CHAPTER III

RESEARCH METHODOLOGY
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3.1: Focussing the Issue

The present study is basically designed to be an exploratory research. It is a blending of (i) model building, (ii) hypotheses testing, (iii) case studies and (iv) simple fact presentation. The researcher has endeavoured to explore, through survey, much of the available information on depreciation accounting. An attempt has been made to build hypotheses. Facts have been simply presented, wherever necessary, in different chapters. In fourth, sixth, seventh and ninth chapters case studies have been done. A model has also been proposed in the last chapter for calculation of depreciation.

3.2: Hypotheses of the study

For a meaningful approach to the investigation under consideration, it has been deemed necessary to view the problem against the background of a sound theoretical framework. With this end in view, a review of literature on depreciation accounting has been made. But the related published literature on depreciation accounting in Bangladesh is, indeed, scanty. Hence, the hypotheses to be tested have been deduced on the basis of partly literature review, partly pilot study* and

* The preliminary draft of the schedules (meant for collection of data) was pilot-tested by interviewing thirty two concerned respondents of different industries under study to remove the ambiguities from the questions.
partly the researcher's intuition. The null hypotheses and
the way they have been derived are stated below:

(A) Depreciation accounting principles: The researcher has
seldom come across literature having discussion on depreciation
accounting principles. However, from the discussion made in
chapter I under the sub-heading Genesis of the study, the
following depreciation principles emanate:

(a) Depreciation is to be charged in terms of allocation
of original cost of fixed assets.

(b) Residual value, if any, is to be considered while
charging depreciation on fixed assets.

(c) Depreciation is to be charged equitably (that is, in
a rational and systematic manner) over the estimated useful
life of fixed assets.

(d) The useful life of fixed assets is to be estimated as
accurately as possible for depreciation calculation.

(e) The obsolescence of a fixed asset due to innovation
or technological development is to be considered one of the
guiding principles of estimating depreciation.

(f) The rate of depreciation accounting is to be in
consonance with the actual time for which the asset is put
to use.

(g) The method of charging depreciation is to be
consistently used.
Depreciation process is to be used as a measure for fair ascertainment of cost and consequential profit or loss.

Depreciation is to be charged keeping in view inflation in the economy.

Depreciation is to be charged basing on the proportion of services or output derived from the asset each year.

These principles have prompted the researcher to see whether the policy dealing personnel differ, across industries and between sectors, with respect to the extent of existence of depreciation accounting principles in the depreciation policy pursued by the industrial undertakings of Bangladesh. Again, it is a matter of his interest to study whether any difference or gap between the actual and normative practices of depreciation accounting principles exist in the industrial organizations of Bangladesh. On the basis of these interests two hypothesis have been set up hereunder:

Ho-1: There is no significant difference of opinion amongst the policy dealing personnel, across industries and between sectors, with respect to the extent of actual practice of different depreciation principles.

Ho-2: There is no significant difference, for a given industry or sector, between the actual and normative practices of different depreciation principles.

(The above hypotheses have been tested in Chapter IV)

(B) Depreciation policy guidance: It is presumed that the factors guiding depreciation policy in the industrial enterprises of
Bangladesh are (i) traditional and customary practice, (ii) advice and guidance of professional chartered accountants, (iii) prevailing legal codes of the country like Companies Act, Income Tax Act, etc. and (iv) parent company's guidance (in case of multinational companies). It is of interest to know whether there exists any difference of views amongst the policy dealing personnel of different industrial undertakings as to the factors having influence on depreciation policy. It is, therefore, hypothesized that:

Ho-3: There is no significant difference of opinion amongst the policy dealing personnel, both across industries and between sectors, with respect to the factors guiding depreciation policy.

(The above hypothesis has been tested in Chapter IV).

(C) Concepts of depreciation: The concepts of depreciation, as discussed in chapters I and II, are varied. It has been gathered from the pilot study undertaken that the concepts of depreciation used in the industrial enterprises of Bangladesh may not so much vary from one industry to another and from one sector to another. The policy dealing personnel, both across industries and between sectors, may not differ with one another with respect to the concepts of depreciation they are using in their respective industries and sectors. It is, therefore, hypothesized that:

Ho-4: There is no significant difference of opinion amongst the policy dealing personnel, both across industries and between sectors, with respect to the concepts of depreciation followed by them (enterprises).

(The above hypothesis has been tested in chapter IV).
(D) **Purpose of charging depreciation**: It is generally believed that the purposes of charging depreciation are: (a) allocation of cost to fairly measure profit or loss; (b) proper evaluation of fixed assets; (c) financing the replacement of fixed assets; (d) financing the working capital needs and (e) having the advantage of tax relief. The pilot study undertaken by the researcher indicates that the policy dealing personnel do not differ from industry to industry and sector to sector as far as the said purposes of charging depreciation are concerned. Accordingly, it is hypothesized that:

**H0-3**: There is no significant difference of opinion amongst the policy dealing personnel, both across industries and between sectors, with respect to the purposes motivating the charging of depreciation.

(The above hypothesis has been tested in chapter IV).

(E) **Depreciation methods and their selection**: It is gathered from the survey of literature as well as from the pilot study undertaken that in the industries under study, the popularly used methods of charging depreciation are straight-line and reducing-balance methods. "They are followed by about 90 per cent industries, a few of which apply both the systems for different assets." In this


connection, it is worthwhile to note that there are certain factors which influence the selection of depreciation methods. And these factors include: (a) equitable distribution of the asset's cost over its estimated useful life, (b) simplicity in application, (c) conformity with income tax regulations, (d) recovery of funds for the replacement of assets, (e) an ultimate equalizing effect of the rate of return because of lower repairs and maintenance cost coupled with higher depreciation charge in the initial years and vice versa in the later years, (f) consistency with other enterprises in the same sector of the same industry, (g) recognition of functional obsolescence of the asset by concentrating the major part of depreciation charge in the initial years of its estimated useful life, (h) matching of costs with revenues realistically, (i) as a matter of traditional practice, (j) charging of higher depreciation in view of higher income from greater serviceability of the asset in the initial years and vice versa in the later years. Hence, the researcher is interested to examine how these factors have been ranked and whether there is any significant difference in the ranking given by the policy dealing personnel for selecting the methods mentioned above. Therefore, it is hypothesized that:

Ho-6: There is no significant difference, from industry to industry, as well as from sector to sector with respect to the use of depreciation methods.

Ho-7: There is no significant relationship between the rankings of the factors considered for the selection of straight-line method and those for reducing-balance method.

(Ho-6 has been tested in chapter-V and Ho-7 in chapter IV).

(F) Depreciation rate fixation: It is generally thought that the factors which, ipso facto, influence depreciation rate fixation in the industrial enterprises of Bangladesh are, *inter alia*, (a) physical or useful life of fixed assets, (b) asset utilisation intensity, (c) technological development, (d) nature of assets, (e) depreciation rates followed by other units in the same sector of the same industry, (f) depreciation allowance rates prescribed by Tax Codes and (g) arbitrary estimation. It is also believed that the ranking given in order of importance to the factors influencing depreciation rate fixation may not significantly vary. The researcher is, therefore, interested to investigate whether or not the policy dealing personnel within each industry and within each sector under study significantly agree with each other as to the ranking of factors affecting depreciation rate fixation. It interests the researcher further to study whether opinions of the policy dealing personnel significantly vary from industry to industry and sector to sector regarding the ranking of factors having influence on depreciation rate fixation. Accordingly, the following three hypotheses emerge:
Ho-8: There is no significant agreement in the opinions of
the policy dealing personnel within each industry and within each
sector under study with respect to the ranking of factors influencing
depreciation rate fixation.

Ho-9: There is no significant difference of opinion amongst
the policy dealing personnel from industry to industry with regard
to the ranking of factors influencing depreciation rate fixation.

Ho-10: There is no significant difference of opinion between
the policy dealing personnel of public sector and those of private
sector with respect to the ranking of factors influencing depre-
ciation rate fixation.

(The above hypotheses have been tested in chapter IV).

(g) Useful life estimation: It is a well-known fact that the useful
life of fixed assets is a vital variable in determining the amount
of depreciation. Perhaps it influences the calculation of depre-
ciation more than all other variables. Generally, the factors
having influence on the determination of the useful life of fixed
assets include manufacturers' or suppliers' specification, past
experience, mechanical engineers' recommendation, civil engineers'

5 Ibid., p.63.
6 M.S.Srinivasan, Financing Asset Replacement: A Study
and analysis of some factors (Calcutta: The Institute of Cost and
7 Ibid., pp.73-74; also see International Accounting
Standards 4, "Depreciation Accounting", International Accounting
8 M.S.Srinivasan, op.cit., p.76.
recommendation of arbitrary estimation, Tax Codes, etc. In this connection, there is also a view that there are different types of lives (namely, physical life, technological life, and market life of the asset's output) which are taken into consideration for the purpose of estimating the useful life of fixed assets. Furthermore, it deserves mention that there are some who hold the view that the factors and the types of lives stated above may not also help in estimating the fixed asset's useful life accurately. According to some authors, actuarial techniques may well be adapted for use in estimating the useful lives of physical properties. Lewis is of the view that the life table of machines somewhat resembles the life table of human beings. Sengupta shares these views by suggesting Makeham's law (which is an actuarial method for constructing the life table of human beings) for estimating the life of machines. It is, however, believed on the basis of the pilot study undertaken that the factors and types of lives stated earlier are all more or less equally considered for estimating the useful life of fixed assets.

Ibid.

10 Ibid., p. 2.


The pilot study also indicates that the opinions of the policy dealing personnel may not significantly vary from industry to industry and sector to sector as to the consideration of the above stated factors and types of lives; similarly, the difference of opinions amongst the policy dealing personnel, whether across industries or between sectors, may not also exist significantly with regard to the applicability of Makhem's Law (a law of mortality of human beings) for estimating the useful life of machines. It is, therefore, hypothesized that:

Ho-11: There is no significant difference of opinion amongst the policy dealing personnel, both across industries and between sectors, with respect to the consideration of different (a) factors and (b) types of lives in estimating the useful life of fixed assets.

Ho-12: There is no significant difference of opinion amongst the policy dealing personnel, both across industries and between sectors, with respect to the applicability of Makhem's Law in estimating the useful life of machines.

(The above hypotheses have been tested in chapter IV).

[H] Depreciation as a source of funds or otherwise: It is a widely held view that depreciation, when charged to revenue as an expense, also sets aside or segregates in the same way a fund equal to it out of the same. 16 Helfert recognizes depreciation as a source

Some will call depreciation a source of funds; other will say with respect to operations that sales is the only real source and that depreciation, being a non-cash charge, falsely offsets and reduces the funds flow from profit. To record the current flow it must, therefore, be added back (in effect as an additional source) to profit. Whichever interpretation is used, the amount of depreciation charged against operations should be reflected as a source.

Conversely, most accountants are aghast at the idea that depreciation provides funds. They say that depreciation is a prepaid cost to be charged to operations over the serviceable life of the facility. Depreciation, in fact, in itself does not provide a flow of funds to take care of asset replacements. Funds come from the revenues and the charging of depreciation does not increase the flow of funds. This controversy interests the researcher to examine, in the context of the industries under study, whether the policy dealing as well as operating personnel significantly differ from industry to industry and sector to sector with respect to treatment of depreciation as a source of funds. Thus, it is hypothesized that:

He-13: There is no significant difference of opinion amongst the policy dealing as well as operating personnel, both across industries and between sectors, with respect to the treatment of depreciation as a source of funds or otherwise.

(The above hypothesis has been tested in chapter VII).


(I) Accounting depreciation for extra-shift uses of machines: It has been gathered through pilot study that no depreciation is charged at an extra rate in the industrial concerns for extra-shift uses of machines but the operating personnel of both public and private sector enterprises are in favour of charging depreciation at an extra rate, keeping in view the use intensity of machines. The pilot study further reveals that there is not much difference in views amongst the operating personnel sector-wise, regarding their suggestions of accounting depreciation rates for extra-shift uses of machines. Thus, it has been hypothesized that:

H0-14: There is no significant difference of opinion between the operating personnel of public sector and those of private sector industrial enterprises with respect to their suggestions for accounting depreciation rates for double-shift and triple-shift uses of machines.

(The above hypothesis has been tested in chapter VIII).

(J) Tax-Law prescribed depreciation allowances: Depreciation allowances\(^1\) as prescribed by the Bangladesh Income Tax Law include (a) normal depreciation allowance, (b) initial and special depreciation allowance, (c) extra-shift depreciation allowance and (d) accelerated depreciation allowance and investment allowance.

It becomes a matter of interest for the researcher to know whether the rates of these allowances are adequate or not to the

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industrial organisations.

Of all the rates of different depreciation allowances (as shown in table 8.14 in chapter VIII), the rates prescribed for new provisions of accelerated depreciation and investment allowance seem to be very high. This arouses curiosity in the mind of the researcher to be apprised of the views of the operating personnel regarding the justification or otherwise of the rates of the above two depreciation allowances.

Another point of query that evokes interest in the researcher is whether the bases (original cost and written-down value) of Tax Law prescribed depreciation allowances are justified or not.

The pilot study undertaken by the researcher indicates that both policy dealing and operating personnel do not so much differ from industry to industry and sector to sector, in their views in regard to the above points of interest. Therefore, the following hypotheses emerge:

Ho-15: There is no significant difference of opinion amongst the policy dealing as well as operating personnel, both across industries and between sectors, with respect to adequacy or otherwise of the rates of different depreciation allowances prescribed by Bangladesh Income-Tax Law.

Ho-16: There is no significant difference of opinion amongst the policy dealing and operating personnel, both across industries
and between sectors, with respect to the justification or otherwise of new provision for accelerated depreciation and investment allowances at the existing high rates.

Ho-17: There is no significant difference of opinion amongst the policy dealing as well as operating personnel, whether across industries or between sectors, with respect to the justification or otherwise of the bases (that is, original cost and written-down value) of different depreciation allowances under Tax Law.

(The above hypotheses have been tested in chapter VIII).

(K) Depreciation and inflation accounting: Runaway inflation has been a common phenomenon in most countries, particularly since World War II, albeit the need for stabilized accounting was appreciated as far back as 1955 when Sweeney's stabilized accounting was published. In Bangladesh, inflation is highly unlikely to disappear in near future. It is a well-known fact that the value of an asset, subsequent to its acquisition, increases considerably because of inflation. Consequently, depreciation based on historical cost does not fully reflect the value of the asset consumed during the accounting period. Charging of depreciation on the basis of historical cost helps only in maintaining proprietorship capital as represented by its operating capacity. Some have suggested that

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depreciation should be charged on replacement cost to save the industries of Bangladesh from impending scarcity of capital. This has prompted the researcher to study the reaction of the policy dealing and operating personnel of every industry and sector under study, on the issue of charging depreciation under Current Value Accounting. It is a well-acknowledged fact that charging of depreciation under inflation accounting has both merits and constraints. The estimation of current value is a must for the purpose of charging depreciation under Current Value Accounting. And this estimation of current value is a difficult job. It is also a widely held view that Current Value Accounting adds to work load as well as expenditure load and above all, this Current Value Accounting/Inflation Accounting is a complicated matter. At the time of pilot study undertaken, all possible merits and demerits were explained to the respondents and then it was learnt that many of them were in favour of introducing Current Value Accounting and that both the policy dealing and operating personnel did not so much differ from one industry to another and from one sector to another regarding charging of depreciation under inflation accounting. It is, therefore, hypothesized that:

Ho-18: There is no significant difference of opinion amongst the policy dealing as well as operating personnel, both across industries and between sectors, with respect to the introduction of Current Value Accounting for charging depreciation to give effect to inflation.

(The above hypothesis has been tested in chapter IX).

25 Ibid., p.48.
3.3: The Population

The population for the purposes of this study comprises all undertakings in Bangladesh in jute, textile, chemical and pharmaceutical and steel industries—whether in public sector or in private sector. On the basis of (i) size, (ii) industry and (iii) sector to which the enterprises belong, the population has been sub-divided into different mutually exclusive and collectively exhaustive strata. From each stratum, a sample of enterprises of pre-determined size has been randomly drawn. The population for this study encompasses 265 industrial enterprises, the break-up of which is as follows:

Table 3.1: Break-up of population for the study

<table>
<thead>
<tr>
<th>Industries studied</th>
<th>Population</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public sector</td>
<td>Private sector</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>No. of enterprises</td>
<td>No. of enterprises</td>
<td></td>
</tr>
<tr>
<td>Jute</td>
<td>6926</td>
<td>18</td>
<td>87</td>
</tr>
<tr>
<td>Textile</td>
<td>55</td>
<td>45</td>
<td>100</td>
</tr>
<tr>
<td>Chemical and Pharmaceuticals</td>
<td>8</td>
<td>31</td>
<td>39</td>
</tr>
<tr>
<td>Steel</td>
<td>17</td>
<td>22</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>116</td>
<td>265</td>
</tr>
</tbody>
</table>

As per record with Bangladesh Jute Mills Corporation on April 9, 1981, out of total 72 jute mills in the public sector, one was under construction and two started production in 1980. So, these three jute mills have not been considered in the population for this study.
The study includes two more industrial undertakings — (1) Bangladesh Lamps Limited and (2) Bangladesh Electrical Industries (Private) Limited. These two enterprises have been included in the study exclusively for the purpose of case studies, because they are the only two manufacturing organisations which maintain depreciation accounting under a distinctive accounting system, namely, inflation accounting. Discussion on them is confined to chapter IX. These two enterprises have not been aggregated with other sampled enterprises for the purpose of statistical analysis.

3.4: The sampling procedure

Stratified random sampling technique has been used with proportional allocation basis (of around 25 per cent) in mind to draw the samples from the population of each stratum. However, in certain cases where the population size is small, this proportional allocation basis has not been strictly adhered to.

The criterion used for determining the size of an enterprise is the written-down book value of its fixed assets together with all other assets' value as of 31st December 1980. For the purpose of this study, samples have been drawn only from the industrial enterprises constituting the population (as mentioned earlier). The various enterprises have been divided into three strata according to size—the first stratum includes enterprises having total assets amounting to Taka 5 crores or less each, the second stratum consists of enterprises whose value of total assets is more than Taka 5 crores but less than Taka 10 crores each and the third stratum comprises
those enterprises whose total assets have a value of more than Taka 10 crores each. All these can be seen in table 3.2 that follows.

3.5 Sources of information

In Bangladesh, public sector industrial enterprises are placed under the control and supervision of sector corporations like Bangladesh Jute Mills Corporation (BJMC), Bangladesh Textile Mills Corporation (BTMC), Bangladesh Chemical Industries Corporation (BCIC) and Bangladesh Steel and Engineering Corporation (BSEC) which were all set up under the President's Order No.27 — The Bangladesh Industrial Enterprises (Nationalisation) Order, 1972. Therefore, all policy matters are decided at the corporation level in case of public sector enterprises. The plant level managements are engaged in implementing the policies framed by corporations. In case of public sector, primary information was collected from the policy dealing personnel working at the above 4 sector corporations' head offices and in case of private sector, from the policy dealing personnel working at the head offices of the enterprises. Primary data were also collected from the operating personnel engaged in the implementation of accounting policies of selected sampling enterprises, regardless of whether they belonged to public or private sector.

Here it is worthwhile to give a profile to the policy dealing and operating personnel meant for this study. The policy dealing personnel are directly or indirectly concerned with the
Table 3.21 Population size and Sample size in each stratum

<table>
<thead>
<tr>
<th>Strata (Size of assets' Value)</th>
<th>Public Sector</th>
<th>Private Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jute Industry</td>
<td>Textile Industry</td>
</tr>
<tr>
<td></td>
<td>Chem. and Pharma Industry</td>
<td></td>
</tr>
<tr>
<td>Pop. - Sample Size on</td>
<td>Pop. - Sample Size on</td>
<td>Pop. - Sample Size on</td>
</tr>
<tr>
<td>Stratum I (Taka 5 crores or less)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>29</td>
</tr>
<tr>
<td>(33.33)</td>
<td>(24.14)</td>
<td>(50)</td>
</tr>
<tr>
<td>Stratum II (Above Taka 5 crores but not above Taka 10 crores)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>(26.83)</td>
<td>(23.53)</td>
<td>(100)</td>
</tr>
<tr>
<td>Stratum III (Above Taka 10 crores)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>(25)</td>
<td>(22.22)</td>
<td>(33.33)</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>18</td>
</tr>
<tr>
<td>(100)</td>
<td>(26.59)</td>
<td>(100)</td>
</tr>
</tbody>
</table>

N.B. (1) "N.E." stands for number of enterprises.
(2) Figures in the parentheses indicate the percentage of enterprises.
formulation of depreciation policies. They are normally professional experts and/or have considerable job experience. They include Finance Director, Chief Accountant, Controller of Accounts, Additional Chief Accountant, Deputy Chief Accountant etc. in the public sector industrial enterprises of Bangladesh. In case of private sector, the term includes General Manager (Finance), Finance Manager, Manager (Accounts), Deputy Manager (Accounts), Chief Accountant and in some cases Senior Accountant and Accountant as well. On the other hand, the operating personnel are involved in the implementation of depreciation policies. They are mostly Senior Accountants, Accountants and Assistant Accountants. These personnel have also job experience. It is, however, needless to say that, in most cases, the policy dealing personnel are comparatively highly qualified in relation to the personnel concerned with the implementation of policies.

For collection of secondary information, existing literature (like books, journals, magazines etc. and official records, such as, reports, statements, manuals and accounts of sector corporations and individual enterprises concerned) were consulted. The lists of enterprises were procured, in case of public sector, from the aforesaid sector corporations; and in case of private sector, similar lists were collected from Bangladesh Jute Spinners Association, Bangladesh Specialised Textile Mills Association, Bangladesh Association of Pharmaceuticals Industries and Bangladesh Re-Rolling Mills Association.

The following table shows the numbers of policy dealing
and operating personnel from whom primary data were collected:

<table>
<thead>
<tr>
<th>Industries under study</th>
<th>Number of policy dealing personnel</th>
<th>Number of operating personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public</td>
<td>Private</td>
</tr>
<tr>
<td>Jute</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>Textile</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Chemical and Pharmaceuticals</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Steel</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>45</td>
</tr>
</tbody>
</table>

3.6: Investigation procedure

At the first instance, much of the available literature was reviewed. Secondly, some professors of accounting and statistics, and some accounting associations both at home and abroad were contacted through mail for clarification of certain points. These points are: (i) Is depreciation in itself a source of funds? (ii) What are the points of clear-cut difference among Current Purchasing power Accounting, Current Cost Accounting and Continuously Contemporary Accounting so far as adjustment of depreciation is concerned? (iii) Confusion regarding the applicability of different statistical test procedures etc. Thirdly, all the corporations under study and all the enterprises, whether public or private, were
visited by the researcher to interview the available policy dealing and operating personnel by administering interview schedules. Lastly, books of accounts, annual financial statements (profit and loss account and balance sheet) etc. were consulted for gathering factual information.

3.7: Test Vehicles

The test vehicles of this study are four sets of schedules which have been given in appendix B. The first set of schedule is meant for policy dealing personnel, the second set for the operating personnel and the third set for chief operating personnel of each of the 66 selected sampling units functioning in both public and private sectors of Jute, Textile, Chemical and Pharmaceutical and Steel industries of Bangladesh. The fourth set of schedule is meant for both policy dealing and chief operating personnel of two manufacturing organisations practising inflation accounting.

The first set of schedule contains 21 structured opinion-based questions concerning depreciation accounting principles and policies. The second set comprises 15 structured opinion-oriented questions on depreciation practices and the third one consists of 21 questions for factual information regarding depreciation practices. Apart from these, there is another set of schedule covering 12 questions based on opinions and actual practices of depreciation accounting in an inflationary environment.

To develop a list of information items for framing schedules, the researcher, however, reviewed available existing literature on
depreciation accounting and consulted financial reports and manuals of different sector corporations and industrial enterprises. Such a study revealed a list of information items. The preliminary draft of the schedules was prepared and pilot-tested. Three policy dealing personnel and three operating personnel of each of the four industries under study in the public sector and also four policy dealing personnel and four operating personnel in the private sector were interviewed to pre-test the preliminary draft of the schedules. With a view to eliminating ambiguities from the questions asked, the schedules and pilot-test results were discussed with a few policy dealing and operating personnel and some university professors too. After giving a careful consideration to their suggestions, the schedules were given final shape for administration.

3.8: The data processing procedure

After the schedules were administered to and collected from respondents, the researcher applied the process of tabulation to summarize all of the data from the schedules for the purpose of statistical analysis. First, the data were transferred from the schedules to the code sheets and then the master tables were prepared with the data therefrom.

Initially, most of the tabulations and some of the calculations were conducted by hand. However, later on, an electronic calculator was utilized for computations and application of statistical tests, excepting the chi-square and Fisher's exact probability tests for which a use of computer facilities was made.
The computational precision was mostly confined to two digits after decimal points. However, in some instances, three digits to the maximum were regarded.

3.9 Statistical techniques used

To begin with, it may be mentioned that the basic descriptive statistics used in this study are frequencies, percentages, means and the like. As to the inferential statistics used to test the tenability and non-tenability of null hypotheses, it is worthwhile to state that test procedures used in the study are only non-parametric statistical tests. There are, however, certain reasons for which these tests have been applied. First, the researcher was in obscurity about the normality of the distribution of population from which samples were drawn. Secondly, the available data were only in ranking and/or rating form and qualitative and/or ordinal in nature. Thirdly, in order to increase the generality of findings, since nonparametric statistical tests could be hemmed in by a fewer and less stringent assumptions than parametric tests, non-parametric tests rather than corresponding parametric tests have been used to avoid making assumptions concerning normality (say).

For the purpose of testing the statistical validity of null hypotheses stated in/chapter 4, the following inferential tests have been used:


(1) **Chi-Square test** for independent samples: This test has been applied to determine whether the observed differences in the relative frequency distributions across independent samples constitute convincing evidence of significant differences in the responses. The formula used in the study is: \( \chi^2 = \sum \frac{(f_o - f_e)^2}{f_e} \) where the symbols \( f_o \) and \( f_e \) stand for observed and expected frequencies and summation is over all categories whose frequencies are observed (and whose expected frequencies are not below some minimum value).

(2) **Fisher's exact probability test** The purpose of using this test is not different from that of the Chi-square test. This test has been used for the observed frequencies in a 2x2 contingency table as hereunder:

<table>
<thead>
<tr>
<th></th>
<th>-</th>
<th>+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>A</td>
<td>B</td>
<td>A + B</td>
</tr>
<tr>
<td>Group II</td>
<td>C</td>
<td>D</td>
<td>C + D</td>
</tr>
<tr>
<td>Total</td>
<td>A+C</td>
<td>B+D</td>
<td>N</td>
</tr>
</tbody>
</table>

The formula for finding the exact probability of a particular set of frequencies in the above 2x2 contingency table, where the marginal totals are considered fixed, is as follows:

\[
P = \frac{(A+B)! (C+D)! (A+C)! (B+D)!}{N! A! B! C! D!}
\]

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30 Sidney Siegel, *op.cit.*, pp.96-97.
Stated in words, the exact probability of the observed occurrence is calculated by taking the ratio of the product of the factorials of the four marginal totals to the product of the cell frequencies multiplied by $N$ factorial.

(3) **Wilcoxon matched-pairs signed-ranks test**: This test has been used to test the magnitude of differences between the paired observations, that is, between actual and normative depreciation accounting principles. These differences have been ranked in increasing order of absolute magnitude, the smallest absolute difference receiving a rank of one. Tie ranks resulting from pairs having the same differences have been handled by assigning to each of the items the average of the ranks in question. Tie scores for a given pair resulting in a zero difference have been tackled first, by ranking them and then, by randomly assigning them to positive and negative signs. The smaller of the like-signed ranks have been summed up to determine Wilcoxon's $T$ value. But when the sample size (or $N$) is larger than 25, the sampling distribution for Wilcoxon's $T$ statistic is considered approximately normally distributed; and in this connection the following formula of mean, standard deviation and $Z$ statistic have been used:

\[
(1) \text{Mean} = \sqrt{\frac{T}{N(N+1)}}
\]

---


(ii) Standard deviation = $\sigma_T = \sqrt{\frac{N(N+1)(2N+1)}{24}}$ and

(iii) The significance test is based on

$$ Z = \frac{T - \mu_T}{\sigma_T} = \frac{T - \frac{N(N+1)}{4}}{\sqrt{\frac{N(N+1)(2N+1)}{24}}} $$

where

$N$ is the number of pairs ranked and $T$ is the sum of the smaller of the like-signed ranks.

(4) Kendall Coefficient of Concordance $W$ Statistic: This test has been applied to measure the degree of agreement or otherwise of rankings given by the policy dealing personnel within each industry and within each sector. The formula to calculate this statistic is hereunder:

$$ W = \frac{S}{\frac{1}{12} K^2 (N^2 - N)} $$

where $S$ = sum of the squares of the observed deviations from the mean of $R_j$, the rank totals, that is, $S = \sum \left( R_j - \frac{\sum R_j}{N} \right)^2$;

$K$ = Number of sets of rankings which is, in this case, the number of policy dealing personnel; $N$ = Number of factors ranked.

Formula for correction of ties: $T = \sum - \frac{(t-1)^3}{12}$, where $t$ stands for number of observations tied in a group for a given rank. The corrected $W = \frac{S}{\frac{1}{12} K^2 (N^2 - N) - \sum T}$ where $\sum T$ stands

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Ibid., pp. 231-235.
for summing the values of $T$ for all the $K$ rankings.

When $K$ is larger than 20, the distribution of $K(N-1) W$ is approximated by the Chi-square distribution with $(N-1)$ degrees of freedom.\(^3\)

(5) **Kruskal-Wallis One-way analysis of variance by ranks**:\(^4\)

This test has been applied to test the significance of inter-industry differences in rankings with respect to the factors influencing depreciation rate fixation. The formula of Kruskal-Wallis $H$ test is as follows:

$$H = \frac{12}{N(N+1)} \left( \sum_{j=1}^{K} \frac{R_j^2}{n_j} \right) - 3(N+1)$$

$$= \frac{12}{N(N+1)} \left( \sum \frac{R_j}{n_j} \right)^2 - 3(N+1)$$

where $K =$ number of samples; $n_j =$ number of cases in jth sample; $N= \sum n_j$, the number of cases in all samples combined; $R_j =$ sum of the ranks in jth sample (column); $\sum_{j=1}^{K} \frac{R_j}{n_j}$ directs one to sum over the $K$ samples (columns).

If there are more than 5 cases in various groups (in other words, if $n_j \geq 5$), the sampling distribution of $H$ follows closely

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\(^4\)Sidney Siegel, *Non-Cit.* p. 185; also see Ann Hughes and Dennis Graweis, *Non-Cit.*, p. 416.
the chi-square distribution with \((K-1)\) degrees of freedom\(^{36}\) (where \(K\) is equal to number of columns, that is, the number of industries under study in this case).

In the case of ties occurring between two or more scores, each score is given the mean of the ranks for which it is tied. To correct the effect of ties, the \(H\) statistic has been first computed by the formula given on the previous page and then divided by

\[
1 = \frac{\sum T}{N^3 - N}
\]

where

\[T = t^3 - t\] (when \(t\) = the number of tied observations in a tied group of scores); \(N\) = number of observations in all \(K\) samples together, that is, \(N = \sum n_j\); \(\sum T\) directs one to sum over all groups of ties. The corrected \(H\) statistic for ties has been computed by the following formula:\(^{37}\)

\[
H_c = \frac{12}{N(N+1)} \sum_{j=1}^{K} \frac{R^2_j}{n_j} - 3(N+1)
\]

\[
1 - \frac{\sum T}{N^3 - N}
\]

(6) **Mann-Whitney U-Statistic**\(^{38}\) This statistic has been used for inter-sector analysis of rankings with respect to the factors of influencing depreciation rate fixation. The value/\(\text{Mann-Whitney}\)

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\(^{36}\) Ann Hughes and Dennis Graweig, *ibid*.


U-statistic is the smaller of:

\[
U_1 = n_1 n_2 + \frac{n_1 (n_1 + 1)}{2} = \sum R_1
\]

and

\[
U_2 = n_1 n_2 + \frac{n_2 (n_2 + 1)}{2} = \sum R_2
\]

where \( n_1 \) = Number of respondents in public sector; \( n_2 \) = Number of respondents in private sector; \( \sum R_1 \) = sum of the ranks in public sector; and \( \sum R_2 \) = Sum of the ranks in private sector.

To correct the effect of ties, \( \sum T \) has been arrived at by summing the values of \( \frac{3}{12} t^2 - t \) for each of the tied groups (where \( t \) is the number of observations tied for a given rank).

If \( n_2 \) is larger than 20, the sampling distribution of \( U \) is expected to be approximately normally distributed, with:

\[
\text{Mean} = \mu_U = \frac{n_1 n_2}{2} \quad \text{and (after correction of ties)}
\]

\[
\text{Standard deviation} = \sigma_U = \sqrt{\frac{n_1 n_2}{N(N-1)}} \left[ \frac{\frac{3}{12} N - N - \sum T}{12} \right].
\]

Hence, the probability associated with a value as extreme as the observed value of \( U \) is determined by computing the value of the unit standard normal variate \( Z \) by the following formula:

\[
Z = \frac{U - \mu_U}{\sigma_U} = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{n_1 n_2}{N(N-1)} \left[ \frac{\frac{3}{12} N - N - \sum T}{12} \right]}}
\]

where \( N = n_1 + n_2 \).
(7) **Spearman rank correlation coefficient:** $r_s$;\footnote{William L. Hays and Robert L. Winkler, *Probability, Inference and Decision* (New York: Holt, Rinehart and Winston Inc., 1971), p. 841.} For the purpose of comparing the rankings of factors influencing straight-line and reducing-balance methods selection, this statistic has been used.

$$r_s \text{ or } \rho = 1 - \frac{6 \sum d_i^2}{N(N^2-1)}$$

where $r_s$ or $\rho$ = correlation coefficient between ranks; $N$ = number of paired observations; and $d_i$ = difference between each pair of ranks.

Since in this situation $N$ (number of paired observations, that is, number of factors influencing depreciation methods) is equal to 10, the following test\footnote{This test is really satisfactory, however, only when $N$ is fairly large; $N$ should be greater than or equal to 10. For reference, see *ibid.*, p. 844.} has been applied to test the significance of the Spearman rank correlation coefficient:

$$t = \frac{r_s \sqrt{N-2}}{\sqrt{1-r_s^2}}$$

with $N-2$ degrees of freedom.

3.10: **Level of significance**

For testing the statistical significance of association and differences amongst responses as well as ranks, two levels of significance, namely $\alpha = 0.05$ and $\alpha = 0.01$ have been used for this study.

3.11: **Footnote citation technique used**

The style of footnote citation used in this study follows
from what is suggested in the books of Roth, Best and Iverson. Footnotes have been numbered consecutively within a chapter. When a reference to the same author's same work has followed without any intervening reference, the abbreviation *ibid.* has been used. In case of the page number for the second or later reference being different, the page number has followed *ibid.* Again, in case of non-intervening reference, when the work has differed but the author has not, the abbreviation *idem.* (which means the same person) has been used. In other words, in case of the same author's different work in a consecutive footnote reference, *idem* has been used to avoid repetition of the author's name, while repeating exactly the same and non-consecutive reference of the same work and same page, *loc.cit.* with the surname of the author has been used. The abbreviation *op.cit.* following the surname of the author and being followed by the page number has been used when another reference has intervened. So, *op.cit.* has been used for the same work and different page reference and *loc.cit.* for the same work and same page reference. Both of them have been used when another reference has intervened. *Passim.* has been used for "here and there scattered" and *n.d.* for "no date of publication available or given". Instead of "and the following" *page/pages, f./ff.* has been used immediately after the page number. Instead of editor/editors of a book, *ed./eds.* has been used immediately before the name/names of the editor/editors. For a work translated by some body, *trans.* has been used immediately before his name.