CHAPTER   IV

METHODOLOGY

In this chapter the procedure adopted for conducting
the present investigation has been described. The method
used for investigation has been discussed under the
following heads :

    4.1   Research Design

    4.2   Sampling Design

    4.3   Collection of Data

    4.4   Experimental Procedure

    4.5   Statistical Treatment of Data

    4.6   Operational Definitions

4.1   Research Design

The main aim of the study was to collect information
regarding the techniques, production processes, designs
and wear characteristics of floor coverings manufactured
in Himachal Pradesh. Keeping the broad objectives of the
study in mind, a research design was planned which
included descriptive survey method for collecting
complete and authentic first hand data regarding the
production and manufacture of floor coverings. Experimental
procedure was thought to be the most appropriate technique
to study the wear characteristics of carpets. Different

sequences that led to the planning of the research design
have been dealt with in the following manner :

4.1.1   Theoretical Framework of the Study

In view of the objectives of the research the
investigator conceptualised a broad framework of the
study. From the available literature it was visualised
that in Himachal Pradesh, both organised and unorganised
sector would be working complimentary to each other in
the production of floor coverings, the manufacture of
which demanded certain inputs. Furthermore some kind of
marketing channels had to be adopted for the sale of
these floor coverings.

The investigator further developed this skeletal
framework to arrive at the final theoretical framework
which was adopted for the study(Figure 3). It was
conceptualised that large, medium and small scale units
alongwith cottage type weaving units, falling under
organised and unorganised sector were engaged in the
manufacture of floor coverings. The establishment set up
of the large scale units would include administrative
employees, skilled workers and unskilled workers.
Weavers, designers, dyers, talims and trimmers would
comprise the category of skilled workers whereas
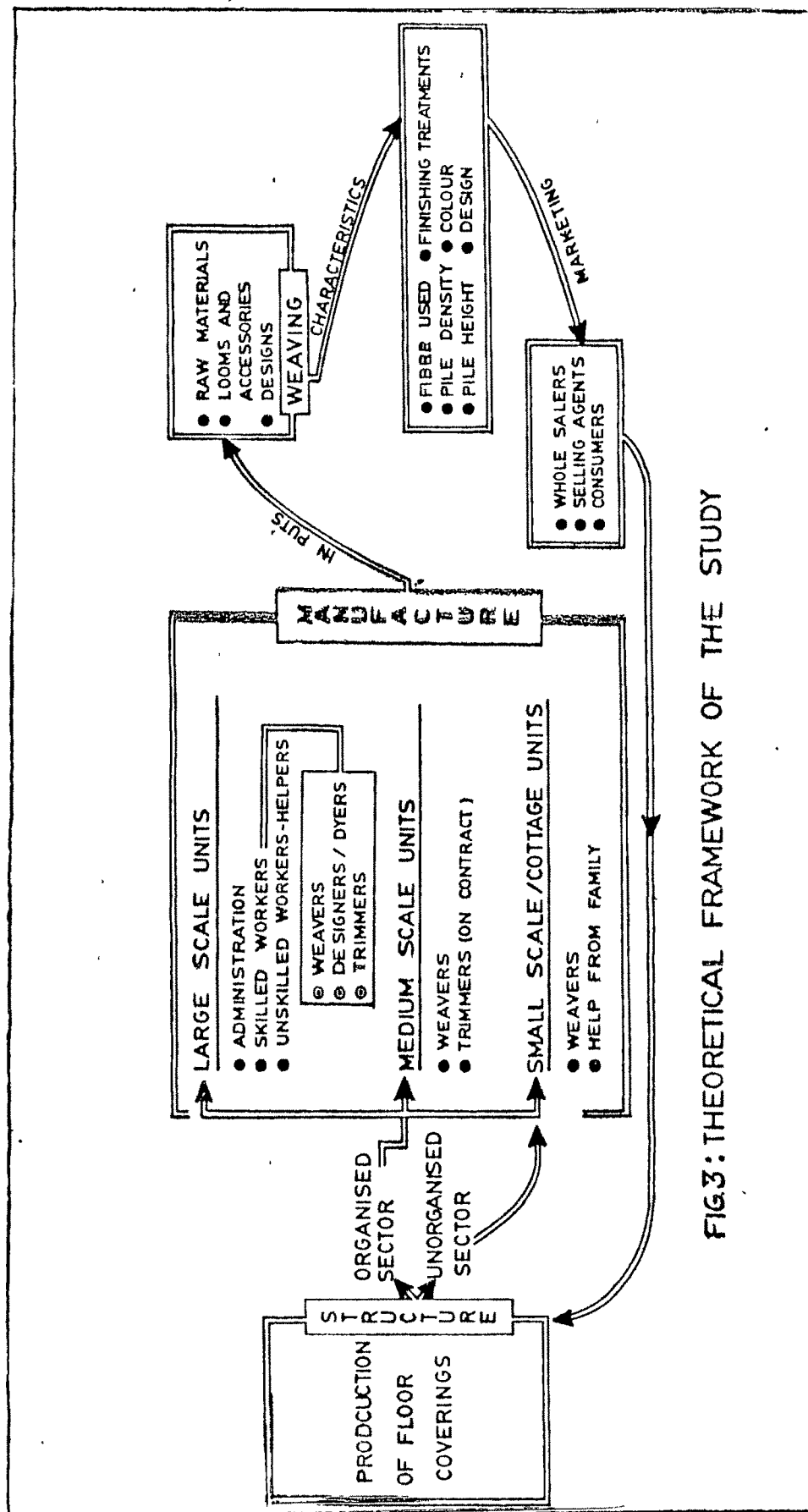helpers, peons etc. would fall under the category of

RAW MATERIALS
● LOOMS AND
● ACCESSORIES
● DESIGNS

WEAVING

CHARACTERISTICS

FINISHING TREATMENTS
● FIBRE USED ● FINISHING TREATMENTS
● PILE DENSITY ● COLOUR
● PILE HEIGHT ● DESIGN

MARKETING

WHOLE SALERS
● WHOLE SALERS
● SELLING AGENTS
● CONSUMERS

IN PUTS

MANUFACTURE

LARGE SCALE UNITS
● ADMINISTRATION
● SKILLED WORKERS
● UNSKILLED WORKERS-HELPERS
   ⊚ WEAVERS
   ⊚ DESIGNERS / DYERS
   ⊚ TRIMMERS

MEDIUM SCALE UNITS
● WEAVERS
● TRIMMERS (ON CONTRACT)

SMALL SCALE/COTTAGE UNITS
● WEAVERS
● HELP FROM FAMILY

ORGANISED SECTOR

UNORGANISED SECTOR

STRUCTURE

PRODCUCTION
OF FLOOR
COVERINGS

FIG.3: THEORETICAL FRAMEWORK OF THE STUDY

unskilled workers. Medium scale units might be made up
of weavers and trimmers only. It was perceived that the
set up of the small scale and cottage units would have
only weavers who must be receiving some help from other
members of the family. Raw materials, looms and
accessories, provision of designs etc. were other inputs
which were required for the manufacture of floor
coverings. Fibre used, pile density, pile height, design
and colour of the floor covering and finishing
treatments given to these were thought to be the
outstanding features of the floor coverings which had
an effect on the ultimate selection by the consumers.
All manufacturers, be it small, medium or large scale,
adopted certain marketing channels for the sale of their
carpets and rugs, which might be sold to wholesalers,
retailers or to the consumers directly.

4.2 Sampling Design

4.2.1 Locale of the Study

The investigation was carried out in different
districts of Himachal Pradesh, where different kinds of
floor coverings were being manufactured. This locale
was selected because of following reasons :

i) The investigator belonged to Punjab, a neighbouring
state and possessed knowledge about the social set up

of people of Himachal Pradesh. Understanding of the language and the socio-cultural background of the population was helpful in creating rapport between the two.
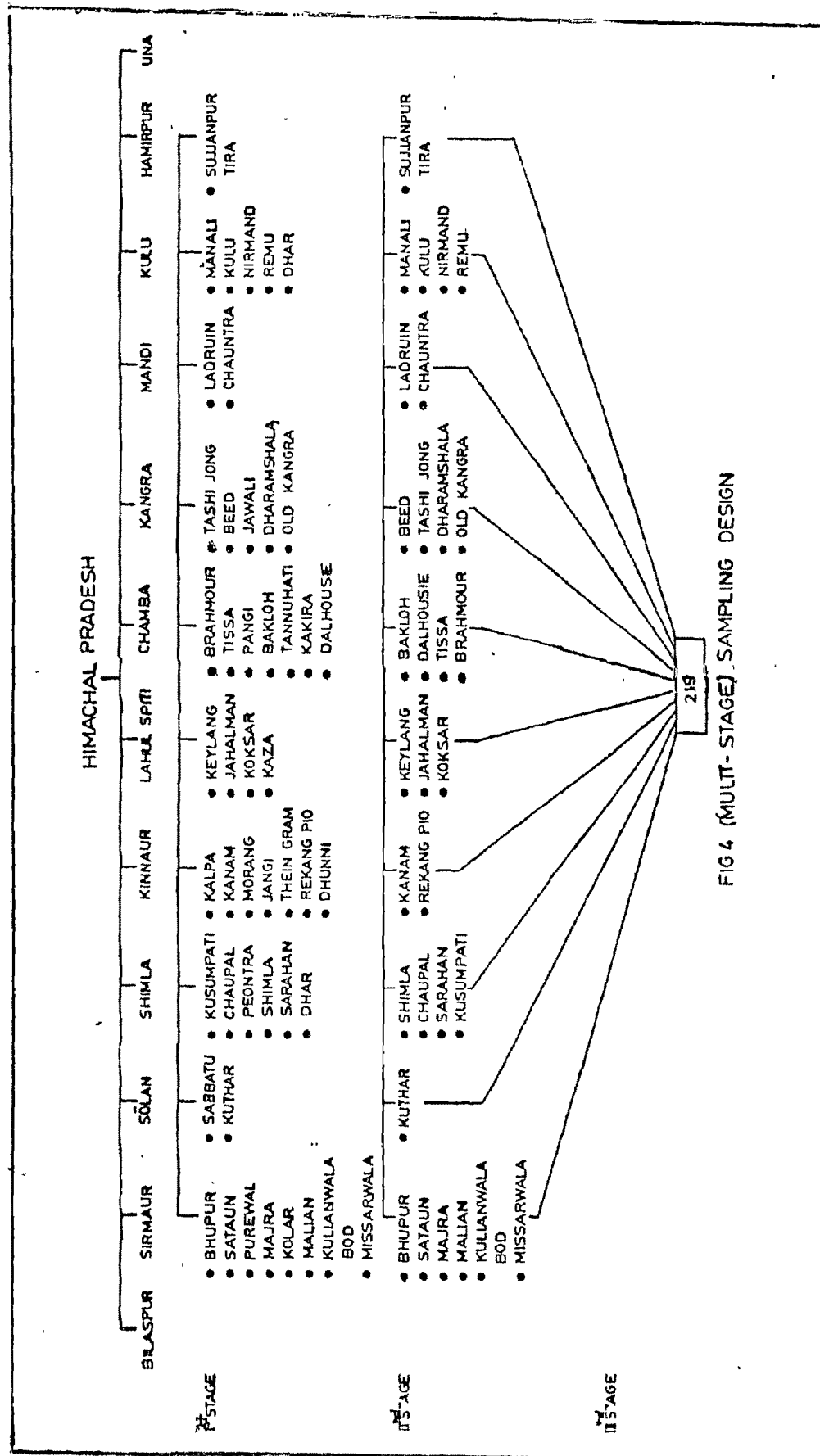
ii) The investigator had worked in certain parts of the state earlier. Familarity with the life styles of the area and an insight into the social sanctions and barriers were the motivating factors which ensured a close interaction between the investigator and the respondents.

iii) Some of the floor coverings were indigenous to an area or a district. To get an authentic data pertinent to all types of floor coverings being manufactured in the state, it was essential to give due representation to all districts where such activity was being carried out.

4.2.2 Sampling Procedure

A multi-stage sampling design was used to draw out the required sample. Moving through a series of stages graduating from more inclusive to less inclusive, the investigator finally arrived at the population elements that constituted the final sample (Figure 4).

The first stage of the technique included identification of those districts of the state where

HIMACHAL PRADESH

BILASPUR SIRMAUR SOLAN SHIMLA KINNAUR LAHUL SPITI CHAMBA KANGRA MANDI KULU HAMIRPUR UNA

I STAGE

- BHUPUR
- SATAUN
- PUREWAL
- MAJRA
- KOLAR
- MALIAN
- KULIANWALA BOD
- MISSARWALA

- SABBATU
- KUTHAR

- KUSUMPATI
- CHAUPAL
- PEONTRA
- SHIMLA
- SARAHAN
- DHAR

- KALPA
- KANAM
- MORANG
- JANGI
- THEIN GRAM
- REKANG PIO
- DHUNNI

- KEYLANG
- JAHALMAN
- KOKSAR
- KAZA

- BRAHMOUR
- TISSA
- PANGI
- BAKLOH
- TANNUHATI
- KAKIRA
- DALHOUSE

- TASHI JONG
- BEED
- JAWALI
- DHARAMSHALA
- OLD KANGRA

- LADRUIN
- CHAUNTRA

- MANALI
- KULU
- NIRMAND
- REMU
- DHAR

- SUJJANPUR
- TIRA

II STAGE

- BHUPUR
- SATAUN
- MAJRA
- MALIAN
- KULIANWALA BOD
- MISSARWALA

- KUTHAR

- SHIMLA
- CHAUPAL
- SARAHAN
- KUSUMPATI

- KANAM
- REKANG PIO

- KEYLANG
- JAHALMAN
- KOKSAR

- BAKLOH
- DALHOUSIE
- TISSA
- BRAHMOUR

- BEED
- TASHI JONG
- DHARAMSHALA
- OLD KANGRA

- LADRUIN
- CHAUNTRA

- MANALI
- KULU
- NIRMAND
- REMU

- SUJJANPUR
- TIRA

III STAGE

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FIG 4 (MULTI-STAGE) SAMPLING DESIGN

floor coverings were being manufactured. In the second stage the investigator listed the towns and villages in each district where weaving units were situated. In the next step a selected number of towns and villages were short listed. The basis for this was the type of floor covering manufactured and easy approach to the location, either by a vehicle or on foot. From each of the short listed towns and villages, final sample was drawn out through purposive sampling. The investigator finally selected 219 respondents which comprised 15.6 per cent of 1400 persons engaged in the manufacture of carpets and rugs in the state (52).

4.3 Collection of Data

Going by the objectives of the study, a multi-method tool consisting of structured interview schedule and simple as well as participatory observation were thought to be the most suitable for eliciting information.

4.3.1 Development of Interview Schedule

After critically reviewing the existing literature and analysing the theoretical framework of the study, it was felt that in order to get an indepth information it was essential to prepare separate interview schedules for different personnel involved in the manufacture of floor coverings. Hence three sets of part closed end

and part open end interview schedules were developed -
one each for the enterprenuers, the weavers and trimmers
and the designers and _talims_. Each of these contained a
set of questions covering different aspects of manufacture
of floor coverings. The details of these instruments have
been discussed below:

i) For the Enterprenuers - Developed for the owners of
the manufacturing units this schedule had three well
defined sections.

The first section dealt with the background
information regarding the unit. It included questions
pertaining to history of the unit, type of management,
capital investment, financial assistance sought and
the type of floor covering manufactured.

Raw stock supplies and the technical details of the
floor coverings were dealt with in the second section.

The third section of the schedule was aimed at
eliciting information regarding the establishment and
marketing channels adopted by the enterprenuers. The
problems, complaints and the suggestions of the
enterprenuers were also incorporated in the schedule.

ii) For the Weavers and the Trimmers - This schedule
was prepared to collect information from craftsmen and

trimmers engaged in the manufacture of floor coverings. For conducting the interview smoothly and to maintain a systematic record of information, the schedule had been split into four parts.

The first part elucidated information regarding background and establishment details of the weavers. Questions pertaining to the individual and family profile of the respondents, type of work done, whether employed or self-employed, financial details and the type of assistance rendered by family members and other employees had been asked in this section.

The second section of the schedule dealt with the raw stock supplies and the equipments used, type and amount of fibres, yarns, dyes and chemicals used, functions of these, place of purchase and type of looms and accessories used.

Technical details such as the manufacture of different types of floor coverings, their dimensions, weight, ply of the yarn used, pre-manufacturing, manufacturing and post-manufacturing processes involved, designs and colours used were covered in the third section of the schedule.

The last section of the schedule had questions
regarding the production and marketing details. At the
end an inquiry was made into the problems faced by the
respondents and their suggestions for the improvement
and upliftment of the craft were asked.

iii) **For the Designers and Talims** - This schedule was
prepared for the designers and the _talims_ employed in
this industry.

The first part of the instrument, relatively smaller,
had questions pertaining to individual and family
background of the respondents. An inquiry into the work
pattern of the respondents, equipments used by them and
the technical details of the work alongwith the
semiotics of the designs and colours was made in the
second section of the interview schedule. The problems
and the suggestions of the respondents were incorporated
at the end of the schedule.

4.3.2 Pre-Testing

In order to catch and solve unforeseen problems in
administration of the interview schedule, it was pre-
tested on a non sample group comprising of 15 respondents.
From the pre-testing of the schedules it was seen that a
few alterations in the sequence of questions were needed.
These were carried out as per requirement.

4.3.3 Method of Data Collection

Data for the present investigation was collected through extensive field work. To get complete and authentic information the investigator personally administered the interview schedule. For a comprehensive interpretation of technical details, designs and colours used in the floor coverings observation technique was used. This was further supplemented by participatory observation in which the investigator personally carried out the weaving of floor coverings.

Prior to selection of sample the investigator obtained the lists of manufacturing centres and areas in which manufacture of floor coverings was concentrated. This was done with the help of Himachal Pradesh Handloom and Handicraft Corporation Limited. After finalising the sample, the investigator chalked out a tour programme, copies of which were sent to different Tibetan weaving centres and the office of the Himachal Pradesh Handloom and Handicraft Corporation which informed its district level officials regarding the proposed tour. For collection of data regarding the indigenous floor coverings the investigator sought the help of district handicraft officers or the local resource persons. The investigator travelled through the state from mid-April to July 1989, for the purpose of data collection.

4.4 Experimental Procedure

The wear characteristics of the carpets have been studied through experimental procedure, which has been dealt with under the following heads :

4.4.1 Materials Used

4.4.2 Construction Particulars of Carpets

4.4.3 Preparation and Application of Finish

4.4.4 Determination of Compressibility and Recovery

4.4.5 Determination of Resiliency

4.4.6 Determination of Appearance Retention

4.4.1 Materials Used

i) Carpets used: Pure wool pile carpets of maroon colour were used for the experiment. These had cotton warp and weft and had been woven at the Tibetan Refugee Self Help Handicraft Society, Shimla, on special request of the investigator. The following information had been given on the label of these carpets -

Knots : 6 x 8

Area : 2.25 Square feet

ii) Finish used: Ahuracryl TX 50, an acrylic acid emulsion was used as the finishing agent for the carpets. The characteristics of the finish as given by the manufacturer were -

General Characteristics	: Ahuracryl TX 50 is an acrylic based emulsion which yields soft, pliable and transparent film having good wash fastness
Colour	: Milky white
Solubility	: In cold or warm water
Active Matter Content	: 50 per cent
pH	: 5.5

4.4.2 Construction Particulars of Carpets

i) Pile density: Pile density was calculated by counting the number of pile knots in warp and weft direction. For this purpose 10 cms x 10 cms squares were marked at various places on the back of the carpets. Number of knots in each direction were then calculated. An average of five readings was taken. Pile density was calculated in the following manner -

$$\frac{\text{Pile Density}}{(10 \text{ cms sq})} = \frac{\text{Number of knots in warp direction X}}{\text{Number of knots in weft direction}} \tag{5}$$

ii) Pile height: Pile height was measured with the help of a millimeter scale. Carpet was spread on a flat surface and the scale was inserted among the rows of pile. Care was taken to keep the scale vertical, at right angles to the carpet. Readings corresponding to the distance between the roots and the tips of the pile were taken as the pile height. An average of five readings

at different places on the carpet was taken for measuring the height of the pile (5).

iii) <u>Weight of the carpets</u>: For determining the carpets weight, samples of 25 cms x 25 cms were cut out of each carpet. These were conditioned and weighed. An average of three readings was taken. The weight of carpets in grams per unit ₁area was calculated with the following formula –

Weight in grams/sq.m. = Weight of 25 cms sq. x 16

(5)

iv) <u>Weight of the pile</u>: To know the weight of the pile, hundred undamaged tufts of pile were taken and conditioned. Later these were weighed. An average of five readings was taken. Following formula was used to calculate weight of pile in grams per unit area –

$$\text{Weight in grams/sq.m.} = \frac{\text{Weight of 100 tufts X Number of pile knots/sq.m.}}{100}$$

(5)

4.4.3 Preparation and Application of Finish

The research was aimed at studying the effect of acrylic acid, a thermoplastic finish on wear characteristics of carpets. For applying the finish, magnesium chloride was used as a catalyst. The following recipe suggested by Krishnia (40) was used for preparing the finish –

Chemicals	Percent Concentration of Finish	
	2.00	4.00
Ahuracryl TX 50 ..	4 ml	8 ml
Magnesium Chloride..	.5 mg	1 mg
Water to make 100 ml		
Total ..	100 ml	100 ml

For preparing the finish, the catalyst was dissolved in water and it was added to the finish. To mix the chemicals evenly the solution was stirred with a glass rod. To determine the suitability of method of application of finish, the investigator conducted trials in which the finish was applied by spray method, brushing method and dipping method. The results of the trials showed that brushing and dipping methods were better suited for applying finish to carpets as these resulted in deeper and even absorption of the finishing solutions. Hence two sets of each concentration were prepared and were applied on the carpets by brushing and dipping method.

i) **Brushing method:** The carpet was kept on a firm, flat, inclined surface and the finish was evenly poured over the carpet. After allowing some time for absorption of the finish, the carpet was vigorously brushed with

the help of a plastic scrubber. This treatment was given
repeatedly for half an hour, alternatively pouring the
finishing solutions and brushing it. Within this time
the carpet had thoroughly absorbed the finish which had
seeped through its backing as well. The carpet was then line
dried.

One such sample was prepared for each concentration
of the finish.

ii) <u>Dipping method</u>: In this method the finishing
solution was poured into a flat bottomed tray which was
slightly bigger in size than the samples. With the pile
facing downwards, the sample was dipped in this solution
for half an hour. This resulted in hundred per cent
absorption of the finish. The sample was then line dried.

One carpet sample was prepared for each concentra-
tion with this method as well.

When completely dry the samples were cured in an
oven at 150°C for 5 minutes. In the oven, each sample
was kept on a wooden frame so that it did not touch the
metallic surface.

To determine the effect of finishing treatment on
carpets, the samples were subjected to various tests.

All the tests were conducted after conditioning the samples at 65 ± 2 per cent relative humidity and 27 ± 2°C temperature (8, 13).

4.4.4 Determination of Compressibility and Recovery

Compressibility and recovery were tested on a Prolific Carpet Thickness Gauge according to British Standards Method (13). Two samples of 25 cms x 25 cms were cut and marked A, B, C and D, E at different places so as to spread the tests throughout the samples. Zero reading on the base plate was obtained. The carpet specimen at point 'A' was placed on the base plate, making sure that the carpet backing was flat, without any creases. The presser foot was gently lowered onto the specimen at the place marked 'A' till the indicator lighted. The reading on the dial (t_o) was noted. Without raising the presser foot weights adding upto 12 lbs/in² pressure were put on the loading shaft of the gauge. After half a minute reading on the dial was again noted (t_c). The weights were removed and the pile was allowed to recover for half a minute and again the reading was taken (t_r). An average of five such readings was taken. Percentage compressibility and recovery of the carpets was calculated with the help of the following formula -

$$\text{Percentage Compressibility} = \frac{t_o - t_c}{t_o} \times 100$$

$$\text{Percentage Recovery} = \frac{t_r}{t_o} \times 100$$

where t_o = Original thickness at .25 lbs/in² pressure

t_c = Compressed thickness at 12 lbs/in² pressure

t_r = Recovered thickness at .25 lbs/in² pressure
after loading to 12 lbs/in. pressure

4.4.5 Determination of Resiliency

Resiliency of the carpets was also tested on
Prolific Carpet Thickness Gauge. Two samples of 25 cms x
25 cms were taken and marked A, B, C, D and E at different
places. As in compressibility and recovery test, t_o the
original thickness at .25 lbs/in² pressure at point 'A'
was taken. Without raising the pressure foot extra
weights to get 0.75, 3, 6, 9 and 12 lbs/in.² pressure
were added. The thickness of the carpet was recorded
after half a minute of addition of weight upto 12 lbs/in.²
pressure. Then the pressure was decreased to 0.25 lbs/in²
While unloading the reading was taken after unloading
of each incremental weight. An average of five readings
for each treatment was taken.

To calculate the changes in resiliency, changes in
carpet thickness were plotted against the corresponding

pressure for compression as well as recovery cycle. The graph was cut along the outlines to get total area under compression. Quantitative reading of total area under compression was taken by weighing the graph. To obtain the area under recovery the graph was cut along the recovery cycle curve and was again weighed. From the two readings, percentage resiliency was calculated in the following manner -

$$\text{Percentage Resiliency} = \frac{\text{Work of Recovery}}{\text{Work of Compression}} \times 100$$

(5, 13)

4.4.6 Determination of Appearance Retention

The appearance retention of the samples was tested by applying two types of tests. Details of these have been mentioned below -

i) Determination of Thickness Retention: Thickness retention of the carpets was tested on Prolific Dynamic Loading Machine by using standard test methods (8). A sample of $12\frac{1}{2}$ cms x $12\frac{1}{2}$ cms was cut and marked A and B at two places. Original thickness of the sample at A and B was noted before subjecting it to dynamic loading. The sample was then clamped onto the traverse plate of the Dynamic Loading Machine in such a manner that the warp yarns were always at right angles to the plate. Care was taken to keep the sample backing flat along

the plate. The machine was set for 50 impacts and was switched on. After subjecting the sample to 50 dynamic loading impacts, its thickness at A and B was again noted. The process was repeated to measure changes in thickness after 100, 200, 500 and 1000 impacts. An average of four readings for each carpet was taken. Percentage of thickness retained after 50, 100, 200, 500 and 1000 impacts was calculated by using following formula -

$$\text{Percentage Thickness Retained} = \frac{T_i}{T_o} \times 100$$

where T_o = Original Thickness at 0.25 lbs/in.^{2} pressure

T_i = Thickness at 0.25 lbs/in.^{2} pressure after specific number of impacts

ii) <u>Determination of Compressibility and Recovery After Dynamic Loading Impacts</u>: For the purpose of testing compressibility and recovery of carpets after dynamic loading a sample of $12\frac{1}{2}$ cms x $12\frac{1}{2}$ cms was cut and marked A and B at two different places. Reading of the original thickness of the sample at 0.25 lbs/in.^{2} pressure (t_o) was taken in the manner similar to the one used for testing compressibility and recovery. Thickness was also noted after half a minute of adding

12 lbs/in^2 pressure (t_c) and after removing the weight (t_r). The sample was then subjected to 500 dynamic loading impacts by the procedure already explained in the thickness retention test. Again t_o, t_c and t_r readings were taken at points A and B (8). The procedure was repeated after 1000 impacts as well. An average of four readings was taken for each carpet sample after 500 and 1000 impacts. Compressibility and recovery of the samples after dynamic loading was calculated by using the formula suggested in 4.4.4.

4.4.7 Determination of Abrasion Resistance

Abrasion resistance of the carpet samples was tested on Prolific Carpet Abrasion Tester using standard test methods (13). Circular samples of $3\frac{3}{4}$ cms diameter were cut with the help of a circular cutter. Five samples, disposed throughout the carpet were cut from treated as well as the control carpet specimens. Outer ring of the tufts from each sample was removed and these were numbered at the back. The samples were conditioned overnight at 65 $\pm$ 2 per cent humidity and 27 $\pm$ 2°C temperature, in a humidity chamber. Before subjecting it to abrasion each sample was weighed and its weight was noted (W_o). For abrading, a sample was mounted on the specimen holder. The abradant holder was mounted

with a new abradant of 13¾ cms diameter. Each sample was
then abraded for 1000 rubs after which these were again
conditioned overnight. Next day the samples were again
weighed before abrading each one to further 1000 rubs
(W_r). The procedure was repeated till all the specimens
had been subjected to a total of 4000 rubs and weighed
after conditioning. After every 3000 rubs the abradant
cloth was changed.

Average weight loss after every 1000 rubs was
calculated for all the carpets. Later percentage of
weight retained after every 1000 rubs was calculated
in the manner mentioned below -

$$\text{Percentage Weight Loss} = \frac{W_o - W_r}{W_o} \times 100$$

where W_o = Original weight of the
sample

W_r = Weight of the sample
after every 1000 rubs

4.5 Statistical Treatment of Data

The investigator systematically coded the responses
to each question of the interview schedule. Coded data
was used to form appropriate tables according to the
specific objectives of the study. Since most of the data
was descriptive in nature, percentages were calculated.
Wherever needed relational statistics was also used.

The data was illustrated in the form of graphs, histograms and pie charts.

4.6 Operational Definitions

Rug: The term refers to a thick mat used as a floor covering which might be either flat-woven or have a pile structure. These can be made of felt also.

Carpet: A carpet has been defined as a thick, soft, pile-woven rug which might be used as a floor covering, bed cover or a prayer rug.

Field of the Carpet: This is the main body of the carpet, consisting of an inner central portion which is usually flanked by border and guards.

Border of the Carpet: Border refers to a broad, continuous band or bands which run on two ends or all the four sides of carpet, enclosing the field. These might be flanked by guards on either side.

Guards of the Carpet: Guards are comparatively narrow bands which enclose the border of the carpet. A carpet might have two to five guards.

Tibetan Carpets: In the present investigation the term has been used to describe all such carpets in which the pile has been made by casting knots on a gauge rod.

Galicha: To differentiate between the two types of carpets made in Himachal Pradesh, the term _galicha_ has been used for carpets in which the pile has been made by knotting the pile yarn around the warp yarns directly, without the use of a gauge rod.

Chugdan: In Tibetan language the _chugdan_ refers to a floor covering in which the pile is made by looping the yarn around warps instead of knotting. In the present investigation the term has been used to describe floor coverings in which the pile has been made either by knotting or looping _leftover_ woollen yarns.

Durrie: _Durrie_ has been defined as weft-faced, flat-woven rug made in plain weave.

Kharcha: The word refers to a very rough, plain-woven floor covering made from goat hair.

Thobi: _Thobi_ is a warp-faced, plain, flat-woven floor covering made from goat hair.

Namda: _Namda_ is a flat, non-woven rug made by felting the wool fibres.

Boru: The term refers to a flat floor covering made by doing embroidery on a gunny bag or a hessian cloth with cross stitch.

Skilled Workers: The term refers to the workers engaged in execution of pre-manufacturing, manufacturing or post-manufacturing operations of floor coverings.

Craftsmen: The word craftsmen has been exclusively used for the workers engaged in the manufacturing operations of floor coverings.

Units of Measurement: Both, the British as well as the Meteric System of measurement, have been used in the investigation. An attempt has been made to follow the meteric system as far as possible but British System of measurement has been used in a few standard test methods.