Chapter 3

Research Methodology

Methodology: The study is exploratory and descriptive in nature. It has used both qualitative as well as quantitative techniques. Qualitative, as in-depth interviews with experts have been conducted, where the questionnaire so prepared have been filled with face to face interaction so as to capture the in-depth views of respondents. Also, the questions in the questionnaire are to a certain degree open-ended, where the personal opinions of the experts could be incorporated. The questionnaire otherwise is closed ended, which has enabled data to be collected for further quantitative and statistical analysis.

- Sample Design: A Purposive Method of sampling has been adopted. The target population for the study included experts under various categories and the target population for the proposed has not been clearly defined by any agency. Art Dealers, Art Historians, Artists, Gallery Owners and Miniature Painting Collectors have been the different categories of experts who have formed the target population for the proposed study. These categories of respondents have been defined during the submission of the Research Proposal and while conducting the study. These experts have special focus and expertise in Miniature Paintings, and who have more than five years of experience in the field. Similarly, collectors who have a collection of miniature paintings, and who have at least five years or more of experience in collecting art have been targeted.
Thereafter, use of references from participants of the survey has also been used for collection of further data. Further, in order to keep the data free from bias, random sampling methods have also been used. Therefore, the approach to data collection has been a blend of probabilistic and non-probabilistic methods of sampling.

- **Sample Size:** As explained earlier, the sample consists of highly experienced experts in the field of miniature painting, and hence, keeping in view their availability, the cost and time considerations, and based on the above-mentioned Literature Review, the sample size had been fixed at 21. Quite a few studies have been conducted on the flexibility of the sample size and on ‘theoretical saturation’ (Glaser 1978, Silverman 2010, Strauss & Corbin, Guest, Bunce and Johnson 2006), which has been kept in mind while deciding on the proposed sample size.

- **Instrument of Data Collection:** A structured questionnaire had been developed to conduct interviews of the experts. The first draft of the questionnaire had been prepared in consideration with evidences available in past literature. It was then finalized post-face and content validity testing being conducted with the help of experts. This final draft of the questionnaire was administered among the sample units of the study.

- **Data Inputs**
  
  - **Sources of Data:** The present study is based on primary as well as secondary data. The primary data has been collected first hand, as data mentioned in the questionnaire. The secondary data has been collected for the purpose of developing conceptual and theoretical framework of the study. Also, the existing facts and figures from different sources like official reports, journals, news coverage, auction data,
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and online platforms etc. have been used at suitable places. The Base Price for the various schools of paintings have been arrived at mainly in consultation with experts and moderately by referring to previous auction data. As the study had the intent to find an intrinsic value of miniature paintings, views of experts have been given more weightage, rather than previous auction data (as the same does not point towards an intrinsic or fair value of a miniature painting).

- **Method of Data Collection:** The primary data has been collected through personal as well as online interview/survey with various sets of sample units.

**Instrument Development (process followed) and Expert Review (Pre-Testing)**

As mentioned above, the Survey Questionnaire prepared earlier was reviewed by four experts. One of the experts is a renowned Art Historian and an expert on Miniature Paintings, the second is a Gallery Owner in Udaipur, who is one of the leading names in Miniature Paintings in the city, and the third one is a dealer based out of Bikaner. The fourth expert who reviewed the questionnaire is a Professor who has specialization in Statistical Analysis.

On reviewing the earlier Questionnaire, the following changes were suggested, and incorporated:

1. Details of E-mail ID and Contact No. , and some more demographic details of the respondent have been added;

2. The No. of Questions have been reduced from 15 to 9;

3. The various periods of the schools have been selected keeping in mind the dates between which majorities of the works have been executed for these respective schools;
4. Names of certain Schools have been added, while some have been merged with the parent School;

5. A non-attributed/ascribed/signed painting has been given a base-value, based on which any % change of a painting’s value may be calculated;

6. Specific names of artists have been removed, as it would have been difficult to name each and every miniature artist of those times. Instead, the question has been slightly reframed to include all artists;

7. Price ranges have been mentioned, basis discussion with experts and past sale/auction data;

8. A provision has been made for the respondents to mention any other value (apart from the ones in the price range), so as to give more robustness to the model.

**Results from the Pilot Testing**

**Pilot Testing:** Based on the Pre-Testing and Expert Review, an internal Pilot Testing was conducted on four respondents, who also form a part of the main survey. As laid down by Converse and Presser (1986), the Pre-Test and Expert Review was done in a participatory manner, whereas the Pilot Testing was conducted in an undeclared manner.

Based on the Pilot Testing conducted on four respondents, the following were the changes that were carried out on the questionnaire.

1. The No. of questions was increased to 9 from 12, to include specific questions on rarity, condition and subject matter of the paintings.
2. Separate questions on pricing of paintings and drawings have been merged, and a question bringing out the difference of prices between paintings and drawings has been included.

3. The price range, mentioned in the earlier questionnaire, was predominantly on the basis of previous sale records in auctions. However, the experts pointed out that as the purpose of the study was to find the intrinsic value of a painting (and not what has been paid for in an auction), hence, the prices should be changed accordingly. Hence, the pricing have been based more on expert advice and views, and less on auction data. However, in some cases low and high estimates of auctions have been considered to arrive at the pricing in the questionnaire.

4. Name of the Deogarh School has been added.

5. No. of demographic options have been merged to bring in more focus

**Statistical Tools for Analysis:** The current research is based on the response of experts of the related field which is yet not explored and there are many grey areas. After considering various techniques under multi-criterion/attribute decision modeling (MCDM/MADM), the Grey relational analysis was finalized to undertake data analysis to identify the ranking of the essential variables for the valuation model proposed in the study. The Grey relational analysis is based on Grey Theory and measures the degree of approximation amongst the sequences using the Grey Relational Grade (Deng, 1989). Initially the Grey Relational Analysis was proposed by Deng in 1982. The GRA (Grey Relational Analysis) has been used in a variety of studies. The extant literature based on GRA has shown that this technique has been used in several studies based on engineering problems. And gradually, operations, supply chain and other disciplines like education have also used this method for ranking the factors. It examines the degree of relationships amongst the discrete sequence data. In other words, it makes a comparison of development trends of grey
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system factors. For this, development trends of similar degree and different degree among the factors are examined. The grey system examines each relationship one by one as a decision by system which provides more reliable basis for the available information.

As the name suggests, a grey system is a system in which some part of information is unknown and a part of information is known. In such a system the quality and quantity of information form a continuum. This continuum is formed from a complete lack of information to complete information. And this process is formed from a black through grey and then through grey to white.

The basic idea of grey-correlation-analysis is to judge the close degree of connection amid diverse sequences according to the likeness degree of the geometric shape of sequence curves. The nearer the geometric shape of general polygons is, the better the degree of correlation amid corresponding sequences is and vice-versa. This method is used in different samples where there are clear rules and it is suitable to calculate. This method can be applied to resolve the problems caused by principal component analysis, regression analysis and other mathematical statistics methods in system analysis (Liu et. al. 2014). Further the grey system theory can also resolve the problems of “small sample size” focusing on the matters which have the obvious outreach but not apparent implications. Grey Relational Analysis is based on the Grey System Theory and it primarily studies the dynamic process. GRA can coalesce the Grey System Theory with Grey System Methods to emphasize and analyze pertinent issues (Lu and kees 2007). The Grey Relational Analysis is used to transfer multi-response problems into single-response problems.

In the following section a detailed procedure for the grey relational analysis has been dis- cussed.
For a multi-attribute decision making (MADM) problem, if there are m alternatives and n attributes, the $i^{th}$ alternative can be expressed as $Y_t = (y_{i1}, y_{i2}, \ldots, y_{ij}, \ldots, y_{in})$, here $y_{ij}$ is the performance value of attribute j of alternative i. The term $Y_i$ can be translated into the comparability sequence $X_t = (x_{i1}, x_{i2}, \ldots, x_{ij}, \ldots, x_{in})$ by the use of one of the equation (a)-(c), where $\bar{y}_j = Max\{y_{ij}, i = 1,2,3, \ldots, m\}$ and $\underline{y}_j = Min\{y_{ij}, i = 1,2,3, \ldots, m\}$.

$$x_{ij} = \frac{y_{ij} - \underline{y}_j}{\bar{y}_j - \underline{y}_j}; \quad i = 1,2,\ldots,m \quad j = 1,2,\ldots,n$$ (a)
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\[ x_{ij} = \frac{y_j - y_{ij}}{\bar{y}_j - \bar{y}_j}; \ i = 1, 2, \ldots, m \quad j = 1, 2, \ldots, n \]  

(b)

\[ x_{ij} = 1 - \frac{|y_{ij} - y_j^*|}{\max\{\bar{y}_j - y_j^*, y_j^* - y_{ij}\}}; \ i = 1, 2, \ldots, m \quad j = 1, 2, \ldots, n \]  

(c)

Equation (a) is used for larger-the-better attribute, whereas equation (b) is used for smaller-the-better attributes and equation (c) is used for ‘closer-the-desired-value-y_j^*'-the-better attributes.

Larger the better attributes

\[ \eta_{ij} = -10 \times \log \left( \frac{1}{r} \sum_{k=1}^{r} \frac{1}{v_{ijk}^2} \right) \]

Smaller the better attributes

\[ \eta_{ij} = -10 \times \log \left( \frac{1}{r} \sum_{k=1}^{r} v_{ijk}^2 \right) \]

Grey Relational Coefficient Calculation

The grey relational coefficient is used to determine how close \( x_{ij} \) is to \( x_{0j} \). The larger the grey relational coefficient, the closer these two values are. The grey relational coefficient can be calculated by using following equation.

\[ \gamma(x_{0j}, x_{ij}) = \frac{\Delta_{min} + \zeta \Delta_{max}}{\Delta_{ij}^* + \zeta \Delta_{max}}; \ i = 1,2,3,\ldots, m \quad j = 1,2,3,\ldots, n \]  

(d)

In the above equation (d), \( \gamma(x_{0j}, x_{ij}) \) is the grey relational coefficient between \( x_{0j} \) and \( x_{ij} \), and
\[ \Delta_{ij} = |x_{0j} - x_{ij}| \]

\[ \Delta_{\text{min}} = \text{Min}\{\Delta_{ij}, i = 1,2,3,...,m; j = 1,2,3,...,n\} \]

\[ \Delta_{\text{max}} = \text{Max}\{\Delta_{ij}, i = 1,2,3,...,m; j = 1,2,3,...,n\} \]

\[ \zeta \text{ is the distinguishing coefficient, } \zeta \epsilon [0,1] \]

The rationale of the distinctive coefficient is to increase or reduce the range of the grey relational coefficients.

**Grey Relational Grade Calculation**

After applying the above equations to calculate the grey relational coefficients, the grey relational grade can be calculated by applying the following formula.

\[ \Gamma(X_0, X_i) = \sum_{j=1}^{n} \omega_j \gamma(x_{0j}, x_{ij}); \quad i = 1,2,3,\ldots,m \quad (e) \]

In the above equation (e), \( \Gamma(X_0, X_i) \) is the grey relational grade between \( X_i \) and \( X_0 \). It represents the level of correlation between the reference sequence and the comparability sequence. \( \omega_j \) is the weight of attribute and usually depends on decision makers judgments or the structure of the proposed problem. Additionally, \( \sum_{j=1}^{n} \omega_j = 1 \). the grey relational grade specifies the degree of resemblance between the comparability progression and the reference series (Fung 2003).

**Kruskal-Wallis Test**

Nonparametric Tests use less rigorous assumptions than parametric counterpart and such tests also use less information from the sampled data set. One such Non-Parametric Test is the Kruskal-Wallis H Test (which is an alternative to one-way ANOVA). The Kruskal-Wallis H Test
is based upon the assumption that the random variables are continuous and measurable on an ordinal scale. This H-Test is used to examine the difference in the mean returns of two populations. The H-Test follows Chi-Square distribution based on k-1 degrees of freedom. It uses the ranks of the data rather than continuous and measurable on an ordinal scale. The K-W H test measures the degree to which the actual observed mean ranks are different from their expected values. If the difference is very large then the null hypothesis should be rejected. The statistical equation of this test is as follows:

\[ H = \frac{12}{N(N + 1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(N - 1) \]

Where, \( N = \sum_{i=1}^{k} n_i \), \( R_i = \sum_{j=1}^{k} R_{ij} \).

**Organization of Doctoral Thesis (Proposed Chapter Scheme)**

The following sections have mentioned the structure of final Research Report and the timelines for completion of various activities.
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**Bibliography**

**Appendix**