Chapter 2: Methodology
2. Methodology

2.1 Introduction to Research Design:

As mentioned earlier, the present study focuses on the collaboration, learning and technology development aspects of software companies. A survey was carried out among the software companies that were collaborating with other organisations in learning and technology development. The primary data were collected through structured questionnaires and case study techniques. Information and data collected from the companies were statistically analysed. The questionnaire developed was pre-tested through a pilot-survey of few companies in Hyderabad. After the pre-testing of the questionnaire, the corrections were incorporated and the final data were collected using the corrected questionnaire. The data collected was analysed using a statistical package called SPSS.

2.2 Unit of Study:

For the purpose of the present dises, a software development company is the unit of the study. The software company might have multiple working locations spread across the country, but it was considered as a single unit for the study.

2.3 Base Year

All the data and information collected was for the base financial year 2000-01. That is, the base financial year is from April 2000 to March 2001. Any other information collected for the purpose of comparison was for an year and that is financial year starting from April and ending March of next calendar year. Example: Year 1999-2000 means data pertaining to that financial year starting form April 1999 and ending March 2000.
2.4. **Universe of the study:**

The universe of the present study consists of all the software development companies in Hyderabad that collaborated with other companies outside the country at the time of the study. Companies that satisfied the following criteria were included in the universe.

- A company registered under the companies act of government of India (as a partnership firm or private limited company or a public limited company) and should have its registered office in Andhra Pradesh.
- A company that had computer software design and development as primary areas of business in general and other primary related areas in specific.
- A company that had at least one collaboration with a company inside or outside the country.

A list of companies that satisfied the above criteria was obtained from the Software Technology Park of India, Hyderabad and all the companies were registered under a 100% EOU scheme for software companies. The registered companies enjoy certain tax, duty and other benefits if they have a foreign collaboration and export software to other countries. This scheme is implemented under a Government organisation called "Software Technology Parks of India (STPI)" and the scheme is called “STPI 100% Export Oriented Unit (EOU)”. So companies registered under STPI EOU scheme were included in the universe of the present study as per the following conditions:
Any company that has to qualify under STPI EOU scheme has to be a registered company in India, under the companies act of government of India (as a partnership firm or private limited company or a public limited company).

The company has to be involved in software development and any other related areas. (Here the universe has to be selected from the list of those STPI EOU registered units that have computer software design and development as primary areas of business in general and other primary related areas in specific)

The minimum eligibility to get registered under this scheme is that the company should have at least one collaboration with a foreign company and the company should export the software to that country.

Finally the universe for the present study is defined as follows:

All those companies registered under "STPI 100 % EOU scheme" under STPI, Hyderabad and have computer software design and development as primary areas of business and other primary related areas (such as software services, software maintenance, etc) and are live during the financial year 2000-01.

2.5 Sampling:

Stratified random sampling strategy was used. The units were stratified on the size - annual turnover together with the number of people employed.
Table No 2.1: Definition of company size

<table>
<thead>
<tr>
<th>Company Size</th>
<th>Annual Turnover in Rs. Crores in 2000-01</th>
<th>Number of Employees in 2000-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>Less than 10 million</td>
<td>Less than 24</td>
</tr>
<tr>
<td>Medium</td>
<td>11 to 100 million</td>
<td>25 to 99</td>
</tr>
<tr>
<td>Big</td>
<td>More than 101 million</td>
<td>More than 100</td>
</tr>
</tbody>
</table>

Note: A company has to satisfy both the conditions of turnover and number of people to be categorised as small, medium & big-

Table No 2.2: Study universe and sample

<table>
<thead>
<tr>
<th>Company Size (A)</th>
<th>No of STPI companies (software) (B)</th>
<th>No of companies approached interview — (as percentage of (B)) (C)</th>
<th>No of companies agreed to participate - (as percentage of (C)) (D)</th>
<th>No of companies agreed for in-depth interview - (as percentage of(D)) (E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>184</td>
<td>46 (25 %)</td>
<td>16 (35 %)</td>
<td>5 (31 %)</td>
</tr>
<tr>
<td>Medium</td>
<td>98</td>
<td>25 (25 %)</td>
<td>11 (44 %)</td>
<td>3 (27 %)</td>
</tr>
<tr>
<td>Big</td>
<td>42</td>
<td>10 (25 %)</td>
<td>5 (50 %)</td>
<td>2 (40 %)</td>
</tr>
<tr>
<td>Total</td>
<td>324</td>
<td>81 (25 %)</td>
<td>32 (40 %)</td>
<td>10 (31 %)</td>
</tr>
</tbody>
</table>

Note: N = 32

2.6 Pilot Study:

A pilot study was conducted for the purpose of refining the questionnaire and the variables for the study. Based upon the feedback from the pilot study appropriate changes were made in the questionnaire.
2.7 **Methods of Data Collection:**

Data were collected with the help of a structured questionnaire through personal interviews. In-depth interviews were also conducted with some decision makers in the organizations.

2.8 **Sources of Data:**

Both primary and secondary sources were tapped for data.

2.8.1 **Primary Data:**

Software companies involved in collaborations were studied and the primary data was collected with the help of a structured questionnaire.

2.8.2 **Secondary Data:**

Information regarding the companies was collected from the central agencies like Software Technology Park of India (STPI), National Association of Software & Service Companies (NASSCOM), Council for Promotion of Export in Electronics and Software (CPEES), and other relevant agencies.

2.9 **Variables for the study:**

2.9.1 **Independent Variables:**

**Age:** Age of the organisation is defined as the number of years the company has been in existence and was calculated from the difference in the years between 2001 (the base year for the present study) and the year of establishment of the organisation

**People:** Number of total employees (both technical and managerial) in the software companies during the financial year 2000-01.
Size: The size of the company is defined based upon the total turnover of the company during the base year 2000-2001. The companies are classified into 3 groups based on their annual turnover viz., Small having less than 15 million Indian Rupees turnover, Medium from 51 to 200 Million Indian Rupees turnover and big more than 200 million Indian Rupees turnover during the base year 2000-2001.

**Basis for Collaboration:** Basis for collaboration is defined as the platform on which the collaboration relationship is executed or the significant factor that brings two organisations together to form a collaboration relationship.

**Collaboration Duration:** Collaboration Duration is defined as the period of collaboration relationship between the collaborating companies.

**Number of Projects:** Total no. of projects executed in 2000-2001 in collaboration with the respective collaborator.

**Learning Program — No. of Days:** The total number of days that an organisation has spent in learning programs or the number of days the program has been conducted. This is measured in number of person-days.

**Learning Program - No. of People:** The total number of people who have attended the learning programs or the number of people for whom the learning programs have been conducted. This is measured in number of persons.

**Mode of Learning:** Mode of learning is the process adopted by the organisation in acquiring the required skills for software development.

**Total Number of People:** The total number of people employed by the organisation at the time of study.
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**Project Time Factor:** The project time factor is defined as the ratio of time variation between estimated time & actual time, and the estimated time. This essentially indicates the time overrun in the projects and it is expected that it should always be near to 0, on a scale of 0 to 1.

**Project Effort Factor:** The project effort factor is defined as the ratio of effort variation between estimated effort & actual effort, and the estimated effort. This essentially indicates the effort overrun in the projects and it is expected that it should always be near to 0, on a scale of 0 to 1.

**Quality Function Deployment:** QFD is the number of functional points or kilo lines of code defined (estimated) versus the delivered (actual). The project QFD is defined as the ratio of "the functional points variation between estimated & the actual FPs and the estimated FPs.

2.9.2 Dependent Variables

**Collaboration Strength Index (CSI):** The collaboration strength index is the combination of three variables and they are - basis for collaboration, collaboration duration and the number of projects executed with the collaborator.

**Organisational Learning Index:** OLI is an indicator of an organisation's learning and is a combination of number of learning people, number of learning days, and the total number of people.

**Software Development Index (SDI):** SDI is a combination of software development related variables like development time, development effort and quality function deployment.
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Note: (In all the above three indices, wherever the variables are quantifiable, their numerical values are taken, like in the case of collaboration duration. Wherever the variables are qualitative, like the basis for collaboration, ranking is given to quantify them.

2.10 Analysis:

Both qualitative and quantitative methods were used for analysing the data. The qualitative methods include - case study analysis. Data on software development processes relevant for the present study were collected through the personal interviews with the key persons (Technocrats, Project managers, system analysts and Corporate Executives) in the organisations. The quantitative analysis was made using the Statistical Package for Social Sciences (SPSS).

2.10.1 Qualitative Analysis:

This was carried out to arrive at the qualitative parameters inherent in collaboration, learning and software development which are not quantifiable and were ranked to derive quantifiable indices.

2.10.2 Quantitative Analysis:

This was carried with the help of some basic statistical tools and techniques like simple frequencies, bivariate and multivariate contingency tables and correlation. Multiple regression was carried out by including the three indices viz., Collaboration Strength Index (CSI), Organisation Learning Index (OLI), Software Development Index (SDI), developed to test the hypothesis.