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# From Kautilya to Benford – Trends in Forensic and Investigative Accounting

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## Abstract

One of the most challenging tasks for a professional accountant is to seek out all such possible loopholes in accounting control systems which may be used to misappropriate corporate funds; and plug these up in good time. However, inspite of tight controls fraudulent misappropriations do occur. Here we look at a possible combination of a few interesting methods of inquiry, both ancient and modern, which may aid investigative accountants in tracking down the perpetrators of corporate frauds by correctly following the 'dirty money trail'

**Key words**

Investigative accounting, fraud classification, Benford's law, audit sampling

## Introduction

A forensic accountant's primary task can be of two types:

### Investigative Accounting

- Reviewing the factual situation and provision of suggestions regarding possible courses of action.
- Providing assistance with the protection and recovery of assets.
- Co-ordination with other experts including:
    - Private investigators;
    - Forensic document examiners;
    - Consulting engineers.
- Providing assistance with the recovery of assets by way of civil action or criminal prosecution.

### Litigation Support

- Providing assistance in obtaining documentation necessary to support or refute a claim.
- Reviewing the relevant documentation to form an initial assessment of the case and identify areas of loss.

- Providing assistance with Examination for Discovery including the formulation of questions to be asked regarding the financial evidence.
- Attending the Examination for Discovery to review the testimony, assisting with understanding the financial issues and formulating additional questions to be asked.
- Reviewing the opposing expert's damages report and reporting on both the strengths and weaknesses of the positions taken.
- Providing assistance with settlement discussions and negotiations.
- Providing attendance at trial while hearing the testimony of the opposing expert and also providing assistance with the cross-examination. [1]

In our present paper, we will primarily concern ourselves with the first of the above two functional areas i.e. investigative accounting. *Investigation* implies a systematic inquiry to establish the truth or falsity of some pre-formed hypothesis about any event. The services of professional accountants are often sought to investigate the accounts and other financial records of a body corporate. Though the standard auditing methodologies are often also applicable in investigative accounting, an investigation calls for a much more thorough scrutiny of the problem area than what is required in a statutory audit. This is primarily because of the nature of evidence being sought – while an auditor is often satisfied with *persuasive* (secondary) evidence, an investigator always looks for *conclusive* (primary) evidence. [2] Seeking out a piece of primary evidence of fraud from a number-maze of innumerable account heads each containing innumerable transactions

thereunder is a rather unenviable task and calls for a sophisticated range of inquiry techniques to help the investigative accountant get a “lock-in” with a certain acceptable degree of confidence. Among other things, this calls for a classification process to narrow down the search.

## Classification system for financial frauds in Mauryan India

Accounting historians credit the fifteenth century Franciscan monk-mathematician Luca Pacioli with formally laying out the fundamental principles of double-entry bookkeeping. However, more than 2000 years ago in ancient India, Kautilya, in his classic treatise *Arthashastra (Science of Material Wealth)*, had already given detailed instructions on check-and-balance accounting and auditing for the royal treasury of the great Mauryan Empire. [3] However, Kautilya conceded that *it is just as difficult to detect an appointed official’s dishonesty, as it is to detect how much water the swimming fish drinks*. [4]

However, questions have been raised time and again by various scholars doubting the actual contribution of Kautilya in composing the Arthashastra. In his doctoral thesis, Trautmann has concluded that while there is some historical evidence to suggest that a single person (probably Kautilya) composed most of the Arthashastra, the compiled work almost definitely has no single creator. [5] It is more than likely that it was a compilation of earlier works by Brahmanical scholars of the later Vedic age. However, there is now a

more or less uniform consensus among historians that Kautilya and his disciples accomplished a large part of the original compilation (along with some further additions).

## Kautilya on classification of financial frauds

In the Arthashastra, stress has been given both on fraud prevention as well as fraud detection. Kautilya had listed several ways of misappropriating public funds by way of fraud against which auditors at the royal treasury had to always be on their guard. Some of these frauds relevant in today's corporate environment are as follows:

(a) **Falsifications (of date) with a motive of personal profit:** Showing a later date than the one in which income was received or showing an earlier date than the one on which expenditure was incurred and using the proceeds in both cases for personal profit for a period.

(b) **Misrepresentations (of income received or expense incurred) with a motive of personal profit:**

(i) Revenue due on a given date is allowed to be collected at a later date for a consideration

(ii) Revenue not due till later is collected earlier by force or deceit but credited on due date

(iii) Revenue paid by one is credited in the name of another for a consideration

(iv) Revenue for treasury realized in the capacity of a collector is misappropriated by an individual by force or deceit

(c) **Discrepancies (arising out of willful fraud) in:**

- personally supervised work
- account heads
- labour and overhead charges
- work measurement
- totaling
- quantity
- price
- weights & measures
- containers of goods

Actual income was calculated under the three major account heads: (a) current income, (b) transferred income and (c) miscellaneous revenue. The last category had three further sub-divisions, which mainly included recovery of previously written off debts etc., realizable economies made in investment against planned budget and any differential (value-added) income. In the books of accounts, every entry was to be recorded on the date of transaction duly classified under the different heads *on both sides* – receipt and debit. Not maintaining a systematic and legible accounting record was a punishable offence as this was deemed a precursor of fraud. An elaborate check-and-balance system was in place to ensure the timely submission of accounts and accounting for every

transaction in minute detail; complete with narration and all. In case of a discrepancy being discovered after audit, the official concerned was made to pay a penalty at least equivalent to the discrepancy if such discrepancy had the effect of either concealing a higher actual income or a lower actual expenditure. [6]

Over the ages, what has primarily changed about financial frauds is the *modus operandi* of the perpetrators given the benefits of modern technology – especially that of Information Technology and satellite communications that enable swift fund movements electronically across continents just with a few key depressions. However if we systematically categorize the various financial frauds that are being unearthed by the present-day auditors and investigators across the world we will probably find that most of them can be roughly placed under one of the aforementioned Kautilyan classifications.

**A few instances from the Enron collapse [7] – understanding Kautilya's relevance**

Instance I: Enron had created a constellation of partnerships that allowed managers to shift debt off the books. Thus some partnerships' losses would have to be paid for out of Enron stock or cash in 2003, bringing the debts back home.

Relate to: *Account payable to one is credited in the name of another for a consideration, or corollarily, account receivable from one is debited in the name of another for a consideration*. The debts that were actually realizable from Enron were shifted onto the books of some dubious partnership firms, obviously against some consideration!

Instance II: Whitewing was formed in 1997 as an Enron subsidiary. In 1999 Enron decided to move Whitewing off its books, which it accomplished by giving half of the partnership's control to an unnamed investor. The arrangement allowed Enron to escape reporting losses on some assets that were no longer worth what Enron had originally paid for them, according to some company officials. Such losses would have adversely affected Enron's stock price.

Relate to: *Showing a later date than the one in which income was received or showing an earlier date than the one on which expenditure was incurred and using the proceeds in both cases for personal profit for a period*. Capital expenditure was reported in 1999 at their 1997 values. Thus there was an overvaluation of assets, the proceeds of which were used to artificially inflate the stock price.

Instance III: An Enron shareholder has filed a legal suit in Texas state court alleging that Enron's board violated its duty to the company by permitting the chief financial officer to engage in a series of outside transactions. These alleged outside transactions earned millions of dollars in fees for him and other investors in the partnerships.

Relate to: *Revenue for treasury realized in the capacity of a collector is misappropriated by an individual by force or deceit*. A responsible officer of the company earned individual profits by abusing his fiduciary position in the company.

## Objective identification of the nature of a financial fraud – building on the Kautilyan classification

Modern technology has armed the investigative accountants with tools and techniques not only to track down the perpetrators of fraud more efficiently than was possible in the absence of those technologies but also to carry out a multi-faceted analytical inquiry into the nature of financial frauds and their perpetrators.

We prefer classifying financial frauds in the modern corporate scenario using a systematic, two-way categorization. One is in terms of the *nature of fraudulent manipulation*. This classification is derived from the Kautilyan one. The other categorization is in terms of *involvement of the perpetrators* e.g. fraud by an individual, a group of isolated individuals or a collusive fraud. A sub-classification within this second categorization could be based on whether the group (isolated or collusive) consists of hierarchical positions or horizontal positions in the organizational structure. Then what we have come up with is the following ***manipulation-involvement*** or ***MI-matrix***:

**Increasing complexity of involvement (i)**

| | ***Manipulation*** | | | | |
|---|---|---|---|---|---|
| ***Involvement*** | $\alpha_{11}$ | $\alpha_{12}$ | $\alpha_{13}$ | $\alpha_{14}$ | $\alpha_{15}$ |
| | $\alpha_{21}$ | $\alpha_{22}$ | $\alpha_{23}$ | $\alpha_{24}$ | $\alpha_{25}$ |
| | $\alpha_{31}$ | $\alpha_{32}$ | $\alpha_{33}$ | $\alpha_{34}$ | $\alpha_{35}$ |
| | $\alpha_{41}$ | $\alpha_{42}$ | $\alpha_{43}$ | $\alpha_{44}$ | $\alpha_{45}$ |
| | $\alpha_{51}$ | $\alpha_{52}$ | $\alpha_{53}$ | $\alpha_{54}$ | $\alpha_{55}$ |
| | $\alpha_{61}$ | $\alpha_{62}$ | $\alpha_{63}$ | $\alpha_{64}$ | $\alpha_{65}$ |
| | $\alpha_{71}$ | $\alpha_{72}$ | $\alpha_{73}$ | $\alpha_{74}$ | $\alpha_{75}$ |
| | $\alpha_{81}$ | $\alpha_{82}$ | $\alpha_{83}$ | $\alpha_{84}$ | $\alpha_{85}$ |

**Increasing complexity of manipulation (j)**

$\underline{\alpha_{ij}}$:

i = 8: Single fraud perpetrated by single individual
i = 7: Multiple frauds perpetrated by single individual
i = 6: Single fraud perpetrated by group of isolated individuals
i = 5: Multiple frauds perpetrated by group of isolated individuals
i = 4: Single fraud perpetrated by a horizontally collusive group
i = 3: Multiple frauds perpetrated by a horizontally collusive group
i = 2: Single fraud perpetrated by a vertically collusive group
i = 1: Multiple frauds perpetrated by a vertically collusive group

j = 5: Combination of 1, 2, 3 and 4
j = 4: Suppression or destruction of key transaction records
j = 3: Misrepresentation of the fundamental nature of transaction
j = 2: Falsification of transaction date/amount/particulars (double-entry basis)
j = 1: Falsification of transaction date/amount/particulars (single-entry basis)

We are of the view that frauds committed by vertically collusive groups involving fundamental misrepresentation of transaction records are among the most complicated ones and often are the hardest ones to crack and have the strongest repercussions on the enterprise. This is mainly because of the difficulty to figure out exactly at which organizational level the fraud actually originated and how high up (or deep down) the organizational hierarchy the 'rot' runs in the event of a vertical collusion. Therefore, in terms of involvement and manipulation, $\alpha_{15}$ is of the highest order of complexity while $\alpha_{81}$ is the least complex in our *MI-matrix*. Illustratively, the Enron case would definitely figure very close to the $\alpha_{15}$ cell on the *MI-matrix*. However, the classifications used in constructing the above matrix may always be fine-tuned by the investigative accountant to better suit the particulars of a case.

Once a particular case has been objectively classified on the *MI-matrix*, the investigative accountant may start looking for incriminating evidence in the financial records *from the right perspective*. For example, the search perspective will definitely differ if there is fundamental alteration in the nature of a transaction as compared to a simple erring journal entry. The perspective will also differ if only a single individual is involved rather than a collusive group.

## From Kautilya to Benford

After a financial fraud has been objectively identified based on the classification scheme proposed by Kautilya, comes the most important task of locating the fraudulent transactions form a vast sea of accounting records. In this regard, perhaps the most interesting methodological tool (still under a lot of academic research) is that offered by a 19th century mathematical enigma known as *Benford's law*.

## The discovery and re-discovery of Benford's law

In 1881, an American mathematician **Simon Newcomb** discovered to his surprise that the first few pages of a logarithmic table corresponding to the lower significant digits (typically those below 5) were comparatively dirtier than the later pages corresponding to the higher significant digits (typically those above 5). [8] This he attributed to greater usage of the first pages than the later ones; which in turn led him to reason that the

probability distribution of an user accessing any of the pages at any given time was skewed in favour of the earlier pages corresponding to the lower significant digits! This was directly in contrast with the normal theory of probability according to which the probability of randomly picking any number between one and nine should be equal to the unique value of 1/9 or roughly 11.11%. Almost half a century later in 1938, another American – the physicist **Frank Benford** was going through a large collection of numerical data from disparate sources when he stumbled upon a similar finding. [9] Benford came up with a huge volume of data to empirically support his finding and went on to publish his findings in a number of papers. Thus the 'principle' came to be known as "Benford's Law".

The biggest characteristic feature of the Benford distribution is that it can act as the "**signature of Nature**". In accordance with Benford himself, while we count arithmetically as 1, 2, 3, 4, … ; *nature* counts geometrically as $e^0$, $e^x$, $e^{2x}$, … etc. Thus Benford's distribution is observable in most naturally occurring numbers but not in artificially manipulated or concocted data. Accounting data is one type of data that is expected to closely follow the Benford distribution. *Therefore, theoretically, the more an observed set of accounting data deviates from the pattern predicted by Benford, the more are the chances that the data is not authentic*.

Although Benford's distribution is not a probability distribution in the true sense of the term since it diverges; it can explain a host of physical and man-made features better than any other known probability distribution. For example, if street addresses are distributed

uniformly over the range of 1 to a specified cut-off point, then they will follow a pattern closely resembling the Benford distribution.

**Table I**

| **First Significant Digit** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
|---|---|---|---|---|---|---|---|---|---|
| **Benford Probability** | **0.301** | **0.176** | **0.125** | **0.097** | **0.079** | **0.067** | **0.058** | **0.051** | **0.046** |

There have been some research already on the application of Benford's Law to financial fraud detection but most of the practical work in this regard has been concentrated in detecting the first digit frequencies from the account balances selected on basis of some known audit sampling method and then directly comparing the result with the expected Benford frequencies. We have voiced slight reservations about this technique in so far as that the Benford frequencies are necessarily **steady state frequencies** and may not therefore be truly reflected in the sample frequencies. As samples are always of finite sizes, it is therefore perhaps not entirely fair to arrive at any conclusion on the basis of such a direct comparison, as the sample frequencies won't be steady state frequencies.

However, we have shown (Kumar and Bhattacharya, 2002) that if we draw digits randomly using the **inverse transformation technique** from within random number ranges derived from a cumulative probability distribution function based on the Benford frequencies; then the problem boils down to running a *goodness of fit* kind of test to identify any significant difference between observed and simulated first-digit frequencies. This test may be conducted using a known sampling distribution like for example the **Pearson's $\chi^2$ distribution**. [10]

The first-digit probabilities can be best approximated mathematically by the log-based formula as was derived by Benford: **P (First significant digit = d) = $\log_{10}$ [1 + (1/d)].**

**Computational Algorithm:**

1. Define a finite sample size n and draw a sample from the relevant account balances using a suitable audit sampling procedure (like *monetary unit sampling* which we have discussed briefly below)

2. Perform a continuous Monte Carlo run of length $\lambda^* \approx (1/2\varepsilon)^{2/3}$ grouped in epochs of size n using a customized spreadsheet software package. Derivation of $\lambda^*$ and other statistical issues have been discussed in detail in our earlier paper (Kumar and Bhattacharya, 2002)

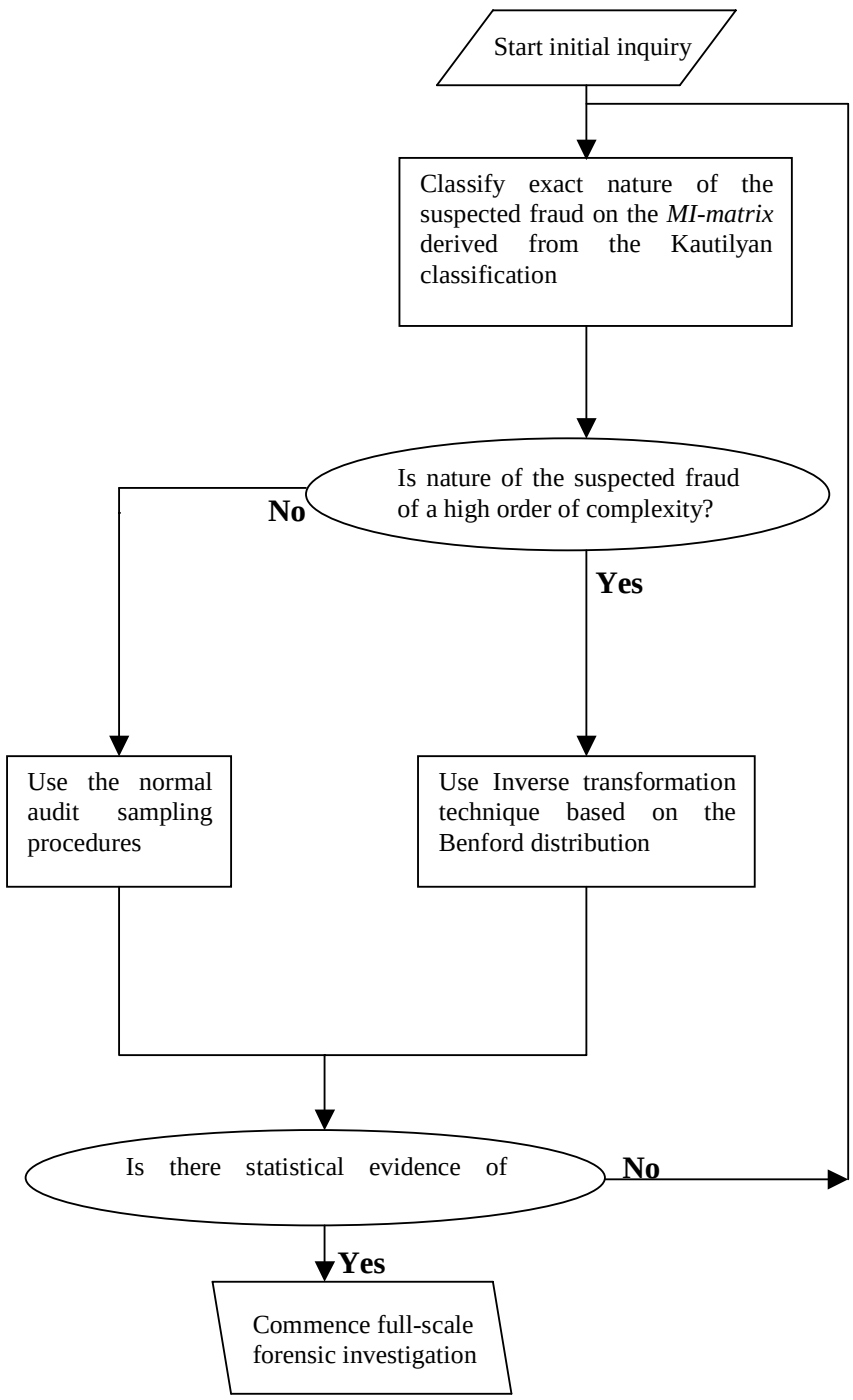
3. Test for significant difference in sample frequencies between the first digits observed in the sample and those generated by the Monte Carlo simulation by using a "goodness of fit" test using the $\chi^2$ distribution. The null and alternative hypotheses are as follows:

**$H_0$:** The observed first digit frequencies approximate a Benford distribution

**$H_1$:** The observed first digit frequencies do not approximate a Benford distribution

This statistical test will not reveal whether or not a fraud has actually been committed. All it does is establish at a desired level of confidence, that the accounting data has not been manipulated (if $H_0$ cannot be rejected).

A statistical sampling method particularly useful for the investigative accountant is the *monetary unit sampling*, which takes into account the materiality of various items by giving proportionately greater weightage to those items that have higher monetary values. This method is useful in situations where the auditors normally expect a very low level of errors and where there are no zero or negative balances in any of the accounts subjected to sampling. ***The method is particularly suitable for forensic accounting purposes where the auditor suspects material overstatement of accounts on a selective basis in an otherwise robust accounting system***. The monetary unit sampling technique treats each monetary unit in the account balances under examination as a separate part of the population. The items with larger monetary values have a greater probability of selection (as they are automatically given a larger weightage in proportion to the size of the monetary units contained therein). Also populations having zero balances are not considered under this method. The selection of the sample is the done on the basis of cumulative monetary values for all the available account balances so as to give higher weightage to the account balances having higher monetary values. Hence this suggested sampling technique is in accordance with the *materiality convention* of accounting. ***The fraud classification scheme proposed by Kautilya can thus be effectively combined with the mathematics of inverse transformation using Benford's law and statistical audit sampling into quite a formidable toolkit for the tech-savvy investigative accountant.***




**A suggested flow chart to combine Kautilyan classification scheme with relevant statistical sampling tools**

## In conclusion

From the days of Kautilya to the present day it is not as much the psychosocial profile of the perpetrator as the modus operandi of corporate fraud that has changed due to changing techno-economic factors. In the modern age of hi-tech commerce there are ample opportunities for both the perpetrators as well as the investigators of financial frauds to keep adding new twists to their schemes. Here we have looked but at a mere handful of the methodological tools for identification, search and detection of financial frauds available to the modern-day investigative accountant and also have proposed a few new ones ourselves. We have shown that the range of tools at the disposal of the investigative accountant can be substantially broadened by combining the fraud classification scheme outlined in the Arthashastra combined with the mathematical elegance of Benford's law.

However, the search for higher degrees of technical sophistication in investigative accounting is a never-ending one as are all scientific quests. It will perhaps pay to remember that no accounting control system can ever be built which will be robust enough to reduce the probability of fraud to an absolute zero. On the other hand, as it is human beings who ultimately commit all frauds, no matter the level of technological sophistication involved there will always be some human errors of judgment which will eventually become the leads for the investigators to track down the perpetrator/s. This proposes to be a fascinating, never-ending saga. We strongly feel that this very opportunity of pitting mind against mind and technology against technology is primarily what gives the practice of investigative accounting its natural charm.

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