# Chapter 2

## Research Design

### 2.1: Problem Identification

- **2.1.1:** Choice of product field as a focal point of study.
- **2.1.2:** Choice of other Industries.

### 2.2: About the survey work.

- **2.2.1:** Sampling Design
- **2.2.2:** Design of questionnaire.
  - **2.2.2.1:** Questionnaire for channel members.
  - **2.2.2.2:** Questionnaire for consumers.
  - **2.2.2.3:** Questionnaire for decision makers.

### 2.3: Statistical Design:

- **2.3.1:** Test of significance for difference between two factors.
- **2.3.2:** Test for difference between two population proportions.
- **2.3.3:** Test for homogeneity.
- **2.3.4:** Small sample exact test for difference between proportions.
- **2.3.5:** Test for independence between proportions.
- **2.3.6:** Estimation of future trend and measurement of industry attractiveness.
Chapter-2
Research Design

2.1: Problem Identification:

In Indian business scenario certain important environmental changes have taken place in the recent past, which have forced the strategists to rethink about the issues of environmental scanning. We may present certain important issues of recent past, which have forced the corporate decision makers to rewrite the business agenda:

- Existence of stiff competition in and within the country. "Think Global act Global" is the main mantra today.

- Changes of economic and political scenario due to influences of foreign institutions, international market fluctuations, turmoil in world politics and communication to financial institution breed high levels of risk and uncertainty in terms of policy formulation.

- "Customer is the King", is the highly chanted phrase of modern world. Industry is experiencing a lot of changes in consumer demand due to major changes in income level, increased bargaining power, presence of close substitutes, entry of cheap imported brands etc.

- Market is facing the experience of borderless world, in true sense, due to drastic change in information technology. Consumers are getting access of world market flavour. So, product expectation level is facing a major
shift from age old branded home made product to newly designed attractive imported goods.

- Revolution in media world and evolution of mass media coverage have made every bit of information available to its end users and forced policy makers to adjust their stand according to the need of the time.
- Changes in social structure, value system and loyalty status lead to uncertainty about mapping consumer mind.

2.1.1: Choice of product field as a focal point of study:

At the time of conducting this study we have fixed certain parameters to minimise the chances of error and to have a true picture of internal and external factor matching process to suggest certain guidelines that might play a significant role for strategy formulation.

Selection of product: In case of every survey-based study, selection of 'hub' is vital to get an unbiased true picture of the problem. Hub should be unique one, which includes all the characteristics of selected industries so that we can point out our control point of activities. In our study we have selected branded fan industry in West Bengal as centre of the wheel due to its unique features.

- Electric fan is a product involving low technology involved product. Technological changes are not possible within a short period of time.
• Price wise fan industry falls under easy-to-reach category for the vast rural and urban population irrespective of income classes.

• Weather condition of this region is another reason for high market potentiality of electric fans. This is a tropical area and due to long lasting summer and continuous humidity, market demand is on higher side compared to other regions in India.

• Recent EXIM policy of government abolished ‘quantitative restriction’ on importing of certain goods. Small appliances including electrical fans are under this category. Some products are under ‘open general licence (OGL)’ list while some may be imported through certain special import licence. This has indulged new competitive equation in fan trade due to threat from foreign brands.

Selection of brands: We have restricted our study to branded products falling under our selected product fields. Due to technological and knowledge upgradation, today’s consumers prefer to deal with branded product. This is because of an urge for proper value for money. Our selected product fields falls under brown goods category. There is high competition from unorganised sector. But slowly demand for branded product is growing and for a new entrant, branded product field is attractive from the point of view of return on investment. Again, serious business expansions are expected from branded players only because of their huge level of investment and long run focus on
vision. Players from unorganised sectors are not clear about their mission. They believe in short run gain. So, serious entrepreneurship is absent on their part.

Selection of place: We have restricted our study to West Bengal consumer market, as we are in a position to do an in-depth study in West Bengal market for having a clear picture about organisations’ thinking process.

Again, this market is unique in nature. This state is on developing process. A shift from rural sector to urban sector is continuously going on. Residential area in metro, mini metros, cities, towns and small towns are growing at a fast rate. Industrialisations, infrastructure development, extension of areas under electrification create a huge scope for further market growth. It is rated high in terms of literacy rate, area potentiality, and combination of urban and rural sectors, upcoming urban youth market, high population density and good industrial prospect. In terms of geographic advantage this state has a unique edge as it is surrounded by important states and touching the border of Bangladesh and Nepal. Social development of people, upcoming upper middle class with increasing purchasing power and agricultural support mark this state as a unique selection for this study.

Availability of complete information is another major reason behind this selection. Among major players in fan trade most of them have production or
marketing operation in West Bengal. So easy access to required information about strategy formulation through environmental scanning is possible.

2.1.2: Choice of other Industries:

At the time of selection of other industries various criteria have been considered to correlate different industries on some basic grounds to find out certain general guidelines applicable to all. In this study we have considered a combination of industries from durable industries and fast moving consumer goods industries. From durable industries we have selected television and refrigerator. We have also extended our study to fast moving consumer goods industries and have covered hair care and health care industries. For industry selection, main criteria are as follows.

- Type of product: All the products are household items and fall under category of necessity items for upper, upper and lower middle-income group. It may be observed that due to recent presence of MNCs with their cost effective offer, increasing buying power of consumer due to economic growth and people aspiration for better life, it is logical to treat these two items under common household items. Industries under selected category are facing high degree of competition due to presence of plenty number of players. Major threats of these industries are from cheap, fake, me-too products from unorganised sectors. Unbranded players grab a major portion of market share.
• Level of competition: In this study selection is completely restricted on certain product fields where manufacturers are facing stiff competition from within and outside of the industry. In these industries frequent launch of new brands is common. Terms like unique selling propositions, brand loyalty are in vulnerable phase.

• Customer involvement: In today’s world, customers are more informative and knowledgeable due to technological revolution and emerging global economy concept. World is small today. Every new deal of any product in any corner of the globe may be available at other corner within a very short period of time. Consumers are aware about market opportunities. They are very particular about maximum return of their investment on any particular product. In every purchase decision paradigm shifted to individual decision making to collective decision making.

• Market potentiality: Considering Indian market scenario in recent years, we can easily assume that it is a potential market for consumer goods. Integration of Indian conservative economy with global open economy transforms more life style focused consumer base.

2.2: About the survey work:

Our findings are based on a survey work on channel members, consumers and corporate decision makers of fan industry in West Bengal. Further we have
extended our study to examine the views expressed by the decision makers of selected consumer durables and FMCGs industries.

Distribution is an important tool to create a competitive edge due to availability of alternative choices and close substitutes of competing products. Task of a firm is to create differentiation through its distribution channel to earn customer trust. In fan trade, price and product technologies can be imitated easily. Firms can differentiate its offer through unique quality of service through their channel members. In fan trade, development of distribution equity is essential for long-range survival. In this study we have done a survey through a structured questionnaire among various dealers of branded fans in West Bengal to find out perception level of channel members of fan trade.

An extensive study on consumers' viewpoint about existing players in the fan trade has been carried out in next phase. In this study respondents were interviewed on different key influencing areas of purchase decision-making. Motto is to present a clear understanding about present market scenario of fan trade to create a base for external factors matching with internal parameters. This survey was conducted through a structured questionnaire to know customer loyalty status, purchase pattern, usage experience and brand identity in a better way. Respondents were selected on random basis throughout West Bengal
covering metro, mini metros, towns, small towns and villages. They were interviewed on shop floor at the time of their purchase enquiry.

In the next phase we have extended our study to identify viewpoint of decision makers of fan trade on the basis of their propensity to take risk. In this survey, we have conducted a direct interview of decision makers with the help of a structured questionnaire. Experts are of the view that an individual's thinking process and behaviour may get influenced by his propensity to take risk. On the basis of attitude towards risk an individual may be considered as risk oriented or risk averse at the time of making business decision.

After judging the viewpoint of decision makers of fan trade we have carried out the same study on decision makers of selected durables and FMCG industries. Motto is to identify common generic checklists for strategic decision-making.

2.2.1: Sampling Design:

The fundamental idea of sampling is that by considering some of the elements in a population, one can draw inferences about the total population. A sample design is a clear-cut plan for attaining a sample from a given population. At the time of developing a sampling design attention is to be paid on the definition of the finite universe under study. In this study we would like to develop definite process for sampling design.
At the time of collecting views of channel members, respondents were picked up randomly from all over West Bengal by using simple random sampling method considering their yearly sale figure. A total of hundred dealers /retailers were included for this study. Selections of respondents were done on the basis of following parameters (Table 2.1). This study was conducted in the year 2000-2001 so that we can cover two consecutive seasons for essential comparison.

Table: 2.1: Selection of Respondents among channel members of fan trade.

<table>
<thead>
<tr>
<th>Yearly Sale Figure (in Pcs.)</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 200</td>
<td>10%</td>
</tr>
<tr>
<td>200-500</td>
<td>25%</td>
</tr>
<tr>
<td>500-1000</td>
<td>30%</td>
</tr>
<tr>
<td>1000-2000</td>
<td>18%</td>
</tr>
<tr>
<td>2000 and above</td>
<td>17%</td>
</tr>
</tbody>
</table>

Similarly for consumer survey three hundred respondents were selected from purchase decision makers by using on the spot selection method. This selection was done after dividing West Bengal consumer gods market under nine broad categories namely Kolkata, South-Bengal, North-Bengal, Midnapore, 24-Parganas (N&S), Howrah, Hooghly, Nadia, Murshidabad. This study was conducted in the year 2000-2001 to get a clear picture about consumers purchase
pattern throughout the year. Total numbers of respondents were selected in the following percentage from the selected regions (Table 2.2).

Table 2.2: Selection of Respondents among consumers of fan trade

<table>
<thead>
<tr>
<th>Area</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kolkata</td>
<td>25%</td>
</tr>
<tr>
<td>South-Bengal</td>
<td>15%</td>
</tr>
<tr>
<td>North-Bengal</td>
<td>10%</td>
</tr>
<tr>
<td>Midnapore</td>
<td>10%</td>
</tr>
<tr>
<td>24-Parganas (N&amp;S)</td>
<td>10%</td>
</tr>
<tr>
<td>Howrah</td>
<td>8%</td>
</tr>
<tr>
<td>Hooghly</td>
<td>10%</td>
</tr>
<tr>
<td>Nadia</td>
<td>5%</td>
</tr>
<tr>
<td>Murshidabad</td>
<td>7%</td>
</tr>
</tbody>
</table>

In the next phase we have extended our study on decision makers of fan trade, selected durable and FMCG industries. For fan trade total responses were sixty. For durable and FMCG industries it were seventy-one and fifty-six respectively. We have subdivided the sample set into two homogeneous segments based on risk taking propensity (Table 2.3). These respondents have been selected randomly from among the complete list of decision makers of selected industries.
depending on their position in the organisational chart. To consider only those persons who have considerable role in strategic decision-making, we have limited our selection to middle and top management level.

Table: 2. 3: Selection of Respondents among decision makers of selected trade

<table>
<thead>
<tr>
<th>Industry</th>
<th>Total Respondents</th>
<th>Risk Oriented Managers(ROMs)</th>
<th>Risk Aversive Managers (RAMs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Trade</td>
<td>60</td>
<td>43</td>
<td>17</td>
</tr>
<tr>
<td>Consumer Durables</td>
<td>71</td>
<td>53</td>
<td>18</td>
</tr>
<tr>
<td>FMCGs</td>
<td>56</td>
<td>34</td>
<td>22</td>
</tr>
</tbody>
</table>

2.2.2: Design of questionnaire:

In this study we have used personal interview method based on structured questionnaire. The main logic behind this is that surveying is an exchange of ideas between interviewer and respondents. A face-to-face interaction is helpful to understand the main intention of the question. This reduces any sort of error of responses. In the next sub sections we have presented copy of questionnaire for ready reference.
2.2.2.1: Questionnaire for channel members:

1. What was your total sale of fans last year?
   - Below 200
   - 200-500
   - 500-1000
   - 1000-2000
   - 2000 and above

2. Please rank following brands on the basis of enquiry rate and conversion of enquiry into sale.
   - Polar
   - Crompton
   - Khaitan
   - Orient
   - Usha
   - Bajaj
   - Others

3. What according to you are the importances of factors that draw a customer towards a brand?
   - Price
   - Advertisement
   - Colour & design
   - Guaranteed & after sales services
   - Recommended by dealers
   - Merchandising
   - Sales promotion
   - Recommended by dealers
   - Merchandising
   - Sales promotion

4. Please rank position of brands against purchase decision parameters.
   - Polar
   - Crompton
   - Khaitan
   - Orient
   - Usha
   - Bajaj
   - Others

5. Please rank the following attributes on a scale of 1-5 (1= Very Poor, 2= Poor, 3= Fair, 4= Good, 5= Excellent) for the above mentioned brands.
   - Complain Settlement
   - Sales force efficiency
   - Margin to dealer
   - Fast moving brand
   - New model introduction
2.2.2.2: Questionnaire for consumers.

1. When you think of best fan which one and only one brand name comes to your mind first?

<table>
<thead>
<tr>
<th>Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polar</td>
</tr>
<tr>
<td>Crompton</td>
</tr>
<tr>
<td>Khaitan</td>
</tr>
<tr>
<td>Orient</td>
</tr>
<tr>
<td>Usha</td>
</tr>
<tr>
<td>Bajaj</td>
</tr>
<tr>
<td>Others</td>
</tr>
</tbody>
</table>

2. If you are to think of other fans, which brand name comes to your mind next?

<table>
<thead>
<tr>
<th>Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polar</td>
</tr>
<tr>
<td>Crompton</td>
</tr>
<tr>
<td>Khaitan</td>
</tr>
<tr>
<td>Orient</td>
</tr>
<tr>
<td>Usha</td>
</tr>
<tr>
<td>Bajaj</td>
</tr>
<tr>
<td>Others</td>
</tr>
</tbody>
</table>

3. What according to you are the importances of factors that influence your purchase decision?

<table>
<thead>
<tr>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
</tr>
<tr>
<td>Quality</td>
</tr>
<tr>
<td>Brand Name</td>
</tr>
<tr>
<td>Reliability</td>
</tr>
<tr>
<td>Sweep</td>
</tr>
<tr>
<td>Fan Speed</td>
</tr>
<tr>
<td>After sales service</td>
</tr>
<tr>
<td>Colour&amp;Design</td>
</tr>
<tr>
<td>Good air circulation</td>
</tr>
<tr>
<td>Power Consumption</td>
</tr>
</tbody>
</table>

4. Which brand(s) do you use now under below mentioned categories?

<table>
<thead>
<tr>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling Fan</td>
</tr>
<tr>
<td>Portable Fan</td>
</tr>
<tr>
<td>Exhaust Fan</td>
</tr>
</tbody>
</table>

5. If you were to purchase this product tomorrow, which brand would be your first choice?

<table>
<thead>
<tr>
<th>Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polar</td>
</tr>
<tr>
<td>Crompton</td>
</tr>
<tr>
<td>Khaitan</td>
</tr>
<tr>
<td>Orient</td>
</tr>
<tr>
<td>Usha</td>
</tr>
<tr>
<td>Bajaj</td>
</tr>
<tr>
<td>Others</td>
</tr>
</tbody>
</table>
6. Why would you like to purchase this particular brand?

<table>
<thead>
<tr>
<th></th>
<th>Price</th>
<th>Brand Name</th>
<th>Previous Product usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertisement</td>
<td>Word of Mouth</td>
<td>Gifts &amp; contest</td>
<td></td>
</tr>
<tr>
<td>Colour &amp; Design</td>
<td>Product Display</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2.2.3: Questionnaire for decision makers:

1. Please identify these characters on which you give preference at the time of selection/promotion of an executive/employee.

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very combative</td>
<td>Very passive</td>
</tr>
<tr>
<td>Very innovative</td>
<td>Non-innovative</td>
</tr>
<tr>
<td>Dynamic</td>
<td>Stable</td>
</tr>
<tr>
<td>Risk oriented</td>
<td>Risk averse</td>
</tr>
<tr>
<td>Quality conscious</td>
<td>Quantity conscious</td>
</tr>
<tr>
<td>Autocratic</td>
<td>Participative</td>
</tr>
<tr>
<td>Cavet emptor</td>
<td>Socially responsible</td>
</tr>
<tr>
<td>Individual</td>
<td>Collective decision-making</td>
</tr>
<tr>
<td>Decision- making</td>
<td></td>
</tr>
</tbody>
</table>

2. Please rank the following factors (i.r. of their importance) for environmental analysis in case of your industry.

<table>
<thead>
<tr>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Factors</td>
</tr>
<tr>
<td>Govt. &amp; Legal Factors</td>
</tr>
<tr>
<td>Market/Competitive Factors</td>
</tr>
<tr>
<td>Suppliers/Technological Factors</td>
</tr>
<tr>
<td>Geographic Factors</td>
</tr>
<tr>
<td>Social Factors</td>
</tr>
</tbody>
</table>
3. Would you like to change the ranking of question no. 2, if priority is given on firm’s Marketing Activities?

No.

If Yes (Please rank according their importance)

Economic Factors   Govt. & Legal Factors   Market/

Competitive Factors   Suppliers/Technological Factors

Factors   Geographic Factors   Social Factors

4. Would you like to change the ranking of question no. 2, if priority is given on firm’s Production Activities?

No.

If Yes (Please rank according their importance)

Economic Factors   Govt. & Legal Factors   Market/ Competitive

Factors   Suppliers/ Technological Factors   Geographic Factors   Social Factors

5. Would you like to change the ranking of question no. 2, if priority is given on firm’s Financial Activities?

No.

If Yes (Please rank according their importance)

Economic Factors   Govt. & Legal Factors   Market/ Competitive

Factors   Suppliers/ Technological Factors   Geographic Factors   Social Factors
6. Please rank the internal factors (i.r. of their importance) considering the requisite qualifications to perform in your industry profitably.

Finance  Marketing  Production
Personnel  Corporate Resources

7. According to your view what should be the priority ranking for a New Entrant in your trade considering both internal and external factors.

Finance  Economic Factors
Marketing  Govt. & Legal Factors
Production  Market/ Competitive Factors
Personnel  Suppliers/ Technological Factors
Corporate Resources  Geographic Factors
                      Social Factors

2.3: Statistical Design:

The main important area of market research starts after availability of data. The main task is to find some order or pattern from these data and to analyse it in an appropriate manner. For example in a standard chi-square analysis one is solely interested in whether or not two variables are statistically independent. But to carry out in-depth study we need to study the degree of association between theses variables. To identify important factor selection and proper matching of them for environmental scanning and strategy formulation, we have used various statistical techniques according the need of the analysis.
2.3.1: Test of significance for difference between two factors:

At the time of factor selection according to their importance, one has to test whether the difference in priorities between two external or internal factors is markedly significant. For this we employ a statistical test (Rao, 1989, Aczel, 1996) based on multinomial distribution.

Let

\[ P_1 = \text{Proportion of respondents assigning highest priority to 1st factor.} \]

\[ P_2 = \text{Proportion of respondents assigning highest priority to 2nd factor.} \]

We may state the null hypothesis and alternative hypothesis as

\[ H_0: P_1 = P_2 \]

\[ H_1: P_1 > P_2 \]

Respectively, the test statistics following multinomial distribution, can be constructed as

\[ Z = \frac{P_1 - P_2}{\sqrt{\frac{1}{n} \left[ p_1 (1 - p_1) + p_2 (1 - p_2) + 2 p_1 p_2 \right]}} \]

Where \( p_1 \) and \( p_2 \) are the sample estimates of \( P_1 \) and \( P_2 \). We reject \( H_0 \) in favour of \( H_1 \) if \( Z_{\text{obs}} \) in large sample exceeds \( Z_{\alpha} \), \( Z_{\alpha} \) being the upper 100\( \alpha \)% point of normal deviate.
2.3.2: Test for difference between two population proportions:

In our study, any particular internal or external factor may carry major importance in more than one industry. To know the degree of importance of any particular factor for an industry in comparison to another, a comparative analysis, based on statistical measure, is essential. To know whether there is any significant difference in degree of factor priority for two industries we need to test whether the difference between those proportions is significant or not. In this study we have used a simple test for difference between proportions (Krik, 1994, Cooper and Schindler, 1999,). Let us consider two populations. The proportion of \( X \), an attribute, is \( p_1 \) in the one population and \( p_2 \) in the other population. Let random samples of sizes \( n_1 \) and \( n_2 \), respectively, are taken from the first and the second population through independent drawings. Here \( \hat{p}_1 = \frac{f_1}{n_1} \) and \( \hat{p}_2 = \frac{f_2}{n_2} \) are two sample proportions of \( X \). We have then

\[
E(\hat{p}_1 - \hat{p}_2) = E(\hat{p}_1) - E(\hat{p}_2) = p_1 - p_2
\]

and

\[
\text{var}(\hat{p}_1 - \hat{p}_2) = \text{var}(\hat{p}_1) + \text{var}(\hat{p}_2) = \frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}
\]
Again, \( \hat{p}_1 - \hat{p}_2 \) will also be normal when \( n_1 \) and \( n_2 \) are sufficiently large. In that case we can say

\[
\frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{p_1(1 - p_1)}{n_1} + \frac{p_2(1 - p_2)}{n_2}}}
\]

will be distributed as approximately a standard normal variable.

Here null hypothesis

\[ H_0: p_1 = p_2. \]

Then

\[ E(\hat{p}_1 - \hat{p}_2) = 0 \]

and

\[ \text{var}(\hat{p}_1 - \hat{p}_2) = p(1 - p)\left\{\frac{1}{n_1} + \frac{1}{n_2}\right\} \]

where \( p \) is the common value of \( p_1 \) and \( p_2 \). If \( p \)

were given by the hypothesis, we may use

\[ \tau = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{p(1 - p)\left\{\frac{1}{n_1} + \frac{1}{n_2}\right\}}} \]

for testing \( H_0 \).

When \( p \) is unknown the proper estimate will be the proportion of \( X \) in the two samples taken together, i.e.

\[ \hat{p} = \frac{f_1 + f_2}{n_1 + n_2}. \]

To test \( H_0 \), we may compute

\[ \tau = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1 - \hat{p})\left\{\frac{1}{n_1} + \frac{1}{n_2}\right\}}} \]

and compare it with the appropriate tabulated value of \( \tau \) for the acceptance or rejection of the hypothesis.
2.3.3: Test for homogeneity:

To statistically analyse the significance of relationship between the type of factor selection and propensity to assume risk we may use the chi-square test statistic. To statistically analyse the significance of relationship between the type of factor selection and propensity to assume risk we have proposed test for homogeneity by using the chi-square test statistic (Fisher, 1954). We have considered null hypothesis

\[ H_0 : \text{there is no structural difference among risk groups in respect of their assigning highest priority to environmental factors.} \]

Corresponding alternative hypothesis is

\[ H_A : \text{there is a structural difference among risk group in respect of their assigning highest priority to environmental factors.} \]

Let there be \( I \) similarly classified populations and \( k \) be the number of classes in each population. Let \( p_{ij} \) be the proportion of the \( j \) th population in the \( i \) th class where \( i = 1, 2, \ldots, k \) and \( j = 1, 2, \ldots, I \). When \( p_{ij} \) are known, we may want to decide if the \( I \) population distributions can be related as identical. We have to test the hypothesis

\[ H_0 : p_{i1} = p_{i2} = \ldots = p_{iI} \text{ for each } i \]

Now suppose a random sample of size \( n_j \) be drawn from the \( j \) th population when \( j = 1, 2, \ldots, I \), the drawings being mutually independent. Let the number of members of this sample which belong to the \( i \) th class be \( f_{ni} \). We have then
Now for each $j$

$$\sum_{i=1}^{k} f_{y} = n_{j}.$$ 

$$\sum_{i=1}^{k} \frac{(f_{y} - n_{j} p_{y})^{2}}{n_{j} p_{y}}$$

is distributed as approximately a $\chi^2$ with df = $k-1$.

Thus,

$$\sum_{i=1}^{l} \sum_{j=1}^{k} \frac{(f_{y} - n_{j} p_{y})^{2}}{n_{j} p_{y}} = \sum_{i=1}^{k} \frac{(f_{y} - n_{j} p_{y})^{2}}{n_{j} p_{y}}$$

being the sum of $l$ independent (approx.) $\chi^2$'s each with df = $k-1$, is itself a $\chi^2$ with df = $(k-1)/l$. According to the hypothesis, therefore,

$$\sum_{i=1}^{l} \sum_{j=1}^{k} \frac{(f_{y} - n_{j} p_{y}^{0})^{2}}{n_{j} p_{y}^{0}}$$

where $p_{y}^{0}$ is the common value of $P_{y}$ for all $j$. It is approximately a $\chi^2$ with df = $(k-1)/l$. This statistic could be used to test $H_{0}$ if $p_{y}^{0}$ were unknown quantities.

By replacing each $p_{y}^{0}$ by its estimator, then

$$\hat{p}_{y}^{0} = \sum_{i} f_{y} = \frac{f_{o}}{n}$$

where $f_{o} = \sum_{j} f_{y}^{0}$ and $n = \sum_{j} n_{j}$.

Frequency $\chi^2$ takes the form
The hypothesis $H_0$ will be rejected or accepted according to the observed value of

$$n\sum \sum \left( \frac{f_{ij} - n_i f_{j-}}{n_i f_{j-}} \right)^2 = n \sum \sum \frac{f_{ij}^2}{f_{ij} n_{ij}} - n$$

2.3.4: Small sample exact test for difference between proportions:

In our study, sample respondents of risk averse managers are less than thirty for all the industries. For statistical test for different inferences on the basis of responses of RAMs, a small sample test for difference between proportions has been employed to find out whether the difference between these proportions is significant or not. To find out whether the proportion is significant we have proposed to use small sample exact test of difference between proportions as given in Mood, Graybill, Bose 1974 and Freund, 1992.

Let a random sample of size $n$ be drawn from an infinite population for which the proportion of individuals having a characteristic $A$, say, $p$, is unknown. We like to test

$$H_0: p = p_{0s}$$
For the number of members of the sample having the characteristics A, we have used statistics $x$. This is sufficient statistics for $p$.

Let the observed value of $x$ be $x_0$. In our study when we are required to test $H_0$ against the alternatives $H_A: p > p_0$, we compute the probability

$$P[x \geq x_0 | p_0] = \sum_{x=x_0}^{n} \binom{n}{x} p_0^x (1 - p_0)^{n-x}$$

If this does not exceed the specified level of significance $\alpha$, we shall consider $x_0$ to be an unlikely value under the hypothesis. Then we will reject null hypothesis.

When the alternative hypothesis is $H_A: p < p_0$, we will compute

$$P[x \leq x_0 | p_0] = \sum_{x=x_0}^{n} \binom{n}{x} p_0^x (1 - p_0)^{n-x}$$

Here we will accept null hypothesis if probability does exceed $\alpha$.

Let us consider two populations for which the proportions of individuals having characteristics A are $p_1$ and $p_2$. We may express by $x_1$ and $x_2$, the numbers of members having the characteristics A in random samples of size $n_1$ and $n_2$ drawn independently from the two populations. Here null hypothesis will be

$$H_0: p_1 = p_2.$$ 

Here we consider the samples for which $x = x_1 + x_2$ is a constant. Under $H_0$ if we denote the common value of the two proportions by $p$, the p.m.f. of $x_1$, $x_2$ and $x = x_1 + x_2$ are
The conditional p.m.f. of $x_1$ for given value of $x$ is, therefore,

$$f(x_1) = \binom{n_1}{x_1} p^{x_1} (1 - p)^{n_1 - x_1}$$

$$f(x_2) = \binom{n_2}{x_2} p^{x_2} (1 - p)^{n_2 - x_2}$$

$$f(x) = \binom{n_1 + n_2}{x} p^x (1 - p)^{n_1 + n_2 - x}$$

The conditional p.m.f. of $x_1$ for given value of $x$ is, therefore,

$$f(x_1 | x) = \binom{n_1}{x_1} \binom{n_2}{x_2} p^{x+ x_2} (1 - p)^{n_1 + n_2 - x - x_2}$$

$$= \binom{n_1 + n_2}{x} p^x (1 - p)^{n_1 + n_2 - x}$$

When the observed value $x_1$ is $x_{10}$ and that of $x$ is $x_0$, we consider the conditional p.m.f. $f(x_1 | x_{10})$ for testing $H_0$.

For alternative hypothesis testing $H_0: p_1 = p_0$ we compute

$$P[x \leq x_{10} | x = x_{10}] = \sum_{x_{10} - n_1} \binom{n_1}{x_{10}} \binom{n_2}{x_{10} - x_1}$$

$$= \binom{n_1 + n_2}{x}$$
We will accept or reject null hypothesis as this probability does or does not exceed $\alpha$.

Our test is a conditional test since, instead of considering all possible random samples of sizes $n_1$ and $n_2$ from the two populations, we are confining our attention only to those samples for which $x = x_1 + x_2$ has the observed value $X_0$.

2.3.5: Test for independence between proportions:

In this study, we present the views of all respondents about the most important external-internal factor combination and propose to carry out the test of association of the factors by using chi square test statistics to identify whether factor matching is at all important for planners. In case they are associated we calculate the degree of association between external and internal factors by using the celebrated Tschupraw coefficient of association (Kendall and Stuart, 1960; Everitt, 1977).

Let a population be classified according to two attributes, $A$ and $B$, into $k$ and $l$ classes, respectively, say,

$A_1, A_2, \ldots, A_k$

and

$B_1, B_2, \ldots, B_l$
Let $P_{ij}$ be the proportion of members of the population belonging simultaneously to the $i$th class of A and $j$th class of B. The proportions $P_{ij}$ define the joint distribution of A and B. The marginal totals

$$P_{i0} = \sum_{j=1}^{k} p_{ij}$$

give the marginal distribution of A; the other marginal totals,

$$P_{0j} = \sum_{i=1}^{l} p_{ij}$$

give the marginal distribution of B.

When $P_{ij}$ are unknown, we may enquire whether A and B are independent. We have then to test the hypothesis

$$H_0: P_{ij} = P_{i0} \times P_{0j} \quad (\text{for all } i \text{ and } j)$$

Let a random sample of size $n$ be drawn from the population, the drawings being mutually independent. If we denote by $f_{ij}$ the number of members of the sample that belong to the $i$th class of A and to the $j$th class of B, then, under the hypothesis,

$$H_0^* = \sum_{i=1}^{l} \sum_{j=1}^{k} \frac{(f_{ij} - np_{i0}p_{0j})^2}{np_{i0}p_{0j}}$$

will be distributed as approximately a $\chi^2$ with df$=k(l-1)$. The proper estimator of $P_{i0}$, which is the population proportion in the class $A_i$, is the corresponding sample proportion $f_{i0}/n$, where $f_{i0} = \sum_j f_{ij}$.

Similarly, the proper estimator of $P_{0j}$ is $f_{0j}/n$. 

52
So, we may compute

\[ \chi^2 = \sum_i \sum_j \left( \frac{f_{ij} - \frac{n f_{ij}}{f_{ii}f_{jj}}}{n} \right)^2 = n \sum_i \sum_j \frac{f_{ij}^2}{f_{ii}f_{jj}} - n \]

We are using \( k+1 \) estimators, of which \((k-1)+(-1)\) are independent. This is so because for given \((k-1)\) of the estimators for \( P_{io} \), the other automatically follows and given \((-1)\) of the estimators for \( P_{oj} \), the other one is automatically determined. So this will be distributed as approximately a \( \chi^2 \) with \((k-1)(-1)=(k-1)(-1)\) degrees of freedom.

If there is a relationship between the two characteristics under consideration, then we will compute strength of the relationship by using contingency coefficient

\[ C = \left( \frac{\chi^2}{\chi^2 + n} \right)^{1/2} \]

Again we use Tschuprow coefficient to measure degree of association by the formula

\[ T_{AB} = \left( \frac{\chi_{AB}^2}{n \sqrt{(k-1)(-1)}} \right)^{1/2} \]
2.3.6: Estimation of future trend and measurement of industry attractiveness:

It is not logical to draw any strategic planning without knowing future rate of attractiveness. For a fault-free move, one has to study the trend of attractiveness. Firms' own capability of factor matching may turn opportunities in its favor provided it has an idea about future attractiveness. Estimation of future trend helps firms for formulation of strategic move to get a competitive edge.

In this study, we have estimated industry attractiveness by using linear regression method. In this study, we have proposed a model for measurement of future trend.

We have presented the prediction from two different angles. In the higher level forecasting, we have carried out projection analysis for system point of view. It means generation of a time series data on industry attractiveness and making prediction from the same. Given the chronological information on profitability, growth, and level of competition, we propose calculation of industry attractiveness. Necessary forecasting has been done by regression method.

To build up a relationship between the 'dependent variable' and the 'independent variables', let us assume that the relationship between $x_i$ and
\( x_1, x_2, \ldots, x_p \) is, at least in an approximate sense, given by the following equation

\[
x_i = a + b_1 x_2 + b_2 x_3 + \ldots + b_p x_p
\]

The values of the variables for the \( \alpha \)th individual may be denoted by \( x_{1\alpha}, x_{2\alpha}, \ldots, x_{p\alpha} \) (\( \alpha = 1, 2, \ldots, n \))

By using least square data to determine the constants of the equation, we get,

\[
\sum_{\alpha} x_{1\alpha}^2 = \sum_{\alpha} (x_{1\alpha} - a - b_1 x_{2\alpha} - \ldots - b_p x_{p\alpha})^2
\]

This means that the constants are to be so determined that equation would be minimum. Alternatively, we may present the equation as

\[
\sum_{\alpha} x_{1\alpha} = na + b_1 \sum_{\alpha} x_{2\alpha} + b_2 \sum_{\alpha} x_{3\alpha} + \ldots + b_p \sum_{\alpha} x_{p\alpha}
\]

\[
\sum_{\alpha} x_{2\alpha} x_{1\alpha} = a \sum_{\alpha} x_{2\alpha} + b_1 \sum_{\alpha} x_{2\alpha} x_{3\alpha} + b_2 \sum_{\alpha} x_{2\alpha} x_{3\alpha} + \ldots + b_p \sum_{\alpha} x_{2\alpha} x_{p\alpha}
\]

\[
\sum_{\alpha} x_{3\alpha} x_{1\alpha} = a \sum_{\alpha} x_{3\alpha} + b_1 \sum_{\alpha} x_{3\alpha} x_{2\alpha} + b_2 \sum_{\alpha} x_{3\alpha} x_{2\alpha} + \ldots + b_p \sum_{\alpha} x_{3\alpha} x_{p\alpha}
\]

\[
\sum_{\alpha} x_{p\alpha} x_{1\alpha} = a \sum_{\alpha} x_{p\alpha} + b_1 \sum_{\alpha} x_{p\alpha} x_{2\alpha} + b_2 \sum_{\alpha} x_{p\alpha} x_{2\alpha} + \ldots + b_p \sum_{\alpha} x_{p\alpha} x_{p\alpha}
\]

The first equation gives, on divided by \( n \),

\[
\bar{x}_i = a + b_1 \bar{x}_2 + b_2 \bar{x}_3 + \ldots + b_p \bar{x}_p
\]

which shows incidentally that the mean point \( (\bar{x}_1, \bar{x}_2, \ldots, \bar{x}_p) \) necessarily satisfies the prediction equation.