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## Performance Evaluation Scaling Model based on Assumption of Normality

The textile Industry occupies a vital place in the Indian economy because of its contribution to the industrial output, employment generation and foreign exchange earnings. Considering the significance and contribution of textile sector in national economy, initiative and efforts are being made to take urgent and adequate steps to attract investment and encourage wide spread development and growth in this sector. The textile industry in India is one of the oldest manufacturing sectors in the country and is currently it's largest. But from last decade its growth is decline.

The primary task of any industry is to serve the economic needs of its members. If this is not done, there is no role for industry. In to serve the member well, a industry must ensure business efficiency which, in turn, closely depends on how well its finances are managed. Non-performance in the financial front will be reflected in the overall performance of the business. Therefore, industry need to know where exactly they stand as far as their financial performance is concerned. However, they are handicapped by the lack of tool to measure financial performance.

The role of statistical tools and techniques in evaluating the performance of a any business unit as regard its financial, Strategic, Human resource production, Operational and Quality aspect is very much wide spread. Various forecasting techniques are usually applied for the performance evaluation of various dimensions of the company. Therefore, this paper aims at developing a statistical model to evaluate the financial performance textile industry.

Ahmedabd is also an important Industrial center, with chemical and Textile industries. Ahmedabd is often described as the Manchester of East, because of its once-booming textile industry. The present paper deals with evaluating the financial performance of ten major textile companies of Ahmedabad using various statistical models and Ratio analysis. The research study is based on the data of major financial parameters of the selected companies for the period of five year from 2000 to 2004. An attempt has been made to analyse the financial trends by using a specialized performance evaluation scaling model and cluster Analysis.

### **Methodology**

This study I selected 10 textile companies of Ahmedabad

Financial data of the companies for five years from 1999-2000 to 2003-04 are analyzed using statistical tools such as mean, standard normal distribution, Mann-Whitney U test and cluster analysis.

### **Construction of the Scale**

The variables included in the construction of the scale are drawn from the audited annual accounts for five years. The five year averages of the value of variables are taken here. Since it has been established (Gupta, 1991) that five year averages are more reliable that the value for any single year.

- Eighteen variables are selected in the first instance for the purpose of constructing the scale. Almost all the variables as shown in the profit and loss account and the balance sheet are included so that no important variable is left out. The scaling technique has a system to eliminate insignificant variables. Name of variables, mean annual values and respective standard deviation are shown in table2. 1

**Table2. 1 Mean and Standard Deviation of Variables**

| Variables                              | Mean    | Standard Deviation |
|--|---------|--------------------|
| Gross sales                            | 231.65  | 406.15             |
| Net sales                              | 222.777 | 391.1              |
| VOP                                    | 222.191 | 391.47             |
| Other Income                           | 4.448   | 12.32              |
| Cost of production                     | 196.783 | 313.92             |
| Selling & marketing Expenses           | 3.384   | 6.55               |
| Distribution Expenses                  | 3.231   | 7.56               |
| PBDT(NNRT)                             | 34.487  | 98.42              |
| PAT(NNRT)                              | -22.767 | 39.82              |
| Export                                 | 74.962  | 170.76             |
| Import                                 | 24.048  | 55.74              |
| Gross Fixed assets(exci. Reval. & wip) | 319.038 | 648.06             |
| Current assets                         | 133.769 | 366.66             |
| Net worth                              | 6.447   | 502                |
| Equity capital                         | 31.199  | 47.26              |
| Long term borrowings                   | 213.202 | 288.21             |
| Capital employed                       | 219.779 | 640.25             |
| Current liabilities & provisions       | 190.781 | 315.08             |

Let  $X_{ij}$  denote the value (crore of rupees) of the  $i$ th variable for the  $j$ th company ( $j = 1$  to 18 and  $i = 1$  to 10)

In order to bring the variables into a comparable form, the variables are standardized by the formula :

Where  $\bar{x}_j$  and  $s_j$  are mean and standard deviation of the  $j$ th variable.

Converting the standard scores into 10-point scale values using standard normal distribution as follow :

| Standard Score | Score Value |
|----------------|-------------|
| $\leq -1.28$   | 1           |
| -1.28 - -0.84  | 2           |
| -0.84 - -0.52  | 3           |
| -0.52 - -0.25  | 4           |
| -0.25 - 0      | 5           |
| - 0.25         | 6           |
| 0.25 - 0.52    | 7           |
| 0.52 - 0.84    | 8           |
| 0.84 - 1.58    | 9           |
| $\geq 1.28$    | 10          |

These standards scores are then converted into score values on a ten-point scale obtained from deciles of standard normal distribution. The score values and total score are shown in table no.2.2.

- To check the consistency of the variable included in the scale, i.e. weather the score value for a variable is in agreement with the total score value, the correlation coefficient of the score of each variable with the total score was calculated and is shown in table 3. If the correlation coefficient is significant, we presume that the selected variables are appropriate. The 15 variable with correlation coefficient significant at 0.01 significance level are retained for the further analysis and remaining variables are deleted at this stage. Table no.2. 3 indicate significant of the variable.

**Table 2.2 Scale value of variables in the sample units**

| Company name | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 | X15 | X16 | X17 | X18 | Total |
|--------------|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Modern denim | 4  | 4  | 4  | 4  | 4  | 5  | 4  | 4  | 2  | 4   | 4   | 5   | 4   | 4   | 6   | 5   | 4   | 5   | 76    |
| National     | 3  | 3  | 3  | 4  | 4  | 4  | 4  | 2  | 1  | 4   | 4   | 4   | 3   | 1   | 5   | 9   | 1   | 9   | 68    |
| M.H.Mills    | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 5  | 4   | 4   | 4   | 5   | 5   | 4   | 3   | 4   | 4   | 74    |

|              |    |    |    |    |    |    |    |    |   |    |    |    |    |    |    |    |    |     |
|--------------|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|-----|
| Arvind       | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 8 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 178 |
| Ashima       | 7  | 7  | 7  | 5  | 5  | 7  | 5  | 6  | 4 | 6  | 5  | 6  | 7  | 7  | 6  | 7  | 5  | 112 |
| Anjani       | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 8 | 4  | 4  | 4  | 4  | 4  | 6  | 3  | 4  | 75  |
| A'bad new ct | 3  | 3  | 3  | 4  | 4  | 4  | 4  | 4  | 3 | 4  | 4  | 4  | 4  | 5  | 3  | 3  | 4  | 65  |
| Soma         | 5  | 5  | 5  | 4  | 4  | 4  | 4  | 5  | 8 | 5  | 5  | 4  | 5  | 6  | 4  | 3  | 5  | 85  |
| Aarvee       | 5  | 5  | 5  | 4  | 5  | 4  | 5  | 5  | 6 | 5  | 4  | 4  | 5  | 6  | 4  | 3  | 5  | 84  |
| Kanco        | 4  | 4  | 4  | 4  | 5  | 4  | 5  | 5  | 8 | 4  | 4  | 4  | 4  | 6  | 4  | 3  | 4  | 78  |

**Table2. 3 Correlation coefficient of the variables**

| Variables                             | Correlation Coefficient | t.01   |
|---------------------------------------|-------------------------|--------|
| Gross sales                           | 0.981565                | 3.36 * |
| Net sales                             | 0.981565                | 3.36 * |
| Other income                          | 0.981565                | 3.36 * |
| Cost of production                    | 0.966527                | 3.36 * |
| Selling & Marketing expenses          | 0.94552                 | 3.36 * |
| Distribution Expenses                 | 0.954859                | 3.36 * |
| PBDT(NNRT)                            | 0.94779                 | 3.36 * |
| PAT (NNRT)                            | 0.391227                | 3.36   |
| Export                                | 0.989898                | 3.36 * |
| Import                                | 0.966224                | 3.36 * |
| Gross fixed assets(exci.Reval. & wip) | 0.970227                | 3.36 * |
| Current assets                        | 0.96825                 | 3.36 * |
| Net worth (net of reval. & DREW)      | 0.824811                | 3.36 * |
| Equity capital                        | 0.867213                | 3.36 * |
| Long term borrowings                  | 0.659716                | 3.36   |
| Capital employed                      | 0.917321                | 3.36 * |
| Current liabilities & provisions      | 0.63856                 | 3.36   |

- Total scores of all the sample units for 15 variables are recalculated and a three-point is constructed Scale Values as follows :

| Score Value                  | Scale Value                    |
|------------------------------|--------------------------------|
| <-0.425 s.d.                 | 1. (indicate poor performance) |
| -0.425 s.d≤Score≤ 0.425 s.d. | 2. (indicate satisfactory )    |
| ≥ 0.425 s.d.                 | 3. (indicate good performance) |

Here and s.d. refer to mean and standard deviations of total scores for 10 societies. Table of total score and classification of the sample units describe in table no.2.4

**Table No.2. 4 Total Score and Classification of the Sample Units**

| Sample units               | Total Score | Classification |
|----------------------------|-------------|----------------|
| Modern Denim               | 64          | 2              |
| National Textile           | 49          | 1              |
| M.H.Mills                  | 62          | 2              |
| Arvind mills               | 150         | 3              |
| Ashima Ltd.                | 96          | 3              |
| Anjani Fabrics Ltd.        | 61          | 1              |
| Ahmedabad New Cotton mills | 56          | 1              |
| Soma Textiles              | 70          | 2              |
| Aarvee Denims Exports Ltd. | 71          | 2              |
| Kanco Enterprises          | 64          | 2              |
| Mean = 73.3 S.D. = 29.33   |             |                |

**3 – point scale**

| Score | Scale Value |
|-------|-------------|
|-------|-------------|

|          |   |
|----------|---|
| ≤61      | 1 |
| 61 to 86 | 2 |
| ≥86      | 3 |

The performance of those societies which get a scale value of 1 is poor whereas those that get a scale value of 3 is good ; a scale value of 2 indicates satisfactory performance.

Thus, we stated with 18 variables whose values are measured in crore of rupees. By adapting the scaling technique we have reduced them into scores which are countable. Therefore, it is appropriate to use a non-parametric test. In order to study the discriminating ability of the variables included in the construction of the scale, Mann-Whitney U test is applied to the extreme groups, i.e., societies classified as poor and good. If the result of the test shows a significant difference. We can conclude that the variable is consistent with the scale, i.e., the test discriminates between the societies in accordance with the scale. Table2. 5 gives the result of the Mann-Whitney U test.

**Table 2.5 Result of the Mann-Whitney U test**

| <b>Variables</b>             | <b>U Value</b> |
|------------------------------|----------------|
| Gross sales                  | 55             |
| Net sales                    | 55             |
| Vop                          | 55             |
| Other income                 | 55             |
| Cost of production           | 55             |
| Selling & marketing expenses | 55             |
| Distribution expenses        | 55             |
| PBDT                         | 55             |
| Export                       | 55             |
| Import                       | 55             |
| Gross fixed assets           | 55             |
| Current assets               | 55             |
| Net worth                    | 55             |
| Equity capital               | 55             |
| Capital employed             | 55             |

All the 15 variables are highly significant.

From the utility point of view it is desirable if a scale, having highly discrimination ability, can be constructed using a minimum number of variables. Thus six variable – Net sales(x2), VOP(x3), Import(x10),Export(x11),Equity capital(x15),Capital employed(x17)- are left out as they overlap with other variables in the set.

A new scale is finally constructed with only nine variables : Gross sale(x1), other income(x4), cost of production(x5),selling and marketing expenses(x6),Distribution expenses(x7),PBDIT(x8),Gross fixed assets9x12), Current Assets(x13),Net worth(x14). Table no. 2.6 summarizes the position of the sample units under this model.

**Table : 2.6 Classification of the sample units under Three-point scale**

| <b>Sample units</b>        | <b>Total Score</b> | <b>Classification</b> |
|----------------------------|--------------------|-----------------------|
| Modern Denim               | 38                 | 2                     |
| National Textile           | 29                 | 1                     |
| M.H.Mills                  | 38                 | 2                     |
| Arvind mills               | 90                 | 3                     |
| Ashima Ltd.                | 58                 | 3                     |
| Anjani Fabrics Ltd.        | 35                 | 1                     |
| Ahmedabad New Cotton mills | 35                 | 1                     |
| Soma Textiles              | 41                 | 2                     |
| Aarvee Denims Exports Ltd. | 43                 | 2                     |
| Kanco Enterprises          | 40                 | 2                     |

Mean = 44.7 S.D. = 17.61

It is significant that neither the classification nor the rankings of sample units changed with the elimination of six variables.

The validity of the scale is established by the known group method. For this purpose, we selected one good and one poor societies functioning in textiles. On the basis of the financial data for the year ending march 2004, we calculated the total score of the nine variables and applied the scale. This model helps us in the reduction of variables from 18 variables to fifteen variables by analyzing the inter-relationship between these fifteen variables by using Mann Whitney U test and further 9 variables by analyzing the inter –relationship between these fifteen variables. We found that the scale correctly classified the societies in good, satisfactory and poor.

### Cluster Analysis

- Cluster analysis is the name for a group of multivariate techniques whose primary purpose is to group objects based on the characteristics they possess. Cluster analysis classifies objects, so that each object is very similar to others in the cluster with respect to some predetermined selection criterion. The resulting clusters of objects should then exhibit high internal (within-cluster) homogeneity and high external (between-cluster) heterogeneity. Thus, if the classification is successful, the objects within clusters will be close together when plotted geometrically, and different clusters will be far apart.
- In cluster analysis, the concept of the variate is again a central issue, but in a quite different way from other multivariate techniques. The cluster variate empirically but instead uses the variate as specified the researcher. This makes the researcher's definition of the variate a critical step in cluster analysis.
- Result of Cluster Analysis :

By using scaling method, we found that scale correctly classified the companies into good and poor.

Cluster analysis was done to find groups of similar companies on the basis of a set of variables. The analysis was made with 15 variables (which are significant as shown in 3) selected in the first instances and finally with 9 variable used in the construction of the scale. Cluster membership of the companies by using 3 group analysis and 2 group analysis with 15 variable and with 9 variables is shown in table no.5

Table no. 2.7 indicates that grouping of companies with 15 variables and 9 variables are almost same. We can therefore conclude that reduction of variables from 18 to 9 variables has not altered significantly the classification of the companies. When we compare this classification with that made on the basis of the scores under scaling technique (table no. 2.2). We find that cluster analysis also endorses the validity of the scale.

**Table No.2.7 Cluster Membership of Sample Units**

| Company Name          | NO. of clusters with 15 variable |                 | NO. of clusters with 9 variable |                 |
|-----------------------|----------------------------------|-----------------|---------------------------------|-----------------|
|                       | with 3 clusters                  | with 2 clusters | with 3 clusters                 | with 2 clusters |
| Modern Denim          | 2                                | 2               | 2                               | 2               |
| National Textile      | 2                                | 2               | 2                               | 2               |
| M.H. Mills.           | 2                                | 2               | 2                               | 2               |
| Arvind Mills Ltd.     | 1                                | 1               | 3                               | 1               |
| Ashima Ltd.           | 3                                | 2               | 1                               | 2               |
| Anjani Synthetic Ltd. | 2                                | 2               | 2                               | 2               |
| Ahmedabad New         | 2                                | 2               | 2                               | 2               |
| Soma Textiles         | 3                                | 2               | 1                               | 2               |
| R.V.Dennim & Export   | 3                                | 2               | 1                               | 2               |
| Kanco Enterprise      | 2                                | 2               | 2                               | 2               |

### Major finding of Present Research

- A special performance evaluation scaling model is constructed and the validity of the scale is established by the known group method. For this purpose, we selected one good and one poor societies functioning in textiles. On the basis of the financial data for the year ending march 2004, we calculated the total score of the nine variables and applied the scale. This model helps us in the reduction of variables form 18 variables to 15 variables by using Mann Whitney U Test and further 9 variables by analyzing the interrelationship between these fifteen variables. We found that the scale correctly classifies the societies in good, satisfactory and poor on the basis of the previous eighteen variables as well as on the basis of the previous eighteen variables as well as on the basis of the reduced nine variables.
- Cluster analysis was carried out to find the groups of similar companies on the basis of a set of fifteen and nine variables respectively, each with two and three clusters. We find that cluster analysis also endorses the validity of the scale.
- So scaling model developed here is powerful enough to measure the efficiency of the textile companies, because it incorporates variables that include different dimensions of development of a business. Therefore, the total score of a society represents its overall financial performance. There is a possibility in this model that a company may be found to be good according to the scale but incurring a loss.
- One limitation of SCALING model is that the reasons for poor performance of companies will not be known automatically. For this purpose, services of financial experts may have to be used.

All the above results confirm that three best performers out of the selected ten companies can be identifies as : Arvind Mills, soma Textiles and Ashima Industry as per Ratio and Trend Analysis. But from the results of Scaling Model, Clusster Analysis and Gross Sales we can prefer Ashima Industry over Soma textiles, thereby choosing only the best performers as Arvind Mills and Ashima Industry.

### **Problem faced by Textile Industry**

Textile in India is characterized by a large number of firms, mostly small and technologically backward and some fairly large and technologically dynamic. Compared with countries competing in international markets, Productivity levels and growth rates are lower in India. There is also considerable variation in productivity between mills in the country. According to published research ineffective management, inability to buy the right type of cotton at the right time and price, lower machine utilization poor working conditions, lack of standardization ineffective financial management are the main reasons for low productivity. There in turn are influenced by factors that are external as well as internal to the firm; lack of plant-modernization, lack of timely availability of spare parts, capacity imbalance between stages of the manufacturing value chain power shortage, lack of proper maintenance and worker absenteeism.

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**Pf Bansari K. Jethwa**  
**Assistant Professor in Statistics(Commerce)**  
**Gujarat Arts & Commerce College,Ahmedabad.**

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