CHAPTER III

MATERIAL AND METHODS
MATERIAL AND METHODS

Field work for the present study was undertaken during 2007 in Dharwad and Gadag districts. Dharwad and Gadag districts are geographically situated in Western sector of the Northern half of Karnataka. The population of “Kanjarbhat” in Dharwad and Gadag districts was about 7300 in 2007, when the fieldwork was started.

The total sample size is 1100, out of which 550 are males and 550 are females. Five features have been used to collect the data namely,

- Demographic Variation
- Blood groups (Serological Variation)
- Dermatoglyphics (Patterns)
- Criminological Dimensions and
- Rehabilitative Programmes

In demography, the total number of families surveyed is 230. Before going to the field, the methods and techniques in other characters were practiced thoroughly.

The subjects of “Kanjarbhat” tribe population of Dharwad and Gadag districts, selected for the study were very co-operative and showed keen interest in the investigation.

DEMOGRAPHIC VARIATION

This information was collected with pedigree charts drawn for the purpose which is based on house hold survey. The chart includes the
information about religion, age, sex, place of birth, age at marriage, age at menarche, age at menopause, number of individuals in the family and their age, sex marital status. Elderly men and elderly women were the most suitable informants in most of the areas.

In the absence of any record about the age/date of birth, age of the person was estimated in relation to some important local events. Cross checking of the age was done with more knowledgeable elderly persons to minimize the errors. In the present work most of the adult persons were able to tell their age in terms of years, but in the cases of minors the age was determined by referring to school records in addition to following the above method in order to be more precise.

Demographic data were analyzed as per the standard techniques following Barclay (1958).

**Sex Ratio**

Sex is the biological characteristic that divides the human race into males and females, and an individual's sex is determined at birth. The number of males and females in a population expressed either in absolute or as percentages of the total is called sex distribution of the population. For comparing the relative strength of the number of males and females in a population the common measure used is the sex ratio. The sex ratio was expressed as the number of males per hundred females.

\[
\text{Sex ratio} = \frac{\text{No. of males in a population}}{\text{No. of females in a population}} \times 100
\]
Fertility

Fertility was expressed in terms of the pregnancy terminations and live born offspring per woman and per fertile woman. The fertile women are those who conceived at least once.

The number of surviving offspring was defined as the number of offspring surviving to a given woman.

Mortality

Mortality was expressed both as number per woman and proportion over total pregnancies which includes both pre and postnatal deaths.

Selection Intensity

Selection intensity is the capacity for the potential of the population to undergo change as a result of natural selection. This is normally measured with the help of the index of opportunity for selection. The index of total selection intensity $I$ measures the maximum potential rate of change by selection (Where '0' indicates no change) (Living Stone and Sphuler 1965). The selection intensity has been calculated according to Crow (1958).

\[ I = I_m + I_f/p_s \]
\[ I_m = p_d/p_s \]
\[ I_f = V_f/ X -2 \]

Where $x$ = the average number of live birth per woman in the age group of 40 years and above. $V_f$ = Variance in the progeny number due
BLOOD GROUPS (SEROLOGICAL VARIATION)

The data for serological variation through ABO and Rh (D) blood groups were collected from 340 individuals (M-170, F-170)

The blood samples were collected for testing of ABO and Rh (D) blood groups systems according to the methods of Race and Sanger (1962). Blood samples were taken from left finger ball with the help of pricking needle. The total 340 blood samples of “Kanjarbhat” were tested (M-170, F-170).

Blood samples were taken from left hand ring finger after taking all precautions. Anti-sera A and Anti-Sera B were used for grouping. Anti-D was used to identify Rh positive and Rh negative groups. Anti-sera ‘A’, Anti-Sera ‘B’, and Anti sera ‘D’ which were used for grouping blood samples were supplied by Span diagnostic private limited Udhna (Surat, Gujarat). Blood samples were tested by employing open glass slide method taking all precautions.

The classification of four blood groups ‘O, A, B’, and ‘AB’ are based on group substances red cells. When red cells are agglutinated in Anti-A antiserum those samples were classified as blood group ‘A’. When red cells were agglutinated by Anti-B, it was blood group ‘B’, when the red cells clumped in both Anti-A and Anti-B anti-sera the samples were classified as ‘AB’ group. When there was no clumping of
cells in both Anti-A and Anti-B anti-sera it was 'O' group. When blood cells clumped with antiserum 'D', samples were grouped as 'Rh' positive and when there was no clumping with 'D' serum the samples were grouped as 'Rh' negatives.

All anti-sera voiles were taken to the field in a thermos flask containing ice. The 'ABO' determination was done by open slide technique whereas; Rh test was performed in tube making use of hand centrifuge for immediate reaction.

The following statistical methods and techniques were employed in the serological analysis.

**Calculation of gene frequencies**

The following formula suggested by Mourant (1976) for calculating ABO gene frequencies has been employed.

\[
p = 1 - \sqrt{B + 0} \quad q = 1 - \sqrt{A + 0} \quad r = \sqrt{0}
\]

Where

- \( p \) = frequency of gene 'A'
- \( q \) = frequency of gene 'B'
- \( r \) = frequency of gene 'O'
- \( p + q + r = 1 \)

In practice the sum is not unity, it differs from negligible amount of 'D'. Bernstein (cited in Mourant 1976) has devised a single means of calculating results in which the values of \( p \), \( q \) and \( r \) are added together then subtracted from the unity to give the difference 'D'.

\[
D = 1 - (p + q + r)
\]
STATEWISE TRIBAL POPULATION PERCENTAGE IN INDIA

- Himachal Pradesh (4.2%)
- J&K (12.4%)
- Chandigarh (5.2%)
- Punjab (4.2%)
- Chandigarh (5.2%)
- Delhi (1.9%)
- Haryana (7.7%)
- Chandigarh (5.2%)
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MANGALYADHARANA CEREMONY AMONG THE KANJARBHAT
DEMOGRAPHIC DATA BEING COLLECTED FROM KANJARBHAT FAMILY

DEMOGRAPHIC DATA BEING COLLECTED FROM KANJARBHAT RESPONDENTS
BLOOD SAMPLE BEING COLLECTED FROM KANJARBHAT MALE

BLOOD SAMPLE BEING COLLECTED FROM KANJARBHAT FEMALE
ANTIGEN-ANTIBODY OF BLOOD GROUPS

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>Group AB</th>
<th>Group O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red blood cell</td>
<td>A</td>
<td>B</td>
<td>AB</td>
<td>O</td>
</tr>
<tr>
<td>type</td>
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<tr>
<td>Antibodies</td>
<td>Anti-B</td>
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<tr>
<td>Antigens present</td>
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<td>B antigen</td>
<td>A and B antigens</td>
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TRANSFUSION OF BLOOD GROUPS

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<td>O-</td>
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<tr>
<td>AB-</td>
<td>O+</td>
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<tr>
<td>A+</td>
<td>B-</td>
</tr>
<tr>
<td>A-</td>
<td>B+</td>
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<td></td>
</tr>
<tr>
<td>O-</td>
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BLOOD GROUP DETECTION USING ANTISERA

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<th>Anti-B</th>
<th>Anti-D</th>
<th>Control</th>
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<tbody>
<tr>
<td>D+pos</td>
<td>O</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>D-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A+pos</td>
<td>A-</td>
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<tr>
<td>A-</td>
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<td></td>
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</tr>
<tr>
<td>B+pos</td>
<td>B-</td>
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<td></td>
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<tr>
<td>B-</td>
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</tr>
<tr>
<td>AB-pos</td>
<td>AB</td>
<td></td>
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<tr>
<td>AB-neg</td>
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<tr>
<td>Not valid</td>
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</tbody>
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TRANSVERSE SECTION OF BLOOD VESSEL SHOWING THE LAYERS AND BLOOD CELLS

Vessel wall
- Tunica adventitia
- Tunica media
- Tunica intima

Blood vessel
- Red blood cell
- White blood cell
- Platelet

BINDING OF ANTIGEN AND RBC/WBC

Antigen A
- Group A
- Group A

Antigen B
- Group AB
- Group B
- Group O

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'D' may be either positive or negative depending upon whether
the observed frequency of group 'A' and 'B' are smaller or greater than
its expected frequency 2pq, and it is necessary that the correct sign is
used in an equation.

Bernstein’s corrected values of pc–qc and rc are given by
following equations.

\[ pc = p (1+D/2) \]
\[ qc = q (1+ D/2) \]
\[ rc = (r + D/12) (1 + D/2) \]

Thus, pc + qc + rc will be a unity.

Then, the expected members for the genes ‘O’, ‘A’, ‘B’, have been
calculated by using the following formula.

\[ O = r^2 \times \text{sample size} \]
\[ A = (p^2 + 2prc) \times \text{sample size} \]
\[ B = (q^2 + 2qr) \times \text{sample size} \]
\[ AB = 2pq \times \text{sample size} \]

A simple chi-square (\(x^2\)) test has been used to observe the inter-
sex differences.

\[ x^2 = \frac{(\text{Obs} - \text{Exp})^2}{\text{Exp}} \]

Where ‘Obs’ is observed number

‘Exp’ is expected number

**Goodness of Fit**

Goodness of fit has been calculated by using the following
formula.

\[ \text{Goodness of fit} = x^2_A + x^2_B + x^2_O \]
That means goodness of fit is the total sum of $x^2$ values of O, A and B.

A simple chi-square test ($x^2$) has been used to observe for comparing two groups with regard to the blood groups.

$$x^2 = \frac{(O - E)^2}{E}$$

Where ‘O’ is the observed frequency and ‘E’ is the expected frequency.

The gene frequencies of Rh (D) and Rh (d) have been calculated by the following formula

$$d = \sqrt{dd}$$

$$D = 1 - d$$

Where ‘D’ represents gene frequency of Rh +ve, ‘d’ represents the gene frequency of Rh –ve.

**DERMATOGlyphICS (PATTERNS)**

For the dermatoglyphic investigation samples of 340 palm and finger prints were collected from 170 males and 170 females of “Kanjarbhat” community. For analysis and for formulating different determinants, the methods used here are taken from Herold Cummins and Charles Midlo (1943). For pattern typing, Henry’s (1900) system of classification is followed.

**Method of taking prints**

The finger and palm prints were taken by using simple ink method. The rolled prints of each digit were taken by keeping left edge
TAKING FINGER PRINT FROM KANJARBHAT MALE

TAKING FINGER PRINT FROM KANJARBHAT FEMALE
of the nail perpendicular to the slab and the same was rolled up to 180°. Right thumb was inked and printed first; other fingers were inked and rolled on the slip in the consecutive order.

Field (1959) has pointed out that “the thumb is rolled from the inside tip of the nail to the outside of the opposite tip of the nail thus the right thumb is rolled from right to left and left thumb is rolled from left to right and the fingers of the left hand are rolled from right to left”.

For taking the palm prints, the ink was applied uniformly throughout the entire palm with the help of a cotton pad, so that interdigital tri-radii and the triradial termination impressions were clearly visible in the prints.

Classification of Patterns

The fingerprint of conventional description is a print of configuration of the ball of the finger to introduce the principle of fingerprint construction attribution.

Plain Arch (PA)

A plain arch is simplest of all the patterns, in which the ridges run from one side of the finger to the other, with a slight rise at the center, making no upward thrust, no backward looping turn or an angle and does not possess any of the basic characteristics of the loop viz., delta core and recurring ridge. “The arrangement of the ridge flow in the plain arch suggests the strands of rope lying over a barrel” (Bridges, 1963). Five percent of all the fingerprint patterns represent plain arch.
TAKING PALM PRINT FROM KANJARBHAT MALE

TAKING PALM PRINT FROM KANJARBHAT FEMALE
Tented Arch (TA)

A tented arch is the pattern of arch type in which most of the ridges enter on one side of the impression and flow or tend to flow, out up on other side, but the ridges at the center must have pronounced upward thrust and arrange themselves and form an angle, or form any two of the three basic characteristics of the loop. There are three types of tented archs.

❖ Tented with angle
❖ Tented resembling a loop
❖ Tented up-thrust

Loop

A loop is a pattern in which one or more ridges recurve i.e., run back on their previous course, making a half turns or moves around the core, having a delta and at least one ridge intervening between the inner and outer termini. The loop patterns constitute about sixty per cent of all prints.

There are two types of loops, the radial and the ulnar. Their names are derived from the two bones of the fore-arm, the radius and the ulna.

Radial Loop (RL)

A radial loop is a loop pattern in which one or more of the ridges enter on either side of the impression, recur, touch or pass an imaginary line drawn from core to delta, and terminate on or toward
FINGERPRINT PATTERNS AND CLASSIFICATIONS

Plain Arch
In plain arches the ridges enter on one side of the impression and flow or tend to flow out the other side with a rise or wave in the center.

Tented Arch
Tented arches are similar to plain arches with the exception that the ridges in the center form a definite angle; or one or more ridges at the center form an upthrust; or they approach the loop type of pattern, possessing two of the basic characteristics of the loop, but lacking the third.

Ulnar Loop
Ulnar loops are those types of pattern in which the loops flow in the direction of the little fingers. The above pattern would be an ulnar pattern if on the right hand, and a radial pattern if on the left hand. The above pattern is also sometimes called a right slant loop, regardless of which hand it appears on.

Radial Loop
Radial loops are those types of pattern in which the loops flow in the direction of the thumbs. The above pattern would be a radial pattern if on the right hand, and an ulnar pattern if on the left hand. The above pattern is also sometimes called a left slant loop, regardless of which hand it appears on.

Double Loop Whorl
The double loop whorl consists of two separate loop formations, with two separate and distinct sets of shoulders and two deltas.

Plain Whorl
A plain whorl has two deltas and at least one ridge making a complete circuit, which may be spiral, oval, or any variant of the circle. An imaginary line drawn between the two deltas must touch or cross at least one of the recurving ridges within the pattern area.

Central Pocket Loop Whorl
The central pocket loop whorl consists of one or more recurving ridges, or an obstruction at a right angle to the inner line of flow, with two deltas between which an imaginary line would cut or touch no recurving ridge within the pattern area. The inner line of flow of a central pocket loop whorl is determined by drawing an imaginary line between the inner delta and the center of the innermost recurve or looping ridge.

Accidental Whorl
The accidental whorl is a pattern with two or more deltas, and a combination of two or more different types of patterns exclusive of the plain arch. This classification also includes those exceedingly unusual patterns which may not be placed by definition into any other classes.
the same side of the impression. The direction of slope of the ridges is downward from the little finger toward the thumb.

**Ulnar Loop (UL)**

An ulnar loop differs from that of radial loop in respect of the slope of ridges. The slope or flow or ridges in ulnar loop is from thumb toward the little finger.

**Whorl (W)**

A whorl is a pattern in which the ridges around the core make at least one complete circuit. Whorls may be spiral, oval, circular or some other variant of a circle. The pattern has two deltas and may be having single or double cores.

**Composites**

Composites form a heterogenous assemblage of patterns. Composites are compound combines in the pattern area, two or more triradii are present. There are four types of composites namely,

- Whorl Central Pocket (WCP)
- Whorl Lateral Pocket (WLP)
- Twin Loops (TL) and
- Accidentals (ACC).

**Central Pocket Loop (WCP)**

In the central pocket loop some of the ridges at the center or core or a loop, give the pattern of a whorl. The test for the central pocket is
that the line of exit of the ridges or the axis should meet at least one recurring ridges at right angle i.e., if the recurring ridges be circular and not angular, it is central pocket. The central pocket loop is subdivided into four types, viz., i) spiral; ii) hook; iii) ring; iv) concave.

**Lateral Pocket Loop (WLP)**

In the lateral pocket one loop serves as a side pocket to the other. The side pocket is formed by the downward bending on one side of the ridges of the other loop before they recur. The ridges about the centre, that is those containing the point of core of the loops, have their existence on the same side of delta. As the pattern is called double loop pattern, it has two deltas and two cores. Interlocking of two loops in this pattern are like the two parts of the latter's.

**Twin Loop (TL)**

Twin loop is also a double loop pattern and the loops here are interlocked like the two parts of the letter 'S'. In twin loop one loop rests on or encircling the other and the ridges containing the point of core have their exit on different sides of the delta. There are two deltas and two cores.

**Accidental (ACC)**

Accidental pattern is the combination of two or more patterns, representing the types other than the central pocket, lateral pocket and twin loop. The occurrence of accidental pattern is rare, and its examples are loop by loop, whorl resting on loop, loop resting on whorl, whorl resting on whorl, arch with pocket (Field, 1954).
STRUCTURE OF FRICTION SKIN
(Cross Section View)
Total Ridge Counts

Total ridge counts are made from triradial point to the core. Accuracy in counting requires a magnification of four to five times. The convenient aid for magnification is the magnifying lens or Henry's disc. Before counting the ridges the triradial point and the point of core are located and then a line is drawn to connect them.

Mainline Formula

Pons (1961) has used Cummins and Midlo's (1936) mainline formula to study the genetics of the transverseness of Palmer main line. To a large extent Palmer configuration are dependent on the course of the lines ‘a, b, c’ and ‘d’, which are in radio-ulnar sequence. The general direction of the ridges can be determined from the two main line. ‘a’ and ‘d’. Numbers have been assigned to various positions round the periphery of the palm where lines ‘a’ and ‘d’ can end. The main line index for each palm is the sum of values of the endings of mainline ‘a’ and ‘d’.

a-b Ridge Counts

The a–b ridge count is the number of ridges occurring in the second interdigital, area between the digital triradii ‘a’ and ‘b’. All ridges which cut or touch a straight line between the triradii are connected to those which do not. The a–b ridge count gives a measure of the distance between the two triradii which is independent of age. The direct measure of the distance from ‘a’ to ‘b’ and a–b counts are highly correlated.
C-Line Polymorphism

Plato (1970) has given the method of describing the termination of palmer C line. According to him line 'C' is the only main line of the palm which is truly polymorphic, since it demonstrates qualitative (directional) as well as quantitative variation manifested in the degree of transversality and size reduction culminating in complete suppression.

The 'C' may have an ulnar direction, a radial, a proximal or even be completely being absent when c triradius is present.

In accordance with the polymorphism, the terminations of 'C' line are classified into four model types depending on the direction of its path. The four model types are:

❖ Ulnar, which includes the terminations 4, 5, 6 and 7.
❖ Radial, with terminations 9, 10, 11, 12 or 13
❖ Proximal represented by the 8th terminations
❖ Absent where 'C' triradius is absent.

atd Angle

Angle atd is the angle formed by joining 'a' and 'd' triradii with axial triradius “t or t” Penrose (1949b:1954) has studied the inheritance of position of the axial triradius, using the atd angle to replace a qualitative differentiation of triradius ‘t’ and ‘t’. A relatively small angle indicates an axial triradius situated near the base of the palm, while a large angle results when the triradius is highly placed. Roughly an atd angle of over 56° is equivalent qualitatively to scoring the triradius as
‘t’, while an angle less than 45° is equivalent to ‘t’, intermediate angles ranking as ‘t’.

The maximal atd angle has proved to be most useful measurement for quantifying the position of the distal axial triradius on both normal and abnormal palms of many kinds. Sometimes we notice ‘a’ and ‘d’ triradii to be closer together than are usual and in such cases the angle will be relatively small, even when the ‘t’ triradius is fairly highly placed. The occurrence of such cases is very rare, together with a misunderstanding of the real value of the maximal atd angle, it leads some times to unwarranted criticism of the methods.

INDICES

The following three principle indices have been calculated.

Pattern Intensity Index

The pattern intensity index is the average number of triradii occurring on fingers per individual. The complexity of pattern increases in the order of arch-loop whorls and is accompanied by an increase in the number of triradii consequently. A low value of index indicates that a high frequency of the index value will be 20 (twenty) and when all archs are there then it will be 0 (zero).

\[
\text{Pattern Intensity Index} = \frac{\text{Frequency of loops} + 2 \times \text{frequency of whorls}}{\text{samples}}
\]
Furuhata’s Index

Furuhata’s whorl/loop index was calculated by dividing the total frequency of loops (both ulnar and radial loops combined) the quotient been multiplied by 100 to give an index value in whole number.

\[
\text{Furuhata’s Index} = \frac{\text{Total number of whorls}}{\text{Total number of loops}} \times 100
\]

Dankmeijer’s Index

Dankmeijer’s arch whorl index was obtained by dividing the total frequency of arches by the total frequency of whorls. The quotient has been multiplied by 100 to give index value in a whole number.

\[
\text{Dankmeijer’s Index} = \frac{\text{Total number of arches}}{\text{Total number of whorls}} \times 100
\]

The value of the pattern intensity stated here as the number of triradii per individual (arch having no triradius, the loop one and whorl two).

Statistical Methods Applied

The following statistical methods and techniques were employed in the dermatoglyphic analysis.

Mean can be calculated by

1) \[
\bar{x} = \frac{\sum x}{n} \quad \text{(discrete data)}
\]
2) $\bar{x} = \frac{\sum fx}{N}, N = \sum f$ - (continuous data)

3) $SD = \sqrt{\frac{E(x - \bar{x})^2}{n}}$ - (discrete data)

4) $SD = \sqrt{\frac{E(x - \bar{x})^2}{N}}$ - (continuous data)

$\bar{x} = \text{mean of obs}$

5) $SE = \frac{SD}{\sqrt{n}}$

6) $\chi^2 = \sum \frac{(O - E)^2}{E}$

$\sim \chi^2_{(r-1, c-1)}$

\text{Where } O = \text{Observed frequency}

\text{E = Expected frequency}

\text{r = No. of rows}

\text{c = No. of columns}

7) Chi-square test $\chi^2$ is used for assessment of association between two attributes or comparison of two or more than two proportions.

8) For observing the difference between two groups the following 't' test was used.
Where $M_1$ and $M_2$ are the mean, and $S_1$ and $S_2$ are the standard deviations of 1st and 2nd group, $n_1$ and $n_2$ respectively sample sizes.

**CRIMINOLOGICAL DIMENSIONS**

In order to understand the criminological dimensions of "Kanjarbhat" an attempt is made to analyse the nature and causes of their criminality. Data pertaining to criminality of "Kanjarbhat" were collected from first hand information elicited through in-depth interviews with key informants. Information was also obtained by referring to the records available in the police stations in these areas and also by referring to the available literature in various libraries.

**REHABILITATIVE PROGRAMMES**

Data pertaining to the rehabilitative programmes were collected by means of observation and in-depth interviews conducted with the beneficiaries of these programmes and the key informants. The validity of these programmes was cross checked with the records of the social welfare department and also the annual reports in order to understand the extent of success of these programmes.
The relevant data and information is collected from the Kanjarbhat respondents, Officers of the Police Department and Station Records of concerned Police Stations of Dharwad and Gadag Districts. Rehabilitative Programmes were initiated in Pre and Post independent from both Government and Non-Government Organisations.

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