CHAPTER I
INTRODUCTION

Industrialization in the modern age is held as a synonym of economic development. The importance of industrialization is marked by its contribution of improving agricultural productivity, stimulating better terms of trade, enhancing technological development and leading the economy on the way of increasing returns (Chatterjee, 2006).

The belief that real progress of India must ultimately depend on industrialization was once expressed by Pandit Jawaharlal Nehru. For India, with a high ratio of population to natural resources and in particular to land, manufacturing industry represents virtually the only hope for increasing labour productivity and raising the level of living. The industrial sector with a relatively higher capacity to save and invest, lends a powerful support in achieving the goal of a self-reliant and a self sustaining economy. The rapid stride in industrialization in India has been accompanied by a corresponding growth in technological and managerial skills, not only for efficient operation of highly complex and sophisticated industrial enterprises but also for their planning, design and construction. Realising the importance of industrialization in the Indian economic development, the Government of India had increased the outlay

for industries from a mere Rs. 55 crores in the First plan to Rs.58, 939 crores in the Tenth plan. (Tenth Five Year Plan, 2002-07)

Though a strong case thus has been built in favour of industrialization, it is not a smooth task in a developing country like India. The process of industrialization gets confronted with a number of barriers like scarcity of capital, inadequate infrastructural facilities, lack of appropriate technology, mismanagement, competition from imported goods, custom barriers etc. (Majumdar, 1996).

While quite many causes can be attributed to the setback in the industrial growth rate in India, the most striking has been the mounting industrial sickness. Industrial sickness not only tends to aggravate the problem of unemployment but also renders infructuous capital investment and creates an adverse climate for further industrial growth. While in advanced countries, where there are adequate social security benefits, this situation is accepted as a normal feature of the industrial scene, such sickness has much more serious economic consequences in a country like India where unemployment and scarcity of resources are the major problems.

Sick industries, start indicating signals which need to be identified and monitored before the industries become gravely sick. In the initial stages of sickness, the warning indications in the various functional areas are termed as *signals* like short term liquidity problems, revenue losses,

overuse of external credit leading to debt burden etc. Overtime, these signals get merged into *symptoms* getting related to plant performance, capacity utilization, share market price and practices in the area of finance, production, marketing and labour relations.

Some of the important *signals* of industrial sickness are

- Frequent breakdown of plants and machinery;
- Decline in technical efficiency;
- Non submission of data to banks and financial institutions;
- Irregular bank accounts;
- Decline in quality of product and service;
- Delay or default in payment of statutory dues such as provident fund, sales tax, excise duty etc and
- Frequent turnover of personnel.

Persistence of the above signals causes a stage when signals merge into symptoms, indicating the impending sickness of the firm.

Some of the important *symptoms* of sickness are

- Persistent shortage of cash;
- Decline in financial ratios;
- Continuous decline in market price of shares;
- Frequent requests to financial institutions for loans;

- Default in payment to suppliers, employees, financial institutions;
- Delay in audit of annual accounts;
- Building up of inventories;
- Reduced credit rating and
- Increase in mortgaged assets (PrasannaChandra, 2001)

The above signals and symptoms which are more, early warning signals assist in identifying whether the industrial unit is prone to sickness.

Industrial sickness however has been producing an adverse impact on the economy. It depicts a condition where the investment in sick units is completely dead. The problem of stringency of financial resources gets worsened. Money locked up in the sick units provides no returns and seriously act as a drain on the financial system, of especially a capital scarce nation. The persistent operation of the chronic loss making firms would snatch the market from more efficient producers. It's worst impact is in making the firms a high cost one, affecting their competitiveness not only within the country but also in the international markets. Persisting nature of industrial sickness, when policies do not allow flexibility for exit and other forms of adjustment, handicapped technological innovations, keeping the employment opportunities stagnant. The social costs of the economy both in terms of financial burden on the State

exchequer and in terms of displacement of labour, loss of production and its adverse effect on other industries would increase sickness in one industry, subsequently affecting all those industries which are connected with it on account of forward and backward linkages.

Industrial sickness, no doubt is a global phenomenon, commonly seen both in the developed and developing countries of the World. However it is more predominant among the developing countries due to its low capital base and a low level of technical and managerial know-how (Singh and Sadhu, 1988). India, in particular has been suffering from this malady. The New Economic Reforms (1991) in India brought about a drastic transition in the agenda of the industrial reforms. In 1980, the reforms were 'pro-business oriented' focusing on the measures of raising the profitability of the established companies which tended to favour incumbents and producers. In 1991, the policy changed towards 'pro-market reforms' focusing on removing the impediments to the functioning of the markets which allowed for increased domestic and foreign competition. These measures favoured entrants and consumers. This policy change greatly affected the business environment of the manufacturing sector which took a turn for the worse. The ongoing liberalization procedure in industrial policies of the Government allowed excessive capacities to be created, making the productive capacities to be much above the demand, pushing down the

market prices, reducing capacity utilization and driving quite a number of units to sickness. (Rodrick and Subramanian, 2004).

During the last three decades industrial sickness in India has assumed unmanageable proportions. It is persistently on the increase with little sign of abatement. It is evident from the fact that in 1980, while only 1401 Non-SSI (large and medium scale industries) units were reported sick, it rose to 3317 units in 2001. Similarly in 1980, while 23,149 small scale units went sick, it escalated to 2, 49,630 units in 2001. The Indian industrial scenario also depicts that the spurt in the number of sick industrial units has caused a consequent locking up of bank credit in the sick units. While the bank credit locked up in the Non-SSI sick units had shown an increase from Rs.1502 crores in 1980 to a high of Rs.21, 269 crores in 2001, it was an increase from Rs.306 crores in 1980 to Rs.4506 crores in 2001, in the case of small scale sick units. Moreover it was vividly seen in India that not only some of the traditional industries like cotton textiles, jute and sugar have been afflicted by sickness but also the non-traditional industries like engineering, chemicals, rubber, cement, electrical and paper industries. (Economic survey, 2002-03).

The industrial sickness frame work in India over the decade 1991-2001, showed that the sickness had been growing at an annual average growth rate of 28 percent and 13 percent, respectively in terms of the number of sick units and outstanding amount of bank credit locked in

these sick units, which was much higher than the annual industrial growth rate which was only 5 percent per annum. It is also astonishing to note that nearly 29,000 units are added to the sick list every year. In fact every tenth unit, in the Non-SSI sector and every third small scale unit is sick. Out of the officially declared total sick units, 90 percent are non-viable. (Tenth Five Year Plan, 2002-07).

Industrial sickness is thus rampant in India. Quite many causes have been identified for the onslaught of this problem.

The major *external* causes for industrial sickness in India are

- Non availability of critical raw materials ;
- Frequent power cuts due to generation of power below the actual requirements of the country;
- Changes in Government policies relating to exports, imports, industrial licensing etc. which affects the imports-exports of raw materials, finished goods and industrial machinery;
- Excessive taxation and increasing prices, causing an adverse impact on the demand;
- Recession in the market and the consequent shortfall in demand resulting in many units working below the break-even point;

- Inadequate finance due to a credit restraint policy followed by credit institutions in accordance with the national objective;
- Imposing unrealistic conditions while sanctioning loans by bankers which would adversely affect the liquidity of the concern and
- Price controls imposed by the Government leading to rise in the cost of production but unmatched by a corresponding rise in the sale price of the product, thereby adversely affecting the profitability of the units.

The notable *internal* causes for industrial sickness in India are

- Faults at the planning and construction stage like wrong location of industries, absence of market analysis, unbalanced capital structure, under-estimation of product cost, reckless spending on unproductive assets etc which will disturb the normal functioning of the units and drive them to sickness;
- Improper choice of technology, unsuitability of product mix, non-flexibility of fixed assets mainly machinery for possible use in the diversified manufacturing set up;

- Inability to raise enough financial resources to withstand operational losses and bear their impact, in the early stages due to poor equity base;
- Entrepreneurial incompetence in the form of lack of basic technical knowledge of their products, lack of basic acumen in planning diversification and lack of control in key areas of operations like finance, inventory and marketing;
- Managerial ineffectiveness in the form of faulty managerial decisions, lack of inventory management, inadequate attention to materials management leading to frequent breakdowns, lack of quality control systems, improper pricing policies, inefficient use of working capital and lack of manpower planning and
- Frequent labour problems due to strikes, lock-out and closure on account of strained industrial relations over issues related to working conditions, wages, bonus, suspensions and retrenchment (Chatterjee, 2006).

The progressive increase in the industrial sickness in India has been causing considerable concern not only to the Government, banks and financial institutions but also financial embarrassment to the

industrial units thereby seriously threatening their very viability (PrasannaChandra, 2001). The industrial sickness in India has adversely affected the economy in quite many ways.

(i) A set back in the employment prospects of the country;

(ii) Fear of industrial unrest due to closure of sick units and the consequent opposition by trade unions thereby threatening the peace and tranquility of the industrial environment as well as industrial production;

(iii) Wastage of scarce resources invested in units that go sick;

(iv) Adverse effect on investors and entrepreneurs in the form of creating a psychology of despair among them. The share price tumbles down affecting the entire stock market. Failure of units acts as a disincentive to other entrepreneurs;

(v) Losses to banks and financial institutions due to locking up of their funds in sick units which affected their lending programme and

(vi) Loss of revenue to Government in the form of a loss of the substantial revenue received by the Government from the industrial units by way of various levies.(Uma Kapila, 2006)

Thus more than being a problem, industrial sickness has been an obstacle for Indian economic development of the country (Ramakanth et al., 1993a). Industrial sickness in India therefore deserves

corrective action at the level of the State. The Government in cooperation with the Reserve Bank of India has instituted arrangements for monitoring sickness in industrial units, so that corrective action can be taken on time. The legislative and institutional framework for dealing with industrial sickness is contained in the Sick Industrial Companies Act 1985 that provided for the setting up of the Board for Industrial and Financial Reconstruction (BIFR) in 1987 and the establishment of the Industrial Investment Bank of India in 1997.

However to prevent an industrial unit from going under sickness, an efficient frame work on forewarning and in diagnosing sickness becomes essential. It is a well established fact that sickness never occurs over night. It develops gradually over time. Thus the rationale for prediction of sickness in advance of its occurrence is to prevent the onslaught of industrial sickness, by doing which crores of rupees of banks, financial institutions and other investors can be put to better use than being locked up in sick units with little chance of recovery. An early warning signal of probable failure of firms will enable both management and the investors to take preventive measures, operate policy changes, reorganize financial structures and thereby improve both private and social resource allocation (Baruch Lev, 1974). But to predict the magnitude of sickness, an objective analysis of the financial conditions of the industrial units over a period is needed, so that an early warning

sickness prediction system is developed. Industrial sickness in India thus requires a comprehensive redressal than quick fixes to revive sick units (Srivatsava and Yadav, 1986). However in the light of the seriousness of the problem, academic research on industrial sickness in India is surprisingly thin. It has either been descriptive or institutional, emphasizing on only the development and dimensions of industrial sickness in India (Ramakanth et al., 1993b)

In the last three decades considerable research has been done to suggest that financial ratios can be used to predict industrial sickness with greater reliability, since financial ratios are considered to be the diagnostic indicators of health of a business. The usage of financial ratios thus helps in reducing the size of the financial data found in the wide range of financial statements to a relatively small set of easily comprehending and economically meaningful indicators (Laurent, 1979). The predictive ability of financial ratios has assumed great significance in the past few years, whereby it is presently used as a criterion for judging the usefulness of ratios. (Beaver et al., 1968) The predictive capability as a criterion for judging the significance of financial ratios is justified by the fact that it envelops the enormity of task required for a complete specification of decision settings.

A pioneering study conducted by Beaver (1966) offered a univariate approach to discriminant analysis, followed by Altman

(1968) who extended it to multivariate analysis in predicting industrial sickness. Until 1980, Multiple Discriminant Analysis (MDA) became the dominant method in sickness prediction. As MDA was found to be affected by assumptions of normality of financial distributions, Ohlson (1980) and Laitinen et al., (1999), as an alternative applied the statistical logit analysis to predict industrial sickness.

However Back et al (1995), Neophytou et al., (2001) revealed that Artificial Neural Networks (ANN) produced promising results in predicting industrial sickness. Wilson and Sharda (1994) compared the Discriminant analysis with Neural Networks (NN) and proved that NN with backpropogation algorithum performed better. Boritz (1995) compared ANN techniques to MDA and Logit and Probit analyses and found that the NN techniques did not provide superior classification rates.

The existing studies on prediction of industrial sickness however were beset with *certain defects*.

The existing industrial sickness prediction models underlined the need for selecting the best set of financial ratios or variables for the prediction model. Majority of the studies never mentioned how to reduce or select the final set of variables from the initial variable set. In fact it is difficult to obtain the best set of variables at one try, using Statistical and Neural Networks methods (Shirata, 1998).

In most of the studies, the selection of sick and matching non-sick companies were made based on stratified sampling. The stratification of sick companies, according to industry, capital employed, size and fiscal year was taken as an essential pre-requisite to the selection of non-sick companies. The selection process of sick and non-sick companies was based on a paired sample design i.e. for every sick company in the list of the sick group, a non-sick company of the same industrial category and of the same financial year was selected.

Moreover, most of the previous studies dealt only with isolated data sets where the financial data pertaining to the different financial years prior to the year of sickness were treated independently in the learning phase of the predictive models.

In this background, the current research work on "**A comparative study of the prediction models of industrial sickness with specific reference to Principal Components Analysis based Multiple Discriminant Model and Evolutionary Neural Networks Model**" concentrated on the Principal Component Analysis (PCA) as a significant technique in the prediction of industrial sickness among Indian industrial companies.

The choice of the Principal Component Analysis was done due to it's significance of allowing any number of financial ratios as inputs, unlike in all earlier models where only a few financial ratios had to be

selected according to choice based criteria. The PCA thus considers the principal component of all financial ratios put together which not only represent the intrinsic information content of the original ratios with a massive reduction in the dimensionality of the input space, but also dispenses with the need to select the ratios appropriately for optimal performance by the classifiers. These principal components or derived variables form the inputs to help in the prediction of industrial sickness.

A significant feature of the current study is that the selection of sick and non-sick companies have been made irrespective of their size, industry category and capital employed. Altman (1968) has made a clear cut statement in his study that "it is not completely clear what the relationship is between size and ratios and matching exact asset of two groups seemed unnecessary". Ohlson (1980) observed in his study that the use of the procedure for matching failed and non failed companies has no benefits to an analysis. Foster (1986) and Taffler (1982) argued that matching failed and non-failed firms by industry and size eliminates the predictive power of these variables, resulting in a restricted rather than a general model of corporate failure. Jiang (1993) in his study has stated that although many studies have used matching paired technique, no research has provided a quantitative guide to the necessity of this technique.

Yet another distinguishing feature of the present study is that the sickness prediction model formulated here, analyzed and compared the predictive accuracy of an isolated data set model (the data pertaining to the different financial years prior to the year of sickness are treated independently as used in the earlier investigations), with a non-isolated dataset model (the data pertaining to the different financial years prior to sickness are considered in an inter-related way). The inclusion of non-isolated datasets in the model has made the model more authentic and reliable. This is due to the fact that financial performance of companies of a particular year is not a water-tight compartment but is an interrelated entity between years (Shirata, 1998). Similarly, Pompe and Bilderbeek (2005) elaborately experimented on datasets chosen from the earlier years, both isolated and in groups and asserted that models involving year one datasets alone are less likely to display timely prediction of failure.

Further the sickness prediction model developed in the current study, analyzed and compared the performance of the statistical and soft computing models. While the statistical model employed Multiple Discriminant Analysis (MDA) as it's classifier, the soft computing Model used Evolutionary Neural Networks (ENN) as it's classifier. Thus, while the statistical model was called as PCA-MDA model, the soft computing model was termed as PCA-ENN model. The models were tested for

external validity using an out of sample period data. Thus an effort had been made to establish the validity of the stationarity assumption, which implies that the relationship between the independent and dependent variables will hold over time (Mensah, 1984).

The objectives of the current study are as follows:

1. To estimate the principal components of the financial ratios and choose the appropriate principal components as inputs for the prediction models;
2. To examine the validity of the statistical prediction model (PCA-MDA Model) in predicting the industrial sickness;
3. To analyze the validity of the Soft Computing Prediction Model (PCA-ENN Model) in the prediction of industrial sickness;
4. To test the predictive power of the Statistical and the Soft Computing prediction models based on about of sample period dataset and
5. To recommend a reliable and an authentic industrial sickness prediction model.

Limitations of the study:

The current study has included in its analysis the financial data of only those large and medium scale companies published by the Reserve Bank of India in its Reports on Currency and Finance. The

study has not considered the cash flow ratios, since the cash flow fund statements were not available for all the years under study and for all the companies. The small scale industries were not included in this study due to non-availability of required financial information as well as the erratic nature of the available data.

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