secondary data was 2595 companies spread across 17 sectors of Indian economy.
The sample size for the primary data was 18 respondents. The respondents were middle and senior level finance executives selected from companies across various sectors under study.
13. Findings from Secondary Data Analysis

13.1 Using Standard Binary Logistic Regression

Following were the sector-specific findings drawn by researcher from the data analysis of 12 sectors out of 17-

<table>
<thead>
<tr>
<th>Name of the ratio</th>
<th>Significant in sectors Out of 12</th>
<th>Chemicals</th>
<th>Coal &amp; Mining</th>
<th>Construction</th>
<th>Consumer Goods</th>
<th>Electrical &amp; Electronics</th>
<th>Food</th>
<th>Information Technology</th>
<th>Packaging</th>
<th>Pharmaceuticals</th>
<th>Power Generation &amp; Supply</th>
<th>Steel</th>
<th>Trading</th>
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</thead>
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<td>Current Ratio</td>
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<td>Current Assets to Total Assets</td>
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<td>Working Capital to Sales</td>
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<td>Inventory to Total Current Assets</td>
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<td>Debtors to Total Current Assets</td>
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<td>Cash to Sales</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sales to Working Capital</td>
<td>2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>Sales to Total Assets</td>
<td>6</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Debt Equity Ratio</td>
<td>3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>Total Debt to Total Assets</td>
<td>7</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Working Capital to Total Assets</td>
<td>8</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Gross Profit to Total Assets</td>
<td>1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Name of the ratio</td>
<td>Significant in sectors Out of 12</td>
<td>Chemicals</td>
<td>Coal &amp; Mining</td>
<td>Construction</td>
<td>Consumer Goods</td>
<td>Electrical &amp; Electronics</td>
<td>Food</td>
<td>Information Technology</td>
<td>Packaging</td>
<td>Pharmaceuticals</td>
<td>Power Generation &amp; Supply</td>
<td>Steel</td>
<td>Trading</td>
</tr>
<tr>
<td>---------------------------------------</td>
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</tr>
<tr>
<td>Net Profit to Total Assets</td>
<td>1</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Net Profit Ratio</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory to Sales</td>
<td>3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Profit Ratio</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
13.2 Overall Findings about Financial Ratios and 12 Sectors processed using Logistic Regression

1) ‘Sales to Debtors’ and ‘Working Capital to Total Assets’ were observed as significant predictors in 8 out of 12 sectors, totaling it up to 67%. These ratios thus have an excellent ability to predict vulnerability of companies to fraud risk.

2) ‘Current Ratio’ and ‘Total Debt to Total Assets’ were observed significant in predicting vulnerability of companies to fraud risk in 7 out 12 sectors, making it to 58% of the total sectors studied using logistic regression.

3) ‘Inventory to Total Current Assets’ and ‘Sales to Total Assets ratio’ were observed as indicators of vulnerability to fraud risk, thereby highlighting the need of forensic accounting, in 6 out of 12 sectors. This meant 50% of the total sectors studied under logistic regression.

4) It was observed that ‘Gross Profit ratio’ was insignificant predictor of fraud vulnerability in all 12 sectors for which logistic regression was performed. All other profitability ratios like ‘Net Profit ratio’, ‘Gross Profit to Total Assets’ and ‘Net Profit to Total Assets’ were seen significant only once. This indicated that effect of gross profit has been taken care of by other financial ratios, which were identified as significant for each sector. Thus, gross profit ratio was particularly not required to judge the vulnerability to fraud risk.

5) Two financial ratios namely ‘Current Ratio’ and ‘Working Capital to Total Assets’ were observed to have appeared together in almost all those cases where either of them was detected as significant.

6) Researcher observed that following ratios were top ranking predictors in 12 sectors studied using “Logistic Regression”-

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Financial Ratio</th>
<th>Indicators generated from Logistic Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sales to Debtors</td>
<td>8 out of 12</td>
</tr>
<tr>
<td>2</td>
<td>Working Capital to Total Assets</td>
<td>8 out of 12</td>
</tr>
<tr>
<td>3</td>
<td>Total Debt to Total Assets</td>
<td>7 out of 12</td>
</tr>
<tr>
<td>4</td>
<td>Current Ratio</td>
<td>7 out of 12</td>
</tr>
</tbody>
</table>

XIX
### 13.3 Sector Specific Findings for 5 sectors using ‘Chi Square Test of Contingency’

<table>
<thead>
<tr>
<th>Name of the ratio</th>
<th>Frequency of occurrence for sectors out of 5</th>
<th>Automobiles</th>
<th>Construction Materials</th>
<th>Diversified</th>
<th>Hotels and Resorts</th>
<th>Shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Ratio</td>
<td>2 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Assets to Total Assets</td>
<td>3 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Working Capital to Sales</td>
<td>4 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Inventory to Total Current Assets</td>
<td>4 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Debtors to Total Current Assets</td>
<td>3 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash to Sales</td>
<td>3 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales to Debtors</td>
<td>1 out of 5</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales to Inventory</td>
<td>3 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales to Working Capital</td>
<td>2 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales to Total Assets</td>
<td>3 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debt Equity Ratio</td>
<td>3 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Debt to Total Assets</td>
<td>4 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Working Capital to Total Assets</td>
<td>2 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Profit to Total Assets</td>
<td>2 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Profit to Total Assets</td>
<td>2 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Profit Ratio</td>
<td>3 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory to Sales</td>
<td>1 out of 5</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Profit Ratio</td>
<td>3 out of 5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13.4 Overall findings about the Ratios and 5 Sectors processed with Chi Square Test-

1) ‘Working Capital to Sales’, ‘Total Debt to Total Assets’ and ‘Inventory to Total Current Assets’ were observed significant indicators or fraud symptoms in 4 out of 5 sectors studied with the help of chi square test.

2) Eight ratios namely ‘Current Assets to Total Assets’, ‘Debtors to Total Current Assets’, ‘Cash to Sales’, ‘Sales to Inventory’, ‘Sales to Total Assets’, ‘Debt Equity ratio’, ‘Net Profit ratio’ and ‘Gross Profit ratio’ were observed significant in 3 out of 5 sectors.

3) ‘Sales to Debtors’ and ‘Inventory to Sales’ were observed significant, only for one sector out of 5 sectors.

4) Researcher observed that following ratios were top ranking predictors when considered independently for each statistical test-

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Financial Ratio</th>
<th>Indicators generated from Chi Square Test of Contingency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Working Capital to Sales</td>
<td>4 out of 5</td>
</tr>
<tr>
<td>2</td>
<td>Total Debt to Total Assets</td>
<td>4 out of 5</td>
</tr>
<tr>
<td>3</td>
<td>Inventory to Total Current Assets</td>
<td>4 out of 5</td>
</tr>
</tbody>
</table>

13.5 Collective Findings from Secondary Data for all 17 sectors selected by researcher-

(1) After having compared sectors under logistic regression and chi square test, researcher ranked the significant financial ratios from each sector on the basis of their frequency of occurrence in each sector-
Comparative chart showing top ranking indicators for all 17 sectors

<table>
<thead>
<tr>
<th>Financial Ratio</th>
<th>Logistic Regression</th>
<th>Financial Ratio</th>
<th>Chi Square Test of Contingency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Indicators ranked as per the frequency of occurrence</td>
<td></td>
<td>Indicators ranked as per the frequency of occurrence</td>
</tr>
<tr>
<td>Sales to Debtors</td>
<td>8 out of 12</td>
<td>Working Capital to Sales</td>
<td>4 out of 5</td>
</tr>
<tr>
<td>Working Capital to Total Assets</td>
<td>8 out of 12</td>
<td>Total Debt to Total Assets</td>
<td>4 out of 5</td>
</tr>
<tr>
<td>Total Debt to Total Assets</td>
<td>7 out of 12</td>
<td>Inventory to Total Current Assets</td>
<td>4 out of 5</td>
</tr>
<tr>
<td>Current Ratio</td>
<td>7 out of 12</td>
<td>Current Assets to Total Assets</td>
<td>3 out of 5</td>
</tr>
<tr>
<td>Inventory to Total Current Assets</td>
<td>6 out of 12</td>
<td>Debtors to Total Current Assets</td>
<td>3 out of 5</td>
</tr>
<tr>
<td>Sales to Total Assets</td>
<td>6 out of 12</td>
<td>Cash to Sales</td>
<td>3 out of 5</td>
</tr>
<tr>
<td>Current Assets to Total Assets</td>
<td>4 out of 12</td>
<td>Sales to Total Assets</td>
<td>3 out of 5</td>
</tr>
<tr>
<td>Working Capital to Sales</td>
<td>4 out of 12</td>
<td>Debt Equity Ratio</td>
<td>3 out of 5</td>
</tr>
<tr>
<td>Cash to Sales</td>
<td>4 out of 12</td>
<td>Net Profit Ratio</td>
<td>3 out of 5</td>
</tr>
<tr>
<td>Sales to Inventory</td>
<td>4 out of 12</td>
<td>Gross Profit Ratio</td>
<td>3 out of 5</td>
</tr>
</tbody>
</table>

(2) It was observed that following three ratios were observed to have appeared the most when analyzed across all 17 sectors. The ratios were as follows –

- a) Total Debt to Total Assets (11 out of 17)
- b) Inventory to Total Current Assets (10 out of 17)
- c) Sales to Total Assets (9 out of 17)
14. **Findings from Primary Data Analysis**

a) It was observed that the awareness amongst finance executives is growing as far as forensic accounting services are concerned. Few respondents mentioned having taken help from forensic accountants.

b) Whistle blowers was the most popular as fraud indicators while ratio analysis was noticed to be a popular detection mechanism. Respondents mentioned that quantitative as also the qualitative red flags are useful in fraud risk mitigation. They choose the red flags depending on the situation.

c) It was observed that the respondents treat financial statement frauds as a severe threat to them since these frauds affect the profitability more intensely than any other type of fraud.

d) Strong internal controls were considered important by all the respondents as the best way of fraud risk mitigation. The indicators of fraud risk vulnerability as identified by the researcher in the present study would certainly help in exerting better internal controls amongst companies.

15. **Summary of Hypothesis Testing**

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Particulars</th>
<th>Statistical test / tool used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 1</td>
<td>Identification of fraud indicators leads to early diagnosis of fraud symptoms</td>
<td>Z scores were used to identify anomalies which led to early diagnosis of fraud symptoms</td>
</tr>
<tr>
<td>Hypothesis 2</td>
<td>Pinpointing the need of forensic accounting using financial ratios for a particular sector</td>
<td>Binary Logistic Regression and Chi Square test of contingency</td>
</tr>
</tbody>
</table>

Primary data analysis resulted in validation and strengthening of both the hypotheses.

1) From both the statistical tests, namely, Logistic Regression and Chi Square test of contingency, it was observed that financial ratios can indicate the vulnerability of companies to fraud risk. Z Scores calculated for both the statistical tests enabled the researcher to identify outlier and inlier companies for every sector.
(Zack, 2013) mentioned that the outlier analysis finds out the anomalies or aberrations in the financial data. Such anomalies indicate the need to dig further to see if it’s a fraud or not. Any such outlier should be considered by an auditor or investigator as a fraud risk and then other non-fraud factors should also be vouched for. As each non-fraud possibility gets eliminated, the fraud risk automatically grows. Outliers thus, point out a danger before the fraud actually takes place or at least before it acquires a monstrous nature.

Secondly, it has been established that financial data to be used for fraud prevention and detection is quite the same, but the difference lies in the motive. Prevention has the motive of caution and care, whereas detection is done with a suspicion in mind and with an urge to find out the fraud. Thus, financial statements can give indications for prevention as well as for detection. The approach of the research is what matters the most.

The hypothesis that “Properly identified red flags or fraud indicators based on financial data leads to early diagnosis of fraud symptoms”, thus stands proved.

2) A firm which is vulnerable to fraud risk has to be more careful regarding fraud prevention. Prevention of frauds can be exercised primarily through strong internal controls, both financial and operational. Ratios which have been observed above as significant indicators can give headway to ‘Specific Areas’ (say, Inventory, sales etc.) as also key relationships (like total debt to total assets, inventory as a percentage of total current assets etc.). This in turn will allow the management of companies to save time and money to be spent on fraud prevention and would also save resultant fraud losses and costs required to be spent on fraud detection. If a full-fledged assignment is taken up by a forensic expert for setting up a fraud control mechanism for a company, it will be extremely costly and the time involved would also be substantial.

In a developing country like India, fraud prevention is yet a luxury and not a necessity, in terms of time, money and expertise. In such scenario, these early indicators will act as an insurance for a company. Prevention fees given to the experts will act as insurance premium and will guard the companies against contingencies. Thus, fraud prevention could be ensured using the indicators identified by the researcher. These preventive measures would in turn act as management controls for a company, thereby contributing to its management control system.
Thus the hypothesis that “Properly identified red flags or fraud indicators based on financial data pinpoint the need of forensic accounting as a management control system for selected areas of transactions instead of implementation of full-fledged forensic accounting system” stands proved.

3) Both the above hypotheses got validated and strengthened with the help of the primary data gathered and analyzed.

16. Conclusion
A detailed study and data analysis brought the researcher to the following conclusions-

a) **Z Scores indicate the outliers for each sector and highlight the vulnerability to fraud risk.**
A study of published financial statements by converting the data into ratios and further into z scores, generated early indicators also called as fraud symptoms. Outliers, can technically, be applied for prevention as also for detection of frauds. However, when applied in an “All is well” situation, they prove to be warning signals.

b) **Specific ratios can be identified as red flags for each sector, which bring forth the fraud symptoms at an early stage.**
‘Sales to Total Assets’, ‘Inventory to Total Current Assets’ and ‘Total Debt to Total Assets’ were observed to be the most significant and commonly observed ratios across all sectors in early indication of fraud possibilities.

Apart from this, researcher identified sector specific indicators for all the sectors. These would pinpoint the vulnerable ratios for each sector. Few ratios were peculiar to each sector owing to its nature, business activities etc.

Second hypothesis of the present study was about using these indicators for pinpointing the fraud vulnerability to specific areas, rather than running a full-fledged forensic accounting system in an organization. These indicators would pinpoint the susceptibility to fraud risk and guide the companies by acting as their shield. This identification would also save a lot of time, money and efforts on the part of management of a company, accountants and the auditors.
c) Logistic Regression and Chi Square test of contingency are extremely strong tools to bring out the need of forensic accounting with the help of ratio analysis.

The researcher began the research process with an intention to develop a statistical model that can help anyone concerned, in identifying early indicators of the need of forensic accounting. A statistical model helps in formulizing an event, phenomenon or relationship between variables and thus allows to quantify the results. This makes it easy for users to understand and interpret the variables under consideration. This is why the researcher was keen on developing model. It was observed that logistic regression generated strong models with excellent predictive ability in case of 12 sectors. However, remaining 5 sectors could not be processed with the help of regression due to redundancies. Hence, chi square test of contingency was performed on the data of those five sectors. Relationship of each financial ratio with vulnerability to fraud risk gave significant findings. These indicators would act as a guard against fraud risk and fraudulent misstatements in financial statements.

d) Sales, Total Assets and Inventory of a company are the most vulnerable elements of accounting as far as fraud risk is concerned and as such, these should be studied carefully by investors before investing.

Anyone who wants to understand the vulnerability to fraud risks, associated with a company belonging to any sector, can use these sector-specific indicators found out by the researcher and understand the threats associated with the company. An overall study of 17 sectors brought to the light three most susceptible areas namely sales, total assets and inventory. So financial ratios related to these three areas plus a detailed inquiry into transactions, documents etc. related to these areas would be very effective in fraud prevention.
17. Recommendations

17.1 Recommendations to the management and auditors of companies-
Following were recommendations given by the researcher based on the detailed study of the research topic:

(I) Fraud Risk Assessment (FRA)
Researcher strongly recommends auditors and managers to prepare a “Fraud Risk Assessment” sheet, in order to map the fraud risk for suspicious areas that have emerged from the data analysis performed by the researcher in the present study. The suspicious areas susceptible to fraud risk as identified were Sales, Total Assets and its composition, Total Debt and Current Assets. The main objectives of the FRA sheet are:- revisiting the existing controls, recognizing the loopholes in the management control system and making necessary changes in controls if required.

Template of Fraud Risk Assessment Sheet

<table>
<thead>
<tr>
<th>Identified Fraud-prone Areas that need special attention</th>
<th>Likelihood</th>
<th>Possible Threats</th>
<th>Existing Controls</th>
<th>People monitoring the Existing fraud risk controls</th>
<th>Exact Loopholes in the system</th>
<th>Additional Controls to be installed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
<td>M</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventor</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debtors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debt</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Assets</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
(II) Checklist of ‘Fraud Prevention Measures’

The fraud risk assessment sheet recommended above would help users in estimation and quantification of fraud risk. Solutions can then be found out in order to prevent frauds to the possible extent. Each business is different and as such would have unique ways of exerting internal controls in their organizations.

Given below is a list of preventive measures that would help in mitigating the fraud risk. These measures are generic in nature and would need alterations while fitting to a particular business or business model. The researcher has given these checklists for Sales, Inventory, Cash, Debtors, Debt and Fixed Assets. A sample checklist has been given below.

The list is indicative in nature and not exhaustive. The purpose of the researcher is to channelize the thought process behind the act of fraud prevention.

Sales

<table>
<thead>
<tr>
<th>Risks Involved</th>
<th>Control Measures</th>
</tr>
</thead>
</table>
| Fake Invoices, Reprints of invoices, Inventory growing faster than sales, more entries towards the year end, goods sold on sale or return basis and entries reversed at the beginning of the subsequent accounting year | • ‘Maker checker’ concept should be used at all crucial stages in sales department  
• Person responsible for billing should not have access to cash / bank accounts  
• Comparison of sales record with the freight record could keep a check on sales process.  
• A track of bad debts being written off should be kept.  
• Segregation of duties between sales personnel and employees who would raise bills and account for sales.  
• Close monitoring of the cash discounts policy and discounting level  
• Monthly ageing of debtors is recommended. |
(III) Close Monitoring of financial ratios which would act as indicators of vulnerable to fraud risk: Common and Sector - Specific

Mapping of the fraud risk and implementing sufficient controls to manage the risk can prove to be useful in fraud fighting. The analysis of secondary data has brought to notice three key ratios and relevant areas which are most vulnerable to fraud risk.

Three financial ratios identified by the researcher in the present study were -

1) Inventory to Total Current Assets
2) Sales to Total Assets
3) Total Debt to Total Assets

These ratios would give a general guideline on installation and implementation of internal controls. Researcher has also identified sector-specific key financial ratios in the present study. Those ratios would pinpoint specific areas vulnerable to fraud risk for each sector and thus monitoring the internal controls would be more effective.

(IV) ‘Analysis of suspicious transactions’ using forensic accounting techniques

This can act as a truly effective fraud prevention tool when performed at regular intervals. It is particularly useful where no prior suspicion exists and number of transactions is really large. Suspicious transactions which appear beyond the regular course of action would be tagged and analyzed in detail under this process. This analysis can be performed manually or can be done with the aid of computers. The techniques of forensic accounting, such as Computer Assisted Auditing Techniques (CAATs), Benford’s law to analyze trends and patterns of numbers, Outlier detection etc. can be of immense use in this regard.

(V) ‘Zero tolerance for fraud’ Policy

Every firm should incorporate the approach of zero tolerance for fraud in the vision, mission statements of the company. It all depends on how the top management views fraud. What percolates till lower level is the culture and values that the top management sets. This has been reiterated by many researchers in the literature. Researcher also has observed similar opinions in the primary data collected for the present study.
(VI) **Delegation and Rotation of duties**

It can reduce the opportunities to commit fraud and thus the incidences of fraud. Few respondents cited this as the most effective tool of internal control. Delegation of duties ensures that all the employees in a department are aware of the task or the project or work being undertaken. Rotation of duties would ensure that no one is indispensable. Thus, delegation and rotation is also a way of ensuring that system prevails over persons. Literature has brought out this point that frauds take place more in organizations where persons are more important that the system.

(VII) **Fraud Hotlines and Whistleblower Policies**

Fraud hotlines and whistle blower policies would be of immense use in fraud risk mitigation when used in addition to quantitative red flags. These hotlines can fetch hints from employees about the nature of frauds and extent of severity in those areas. Appropriate control measures can then be taken.

17.2 **Recommendations to Investors and other stakeholders**

1) The three financial ratios namely ‘Inventory to Total Current Assets’, ‘Total Debt to Total Assets’ and ‘Sales to Total Assets’ are the key financial ratios which investors should watch closely before taking a decision of investment in a company. Even for existing shareholders, these ratios can give a guideline on whether to stay invested or to transfer funds to elsewhere. These ratios also drew attention towards crucial areas which are mainly sales, inventory and fixed assets. A close watch on information on these aspects would show the way towards identification of vulnerability to fraud risk.

2) Sector- specific key financial ratios have also been found out by the researcher in the present study. Those ratios should be referred to, for more precise decision making relating to a particular sector.

3) Investors and as well as shareholders must consider a few qualitative red flags along with quantitative red flags discussed above.
18. **Scope for further Research**

1) The researcher tried to take a broader view of the economy and as such used the financial information which was publicly available in order to dig put indicators. However, a better prediction about fraud risk and need of forensic accounting can be done if these indicators are coupled with certain 'qualitative indicators'.

2) In depth and intricate analysis can be done if the prediction is to be done about a particular company only. In that case, more information about the nature, size and age of the company can be obtained and results can be further improved.

3) The present study was directed towards finding the sector specific indicators of fraud possibilities and as such, the focus was on indicator ratios. A further leap into this research can be taken up by picking lesser companies for study and by concentrating more on identifying year wise trends for every company and identifying indicators on that basis. This will gain more value and quality if coupled with physical checking of documents, staff interviews, identifying psychology of employees etc.

4) Research can be furthered in the area of financial institutions like mutual funds, banks etc. They would have different parameters for checking the possibilities of fraud than ones considered in present research.

5) The present research only figures out the vulnerability to fraud risk. However, a future research can be aimed at the area of figuring out the extent of that fraud risk.

19. **Epilogue**

Complete abolition of frauds appears to be impossible as long as human element exists in organizations. However efforts of fraud risk mitigation would undoubtedly save the name, repute and money of an organization.

Fraud risk controls, both proactive and reactive, are a must for each organization for the benefit of the shareholders, regulatory authorities and external parties attached to the organizations.
Quantitative indicators showing the vulnerability of companies to fraud risk and thereby highlighting the need of forensic accounting would go a long way in controlling fraud risk as also in reducing the frequency and severity of fraud incidences. However, quantitative indicators of fraud possibilities alone would not be sufficient to control fraud risk in entirety.

A combination of proactive and reactive fraud control measures, effective corporate governance, robust internal controls, well-coordinated and timely investigations and corrective actions is the answer to fraud scenarios. Frauds where the owner himself is the designer of a fraud are out of the purview of any such attempt to control and mitigate fraud risk. But the present study would surely be useful in all those cases where the frauds are undesirable to an organization and where prevention is valued.

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