CHAPTER THREE
RESEARCH METHODOLOGY

In this chapter different aspect of research methodology in connection with the study is presented. This chapter is discussed under various sections and subsections. The first section covers the need for the study. The second section highlights the objectives of the study followed by various operational definitions in the third section and research design in the fourth section. The fifth section focuses on the population and the sample. The sixth section deals with the data collection method. The design, modification and administration of the research questionnaire are also dealt in various subsections of this section. In the seventh section, analysis and statistical procedure for interpreting the data is covered. Eighth section is on the limitations of the study followed by reliability of data, dependability of the results and the researcher’s liability in the Ninth section. The core of the tenth section is direction and scope of further study.

3.1 NEED FOR THE STUDY

India is going through information revolution thus making the information system a subsystem of a larger organization\(^1\). Since information is the only truly shared resource for planning, executing and monitoring, it provides the organization with a potent weapon with which they can beat the competition. This is because it is possible for a competitor to analyze and copy the product, the process of distribution, the marketing strategy, etc. But it is more difficult to replicate the internal information system around which these are built. Thus information system becomes a sustainable advantage and by building on them one can stay ahead of the competition\(^2\).

This means that information system becomes a part of business process and makes it unique. As managers continue to invite and strive to segment their markets
even more finely and offer a plethora of products and services it is the information systems that helps in keeping costs under control, provides feedback from the market, allows a faster reaction time, permits flexible manufacturing, caters to design and development changes, supports effective materials management, assists in financing decisions, facilitates targeted (database) marketing, allows organizations to expand geographically into new markets, etc. This is possible because external and internal information is made available for business decision making and managers use it as the weapon. The case in point is provided by the manufacturing industry with particular reference to material and resources planning, logistics and distribution, sales management and direct (database) marketing, service and support, among other areas. Large manufactures fighting for narrowly segmented, geographically depressed, cost sensitive markets against numerous competitors who are continuously inverting information technology to support and manage their efforts. Any improvements in forecasting, distribution models, materials management and sourcing, production planning, etc. is dependent on the information system that drives the organization and this is the battlefield for the modern corporation.

Management Information systems have changed dramatically during the last 20 years as a result of an increased usage of computers by more and more number of organizations. The situation today is significantly different from that existed a decade ago. The computer is increasingly becoming an integral part of Indian corporate life despite the infrastructural deficiencies that are a reality in India.

For the Indian Industry indicators are pointing in the right direction. It may not be a win-win situation in the truest sense. From an incubation period so far, corporate India is gearing up to take competition from their technologically advanced counterparts, head on. And in doing so increasing their own productivity and levels of efficiency. A frequent availability of information, thanks to Information Technology (IT), has definitely led to better planning for many an organization. Computers have
allowed them to have a more systematic approach both in terms of time saving and efficiency. For many, a major shift to IT has enabled them to maintain a stable, if not better market share. The focus for the next couple of years will be on systems integration. From the era when computers were being looked upon as mere ‘box’, the market is certainly looking forward to ‘solutions’. On their part, many of the major IT vendors are trying to become more solution-centric. One can also see concepts like facilities management (a combination of systems integration and IT consultancy), becoming more popular with corporate houses. The advent of the communications era has proved beyond doubt, that without proper communications infrastructure it has become almost impossible to run large organizations. Things are certainly moving towards a totally networked environment. Future technology trends relating to IT, that could give the corporate user the much needed competitive edge is getting acceptance. Fortunately for corporate India, the initiative taken by some of the more enterprising companies has helped in shedding inhibitions about investing money in IT.

The manufacturing segment of the Indian corporate sector has been one of the larger buyers to date. One reason being they are the single largest segment of the industry. This segment has been investing heavily in automation. The manufacturing segment where in a reduced cycle is immediately convertible to profit margins, IT has accounted for faster turnarounds. Another key benefit that can accrue from the adoption of new IT related technologies is the optimum utilization of resources. Then it is faster time to market of a product, as IT helps in designing and taking products to the customer a lot faster than before. This also has the potential of putting these companies on a faster growth track than earlier. As such, we are entering an ironical situation - more competition from MNCs leads to faster growth and results in more competition. An unmistakable impact of this cycle is that henceforth one will not have non competitive companies dying a slow death. It will be a fast road to extinction.

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More critically, infotech, and its usage levels, may just about decide the question of survival and simultaneous fast growth.

Competition, globalization and growth of business are the forces propelling for computerization. For the manufacturing segment the most important criteria seems to be volume and growth of their business. IT can help them manage their resources more efficiently and at the same time handle multiple tasks is a matter of little dispute. Be it problems relating to large volumes like inventory control and efficient retailing or even product assembly there is virtually no area where IT cannot fit in. There are enough indications to point out that most of the large corporate houses are conscious of the need for IT related investments. These are also signs of the top management becoming more and more aware of the fact that computerization can given them the competitive edge.

3.2 OBJECTIVES OF THE STUDY

After detailed literature survey and discussions with experts in the area, it was found that there is a need to evaluate the extent of computerization of the Information systems in large scale, private sector, Indian manufacturing companies, these terms will be explained in a subsequent subsection, covering different management functions like strategic, Marketing, Finance, Production and Personnel. But as we are mainly concerned with Manufacturing companies so the coverage under production management is more.

This study was conducted to find out the extent of computerization of the Information systems. to be guaged by, that for the three categories, the information needs of that level of management which is called upon to make a particular decision are being fulfilled by the information system, the form period is being supported by the system, the type of data requird is being provided by the information system, from which sources the information system drawing the data and the level of difficulty

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encount in implementing this information system. Also, whether the computerization of subsystems covered under the study depends on the equity capital.

As there are about 5000 companies listed on the Bombay Stock Exchange and as there is a constraint on time and cost involved in completing this dissertation, the scope of this study will be confined to large scale, private sector Indian manufacturing companies. The areas covered under the various management functions are

1. Strategic Management
   i) Strategic planning
   ii) Engg and Research
   iii) Legal
2. Marketing Management
   i) Advertising
   ii) Sales Analysis
   iii) Sales forecasting
   iv) Sales Administration
   v) Sales order processing
3. Production management
   i) Bill of material
   ii) Inventory reporting and control
   iii) Requirement generation
   iv) Production scheduling
   v) Production control
   vi) Purchasing
   vii) Receiving
   viii) Quality control
   ix) Maintenance

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4. Finance Management
   i) Accounts Receivable
   ii) Accounts payable
   iii) Cost accounting
   iv) Fixed assets accounting
   v) Budgeting
   vi) Profit and loss statement
5. Personnel Management
   i) Payroll and payroll reporting
   ii) Wage and compensation analysis
   iii) Performance appraisal.

3.3 OPERATIONAL DEFINITIONS

For this study the following terms used are defined as follows:

1) **Computerised Management Information System**: Is used throughout this dissertation to include the following, usually more specific terms. Computer-based Information system (CBIS), computer Information system (CIS), Electronic data processing (EDP) system, Decision support system (DS3), Executive support system (ESS), Information reporting system (IRS), Transaction processing system (TPS) and other information systems used in the organisations.

2) **Manufacturing Process**: The Factories Act, 1948 defines "manufacturing process" as any process for
   i) making altering, repairing, ornamenting, finishing, packing, oiling, washing, clearing, breaking up, demolishing or other wise treating or adopting, any article or substance with a view to its use, transport, delivery or disposal, or
   ii) pumping oil, water, sewage or any other substance, or
   iii) generating, transforming or transmitting power or
iv) composing types for printing by letter press, lithography, photogravure of other similar process or book binding.

v) constructing, reconstructing, repairing, refitting, finishing or breaking up ships or vessels.

vi) preserving storing any article in cold storage.

3) **Large scale companies**: A small scale industry should have equity capital of up to Rs. 60 lakhs so we have defined a large scale companies as those companies have equity capital of Rs. one crore or more.

4) **Private Sector**: Means any company in which not more than fifty percent of the paid up share capital is held by central government or by any state government or governments or partly by the central government and partly by one or more state governments.

5) **Indian companies**: A company incorporated in India has the nationality of this country.

6) **Strategic Planning**: Here the major company decisions are made. Overall company policies are determined and promulgated. Sophisticated CBIS employ business models and simulation to determine the effect of different management policies on the profitability of the company. A mathematical model is constructed that indicates the effect of particular management decisions on such factors as sales, costs, and profits. The model is built from data captured and the simulation is conducted using the same historical data. In addition to the internal data, external data gathered from outside sources is also used on one side are the basic economic factors, such as trends in gross national product, political factors, and population growth, while on the other side are the available cash resources etc. These factors are part of the mathematical model built to evaluate and determine management policy. The results of the strategic planning are marketing policies, as well as the profit plan, capital expenditure schedule, and
operating budget. These figures form the basis of measuring actual operation.

Data Base: A database is prime requisite of a management information system. The database holds relevant data about a company's operation and is usually organized around basic files, such as product file, personnel file, sales file, inventory file, customer file. The file is arranged so that duplication and redundancy are avoided. Information concerning on-going activities is captured once, validated, and entered into the proper location in the database.

Engineering and Research: Is vital for a manufacturing company. The engineers design the products the company produces and develop bill-of-material\(^{11}\). It is also responsible for establishing requirements and standards for quality control and machine maintenance. Routing sheet is also provided by E&R, it indicates the type and sequence of production operations necessary to transform the raw material and components into finished goods.

Requirements Generation: Takes finished goods requirements (sales forecast, plus sales orders, minus finished-goods inventory) from the inventory control and, utilizing the bill of material information from the E&R, determined the requirements for subassemblies, piece parts, and raw material by multiplying the number of finished-goods items by the components that constitute each end item. The total of each subunit is then measured against inventory records to produce net requirements.

Production Schedule: The routing data, supplied by the E&R subsystem is combined with the net requirements to produce a production schedule.

Production Control: Deals with the day to day implementation of the production plan by issuing job packets to the factory (telling them what jobs to work on, the sequence and scheduled completion dates), accepting feedback (including labour, material, expense, and work-in-process data), and producing a variety of quality control and maintenance reports and analyses.
12) **Inventory Reporting and Control**: Inventory control provides for automatic ordering based on such considerations as customer service, economic order quantity, and lead time. When the inventory of particular items reaches a predetermined reorder point, the inventory control directs the purchasing to write a purchase order.

13) **Purchasing**: The purchasing receives inputs from the inventory reporting and control that a purchase order is to be made. The purchase order is made out and sent to the respective vendor or manufacturer.

14) **Accounts payable**: After receiving the purchase order, the vendor fills the order, ships the product to the warehouse, and submits his invoice, which initiates Accounts payable activity and the eventual reconciliation of cash payments.

15) **Sales Forecasting**: The sales forecast is based on historical sales movement and projected external events (buying trends, economic factors and so no). The sales forecast is significant to all aspects of the business. It serves as an input to the inventory control as a basis of establishing inventory policy and enters strategic planning as a basis of influencing total company goals and objectives. It is crucial to the planning process. It determined whether a new item should be introduced or whether an entirely new product line should be developed. It forms the rationale for establishing plant capacity and long-range facility needs. It is a key determinant for budget preparation and profitability projections. In the operational and control area, the sales forecast determines purchasing policies (how much to order, when to order), manufacturing policies, hiring, training, inventory levels and the likes.

16) **Receiving**: After the purchase order is made out by purchasing and sent to the vendor, it becomes a input for receiving. The invoice submitted by the vendor is cross checked with the purchase order. Receiving becomes an input
for inventory reporting and control and the appropriate items are updated.

15) **Accounts Receivable**: After the vendor fills the order, ships the product to the warehouse, and submits his invoice, this invoice becomes a input to accounts receivable for the vendor.

### 3.4 RESEARCH DESIGN

Research design is simply the framework or plan for a study used as a guide in collecting and analyzing data. It is a blueprint that is followed in completing a study. It helps a researcher solve a problem as accurately and objectively as possible. Two definitions of research design are:

A series of advanced decisions that, taken together, comprise a master plan or model for the conduct of an investigation.

In this study survey research was used, as it has high potential to solve theoretical and applied educational problems. Descriptive cross-sectional study was adopted. Descriptive designs are always used when the purpose of the research is to perceive difficulties and opportunities and to identify significant problems, determining what problems are to be solved and selecting best alternative courses of action. The cross-sectional studies seek to find change in comparison between various groups.

### 3.5 POPULATION AND SAMPLE

To find the extent of computerization of management information system in large scale, private sector, Indian manufacturing companies the population, as taken from Investor's guide. The Economic Times, New Delhi, 30 January 1995; is 1088 companies from 58 industries with 947 companies in 1st category, i.e. companies having an equity capital greater than and equal to Rs. 1 crore and less than Rs. 25 crore. ($\leq 1 \text{ cr} < 25 \text{ cr}$)

91 companies in 2nd category i.e. companies having an equity capital greater...
than and equal to Rs. 25 cr and less than Rs. 50 crore ($\leq 25 \text{ cr} < 50 \text{ cr}$)

51 companies in IIIrd category i.e. companies having an equity capital of equal to or more than Rs. 50 crore ($\geq 50 \text{ cr}$)

The list of population, along with the break up on the basis of equity capital is given in Appendix-II.

At relative allowable error $R = 0.05\%$ and 99% confidence level the sample size is 100. For taking the sample of 100 companies from the population of 1088, proportionate stratified sampling is used.

A proportionate stratified sample is one where the number chosen in each stratum is proportionate to its share of the total population stratified selection tends to be more efficient than simple random sampling\(^8\). In forcing the sample in each stratum to be proportional to its portion of the whole population, the risk of under or oversampling the strata is avoided. This markedly reduces the potential sampling error. Information on the composition of the whole population should be currently accurate, or else the allocations in each stratum will themselves be in error and the sample will be biased. Further more, if the criteria used to stratify the population are not associated with what the study is going to measure, they do not improve the probability of drawing a representative sample with respect to the data sought. Stratifying should not be done for its own sake, but it should be done when a real correlation between criteria and data sought seems likely\(^9\).

Ist category i.e. companies with equity capital greater than or equal to Rs. 1 crore but less than Rs. 25 crore represents 86% of the population so the sample of 100 companies will have 86% representation from this category i.e. 86 companies.

IInd category i.e. companies with equity capital ranging from greater than or equal to Rs.25 crore but less than Rs. 50 crore has a representation of 9% in the population so the sample will have companies from this category.

IIIrd category is of the companies having equity capital equal to and greater
than Rs. 50 crore is 5% of the population so the sample from this category will have 5 companies.

After determining the total sample size and sample size within each category, simple random sampling was done using a random number table to pick individual company in each category (Random number table and method for using it is given in Appendix -III)

In simple random sampling all study objects possess an equal chance of being included in the sample. For a given sample of size (say n) all combinations of n study objects possess the same chance of being in the sample. Operationally it involves drawing a random number between 1 to N (population size), so the chance of selecting any typical sample is equal to (1/N).

3.6 DATA COLLECTION METHOD

3.6.1 Questionnaire : Design and Modification

Self adminitered questionnaire was used which rely on efficiency of written words rather than on interviewer. The questions used in the questionnaire were developed on the basis of reviewing the previous literature, to find questions that were used previously, suggestions were received from my teachers and colleagues, after final approval of my supervisor, then questions were formulated.

Once the initial questionnaire was developed, it was pre-tested to iron out fundamental problems in questionnaire design. Verbal and written comments were received and changes incorporated.

To measure reliability of the questionnaire test-retest approach was adopted. “This is a common approach in such areas as educational testing. Test-retest reliability estimates are obtained by repeating the measurement using the same instrument under as nearly equivalent conditions as possible. The results of the two administration are then compared on an item-by-item basis and the degree of correspondence is
determined. The greater the differences, the lower the reliability. The general philosophy behind this approach is that the presence of random fluctuations will cause the items being measured to be scored differently on each administration. The Karl Pearson's coefficient of correlation between the two results is taken as the measure of coefficient of reliability. The correlation was found to be 0.519 falling in the acceptable range.

Researchers have historically shown only a limited interest in measures of reliability. Part of this stems from false reasoning on the nature of reliability. This reasoning is basically as follows “Reliability is concerned with consistency or stability over time. Most research studies are one time affairs. Therefore, we need not be concerned about reliability”. Although reliability is concerned with consistency and stability over time this concern should be used as evidence of variable errors in the measurement. The presence of random errors in any measurement, even if it is a single measurement, can cause the decision maker to reach incorrect conclusions. Therefore, the reliability of a measurement is of importance to the researcher.

3.6.2 Administering Research Questionnaire

The present study covers various quantitative and qualitative data. As such a survey research was undertaken. For this purpose, an information sheet in the form of a questionnaire was prepared and administered to whole of the sample of 100 companies by mail from which 32 responded positively, rest of the 68 were contacted personally, of which 30 responded positively and 38 declined to respond. Then again a sample of 50 companies was generated and 38 responses were received from them. Most of the companies who declined to respond where from the 1st category i.e. companies having equity within the range of equal to and more than Rs.1 crore and less than Rs.25 crore. The reasons for their non participation were varied, like non availability of time, non availability of systems personnel and non computerization of all the subsystems covered in the questionnaire. The questionnaire was administered
to no one in particular. The respondents were managers, executives, systems personnel, office workers and others that perform the same function.

Over a period of few months, the companies were contacted by mail or personally. To increase response rate it was ensured that
a) covering letter accompanied the questionnaire
b) follow up was done.
c) anonymity of organisations and the respondents was ensured and maintained.

3.7 ANALYSIS AND INTERPRETATION OF DATA

3.7.1 Analysis of Data

In decisional research, the analysis of data is done to provide information to help solve the problem at hand. Without a sound analysis, the best that can happen is the part of the information that could have been provided will not be available. The worst possibility is that misleading “information” will be supplied that will contribute to a bad decision.

The data analysis was conducted in two separate phases. In the first phase, the data collected from the previously mentioned sources were tabulated on separate tally sheet for each of the 26 questions (as given in Appendix IV). And then converted into percentages and presented graphically.

In the second phase, Tests For Significance for Difference of Proportion was applied to find whether any significant difference exists between the two categories. For this the second and the third categories were coupled, as these two categories are small in comparison to the first category. Now we have companies with equity capital greater than or equal to Rs. 1 crore and less than Rs. 25 crore and the second category, which will have companies with equity capital greater than or equal to Rs. 25 crore and more. The size of our two sample becomes 86 and 14 respectively.

So in the first phase of analysis, we have three category of companies i.e.

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**Ist Category** : Companies having equity capital with in the range of greater than or equal to Rs. 1 crore and less than Rs. 25 crores.

**II Category** : Companies having equity capital with in the range of greater than or equal to Rs. 25 crore and less than Rs. 50 crores.

**IIIrd Category** : Companies having equity capital with in the range of greater than or equal to Rs. 50 crore.

The sample size in three categories are 86, 9 and 5 respectively. In the second phase of analysis, the second and third categories are coupled and we have only two categories.

**Ist category** : Companies having equity capital with in the range of greater than or equal to Rs. 1 crore and less than Rs. 25 crores.

**II Category** : Companies having equity capital with in the range of greater than or equal to Rs. 25 crore.

### 3.7.2 Statistical Procedure for Interpreting Data

The following is a capsule summary of the statistical procedures used for interpreting the results.

In many decision-making situations, people need to determine whether the parameters of two populations are alike or different. A company may want to test, for example, whether its female employees receive lower salaries than its male employees for the same work. A training director may wish to determine whether the proportion of promotable employees at one government installation is different from that at another. A drug manufacturer may need to know whether a new drug causes one reaction in one group of experimental animals but a different reaction in another group.

In each of these examples, decision makers are concerned with parameters of two populations. In these situations, they are not interested in the actual value of the parameters as they are in the relation between the values of the two parameters that
is, how these parameters differ. Using hypothesis-testing procedures these questions can be assured.

**Test of significance for difference of proportions**: Suppose we want to compare two distinct populations with respect to the prevalence of a certain attribute among their members, we can take samples from each of the two groups in question and use the sample proportions to test the difference between the two populations.

**Comparing two sample proportions**: In some cases, two or more samples are taken and their results compared on the assumption that there is no significant difference between the two results shown by them i.e. \( p_1 \) (the first sample proportion) = \( p_2 \) (the second sample proportion) = \( P \) (the population proportion).

It is possible to carry out a significance test to determine whether the difference between two sample proportions is significant or they could have drawn from the same population.

**Significance Testing**: Let \( p_1 \) and \( p_2 \) be the proportions (or percentages) of two random samples sizes \( n_1 \) and \( n_2 \) drawn from respective populations with proportions (or percentages) \( P_1 \) and \( P_2 \). The null hypothesis is that there is no difference between the two population proportions (or percentages) i.e. \( P_1 = P_2 \).

When the sampling distributions of \( p_1 \) and \( p_2 \) are normal, the distribution of the difference between \( p_1 \) and \( p_2 \) is also normal. Since the mean of the sampling distribution of \( (p_1 - p_2) \) is equal to the difference between the two population proportions (or percentages).

\[
z = \frac{(p_1 - p_2) - (P_1 - P_2)}{\text{S.E}(p_1 - p_2)}
\]

When \( P_1 = P_2, P_1 = P_2 = 0 \) and \( P_1 Q_1 = P_2 Q_2 = PQ \), where \( Q = 1 - P \)

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Thus
\[ z = \frac{p_1 - p_2}{SE(p_1 - p_2)} \]

Where
\[ SE(p_1 - p_2) = \sqrt{\frac{P_1Q_1}{n_1} + \frac{P_2Q_2}{n_2}} = \sqrt{PQ\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} \]

When the value of \( P \) is to be estimated by using the two sample proportions (or percentages) and when the sample sizes of the two samples are large, \( Z \) becomes an approximated value and is written as
\[ Z = \frac{p_1 - p_2}{SE(p_1 - p_2)} \]

Where
\[ SE(p_1 - p_2) = \sqrt{\frac{pq}{n_1} + \frac{pq}{n_2}} \]

and
\[ p = \frac{n_1p_1 + n_2p_2}{n_1 + n_2} \]
\[ q = 1 - p \quad \text{(for proportion)} \]
\[ q = 100 - p \quad \text{(for percentages)} \]

\( p \) is the best estimate of the population proportion (or percentage) \( P \). Also \( p \) is the weighted mean of the two sample proportions (or percentages) \( p_1 \) and \( p_2 \). The weights are based on sample sizes \( n_1 \) and \( n_2 \). Moreover, for large values of \( n \) all the distributions e.g. Binomial, Poission, Negative Binomial, etc are very closely approximated by Normal distribution.

Thus the steps to be used in the normal test are as follows:

(i) Compute the test statistic \( Z \) under Null Hypothesis \( H_0 \).

(ii) If \( |Z| > 3 \), \( H_0 \) is always refuted.

(iii) If \( |Z| < 3 \), we test its significance at certain level of significance usually at 5% and sometimes at 1% level of significance. But as our confidence level is 99%, we will take it as 1% level of significance.

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If $|Z_1| > 2.58$, $H_0$ is contradicted at 1% level of significance and if $|Z_1| < 2.58$, $H_0$ may be accepted as 1% level of significance.

For a single tail test, we compare the computed value of $|Z_1|$ with 2.33 (at 1% level of significance) and accept or reject $H_0$ accordingly.\(^{31}\)

In any test the critical region is represented by a portion of the area under the probability curve of the sampling distribution of the test statistic.

A test of any statistical hypothesis where the alternative hypothesis is one tailed is called a one tailed test. For example, a test for testing the mean of a population.

$H_0 : \mu = \mu_0$

against the alternative hypothesis.

$H_1 : \mu > \mu_0$ (Right tailed) or $H_1 : \mu < \mu_0$ (Left tailed) is a single tailed test. In the right tailed test ($H_1 : \mu > \mu_0$) the critical region lies entirely in the right tail of the sample distribution, while for the left tail test ($H_1 : \mu < \mu_0$), the critical region is entirely in the left tail of the distribution.

In our problem,

Null Hypothesis $H_0 : P_1 = P_2 = P$ (say) i.e. there is no significant difference in the extent of computerization between the two categories of companies under study.

Alternative Hypothesis $H_0 : P_1 < P_2$ (left tailed test) and if $|Z_1| < 2.58$, we will accept the null hypothesis at level of significance $1\% = 0.01$

Test statistic is calculated using the formula

$$z = \frac{\hat{P}_1 - \hat{P}_2}{\sqrt{\hat{P}\hat{Q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$
\[ n_1 = 86, \quad n_2 = 14 \]
\[ X_1 = \text{number of respondents favouring one option in the 1st category.} \]
\[ X_2 = \text{number of respondents favouring the same option in the 2nd category.} \]
\[ P_1 = \frac{X_1}{n_1} \quad \text{and} \quad P_2 = \frac{X_2}{n_2} \]
\[ \hat{P} = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2} = \frac{X_1 + X_2}{n_1 + n_2} \]
\[ Q = 1 - \hat{P} \]

Putting all these values in \( Z \), the test statistic for each option is calculated and its modulus is taken.

### 3.8 LIMITATIONS OF THE STUDY

All research studies have limitations and shortcomings of their own irrespective of the researcher, time and cost involved and the methods adopted in conducting the research and completing the study. So the limitations should be pointed out and accepted while undertaking this study, shortcomings and limitations were faced and best possible means were used to reduce, if not eliminate, them to give this study its final shape and the best possible result that would make this study meaningful.

1) The population was estimated to be 1088 companies which may not be complete.

2) A sample of 100 companies was selected on the basis of standard sampling procedures and scientific method so it is reasonable to conclude that the result represented the population in general. But still generalisation may not be possible.

3) This study was not conducted industry wise as the computerised management Information systems may or may not be similar within particular industry.

4) This study was confined to large scale companies only. Thus, generalization to medium and small scale companies may not be appropriate.
5) Companies having computerised management Information systems were covered so generalization to companies without computerised management Information system cannot be done.

6) The technique of self reporting was used for collecting information, generally considered the weakest. Therefore, external check, like cross checking with others within the organisation where questionnaire were administered personally, was incorporated to reduce inaccuracy and bias.

7) The study was restricted to manufacturing companies. Thus, generalization to other type of companies is not appropriate.

8) This study was done to cover only the private sector. So generalization cannot be done.

9) The general applicability of this research is restricted due to certain limitations. Majority of these can be said to be self imposed. In order to complete it within the boundaries of time and cost, it is kept within manageable limit.

3.9 RELIABILITY OF DATA AND DEPENDABILITY OF THE RESULTS

The data was collected by administering a separate questionnaire to each of the sampling unit. About 80% of the data was collected by administering the questionnaire personally and sometimes the responses were cross checked, also. All the respondents held responsible positions in the organisation and were users of the information system. The questionnaire was pretested to iron out fundamental problems in the questionnaire design. Also the identity of respondents and the organisations were kept confidential. Hence, the data so obtained can be said to be reliable.

As the sample is representative of the population because it is drawn on the basis of established methods and procedures, the sampling process is scientific, the data obtained is reliable, statistical tools are applied to analyze the data, hence, the results drawn from it can be taken as dependable.
But inspite of all these efforts made, the responses of the respondents may be biased. Errors might have crept in and only the researcher is liable for this area of omission and commission.

3.10 DIRECTION FOR FUTURE RESEARCH

1) Research is required for studying computerization of Management Information system in service sector.

2) This study may further be extended by studying computerization of Management Information systems in small and medium scale companies.

3) To gain further insight, a study can be done on the basis of industry which can reveal the extent of computerization of information system within a particular type of industry.

4) A research is required to compare computerised Management Information systems between public and private sectors.

5) A study can be done to know the extent of computerization of Management Information systems used by a particular level of management.

6) The effect of culture and management style on the computerization of Management Information systems also warrants a research.

7) The extent of computerization of Management Information systems can also be studied on the basis of the geographical location.

8) Research is needed to find out investments in computerised Management Information systems with respect to turnover, profits, sales, number of employees etc.

9) Research is needed to consolidate the findings of researches related to the computerization of Management Information systems in India.

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