This chapter presents the detailed sampling design and methodology used in this study.

**Sampling design**

The study is based on data collected through a sample survey covering 305 employees in a number of selected occupation groups employed by agencies located in Burdwan and in Durgapur Municipal areas. The survey was conducted in two phases during 1991-92 and 1992-93. The sample design of the study consisted of two stages:

1. Selection of the universe and
2. Selection of the employees.

Now the question may be asked: why have we selected Burdwan and Durgapur municipal areas for collection of our data for this study? We have decided to take Burdwan for our case study as every type of employees starting from State government to Central government, banks, corporations, all types of schools and colleges, such as Polytechnic, University, Medical College and local bodies like Municipality and Zilla Parishad are available in Burdwan.
The Engineering College of Burdwan district is situated in Durgapur - we have collected data from that place. The study concentrates on different types and levels of higher education. The cost-benefit analysis of higher education only has been undertaken because of the time-constraint of the researcher herself.

The sample selection of employees has been done by using two-stage sampling method. The universe under study has been divided into groups which may be called 'Strata' like Banks, Life Insurance Corporation, General Colleges, Polytechnic, Engineering College, Medical College, State Government Offices, Central Government Offices, Local Bodies, Hospital etc. From each stratum some first stage units (banks, schools, offices etc.) have been selected by simple Random Sampling without Replacement (SRSWOR) from list of offices, schools, banks etc. prepared from the telephone directory. Then from each first stage unit some employees (second stage units) have been selected. Before the second stage selection employees have been divided into categories (second stage strata) like managerial staff, office Assistants and Group 'D' category staff whose qualifications are on or above 'Madhyamik' level of education. Then sampling has been done separately from each second stage Stratum. Before second stage selection the
list of the employees (according to their seniority in the respective organisation) have been prepared separately for each of the above-mentioned category. These category-wise lists are then consolidated to draw sample of employees in form of two independent and interpenetrating half-samples by circular systematic sampling. Random number tables have been used at the time of drawing sample.

In order to explain the sampling method clearly let us take the case of banks. A list of banks situated in Burdwan Municipal area has been prepared. Eight banks have been selected from a list of banks by SRSWOR - 'Four' banks for half-sample 'One' and 'Four' banks for half-sample 'Two'. Three lists have been prepared separately for each of the Eight banks - the first list for managerial staff, the second list for office-assistants and the third list for Group 'D' staff whose qualification is on or above 'Madhyamik' level. At the time of preparing the lists some basic informations like designation, educational qualification, year of joining the organisation etc. have been collected. These category-wise lists are then consolidated according to seniority of employees in their respective organisation for four banks in half-sample 'One' and also for four banks in half-sample 'Two'. Thus we have prepared six lists - three for half-sample 'One' and three for half-sample 'Two'.

1. Our sample is drawn half-samplewise in form of two sub-samples drawn according to the same sampling scheme such that each sub-sample provides a valid estimate of the parameter. The technique of interpenetrating sub-sample was developed by Prof. Mahalanobis during the '30s. It provides a means of control of the quality of data.
and three for half-sample 'Two'. These lists are then used to draw sample of employees half-samplewise by circular systematic sampling. The particular arrangement of workers in the lists and the sampling method followed ensure that our sample consist of employees of different level of seniority in their respective organisation. In our study 34 employees have been drawn from banks - 34 has been divided into two half-samples of 17 each. From each half-sample we have drawn 7 employees from managerial list, 8 from list of the office assistants and 2 from Group 'D' category staff-list.

In the case of University, Medical College, Engineering College, Polytechnic separate lists for teaching and non-teaching staff have been prepared according to their seniority, designation etc. Two random starts have been given in the list of each category in order to get sample units for half-sample 'One' and also for half-sample 'Two' by circular systematic sampling. From local bodies like Municipality and Zilla Parishad the sample units for two half-samples have been selected in the similar fashion.

The information about the qualification, income, expenditure for obtaining the particular level of

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2. This procedure ensures equal probability of inclusion for every unit in the sample and it is being used in Indian National sample survey.
education, the waiting period for getting the first job etc. has been collected through a structured questionnaire from the sample units (employees). All the completed questionnaires have been checked for response and non-response errors. In case of any inconsistent answer another trip has been made to those persons in order to correct the inconsistent answer.

After the aforesaid exercises the employees are divided according to their educational levels. After division it is found that employees belong to eleven types and levels of education stated below:

(1) Madhyamik/School Final
(2) Higher Secondary/Intermediate (Arts, Science, Commerce)
(3) B.A./B.Sc./B.Com. (Pass)
(4) B.A./B.Sc./B.Com. (Honours)
(5) M.A./M.Sc./M.Com.
(6) D.C.E./D.E.E./D.M.E. (Diploma in Civil, Electrical and Mechanical Engineering)
(7) B.E./B.Tech.
(8) M.E./M.Tech.
(9) M.B.B.S.
(10) M.S./M.D.
(11) M.A./M.Sc./M.Com., Ph.D.
The total number of employees surveyed in our study are 305. The number of employees surveyed in each qualification group is given below.

**Educated employees and the sample size: By higher education, type and level, West Bengal 1992-93**

<table>
<thead>
<tr>
<th>Type and level of Education</th>
<th>Sample of employees surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. School Final/Madhyamik</td>
<td>24</td>
</tr>
<tr>
<td>2. General under-graduate (Higher Secondary/I.A./I.Sc./I.Com.)</td>
<td>37</td>
</tr>
<tr>
<td>3. General Pass graduates (2 years' course after H.S.)</td>
<td>88</td>
</tr>
<tr>
<td>4. General Honours graduates (3 years' course after H.S.)</td>
<td>13</td>
</tr>
<tr>
<td>5. Professional under-graduates (D.C.E/D.E./D.M.E. - 3 years' course after Madhyamik)</td>
<td>18</td>
</tr>
<tr>
<td>7. Medical graduates (M.B.B.S. - 5 1/2 years' course after H.S.)</td>
<td>15</td>
</tr>
<tr>
<td>8. General Post-graduates (M.A./M.Sc./M.Com. - 2 years' course after Honours graduation)</td>
<td>46</td>
</tr>
<tr>
<td>9. Engineering Post-graduates (M.E. - 1 1/2 years' course after B.E.)</td>
<td>12</td>
</tr>
<tr>
<td>10. Medical Post-graduates (M.S./M.D. - 3 years' course after M.B.B.S.)</td>
<td>15</td>
</tr>
<tr>
<td>11. General Ph.D. degree holders (M.A./M.Sc./M.Com., Ph.D. - 5 years' after M.A./M.Sc. etc.)</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>305</strong></td>
</tr>
</tbody>
</table>
Coverage

The study covers the following types and levels of higher education for the rate of return calculation:

1. General Under-graduates over Madhyamik.
2. Professional Under-graduates over Madhyamik.
4. General 'Honours' graduates over 'Pass' graduates.
5. Engineering graduates over general Under-graduates.
7. Medical graduates over general Under-graduates.
8. General Post-graduates over general 'Pass' graduates.
9. General Post-graduates over general Honours graduates.
10. Medical Post-graduates over Medical graduates.
11. Engineering Post-graduates over Engineering graduates.

Other Sources of Data

Besides survey of employees all colleges, schools, university and other educational institutions have been covered with a view to collect information on several aspects of institutional cost from their record. Other
sources of data on institutional cost and enrolment figures include published and unpublished record of Higher Secondary Council, Directorate of Schools and Higher Education, West Bengal; Ministry of Education, Govt. of India etc.. For calculating the age-education specific unemployment rate in West Bengal the information has been collected from Directorate of Employment Exchange, West Bengal.

**Methodology**

After collection of information the following methodology has been followed for the estimation of rates of return to different types and levels of education.

First, we have calculated the cost of education. In order to calculate private cost we have considered fees paid by the student, expenditure on books, stationery and other equipment, expenditure on boarding and lodging, travelling expenses, private tuition cost etc.. We have included opportunity cost of the students in total private cost. The students have to forego their earnings when they are engaged in study. The foregone earnings have been calculated from the age-education-earnings profiles of the persons with preceding level of education.
For computation of public cost we have collected income-expenditure accounts of the institutions which show salary of the teaching and non-teaching staff, other allowances, travelling expenses of the staff, expenditure on equipment and other materials, furniture, library books and journals, stationery and other miscellaneous items. Annual rental value of the building has been added with cost.

Total resource cost or social cost of education has been calculated by adding private cost, public cost and opportunity cost of education.

Then we have prepared the age-education-earnings profiles of persons with different types and levels of education. The profiles are constructed from income data collected through survey. For purpose of estimation of universe characteristics the income-data obtained from sample employees are averaged by using appropriate probability weights or multipliers which are based on probability of selection. In general, the formula for the multiplier is as follows:

\[
\text{Multiplier} = \frac{\text{Total no. of first stage unit}}{\text{Total no. taken in the half-sample}} \times \frac{\text{Total no. of second stage unit}}{\text{Total no. taken in the half-sample}}
\]
In the process of estimation of multipliers the aim is to obtain estimates for the strata like banks, colleges, schools, offices etc. No attempt has been made to arrive at over-all estimates pooling all such strata.

At the time of preparing the unadjusted age-education-earnings profiles we have assumed that all earnings are due to education. At the time of preparing adjusted age-education earnings profiles we have tried to isolate the effect of education on earnings. We have constructed pre-tax and post-tax age-education-earnings profiles both for unadjusted and adjusted income of the persons.

Two types of rates of return have been calculated in our study – the unadjusted rates of return to different types and levels of education and also adjusted rates of return to different levels of education. Social as well as private rates of return have been calculated under each category.

At the time of estimating benefits of education we have taken into consideration only direct benefits in terms of earnings of the individual. There are consumption benefits and indirect benefits of education in form of spillovers. But both these types of benefits are difficult to quantify. So most researchers have considered direct
benefits of education at the time of calculating rates of return to education.

The unadjusted private rates of return to different types and levels of education are calculated by taking into account the post-tax income-differential between two successive levels of education and the private costs including foregone earnings of the concerned higher (between the two levels) level of education. The unadjusted social rates of return are calculated by taking into account the pre-tax income-differential between two successive levels of education and the social costs of the concerned higher level of education. The formula for calculation of Internal Rate of Return is as follows:

\[
\sum_{t=s}^{n} \frac{B_t - C_t}{(1+r)^t} = 0,
\]

where \( s \) stands for the age at which the concerned level of education begins, \( n \) indicates the retirement age and \( (n-s) \) is the working period. \( B_t \) indicates benefit, \( C_t \) indicates cost and \( r \) indicates rate of interest. Internal rate of return is that rate of interest at which discounted value of costs is equal to discounted value of benefits.

Before calculating adjusted rates of return we have constructed the adjusted age-earnings profiles. At the
time of constructing adjusted age-earnings profiles, the
earnings of the persons are standardised for socio-economic
and demographic variables. Multiple regression analysis\(^3\)
has been used for this purpose. Annual income of an
individual is supposed to depend on five variables - age,
sex, origin, sector of work and nature of work. As most of
the variables are qualitative in nature they are quantified
by converting them into dummy variables. We want to
construct adjusted age-education-earnings profiles. So we
have taken the coefficient of 'Age' only after running
regression separately for each qualification group. The
adjusted rates of return to seven types and levels of
education have been calculated in the similar fashion as
the unadjusted rates of return. Due to small sample size
we have not calculated adjusted rates of return for all
types and levels of education as in case of unadjusted
data.

Then the rates of return to education are compared
to alternative rates of return to other sectors in order
to find out whether investment in different types and
levels of education is profitable.

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3. The multiple regression analysis and the calculation of
Internal Rate of Return to different types and
levels of education have been performed at the
computer service centre of Indian Statistical
Institute, Calcutta-35.