SITUATIONAL ANALYSIS OF EXISTING DROUGHT CONDITION AND MITIGATION STRATEGIES IN THAR: A CASE STUDY OF NAGARPARKER

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Islamabad, Pakistan
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A thesis submitted in partial fulfillment of the requirements for the degree of

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National Institute of Transportation (NIT)
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THESIS ACCEPTANCE CERTIFICATE

Certified that final copy of MS/MPhil thesis written by **Ms. Anila Hayat**, Registration No. **NUST201362173MSCEE15813F**, of **SCEE/NIT/URP** has been vetted by undersigned, found complete in all respects as per NUST Statutes / Regulations, is free of plagiarism, errors, and mistakes and is accepted as partial fulfillment for award of MS/MPhil degree. It is further certified that necessary amendments as pointed out by GEC members of the scholar have also been incorporated in the said thesis.

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Date:_____

Signature (Dean/Principal):_____

Date:_____

DEDICATION

Dedicated to my Parents.

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First of all I would like to pay my regards to ALLAH the Almighty for providing me with opportunities to prove myself and gain excellence in my endeavors. I also pay my regards to Prophet Muhammad (S.A.W) for being the source of guiding light in life. I would like to pay appreciation to my supervisor Dr. Abdul Waheed for being an excellent mentor throughout my research work. The level of my MS Research work is credited to his encouragement and guidance. I also thank my committee member Dr. Atiq-ur-Rehman, Head of Department, LCWU for being an excellent external supervisor and providing me with prompt response when required. I would also like to thank my committee member Dr. AsgharNaeem for being helpful and providing detailed analysis on my research.I would also like to thank my family and friends for their special support through my difficult times. I would also take this opportunity to thank Mr. Vikram Das for helping me understand the issue in Thar area and introducing me to humanity on such a deep level with surveys in the local communities.

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Anila Hayat

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ABSTRACT

Pakistan is one of those developing countries that are least involved in emissions but has the most vulnerable environmental conditions. Pakistan is facing severe water shortages and flooding asa result of Changes in rainfall patterns; specifically in least developed areas such as Tharparkar. Nagarparkar, once an attractive tourist spot located in Tharparkar because of its tropical desert climate, is now facing severe drought condition from the last few decades. This study investigates the present socio economic situation of local communities, major impacts of droughts and their underlying causes and current mitigation strategies adapted by local communities. Primary and secondary data was used to understand the impacts and explore causes on socio economic life of local communities of study area. The relevant data has been collected through household surveys using structured questionnaires, focus groups and in-depth interviews of key personnel from local and international NGOs to seek the sensitivity of impacts and strategies used to address these impacts in the study area. This investigation is limited to four rural communities of union council Pilu of Nagarparkar district including Bheel, BhojaBhoon, Mohd Rahan Ji Dhani and Yaqub Ji Dhani villages. The results indicates that drought has caused significant economic and social hardships for the local communities as more than 60% of overall population is dependent on rainfall which has been disturbed by irregular rainfall patterns. Decline in Crop yields has forced local community to migrate to nearby areas in search of livelihood opportunities. Communities have not undertaken any appropriate actions minimize the adverse effect of drought; they are completely dependent on the support from government and external aid for survival. Respondents also reported that poverty is major cause of their vulnerability to drought. Increase in population, limited livelihood opportunities, caste system, lack of interest from government sector,

unawareness shaped their vulnerability to drought and other social issues. Based on the results of this study, it is suggested that the local authorities shall create awareness about drought hazards and improve resilience of communities against drought. It is further suggested to develop, introduce and implement water harvesting practices at community level to promote drought resistant crops.

INTRODUCTION

1.1 Introduction to Climate Change

In literal terms **Climate change** is referred to as a variation in the weather patterns that has long lasting effects spread over a extended period of time. It is mainly instigated by features such as biotic processes, solar radiations, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, which has been identified as *global warming*.

The signs of climate change are enthralling as it has been reported that sea levels are rising, glaciers are receding, rainfall patterns are changing, and world is becoming a warmer place. According to the Intergovernmental Panel on Climate Change (IPCC), the emission of greenhouse gases is likely to increase the temperature by 0.2˚ C. (Elizabeth *et al*., 2010).

1.2 Global Effects of Climate Change

Climate change has already affected different countries and the societies attached to it; these affects will leave an imprint for the future generations as well. The different chemical and physical phenomenon being carried out by human beings are leaving long lasting imprints on the natural environment such as: on land and water bodies, farms as well as different cities and all these changes are in haphazard state.

Different regions are being affected differently in terms of warming and precipitations as a few places around the globe are likely to be dry in future and few other places will have extreme precipitations.

The atmosphere is warming and moistening everyday which is causing adverse climatic and weather conditions. Each passing year is hotter than the previous year and more which is causing droughts, hefty rainfall and snow fall to happen often. As the hurricanes are caused heavily dye to water heat on the surface of ocean, it is quite likely that the increase in climatic temperature means that hurricanes will get stronger in the future. Many researchers have been conducted to identify the effects of these weather conditions on coastal population and also the shipping and fishing industries in those areas.

Climate change has been causing a lot of problems around the world but it mostly has a severe impact for eradication of poverty reduction and hence has been causing hindrance in the development of poor countries. The negative impacts of global change cause more problems in the poor countries. As the poor countries are more dependent on natural resources and have limited capability to cope with the rapid change in climatic conditions they face more problems in development. If the ecosystems are maintained in a proper manner then different communities can sustain their livelihoods through these ecosystems. The widely spreading problem of climate change is causing a global dearth situation. This phenomenon is broadly seen in high northern latitudes of the world (Trenberth *et al.*, 2007). Climate change has affected the global population altogether. It is associated with greenhouse emanations, average rise in temperature, rainfall pattern changes and ultimately results in growing sea levels (Moorhead, 2009).

1.3 Drought and its Causes

Drought is defined as deficiency of rainfall for prolong period in any region. It is a gradual phenomenon caused due to less rainfall in a particular area which resultantly causes shortage of water and living conditions in the area and its surroundings. Droughts may thus

cause significant impacts on the ecosystem, agricultural capacity and water resource of the affected area (Graham, 2000).

Drought may also not entirely be a physical phenomenon which can solely be associated to weather. Somehow at a more essential level it is linked to the balance between water supply and demand. As widely known the areas where sustainability is less likely to be achieved the human demands exceed the natural availability, in this case shortage of water resources thus causing drought (West, 2016). The impact of drought varies on different communities and it depends on local governance, socio economic conditions of communities and geographical location. The most radical and severe impact however has been on the developing countries as most of their income is based on agriculture related activities (Fisher *et al*., 2002; Stern, 2006; Cline 2007). Thus, drought is a potential "catalyst" in some developing countries, which are already short in food and water.

The adverse effects of droughts in developing countries demands good governance and effectve preventive actions at local level.With deterioating condition of exisitng socio economic conditions coupled with poor management, local governments are unable to deliver services according to the needs of people. There is need of community based development where community identfy the current issues and help the governments to identify reliable solutions to address them.Community Based disaster risk management is one of the key soultion to global disaster related problems.

1.4 Problem Statement

Pakistan is one of those developing countries which are least involved in emissions but has the most vulnerable environmental conditions. Pakistan ranks 8th in the list of most aggravated countries by climate change on climate risk index 1992-2011 (Harmelin *et al.*,

2013). Climate change brings out widespread impacts on the environmental as well as socioeconomic and other inter-reliant sectors in Pakistan which include water properties, agricultural lands and food safety and security, health factors, telluric ecologies and biodiversity. Pakistan is facing intense shortage of water bodies and floods as well, which results in changing rainfall patterns; specifically in least developed areas such as Thar. Thar has gone through severe drought conditions throughout last century. In the second half of 20th century, worst droughts of 1951, 1968, 1969, 1987, 1988 and 1998 were seen by the habitants of Thar and passed through the same courageously. Drought sand famines of 1899 and 1939 are also in the records when there was not even a single drop of rain in whole Thar.

1.5 Justification of Study

Study of Climate Change has gained much importance in the recent past. Launching of Campaigns on Millennium Development Goals, COP 21, Sustainable development Goals shows the importance of the issue in global world. The study while exploring the root causes of drought condition in Thar will allow proposing mitigation and adaptation strategies to reduce the impacts of recent drought conditions and to catalyze local government in proposing a drought policy. The study will also help in assessing the local governance of various Thar governments to identify the areas lacking good management and in delivering the services more effectively. The study will be essential to assess the effectiveness of various mitigation and adaptation practices being adopted in Thar to address drought conditions. This type of study has never been conducted in Thar before hence will act as first spoon for community based drought management. The research will

help the Tharparker Local Government & Community Development Department to develop an effective drought policy to address the drought condition and other underlying issues.

1.6 Research Objectives

The objectives of this study are:

- To investigate the socioeconomic impacts of ongoing drought on local communities.
- To explore the causes of existing situation in Nagarparker
- To analyze the current adaptation and mitigation strategies
- To propose mitigation strategies to counter drought impacts on the basis of ground facts.

1.7 Research Questions

This study will be guided by four research questions through which instruments will prepared and data will be collected. The research questions are:

a) What are past, present and possible future trends of drought in the study area and how are they perceived as well as explained by local communities?

b) What is level of knowledge and awareness of local community on drought and its impacts

c) What are socio-economic implications of changes at household and community levels in the study area?

d) What are the appropriate policy and strategic interventions that can support local communities to adapt to changes they experience so as to enhance their resilience in future?

Chapter 2

LITERATURE REVIEW

2.1 What is Drought?

Drought is the lack in drizzle and precipitation in an area prolonging to a specific period of time. This usually happens in the monsoon seasons occurring every year and may last for more than a season in severe conditions. This causes shortage of water and hence poses great threat on animals and vegetation. This is a natural phenomenon of climate change and may occur in all kinds of lands whether dry or wet. Drought may be considered as an anomaly that deviates the normal climate and hence it can discriminate from region to region. (National Weather Service, 2006). Human based influences, such as water distribution and management of water supply and demand, can intensify the effects of drought on a particular region. As will be discussed later in this report the link between a drought in a region and the region's capacity of handling its issues is interrelated. It also means different for different regions as each place has its own effects and problems. (National Weather Service, 2008).

2.1 Effects of Climate Change on Droughts

In order to understand the relationship between drought and climate change, it is essential to first differential between climate and weather. Weather is merely the narrative of a particular atmospheric condition at a particular time while climate is the atmospheric behavior over a long term. (Mote, 2006)

Droughts that surface the regions individually are distinct weather events for that region. The climate change that takes place over a long passage of time can be related to weather

changes. Worldwide change in weather commonly referred to as global warming is highly associated with frequent drought occurrence. And it is likely to happen in the coming years that the increase in temperature will cause further rain and snowfall lags.So, the temperature increase will increase the threat of drought in both agriculture and crop yields throughout the world (Wood, *et. al*. 2008).

2.2 Global condition of Drought

In the past few years, there have been quite a lot of droughts that hit massive crop producing regions all over the world. This in turn caused the instability in food production and pricing. In countries that already have limited food retreat, the increase in prices may lead to turmoil, migration and starvation. There have been several reports of increase in food prices all over the world which is associated with poor crop yields specifically in drought prone regions. During the 2007-2008 drought, the Food and Agriculture Organization of the United Nations estimated that increase in food rates increased the number of unceasingly famished people in the word by 75 million (Fenimore, 2017).

2.3 Types of Drought

2.3.1 Meteorological Drought

The Meteorology based drought is defined in accordance with the amount of dryness it causes (in comparison to some "normal" or average level of dryness). It is also calculated as per the duration of time through which the drought is stretched out. Drought commencement usually occurs with a meteorological drought (Wilhite, *et. al.* 1985).

2.3.2 Agricultural Drought

Agricultural drought includes numerous features of meteorological (or hydrological) drought linked to agrarian effects, and mainly focuses on rainfall shortage, soil water discrepancies, compact ground water or basin level required for irrigation, and so on (Wilhite, *et. al* 1985).

2.3.3 Hydrological Drought

Hydrological drought is caused after episodes of prolonged rainfall gaps that effect water supply (i.e., stream flow, basin and lake levels, ground water), possibly resulting in noteworthy social influences. As we know that all states are interlocked by hydrologic systems, the impact of droughts can extend the jurisdiction of rainfall deficit area as well (Wilhite, *et. al* 1985).

2.4 Causes and Effects of Drought

The principal reason for occurrence of most of the droughts can be linked with the areas high pressures (also called as anticyclones) and the variation in atmosphere. At times it is observed that masses floating in the air separate themselves from the airflow and effectually prevent the advancement of weather system from west towards east. In due course of time these blockages cause manifestation of life-threatening weather conditions such as flood, heat wave, droughts and cold snaps. Many climate analysts, after examining the climate records and models that the droughts occurring in tropical regions are most likely caused due to globally changing patterns of temperature irregularities on the sea surface which in scientific terms is referred to as an El Nino. During an El Niño, the strangely warm equatorial Pacific Ocean heats the superimposing atmospheric layer, which

causes changes in the atmosphere hence creating increased possibilities of drought occurrence in various parts of the world (Graham, 2000).

2.4.1 Drought Impacts

Drought is one of the most imperative natural catastrophes and it affects the communities on all points such as social, economic and environmental conditions. Also, the tendency of drought occurrence does not necessarily depend upon the humidity of an area, it may take place in an all humid or a semi humid area. Although the effects caused by it may differ from one region to another. .Drought affects society by causing issues in their social, economic and environmental factors, but the impact on economic conditions is more than the others.

2.4.2 Economic Impacts of Drought

The most crucial effect of drought is on increase in labor cost and eradication of wildlife plants. It also increases the rate of water supply and decreases the procurement of power. Droughts also cause a massive reduction in savings, many bank loans are also reported which are not paid by people in drought prone areas. There is a huge decline in crop prices due to low quality yield production this is turn causes a decrease in income due to reduction of agronomy. Economic instability also creates decrease in land prices and side jobs respectively (Loyaza, *et. al* 2012).

2.5 Environmental Impacts of Drought

Drought also creates environmental issues including cut in river flow, change in groundwater levels, reduction in surface water reservoirs and ponds, increased growth of weed in the fields. It also causes increase in deaths of sea animals such as fish, etc. There

is notable decline in water quality due to droughts. Pest attacks occur more frequently in drought conditions. Plant disease also happen enormously thus causing soil erosions. Droughts also cause surge in amount and intensity of fires occurring in the woods and decrease in diversity of plant species (Nagakawa, 2008).

2.5.1 Social Impacts of Drought

Droughts have serious social impacts as it results in intensified frustration, apprehension and emotional distress, people suffer from extreme poverty and have a notably decreased standard of living, there are little to no leisure based activities in the drought prone areas, a local divide is observed in water supply at a huge level, the cooperation and organizations working for people's benefit lose their reputation, deteriorated customs of cooperation, migration trend increases, very few social ceremonies are held at local levels, education level is highly affected among children as well as teenagers, lack of consistency in the society no continuation of family system is observed respectively (Alston, 2004).

2.6 Drought and Migration

161 countries have faced environmental disasters and all these disasters have been due to changes in weather conditions. These disasters have caused mass displacement all over the world (Bawden, 2015). Financial difficulties in the drought prone areas lead to many unemployment and poverty in these areas. Many villagers migrate to their respective provincial centers due to lack of both water facilities and employment opportunities (Kamal*et. al*, 2004).

The drought affected people migrate to big cities but have no definite homes; it has also been reported that some people live under shelters and construction sites or are found living

their days off on footpaths and benches due to lack in accommodation. Most of the villagers are unemployed and live under extreme poverty, hence are even forced to beg for a living. The rural evacuation becomes a liability for authorities in the big cities that have to provide food and shelter to these migrants (Doshi, 2016).

The droughts which occur due to physical and environmental changes have a significant impact on employment and earning of the people. Households are not self-sufficient enough to run on their own in drought conditions and this happens due to rapid changes in climatic notions and crop degradation. There has also been a rapid increase in the population of different areas around the world which in turn leads to land shortage for agricultural purpose and accommodations. However, the peril that households suffer is caused due to disregard of their existence in terms of marginalization, lack of land lease provisions, little to no mechanism for coping, lack of market opportunities and infrastructure and unavailability of government support, when required. A pattern that is established after migration due to protracted drought is firstly developed with labor and cattle migration. This may not differ in intensity from areas with established high rates of temporary, circular migration (Henry, 2003; Findley, 1994 and Perch, 2001). In comparison to other disasters the percentage of people migrating to other areas was highest in drought prone places (ranging from 10% to 31%) (Burton *et al.* 1993, and Nielsen,2004).

2.7 Global Examples of Drought

Rendering a research attributed to United Nations it is found that one third of the world's population resides in water lacking areas and 1.1 billion people do not have access to safe and healthy drinking water. Worldwide droughts are the considered as the second most g

widespread hazard after floods i.e., covering 7.5 per cent and 11 per cent of the global land area each (Dai *et. a*l, 2004).

Amount of loss caused in land, population and GDP is upto 970 million km2, 57.3 billion andUS$108.6 billion respectively. The amount of land affected by droughts was twice in the 2000s to what it was in the 1970s according to a new analysis by scientists at the National Centre for Atmospheric Research (NCAR). A huge amount of dryness was reported in significant areas of Europe and Asia, Canada, Western and Southern Africa, and Eastern Australia in the past few years. The rapid increase in temperature all around the globe has been a major reason in infuriating more recurrent and concentrated droughts in sub-tropical areas of Asia and Africa, thus worsening the food security issue in the poorest countries of the world. The fraction of land worldwide that experiences dryness due to droughts has risen from 10 to 15 percent in over 30 years and has been reported to be around 30% by 2002 (Dai, 2004).

From the year 2000 and onwards a huge area in South Asia, including India and Pakistan was largely affected with severe droughts. The South Asian region is considered to be the recurrently drought-prone region of the world. Afghanistan, India, Pakistan and Sri Lanka suffer from droughts at least once over a period of three years as reported in the past 5 decades, while Bangladesh and Nepal also report frequent droughts in their respective areas. In 2012, emergency was declared in Tharpakrakar and Mirpur Khas districts of Pakistan due to severe drought and many people had to be relocated (Tareq, 2012). In Cambodia, severe drought affected the late season and longer-duration genotypes (Tsubo et al., 2009). There are a number of examples worldwide that relate to this study.

2.8.1 Drought and its Prevention in Kenya

Kenya suffers from regular extreme weather events which specifically aggravate rural poverty, thus causing over whelming effects on existence of farmers in various regions of the country. In 2000 Kenya went through with the worst drought in its history of 37 years. This resulted in an appeal from the Government to feed 4 million people. The Kenyan Government implemented a three year project based on community service that involved volunteers from the rural communities. This project aimed at strengthening the local and district capacities, through local and innovative mechanisms, to predict, cope with and recover from recurrent drought impacts. A revolving fund was also established to create ownership and solidarity.

2.8.2 Drought in Developing Countries

All the globally declared least developed countries have become the most vulnerable to droughts and its impacts due to basic changes in physical, social, economic and skill features. The increasing biophysical weakness frameworks and concentration in the Asian developing countries cause adverse effects on food security, human health, biodiversity, water resources, hydroelectric power generation, streams, perennial springs, and livelihood. Drought causes increase in pollution, pesticides and diseases. It is also responsible for forced migration and starvation. Following are some examples of drought occurrence and mitigation strategies in some developing countries:

2.8.3 Drought in India

India has been facing long lasting drought and its frequency has been increased in recent years. More than 50% of its population is dependent on hence drought events threatens the overall economy of country. The agriculture in India is majorly dependent on South-west

monsoon rainfall. About 60%ofthetotal agriculture relies on natural rainfall and hence variation in rainfall threaten India's agrarian economy. The direct impact of drought on india’s agriculture is decrease in crop production, vegetable and fruit production.

2.8.4 Drought in Pakistan

The Economic Survey of Pakistan issued a report which stated that drought has increased poor growth performance all over the country. Some areas in Pakistan are affected by drought conditions if the monsoon season does not deliver expected rainfall and thus cause dryness.

If we talk about the history of drought in Pakistan we find out that from 1998-2002 the country experienced the worst drought in its 50 year history. As El-Nino came into existence in 1997 the drought gained concentration in the following year. It reached its peak in 2000 and continued intensifying till 2001. 2002 however was considered a weak year for drought impacts. The same drought also affected some areas in India and Afghanistan along the border. A World Bank warning was issued to Pakistan that this drought will affect the economic growth of the country at large. Balochistan and Sindh were the most affected areas during this drought. 26 districts in Balochistan suffered from starvation as a outcome of this drought. Thousands of peoplein the province were affected by this drought in terms of socioeconomic impacts. A district near the Afghanistan border called Nushki was one of the most vulnerable areas. At that time there had been no rainfall in Nushki in the past 5 years. The drought in Balochistan put more than one million people in the vulnerability index and killed almost two million animals. While, the drought effects in Sindh killed 127 people, all of which were in Tharparkar region close to India.

2.9 History of drought in Thar

Tharparkar has been affected by a drought-like situation impacting livelihoods, nutrition and health conditions. The total under- 5 deaths were reported at 234 in 2013, 326 in 2014, and 398 in 2015, rising from 173 in 2011 and 188 in 2012. According to media reports, the incidence of under-five deaths in Tharparkar is still on rise during the first half of 2016 with 243 deaths recorded. This may suggest a worsening health and nutrition situation following the start of the drought period (WFP, 2016).At least nine more infants died due to malnutrition and the outbreak of various diseases in arid Tharparkar district over a two-day period in December, raising the toll to 476 for 2016, according to local media (Alhasan, 2017).

A joint UN observation mission took place in drought-hit Tharparkar, Umerkot and Sanghar districts from 13-17 February, 2017. The resulting mission reports stated that the areas remain vulnerable and that the situation may become critical or deteriorate into a 'humanitarian emergency' if little or no rain falls during the coming monsoon, and if immediate needs are not met. The mission found that the vulnerabilities outlined in an August 2016 needs assessment remain, while recommendations from detailed assessments and missions conducted from 2015-2016 have not been put into practice (UNCT, 2017).

Chapter 3

METHODOLOGY

The research methodology is most crucial and important factor in any research. Hence this chapter particularizes the methods obtained to achieve research objectives and answer the relevant research questions. This study has adopted mixed organizational approach to report the vulnerability of drought and its adaptation on local level; for current drought conditions in Thar. The study involves the investigation of an issue through diverse tools which allow for multiple aspects of the phenomenon to be revealed and understood (Baxter, 2008).

As identified from the literature review this chapter focuses on methods to conduct the research from both national and international perspectives.

This study is based upon Mixed Research Method which combines the strength of both quantitative and qualitative research approach in data collection, its analysis and interpretation. The research methodology comprised an initial literature review and structured interviews, which were followed by fieldwork.

3.1 Research Design

The research has been carried out in three stages which include collection of background materials, fieldwork, and data analysis.

i. The first stage was to design the detailed research process, select appropriate methodologies, design interview question lists and a questionnaire. It also includes search for background information related to the actual situation of Tharparker.

ii. The second stage was to carry out fieldwork. In this period, interviews, surveys and on-site observation were carried out.

iii. The last stage was to analyze and interpret the data and to write the thesis report.

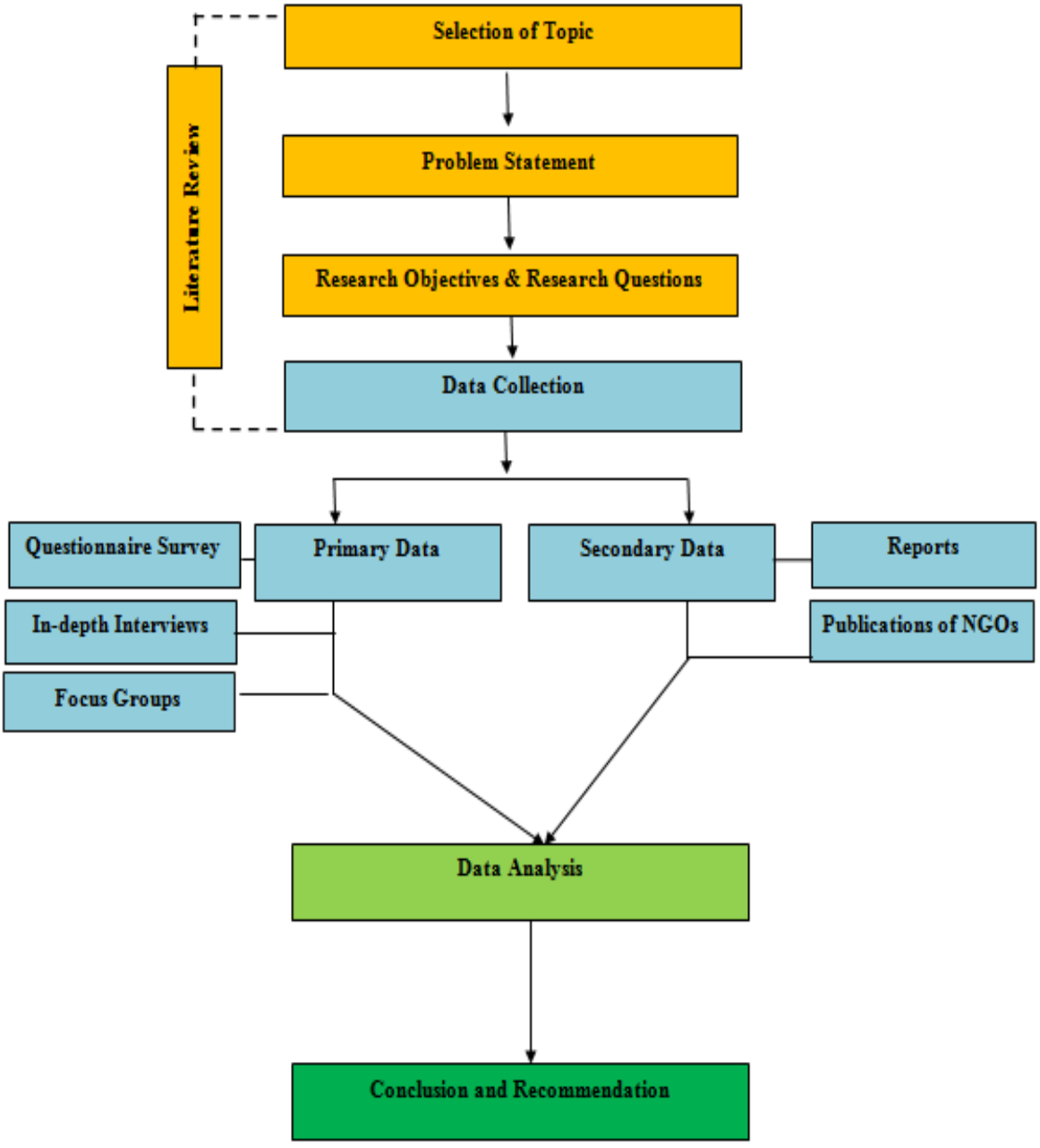


Figure 1Research Methodology

3.1.1 Descriptive Design

Primary purpose is of descriptive design is to paint a word picture of the research; using words or numbers and present a profile, a classification to types, or an outline of steps to answer questions such as who, when, where and how. The descriptive research gives information regarding the current status of the drought its causes and impacts and to describe "what exists" with respect to variables or conditions in this situation; that have been identified in this research. The study is also focused on assessing the current status of strategies adopted by target community to combat drought risks.

3.1.2 Exploratory Design

Primary purpose of exploratory design is to examine a little understood issue or phenomenon to develop preliminary ideas and move towards refined research questions by focusing on the ‘what’ questions. The research also enabled to identify the perception of safety and security of the respondents.

3.1.3 Explanatory Design

Primary purpose is to explain What is Present condition of drought in Thar, What are the impacts and why is this drought prevailed in study are, how to mitigate the risks. The study explains the current situation of Thar and its cross sectoral impacts.

3.2 Research Techniques

The techniques which are going to be used in the present study are quantitative and qualitative research. So the study includes mixed research methods.

3.2.1 Sampling Technique

Researchers rarely observe the entire population but choose a representative group to share views on behalf of the whole population. Total of four villages of Tehsil Nagarparkar were purposively selected for identification of sample size.

The power of purposive sampling lies in selecting information-rich cases for in-depth analysis related to the central issues being studied. Yamane's sample size formula is used to determine sample size. Using the tehsil average of 6 H/H members, about 264 people out of the tehsil population of 2,03,3166 were contacted, translating to 0.13% coverage.

For conduction of this research 20 semi structured interviews were conducted. The key respondents for interviews were from government departments and extension workers, research institutes, NGO and civic society and the business community. These were randomly or purposively sampled depending on the circumstances especially prior knowledge on the topic under research.

3.3 Places of Survey

Data was also collected from four villages of tehsil Nagarparkar in order to take the views of the respondents from whole tehsil. For this purpose, four villages have been selected and almost equal numbers of people were interviewed from all the villages.

3.3.1 Selection of Study Area

The case study area has been selected in accordance with the problem statement after due consultation with the research supervisor. Thar is the most drought prone and affected area of Pakistan. Many attempts have been made over the past decade to mitigate this life threatening issue in Thar. Hence, this study will help in identification of new community based strategies to overcome droughts.

3.3.2 Study Area

Tharparkar contain the Chachro, Mithi, Nagarparkar and Diplo talukas. Nagarparkar taluka compromises of 6 Union Council i.e. Virawah, Pilu, Sathiidera, Nagarparkar, Pithapur and Tigusar. It area is 3,862 Sq. Km and population was 153,106 in 1998. The population was 191,613 persons in 2008. In 2020, the population would be 250,811 and addition 59,198 persons in 2008 projected population. As per census report of concerned district, it is classified as rural area.

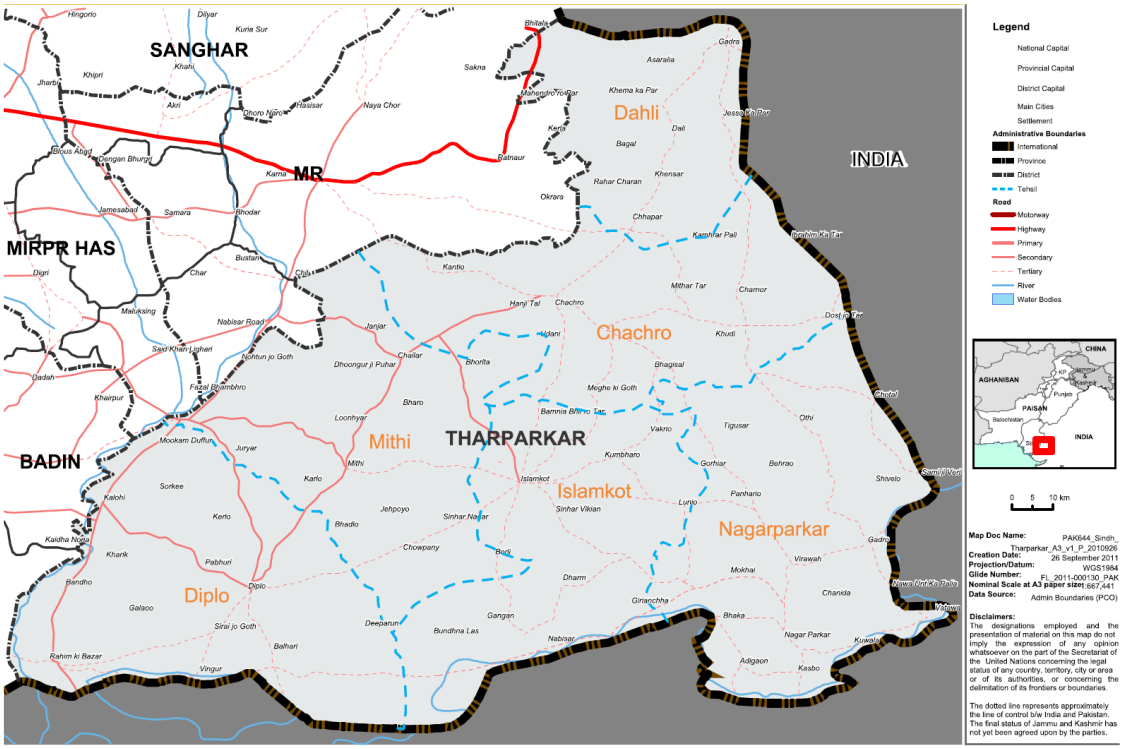


Figure 2 Map of Tharparkar

The terrain of study area is same as rest of Tharparkar. There are sand dunes with valleys. During the rainy season the desert supports extensive vegetation which is used as fodder for livestock. Dug wells are only sources of water consumption for domestic purposes.

3.4 Review of Literature

Relevant literature has been quoted and highlighted to widen understanding of concepts of climate change.

3.5 Research Method

For this research participatory research tools and techniques will be used to assess impacts of droughts and exploring options.

3.6 Data Sources & Collection

3.6.1 Primary Data

The primary data was collected through questionnaires, interviews and focus groups.

- Observations
- Questionnaire Survey
- Semi Structured Interview with institutes
- Focus Groups

3.6.1.1 Observation

Focused observations are conducted to explore and identify drought impacts has been made to see the strategies adopted by local communalities to overcome the impacts of Thar. The photographs were also taken to explore the current situation of drought and its impacts on local communities of Nagarparker.

3.6.1.2 Questionnaire survey

A comprehensive questionnaire was designed to get the data from four villages of Tehsil Nagarparker regarding their socio-economic conditions, existing situation of droughts and

its impacts on livelihood of communities and awareness level of community to overcome the drought condition prevailing in Thar.

3.6.1.3 Semi Structured Interview Schedule

Semi-structured interviews have been held with NGOs, local government authorities and researchers to get insight of drought situation and to get an opinion regarding causes of this drought and to develop mitigation strategies with involvement of local community.

3.6.1.4 Focus Group Discussions

FGDs are informal, guided discussions about a particular topic. This is a brilliant method of getting an indication of how pervasive an idea, value or behavior is likely to be in the community. Two FGDs with 7-15 selected ordinary community members with similar backgrounds were held to gather opinions on awareness on drought and strategies adopted to mitigate its risks. Two FGDs were held in BhojaBhoon and Bheel. The groups were deliberately kept small to ensure the participants would not feel intimidated and could express their opinions openly.

3.6.2 Secondary Data

Methods for secondary data collection are as follows;

3.6.2.1 Document Review

Relevant statistics and reports at district and Tehsil level were reviewed to complement primary data collected during the research. Data collected included demographic, human development, agricultural productivity and climate data. Key data was also obtained from

vulnerability assessment reports and Disaster management and humanitarian assistance reports conducted in Tharparkar.

In summary, the methods employed were rapid appraisal ones: quick and low cost ways of gathering views of stakeholders. This posed the challenge of limited participation, which may affect objectivity and comprehensiveness.

3.6.2.2 Published reports

Major sources of secondary data were the available literature on the selected topic. Literature was thoroughly searched and used in the literature review and in development of survey questionnaires. The available literature also guides in improving research objectives, developing methodology and to assess tourists' perception of safety and security.

3.6.2.3 Departments

Departments and NGOs working in Tharparkar were also visited for secondary information like village profiles, demographic information and their ongoing projects of community based drought management. The data was gathered from TRDP, Focus humanitarian assistance, SCOPE foundation.

3.6.3 Data Compilation and Analysis

According to Ormrod, 2001 data analysis logically involves five steps. These are the steps the study followed to analyze the data collected.

- ***Organization of details about the study.***

  Data obtained from the various respondents was arranged in a logical order.

- ***Categorization of the data.***

  The data was then categorized and clustered into meaningful groups, which provided a view of the trends as observed by the respondents.

- ***Interpretation of single instances***

  The study then examined the questionnaires to determine relevance and application these have to the problem.

- ***Identification of patterns***

  The data was examined to identify patterns to discover any underlying themes and patterns, which would possibly shed light on resolving the problem.

- ***Synthesis and generalizations***

  The study then developed an overall picture of the data gathered from the study and drew preliminary conclusions, which guided the researcher with new insight into the data collected.

3.6.4 SOFTWARE USED

Statistical Package for Social Sciences (SPSS) and Excel computer packages were used to carry out these tasks for quantitative data analysis whilst manual analysis was done for the qualitative data.

Chapter 4

RESULTS AND DISCUSSION

The results obtained from reconnaissance, socioeconomic surveys, interviews with the residents and concerned officials and observations recorded from available & relevant secondary data is discussed as under:

4.1 Socioeconomic Characteristics

During this study it has been identified that the living and coping standards of the local people have been widely affected due to severe drought conditions in the case study areas. The socioeconomic characteristics are affected largely in less rainfall and extreme conditions. People migrate to nearby villages\cities for better opportunities. The first objective of this study focuses on investigation of the socioeconomic impacts of ongoing drought on local communities; the following characteristics have been identified that are likely to have impacts on the local population and will be discussed in detail later in this chapter: Table 1 gives an insight to the socioeconomic characteristics of the case study areas. It has been identified through socioeconomic surveys that majority (59.4%) of the sample population has a household comprising of 7 to 10 people. This finding also leads to the identification of affected population within the case studies. Also, with this finding it is revealed to the observer that lack of education has led to an increased household size which causes further problems in the coping capability of the local population and hence creates casualties' occurrence more than usual. In the aforementioned table it has also been

discussed that average age of the head of household is more than 40 years in most (72.7%) of the surveyed population.

Table 1: Socio Economic Characteristics

Subject Characteristics	**No.**	**Percentage**
Household Size	300	
3 to 6	122	40.6
7 to 10	178	59.4
Age of Head of Household	300	
Less than 40	82	27.3
More than 40	218	72.7
Land Ownership	300	
Leased from State	5	1.7
Communal Land	175	58.1
Inherited	120	40.2
School Going Children	300	
Both male and female	29	9.7
Male	68	22.7
Female	6	2.0
None	197	65.7
Effects of Drought	300	
Loss of Human life	163	54.3
Loss of Livestock	18	6.0
Migrations	119	39.7
Most Vulnerable to Drought	300	
Children	76	25.3
Elderly	13	4.3
Orphans	211	70.3
Monthly Income	300	
	219	73%
	54	18%
	27	9%
Years of Living	300	17.4%
	52	26.3%
	79	56.3%
	169	
Class of Residents	300	73.7%
	221	22.7%
	68	3.6%
	11	

Source: Field Survey 2017

The socioeconomic survey has also showed that most of the population (58.1%) are either living on the communal land or have inherited (40.2%) it from their predecessors and only a small number (1.7%) of the surveyed population is living on land leased from the state. This finding has also shed light on the fact that majority of the local residents (98.3%) are not only living on their own lands but are also a part of these communities since a long time. Hence, it becomes difficult for these local people to migrate to other cities and abandon their own lands on the cost of nothing.

Education stays an integral part of any community and in any socioeconomic far-reaching situation it is important that the right to children education is practiced with integrity. The same was considered while conducting this research and when asked from the sample population if they were providing their children with primary education or not the response was not satisfactory and positive from a huge majority of 90.3% and only 65.7% of the surveyed people responded that their children were not going to any schools.

When asked about the most vulnerable citizens of the community that are affected by droughts it was revealed that 70.3% orphans in the entire population were the most vulnerable to drought conditions as they had no support of family or government organizations and are suffering a great deal on their own. The most drastic effects of drought caused to the local communities are loss of human life (54.3%) and migrations (39.7%) from one place to another without any hopes of opportunities which will be discussed in detail as under:

4.2 Migration

Migration is one of the most highlighted socioeconomic impacts of droughts in Tharparkar. When studied in detail in our case study areas it was discovered that migration is not only

a difficult remedy to overcome drought conditions; it also does not have the desired results for the local people in terms of health, safety and employment opportunities. The results obtained from this research regarding migration conditions are given below:

Table 2: Migration & Its Correlation with other Factors

	Household Migration	Reasons to Move	Current Living Situation	Duration of Displacement
Household Migration	1			
Reasons to Move	-.112	1		
Current Living Situation	.018	-.053	1	
Duration of Displacement	-.225**	.085	.535**	1

**. Correlation is significant at the 0.01 level (2 tailed)

The above table shows that there is a significant correlation in some factors and migration of the local residents. The values achieved through correlation analysis signify.

4.3 Water Resources

Cross tab references have been made to highlight the issues related to provision of drinking water to the local residents. The following Table 3 describes the location of water sources in both private and public dwellings and sources through which water is distributed among the local people from these locations.

4.4 Yield Production & Variability during Drought

An important determinant of development during catastrophes like droughts is food production and economic stability through it. In our case the provision of food and economic development both depend on a local communities and their ability to enhance their living through livestock and vegetation. The following table 4 shows us the

production of crops in the last season and the impacts caused on its production in the year during and after drought:

Table 3: Water Resource Distribution

Location of Water Source			Provision through Usual Source		Total
			Yes	No	
Private Dwelling	Source of Drinking Water	Piped Water	0	14	14
		Tubewell	4	31	35
		Dug Well	67	113	180
	Total		71	158	229
Elsewhere	Source of Drinking Water	Piped Water	0	4	4
		Tubewell	0	3	3
		Dug Well	4	10	14
	Total		4	17	21

Source: Field Survey 2017

Table 4: Yield Production

Last Season Low Yield Reasons			Crops					Total
			none	Barli	Cluster	Mong	Moot	
Low Rainfall	Yield Conditions	very bad		29	27	60	22	138
		bad		13	14	36	13	76
		normal		10	4	0	5	19
		good		0	5	0	4	9
	Total			52	50	96	44	242
Late Cropping	Yield Conditions	very bad		13	14	4		31
		bad		5	5	8		23
		normal		0	4	0		4
	Total			18	23	12		58

Source: Field Survey 2017

4.5 Cattle and Livestock Situation

The cattle and livestock availability is also of prime importance in the drought prone areas. The socio economic survey provides us with the public knowledge of availability of livestock in their respective areas. The following graph gives an overview of the availability of different livestock in the drought struck case study areas of this research:

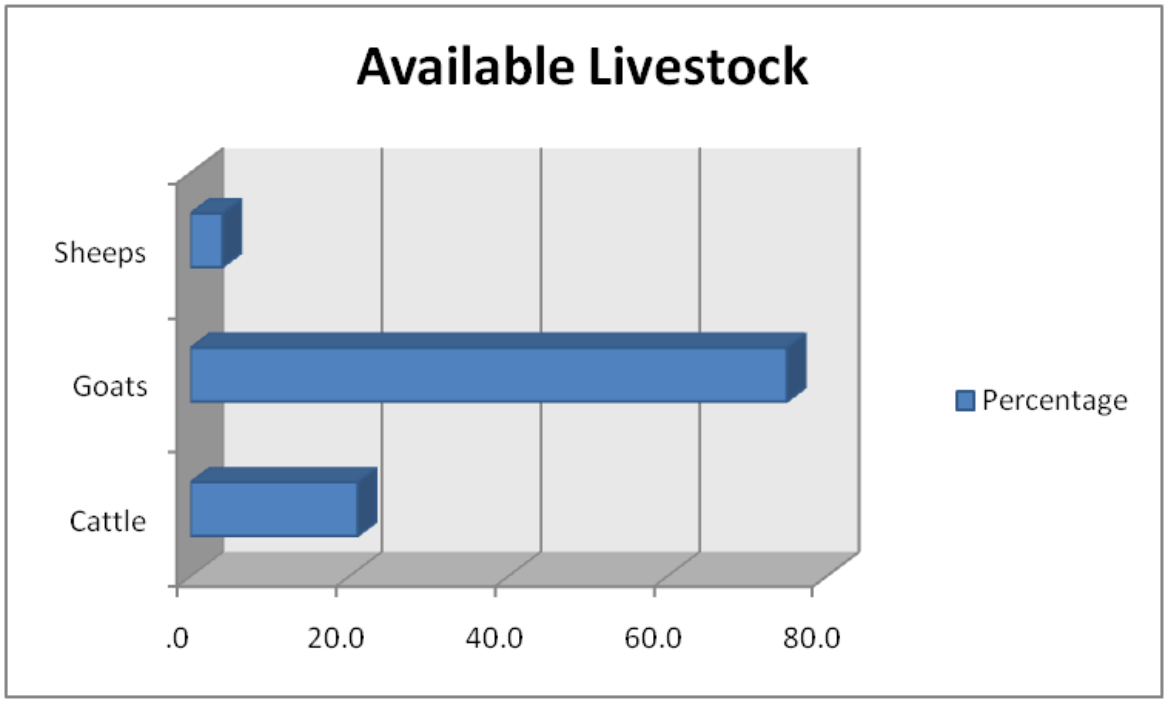


Figure 3: Livestock Availability

4.6 Existing Situation in Nagarparker

This study focuses on the adverse impacts of drought in Thar and in particular the case study area that we have selected for research i.e. Nagarparkar. Here, we are discussing the existing situation in case study area and the different factors that have been the reason to cause these situations. The issues enlightened in the situational analysis have been identified with the help of reconnaissance survey, electronic interviews with the concerned officials and available secondary data on the ongoing condition of different issues among the local residents.

4.6.1 Precipitation

According to consultation with secondary data it has been found that average annual rainfall for Nagarparkar based on available data on the last four drought-hit years i.e. in 2012, 2013, 2014 and 2015, was 365 mm, 741 mm, 155 mm and 350 mm of annual average precipitation respectively. It has also been discovered that our case study area had a spill of 400mm rainfall in the year 2017. The area has been facing frequent droughts since the past three decades so it is essential to use this rainfall as a means of capacitating the locals in drought conditions.

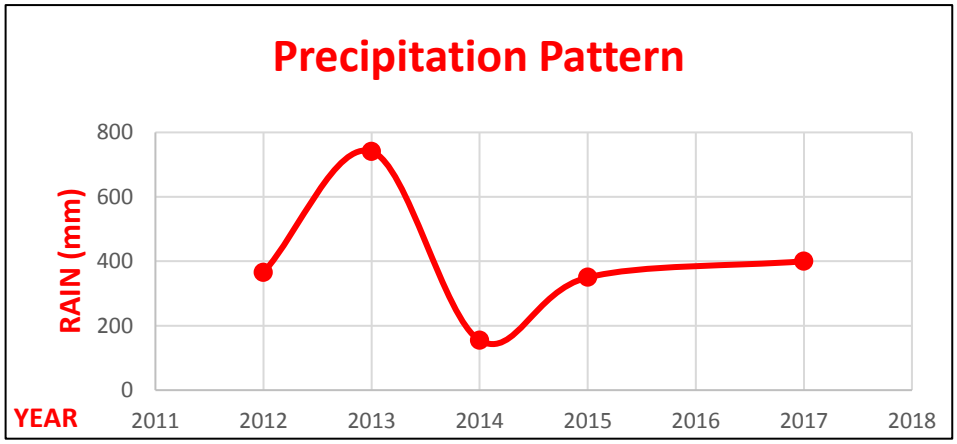


Figure 4: Rainfall over the Years

4.6.2 Population

In the demographical changes the most important and adverse is the change in dynamics of the population. The increase or decrease in population determines the effects that drought has or will cause in future. The population pattern over the past few years has been identified with the help of secondary data. Through consultation of relevant literature it was found that back before the drought hit Thar in 1981 the total population was 546,000. Then again in 1993 drought the population had grown to 747,000. In the year 2015 it was reported that the total population of Thar district was 2,265,000. With the help of this

relevant information the projection for the year 2017 have been made with the help of the following formula of exponential population projection $P_n=P_o\ (1+r)^t$. the projected population for the year 2017 is 2,682,923. The gradual increase in population is show in the graph below

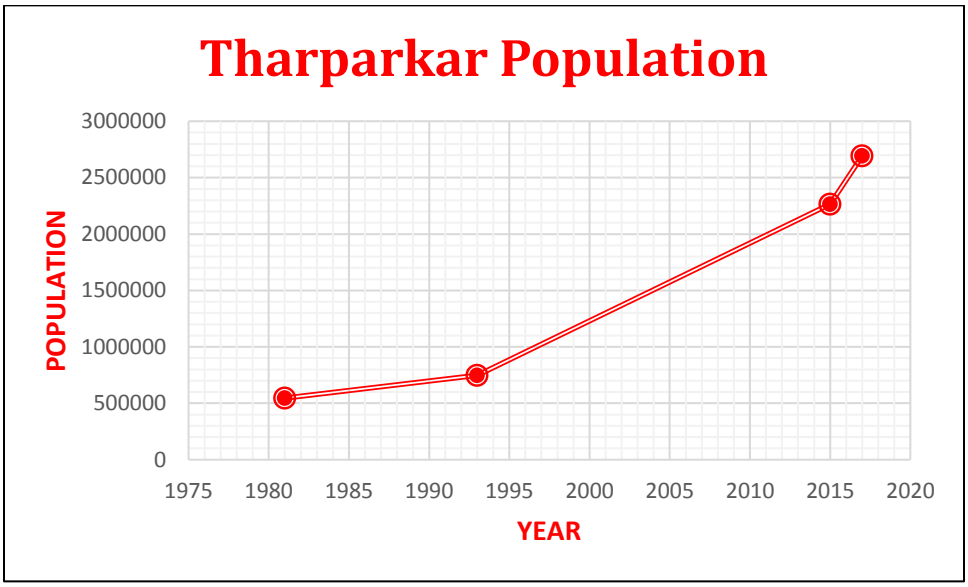


Figure 5: Population of Tharparkar

In the same way population of Nagarparker has also been calculated for the year 2017 using the same formula. Its graphical representation is given as under. Through available secondary data it was found that total population of Nagarparker in the year 1998 was 153,106 and then in the year 2008 it increased to 191,613. The population for 2017 is 252,580 as calculated with the formula.

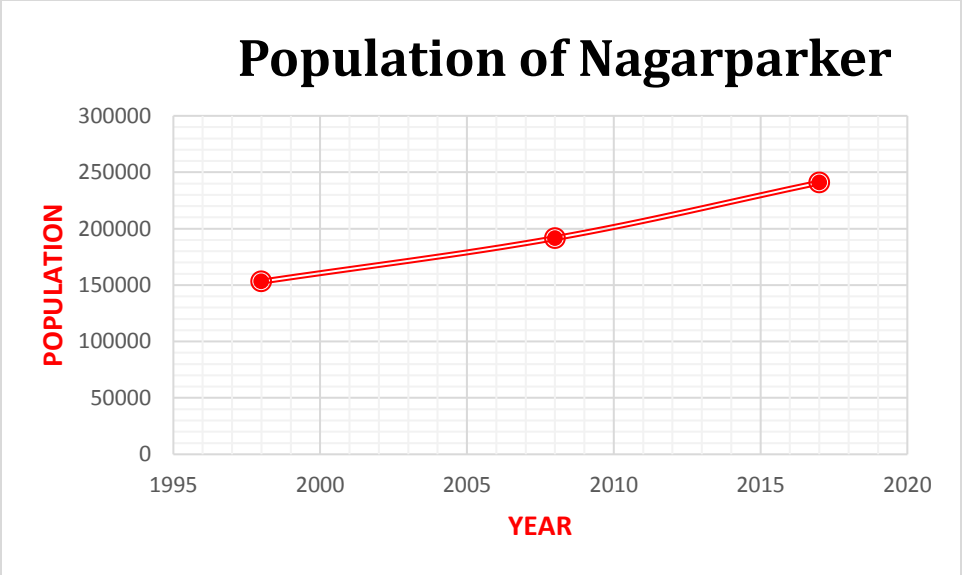


Figure 6: Population of Nagarparkar

The reason of this increase in population is that parents now prefer large families in our case study area so that they could engage them in work. In our socio economic survey it was discussed with the local residents as to how much their children work in the household. From this it was induced that children start lending a hand in work at a very early age. They help fetch water, gather firewood and later begin earning by working at carpet looms, hotels and garages.

4.7 Migration

The irregular rainfall over the past few years depict that drought is a very common phenomenon in Thar. It has been observed that the Thar people have devised ways to get past this issue. One is migration to the barrage areas with their livestock. This migration is subject to the harvesting season in which locals of drought prone areas serve as labor and also harvest their own crops.In exchange to their services these locals are provided with food and water for their animals. The socioeconomic survey conducted in case study area helped us identify how many people migrate to other localities in drought occurrences and

for how long do they stay migrated. The following graphs describe the migration situation in Nagarparker. It shows that 61% of the residents do not move to other locations even when drought hits the area while 39% move to other localities for safety and protection of themselves and their livelihood. The 39% population mostly is from Bheel Village of Pilu who migrate to nearby barrage areas in search of employment opportunities.

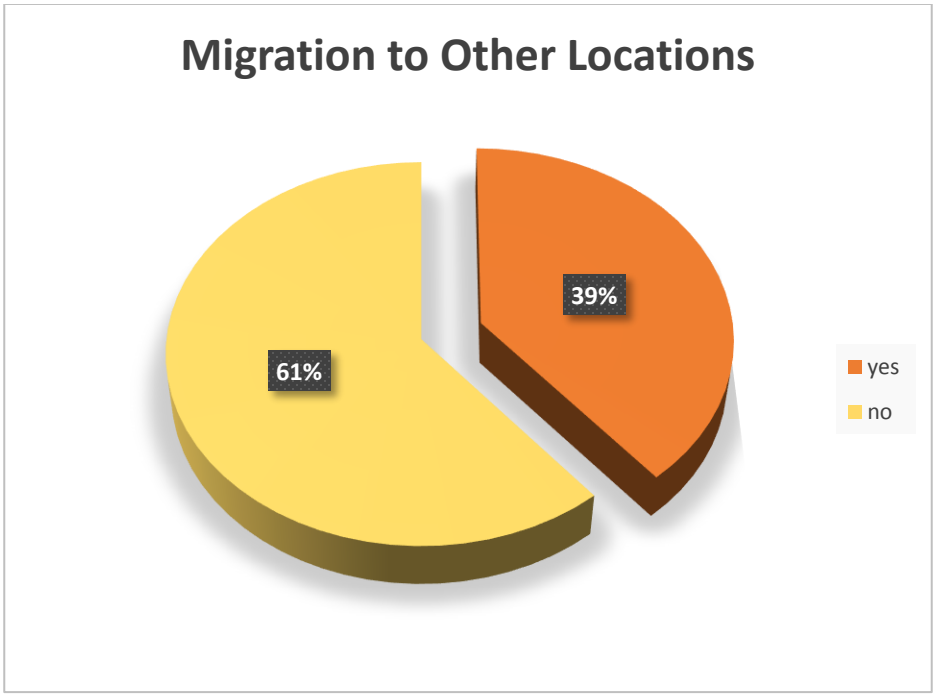


Figure 7: Migration to Other Areas

The families were then asked why they had to leave their homes and find another place in another neighborhood. The following answers were obtained from the local residents which come hand in hand with the fact that the local people do not have enough income and are living a poorly maintained lifestyle.

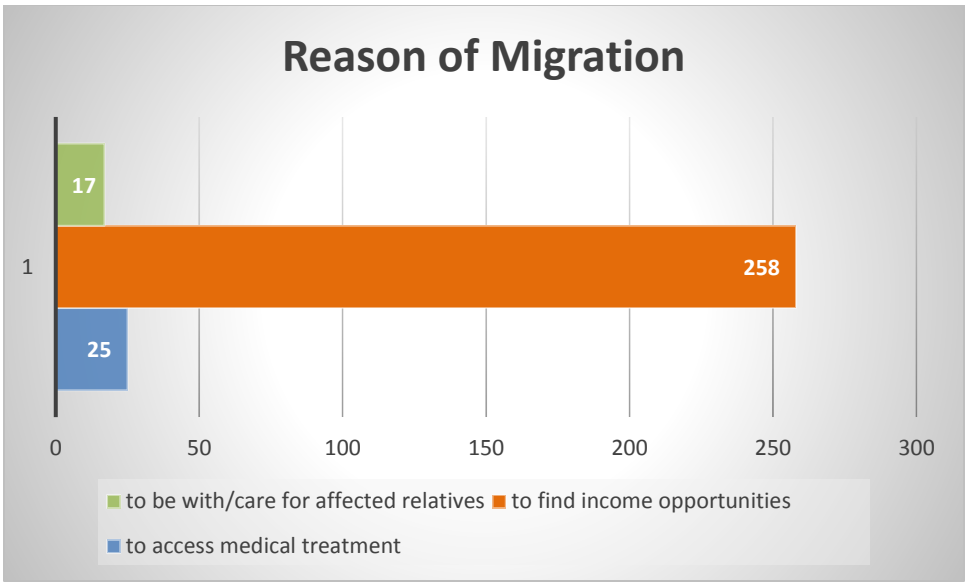


Figure 8: Reason of Migration

Another important factor to be observed while discussing migration in these areas is the period of displacement of the local residents from their respective areas.

It has been observed that most of the residents preferred living in the same area due to lack of funds to help them migrate. And the ones who did migrate to other places displaced only for a couple of weeks. The following graphs show us a figure as per the information gathered from sample population. It shows that about 33% of the total population has displaced from their home from 3 to 6 weeks. While 23% have left their homeland for more than 6 weeks. 25% from 1 to 3 weeks and 19% have displaces for less than a weak.

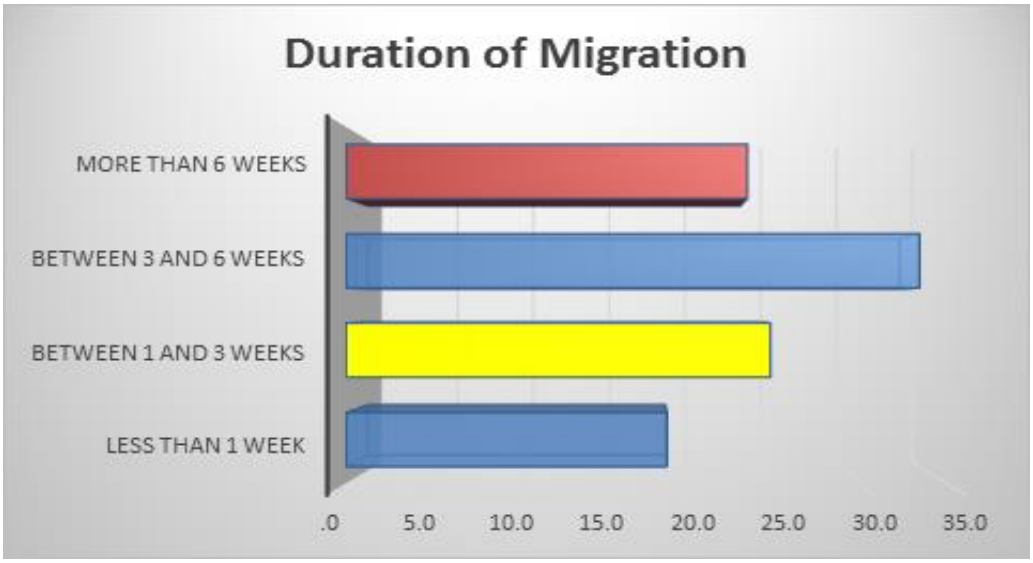


Figure 9: Duration of Migration

4.8 Economic Condition

It has been identified in this research that poverty can be described is the only milestone in the lives of local residents of Thar which will be discussed in detail further in this chapter. The economic condition of the area is adverse and keeps getting worse day by day. People survive with great difficulty relying solely on their livestock or crop production; if there is any.

The economy is thus largely based on families who run their households on loans. This study has helped us identify that almost 80 percent of homes are under heavy debts and 43.5 percent of that loan is used to meet food requirements followed by medical cures (15 percent). Most of the loan (14 percent) is used on marriages and death feasts and only seven percent taken for income generating activities. All remaining loans are taken for other miscellaneous reasons. A large number of families are forced to migrate along with their children and cattle; in other cases, only the earning members embark upon the journey to

the barrage areas leaving behind their families and children at home. Either way, children suffer the most. The graph below shows the breakdown of loans taken for regular monthly expense by the local families. This in turn gives us a review of the economic condition of the area.

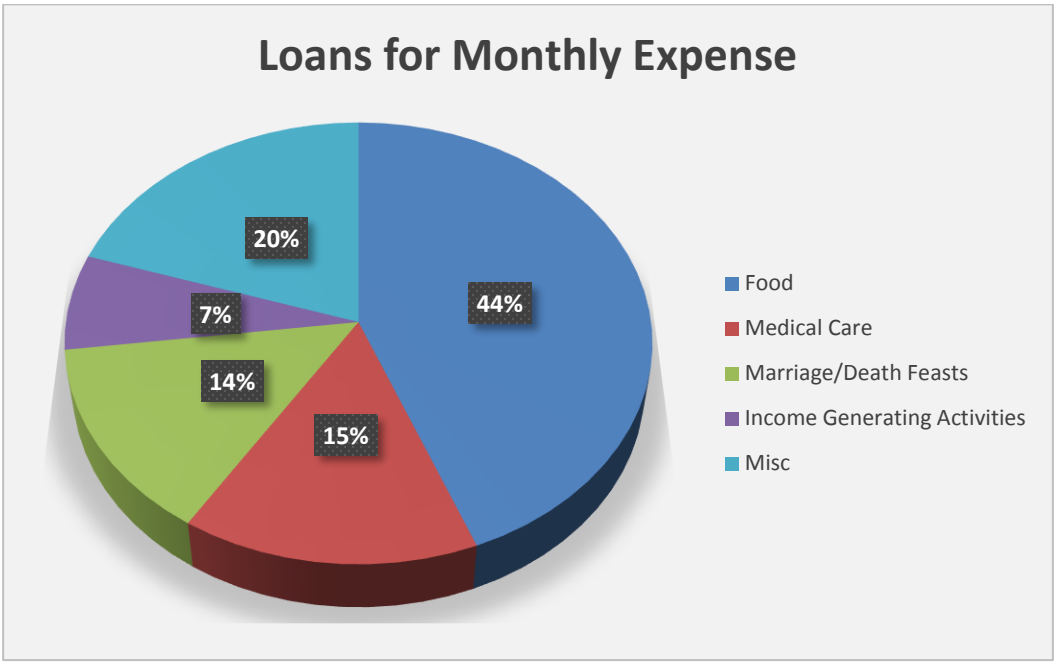


Figure 10:Loans for Monthly Expense

4.9 Monthly Income

As described above the economic condition in Thar is not ideal to maintain an appropriate standard of living.

Through structured interviews with the local residents it was also recognized that the monthly income of people of Nagarparker is below the lower income group as there are very few income generating opportunities available to them.

More than 70% of the entire population has an income level of 5,000 or less, while 18% have an income ranging from 8,000-10,000and merely a handful of people have income ranging from 10,000-25,000.

This situation is described in detail through graphical representation as under:

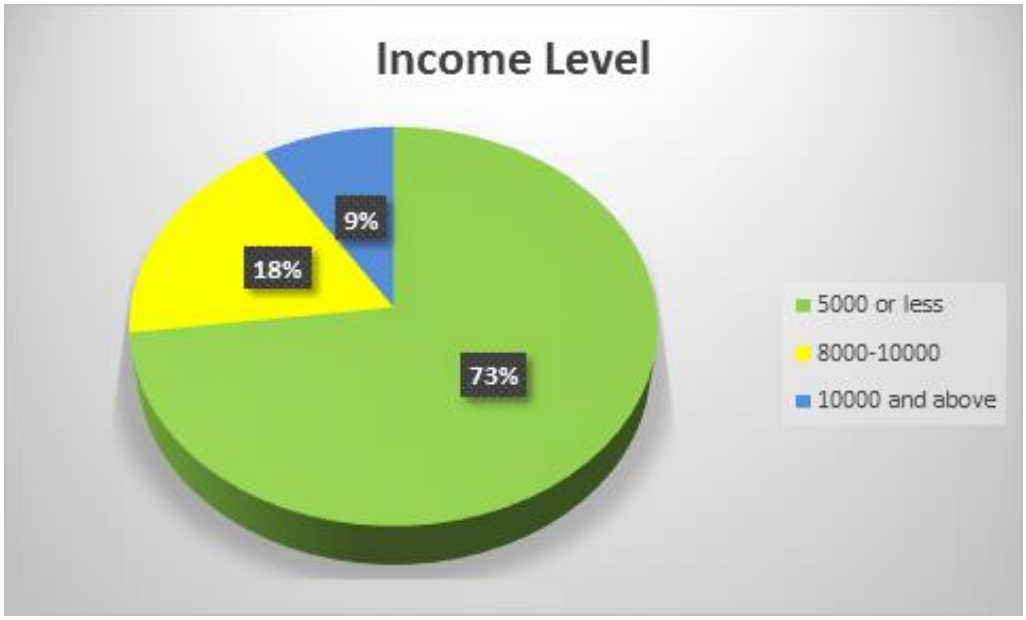


Figure 11: Income Level

4.10 Poverty Ratio

The poverty ratio has been an alarming revelation during this research as it was identified that almost 90% of the total population is living below the poverty line. The status of residents in the case study area is mostly identified with the amount and livestock and land that they own. Only 10% of the entire population is considered as lower middle class. And only a handful of families (less than 100) own cattle of a decent number which deems enough to refer to them as middle class.

It is therefore identified that almost the entire population in Nagarparkar is extremely poor. The reason of this issue has been identified through some available secondary data and electronic interviews with the concerned officials through which it was highlighted that these issues and situations prevail due to lack of support from the government and little to no income generation in the respective areas due to severe weather conditions.

4.11 Health Expenditure

People in Nagarparkar also suffer from different health issues and thus have to pay for their health expenditures even though they have less income to rely on. As discussed in detail the diseases that hit locals of Nagarparker are quite serious and life threatening. People spend a fortune of what they earn in health expense. Also, debts up to 15% in the entire population are also spent on medical care as discussed in economic condition of the area.

4.12 Crime Rate

It was identified from the locals in Nagarparker that the crime is quite low; infact it would not be wrong to state that the crime ratio in Nagarparker is nil. The cause identified behind this is extreme poor conditions. As, the local people are all so depressed and vulnerable they are barely making ends meet. Hence, the crime ratio is nil because people have so many problems to deal with in their lives already that no one is involved in such habits.

4.13 Agriculture

Agriculture is the biggest source of income in Nagarparkar just as it is in other areas of Thar. The different crops being cultivated by the residents have been broken down into categories in the following graph:

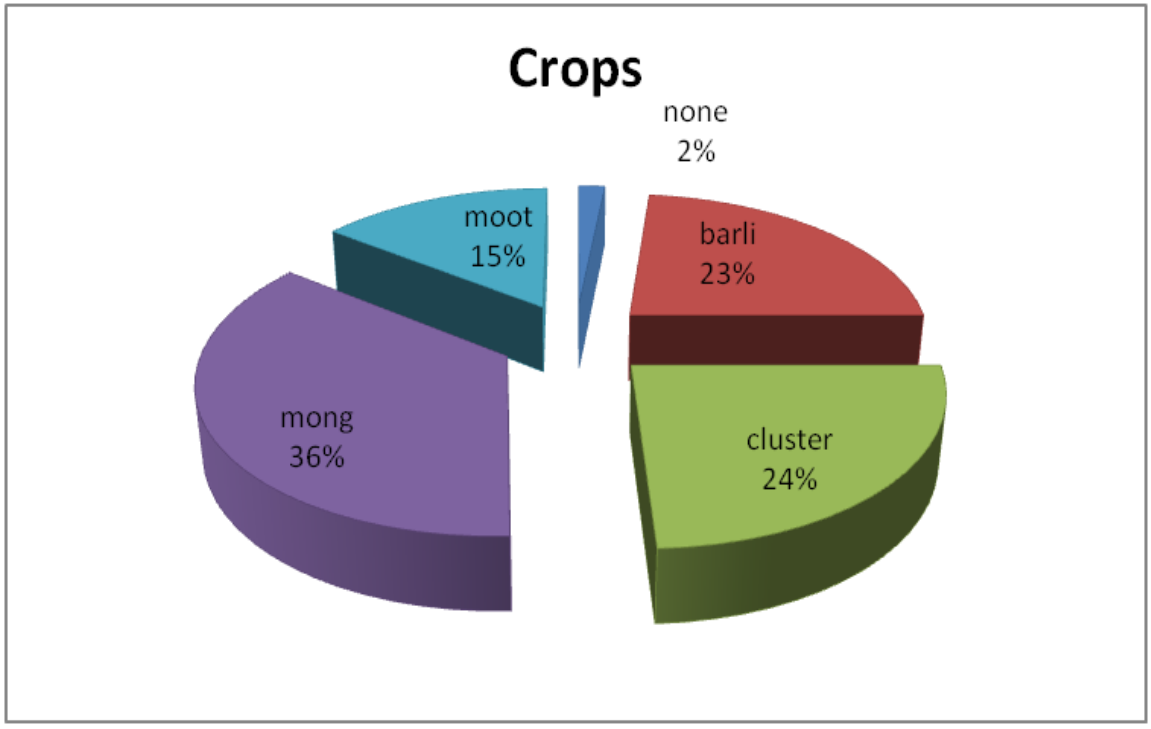


Figure 12: Crop Yields

So, for 36% of the total population the yield production is from Mong, while 24% is from cluster, 23% is from Barli and only 15% from Moot. It has been observed that only 2% of the population does not produce any yields. This shows that most of the economy of the local residents relies on crop production as a source of income generation. The reasons that affected in the good or bad output of the yield production were also identified during surveys from the local residents which are discussed in detail as under:

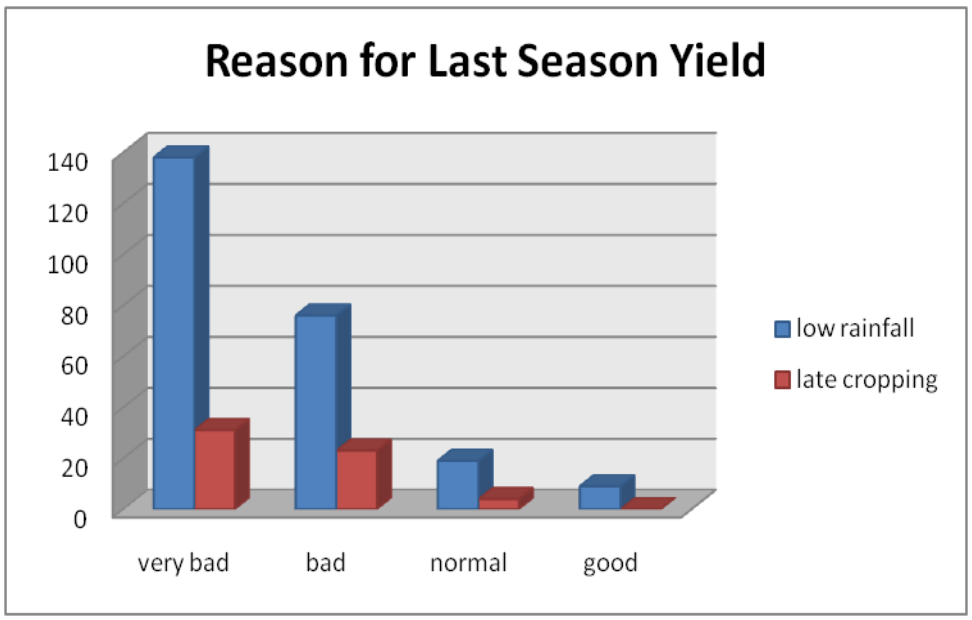


Figure 13: Reason for Low Yield

This graph indicates that a significant amount of crops (56.33%) were very bad in condition du ring the last season whereas 33% were bad in condition. Only a few (7.67%) were normal and a very small number of only 3% were in good condition in the last yield production season. When asked about the reasons of this situation it was identified that a huge amount of yield (80.67%) was due to low rainfall and a few (19.33%) was because of late cropping by the local residents.

4.14 Social Condition

The social issues and their existing condition in case study area are discussed in detail below

4.15 Literacy Rate

The literacy rate in Nagarparker just as in the entire Thar district is very low. There are a number of non-operational government schools with unavailability of teachers and little to

no attendance from school going children. The literacy rate is higher among men than women in the area as they do not allow their females to study and tend to force them into early marriages. The enrollment of both male and female students is described in detail as under:

4.16 Education Enrollment

The existing data in case study area gives us an insight of the education level among the local residents. The research has been conducted to identify total number of school going children in Nagarparker and it was found that 9.7% of the total population (252,580) consists of children who are of school going age. Out of this the maximum number (27.5%) of school going children are male. While only a few (6.8%) are female. It was astonishing to find out that 65.7% of the school going children population was not attending any school.It was also observed that number of children attending school were hardly completing primary level let alone transitioning to matriculation and intermediate. The major reasons behind this are poverty, long distances to school and involvement of children in economic activities such as child labor. Due to this lack of education among local residents it was also noted that the tendency of sending girls to school was also minimal, which makes girls unable to attain even primary level of education.

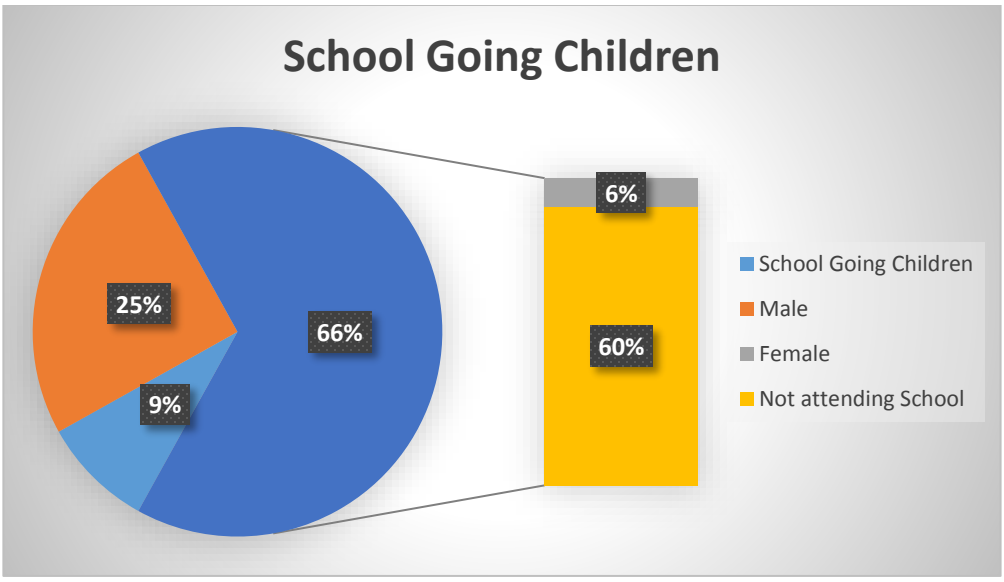


Figure 14: School Going Children

4.17 Causes of Low literacy

Many causes have been mentioned by the residents as the reasons due to which level of education remains compromised in the area of Nagarparker. These causes are:

- Inability to **afford** school fee and books among the local residents for their children
- The population is still divided in **caste system** and hence causes people belonging to different castes refraining their children to attend the same schools
- **Cultural barriers** are also present among the residents due to lack of awareness about importance of education which does not allow them to encourage their children to the right of basic education.
    - The books and government reports depict a false picture of the areas by mentioning more than a thousand schools in Nagarparker. In reality, the area faces a huge **lack of schools** especially with appropriate buildings, proper staff

and furniture to accommodate the students. Incompetent individuals working in the education department are also a cause of this lack.

- **Unavailability of Female Teachers** is also a reason for people to not send their daughters to school.
- The **distance** of school from neighborhoods and lack of suitable transport also has an effect on the attendance.
- In some parts of the area where schools are created at walk or drive distance from the residential area the **road condition** is so bad that it makes it impossible for children to reach the school.

4.18 Drug Use &Suicide Attempts

Focus group discussions were conducted to highlight some of the social issues prevailing in case study areas. One of the problems indicated by the residents was frequent drug usage among the people due to frustration, depression and extreme poverty. Most of these substances abusing people are from the Hindu Community. But, the problem is not religion discriminated and also persists in Muslims too. Many remedial measures have been taken to overcome this issue and some NGOs have even offered counseling to the drug addicts to improve their physical and mental health. Another issue was the emerging rate of suicide attempts in the drought prone areas. It has been identified that suicides mostly occur due to family issues, domestic violence, diseases, poverty and mental disorder but all these problems are caused due to famine, which has a direct demeanor on the domestic problems caused within the area. Also, from secondary data it was found that the rate in suicide

attempts has increased in the past couple of years (Source: Dawn News). The following graph indicates the rate of change in suicide attempts in the past couple of years

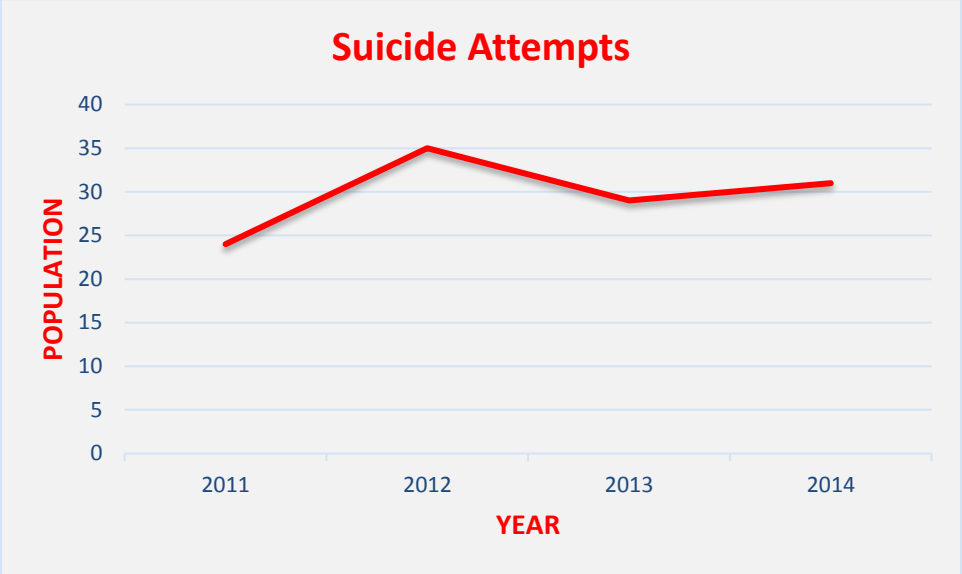
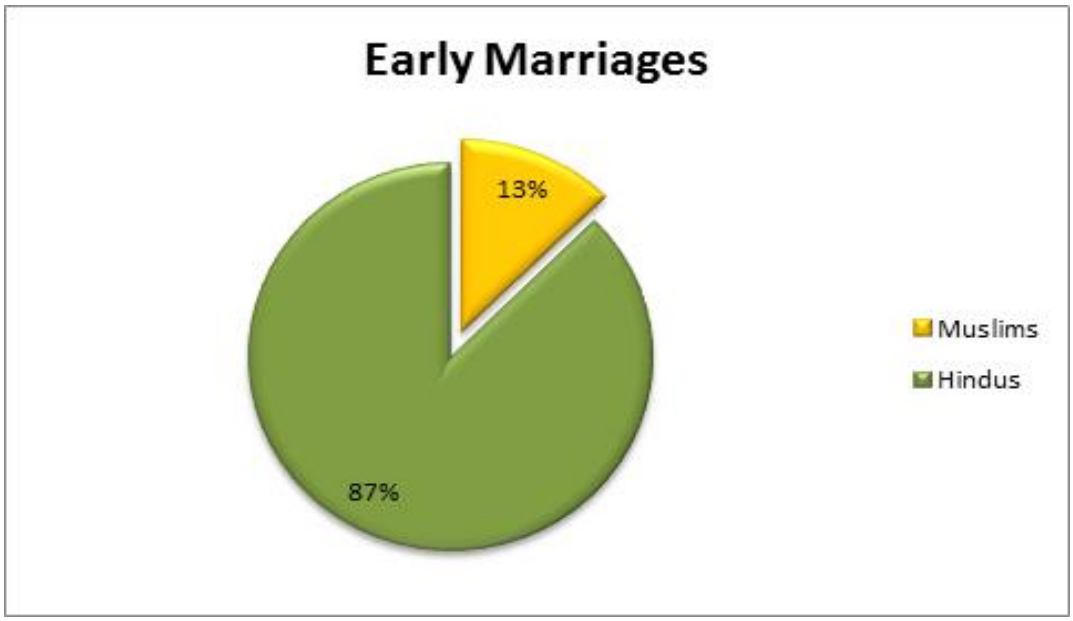


Figure 15: Suicide Attempts

4.19 Early Marriages

It has been identified through focus group studies and one on one interview that early marriages are also a big issue in the local communities. People get their young daughters married to old age men for the sake of money. This problem exists in about 30-40% of the population of Nagarparker. It indicates that due to extreme poverty people are forced to use their daughters as bait for money. It was also found through this survey that 12.58% were Muslims and rest of 87.42% were Hindus which indicates that the custom of marrying off teenaged children in Nagarparkar is dominated by Hindu population. It indicates that due to extreme poverty people are forced to use their daughters as bait for money. According study 12% were Muslims and 88% of population was Hindu.

This is a very sensitive as well as inhumane action on part of the adults and households of the communities. The lack of education and awareness also causes this issue to spread.



4.20 Livelihood

The socio economic survey shows that the entire population is dependent on agriculture and livestock for their livelihood. All the vegetation is rain based and hence a great deal of income generation is affected due to drought conditions in the case study area. Some amount of livelihood is also dependent on migration as the locals move to barrage areas for cultivation of wheat in rainy seasons so that they can consume that yield for rest of the year with their family.

According to our survey about 68% of the population depends on agriculture on its livelihood, 27.8% on livestock and only 4.2% depend on migration. The generation of income depends largely on total rainfall in the study area and the number of livestock owned by the residents.

In the current scenario the entire surveyed population responded that due to the existing rainfall pattern their yield production has decreased to a very low level which has in turn caused a massive decrease in their income generation and hence created an unfavorable livelihood for them.

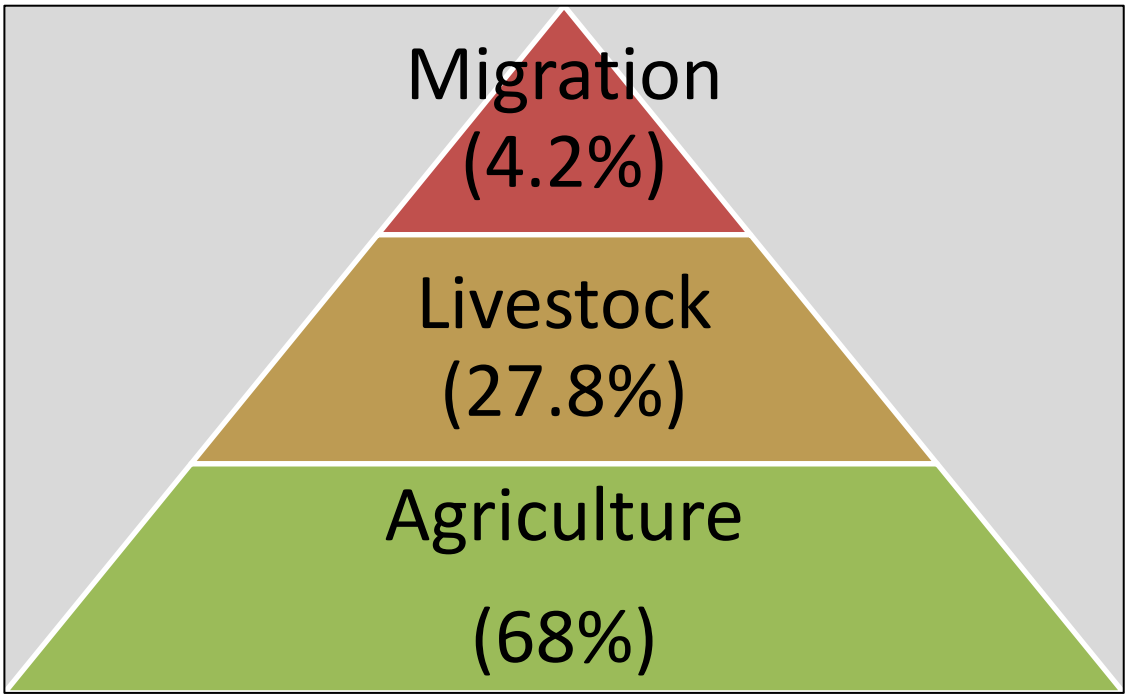


Figure 17. Livelihood Dependence

4.21 Health and Nutrition

Because of a variety of deprivations, Tharparkar lags behind in key indicators of human development. A recently released official document "Millennium Development Goals Report-2013" provides district-level ranking on various human development indicators. According to the report, Tharparkar was ranked as second last in fully immunized children among 23 districts of the province where only 45.9 per cent children were immunized. Similarly, the district was on 20th number out of 23 districts on immunization of children against Measles, which shows only 61.7 per cent coverage.

The district had 6th highest number of under five-year children who suffered from diarrhea. Only 13.6 per cent births are attended by skilled birth-attendants placing the district in bottom within the province. The gap can be compared with 87.8 in Karachi ranked at the top. Concomitant to that just 44.6 per cent pregnant women received antenatal care consultation ranking it as 5th lowest in Sindh.

Another report Multiple Indicator Cluster Survey 2003-04 also revealed that only 31 per cent deliveries are managed through institutions in Tharparkar compared to 73 per cent in Karachi. Similarly, infant mortality rate in the district was 87 out of 1000 live births, higher than the national average of 74.

4.22 Malnutrition

Malnutrition is an important contributor to morbidity and mortality. Tharparkar has the highest under-five mortality rate in Pakistan with 90 to 100 deaths per 1,000 live births, as well as high fertility and malnutrition rates. The rate of Severe Acute Malnutrition is estimated to be 6.4 per cent while Moderate Acute Malnutrition is 22.7 per cent (SMART

survey, March 2014). Levels of immunization are low and there is poor access to antenatal care and health facilities, and very high illiteracy rates.

Malnutrition in Tharparkar is a multi-dimensional phenomena linked to abject poverty, lack of access to health facilities, unavailability of safe drinking water, high levels of illiteracy, lack of family planning, and climate change. There is a humanitarian situation in Tharparkar due to development challenges.

4.23 Diseases

It was observed from previous drought impacts and analysis of the existing situation in the area that the maximum deaths that occur in the case study are either because of malnutrition or water borne disease which are listed below:

- Diarrhea
- Endemic Goiter
- Dental Decay
- Fluorosis
- Malaria
- Dengue
- Infantile Methaeglobinaemia

4.24 Infant Mortality Rate

Almost 300 children died in Thar last year and the rate has been increasing every year due to lack of medical facilities for the pregnant women and continued malnutrition among them. These women not only raise their children but also have to work in the fields and fetch water from faraway places. Deaths of malnourished newborns are common in Thar

due tofrequent a pregnancy which obviously is a result of lack of education and awareness among locals.

4.25 Ground Water Distribution

Through the research it was identified that water is being distributed among local residents of Nagarparker through few sources. Most of the water being given to residents (76%) is being distributed by means of a dug well. 16% of the total water is being used by the locals through tube wells and only 8% is been utilized as piped water. This information also provided an insight into the problem that the residents are facing with most of the water being distributed through dug well. This is causing major sanitation issues and creating water borne diseases. The reason behind this is lack of development in the drought prone areas and little to no attention about the issue of clean drinking water among the higher officials.

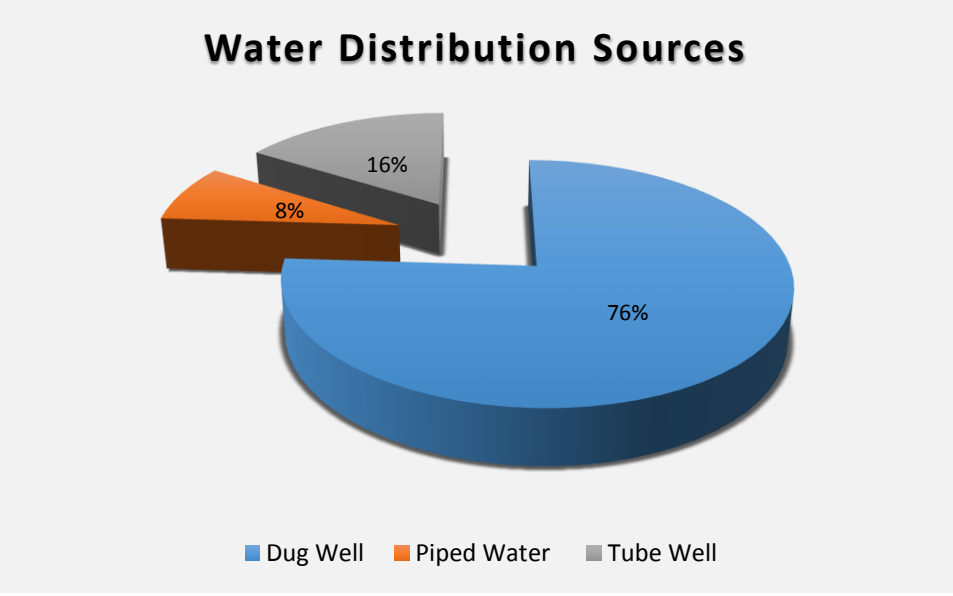


Figure 18: Water Distribution Sources

4.26 Accessibility

The accessibility of water to local residents has been identified through location and distance of the water source from household areas. About 53% of the total surveyed population lives within a 5 km radius of the water source which is dug well in this case while 47% of the Nagarparkar people live more than 5 km away from the water source. Almost 92% of the entire population has a water source located within their area. And only 8% have to fetch water from elsewhere.

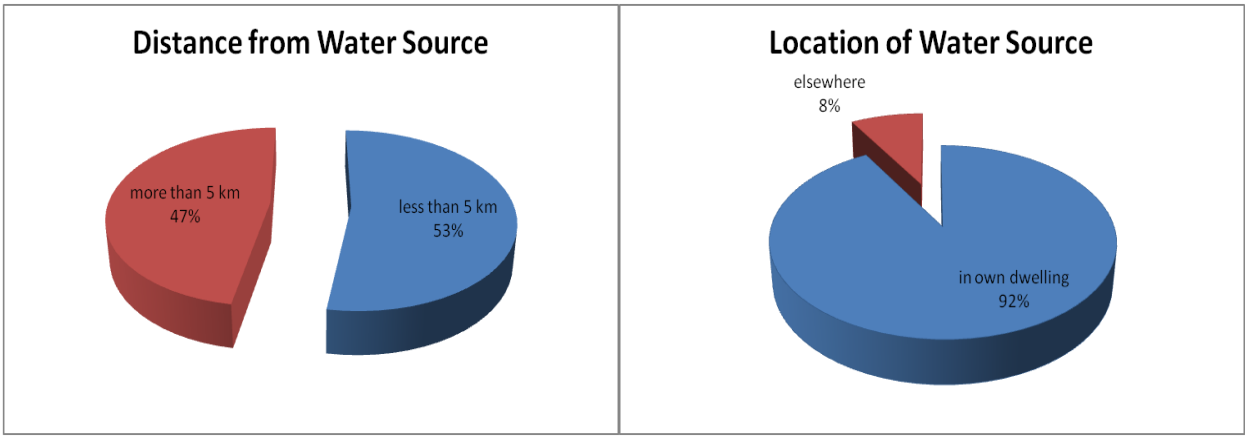


Figure 19: Accessibility & Location of Water

4.27 Water Related Problems

Water quality analysis was also conducted with the help of primary and secondary data in this research. This analysis shows that the groundwater available to residents is not appropriate for human use. Almost 90% of the water samples exceeded the screening levels for harmful chemicals. Hardness and sulphate were readily found in the water samples. It was also observed that the ground water was prone to electrical conductivity.

Therefore, under normal conditions,such quality of water is unfit for human consumption. Arsenic and Fluoride contamination has also been found in the ground water of Nagarparker. Thesecontribute to health hazards such as hypo pigmentation, keratosis, black foot disease, hypertension, diabetes, cardiovascular diseases, dental and skeletal fluorosis, renal and neuronal disorders (as discussed in detail above).

4.28 Availability of Toilets

The availability of toilets also lacks in the area and this issue was also enlightened by the residents in case study area. The surveyed population described their situation as under:

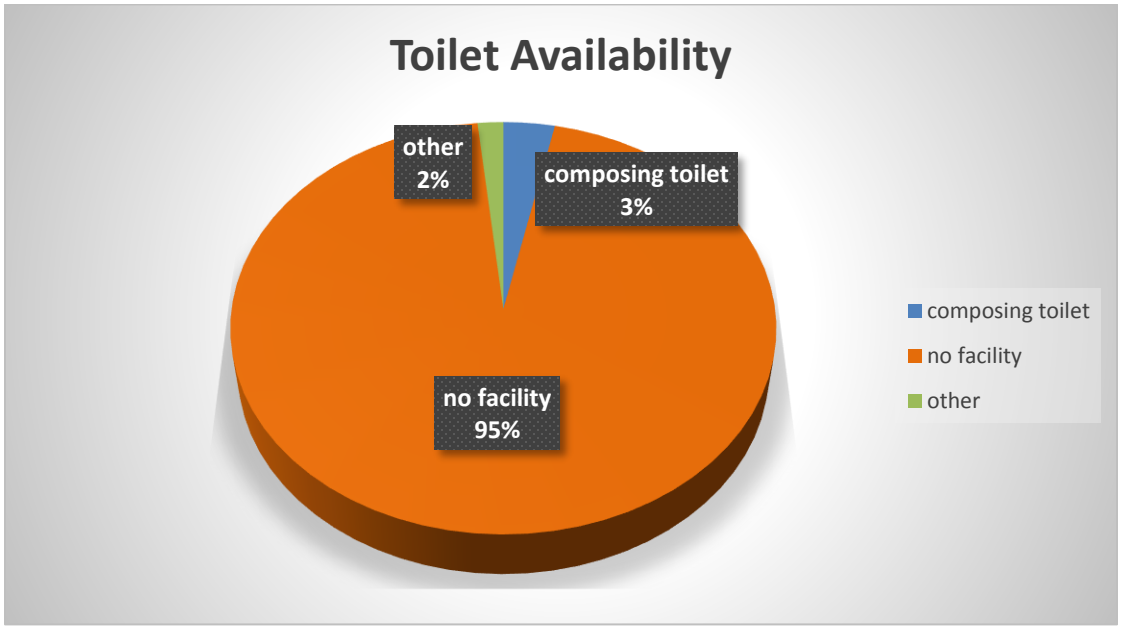


Figure 20 : Availability of Toilets

This graph indicates alarmingly that 95% of the population has no availability of toilets in Nagarparker. Thus the lack of hygiene and rapid increase of various diseases is obvious among the local people.

4.29 Food Security & Availability

During survey from the residents of Nagarparker it was found that almost 68% of the residents had no food stock, while 24% percent reported available food in sufficient for less than a week. Only 8 percent have enough resources that they can afford and buy food.

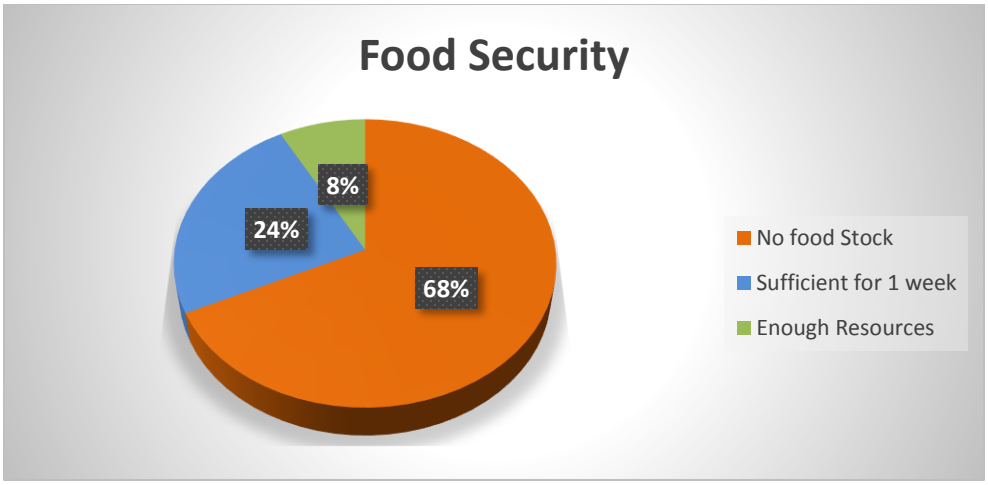


Figure 21: Food Availability and Security

It was also identified that almost 85% of the residents cannot buy food items when required. And only 15% had the capacity of buying food.

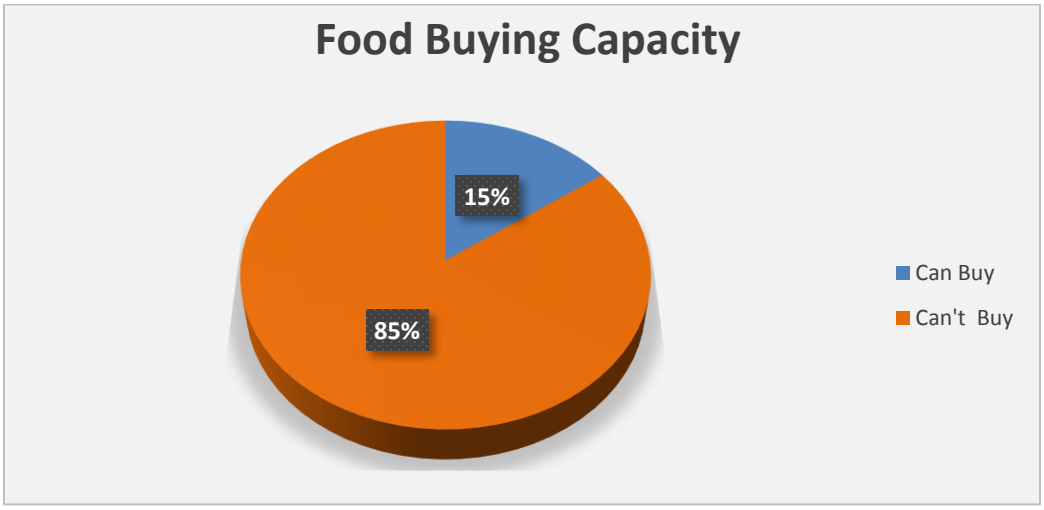


Figure 22 : food Buying Capacity

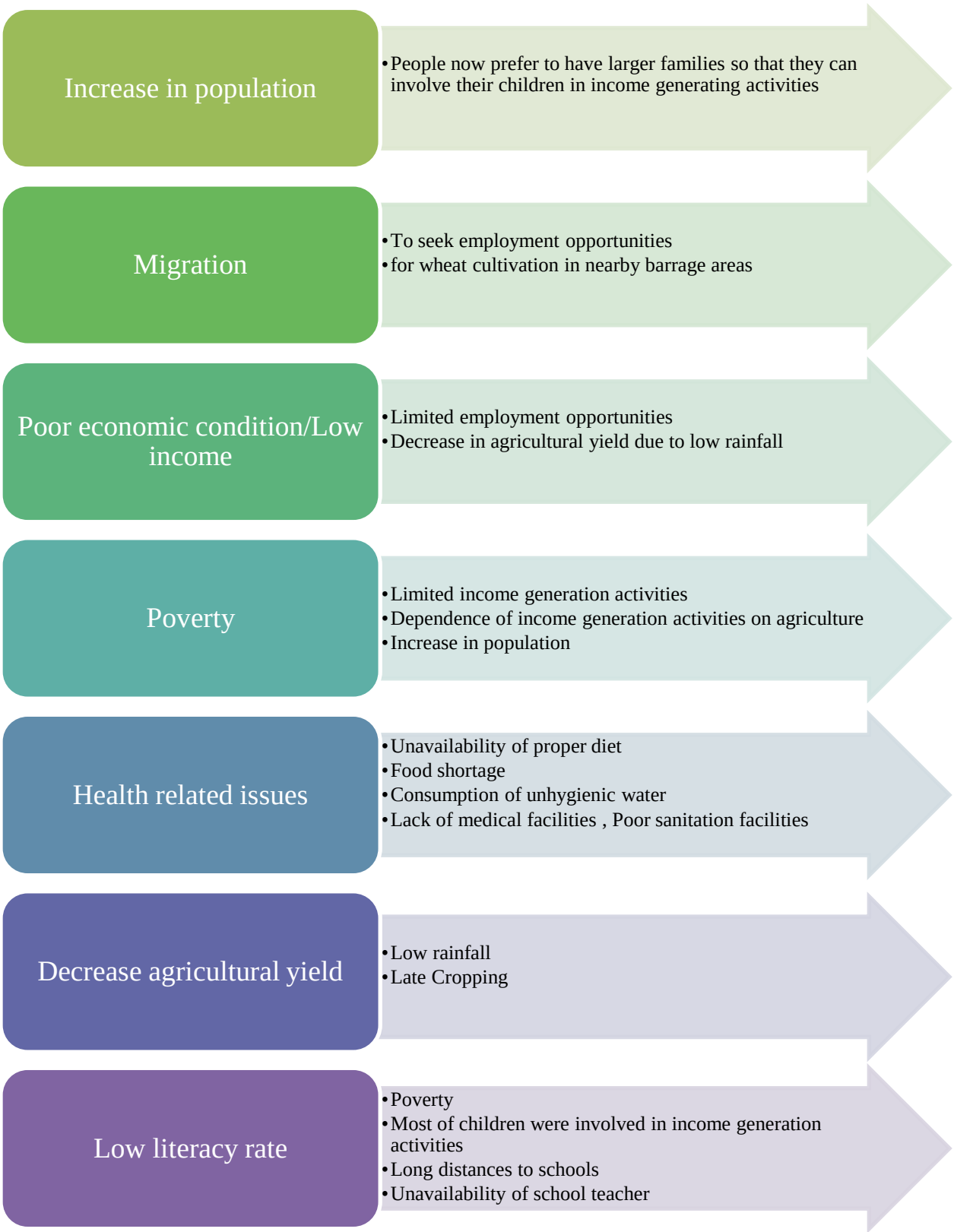


Figure 23: Causes of Existing Situation

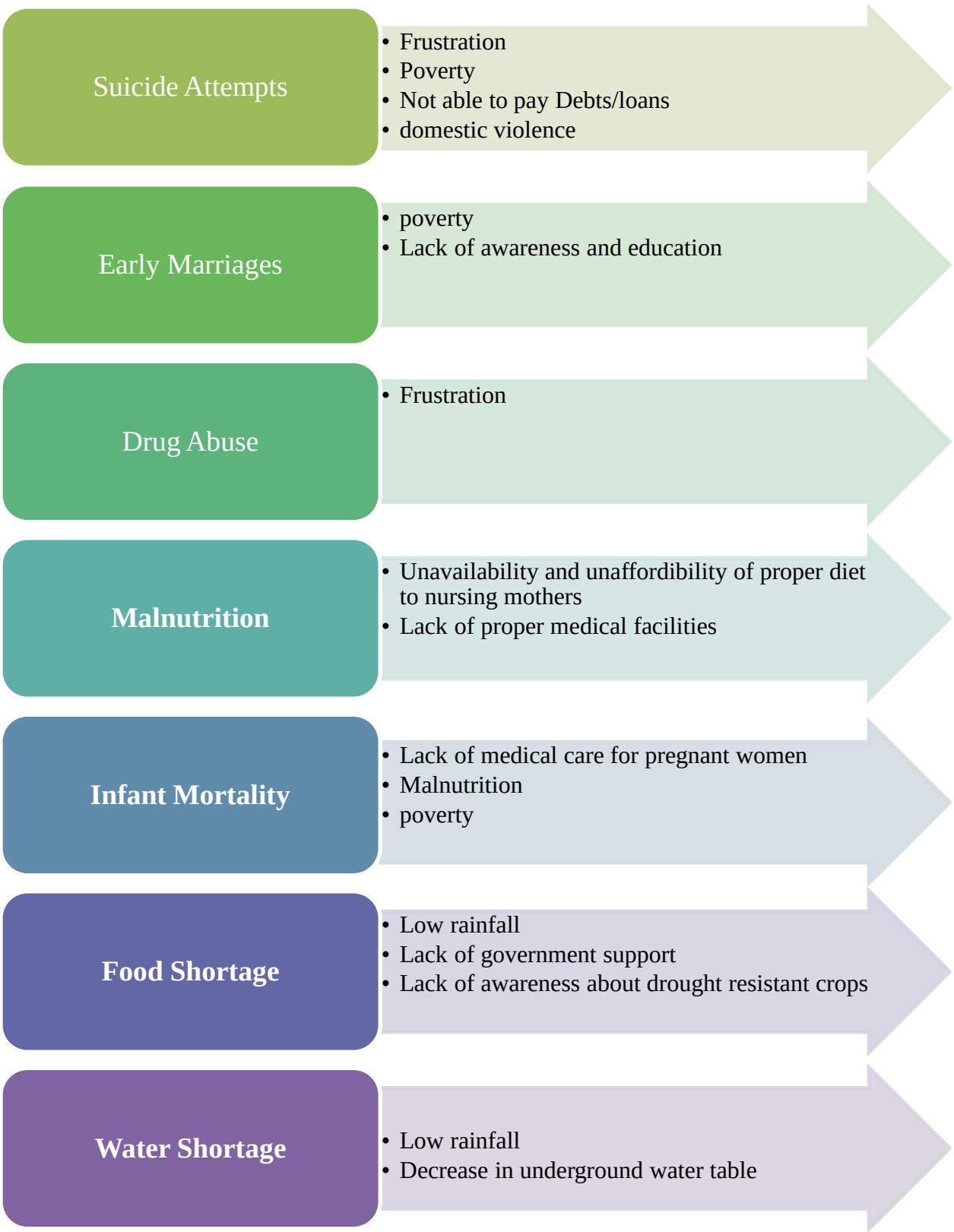


Figure 24: Causes of Existing Situation

4.30 Current Adaptation and Mitigation Strategies

Drought has become a recurrent problem in Nagarparker due to rapid change in climate and gradual increase in population over the years. To cope with this adverse condition some of the locals migrate to nearby areas of Sindh with their cattle to explore income generating opportunities like wheat harvesting. Moreover, local communities also find ways to cope up with these conditions within their neighborhoods with due support from local NGOs and Government altogether. All these different mitigation mechanisms are therefore discussed in detail as under:

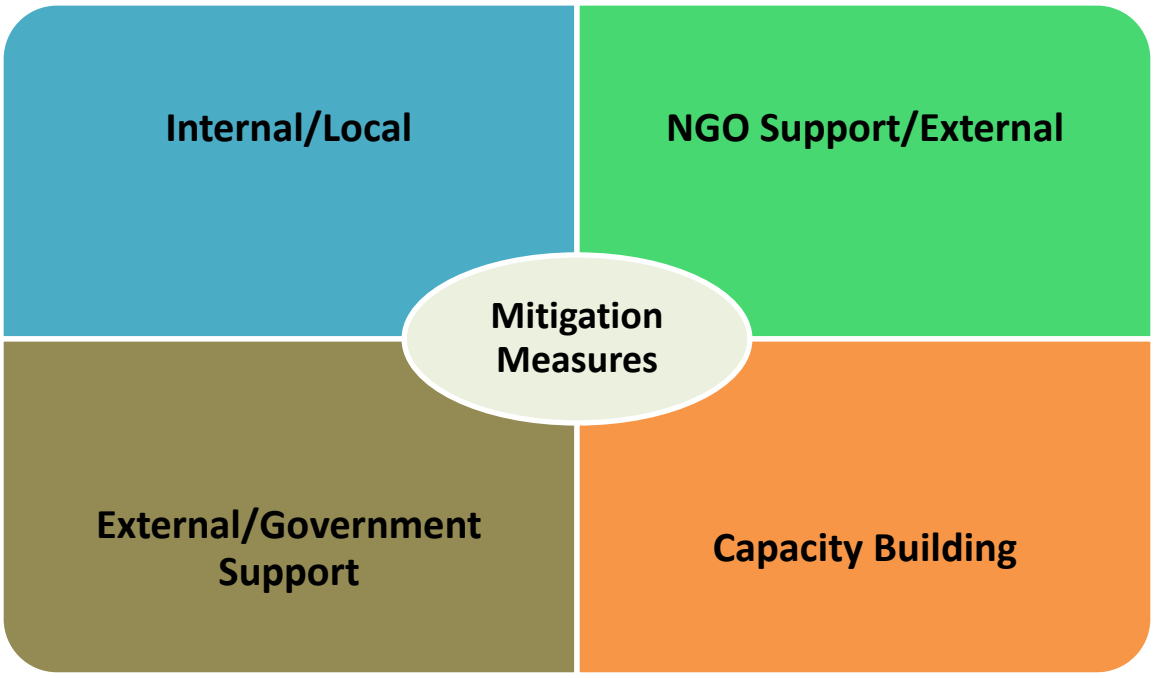


Figure 25 Mitigation Measures

Through this research it has been deduced that mitigation measures adapted in Nagarparker include both internal and external factors. Internal factors are the ways that residents adapt to mitigate or cope up with the drought while external factors are the support that is provided to the residents through NGOs and Government. It is also highlighted through

this research that capacity building is a key factor in creating a better living environment for the residents.

4.31 Migration

As mentioned earlier migration is a tiresome yet prominent feature in the lives of the people of Nagarparker. This phenomenon is widely used as a solution to cope with the exasperating problem of drought. So, it is one of the key mitigation strategy used by the local residents to save themselves and their cattle from drought and its hostile effects.

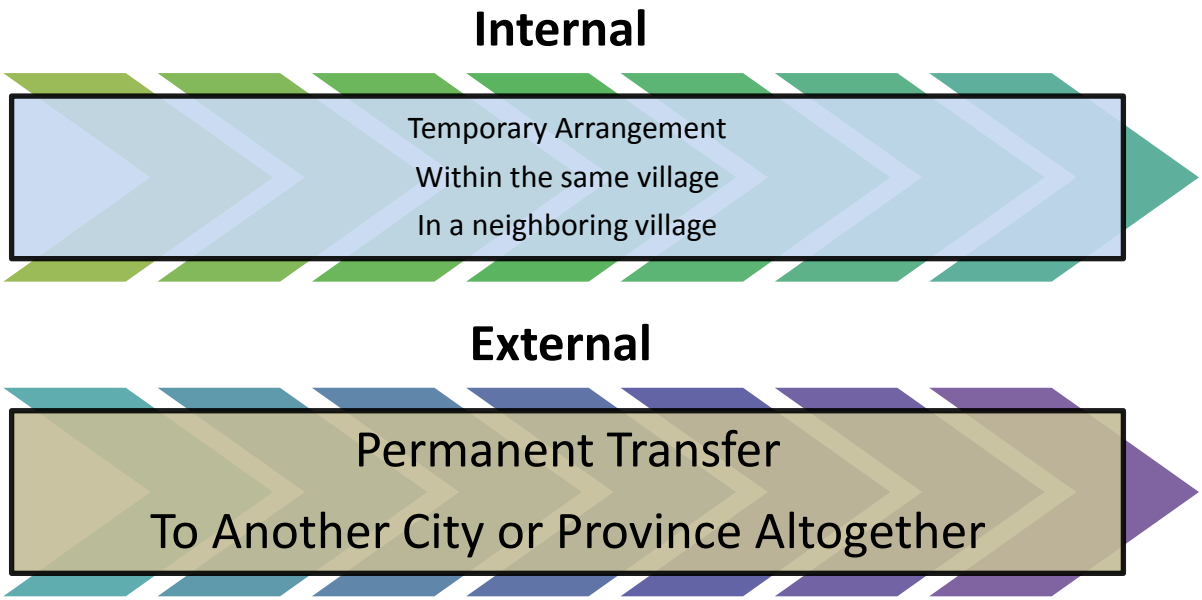


Figure 26: Types of Migration

4.32 Local Mitigation Strategies

The residents were inquired about their local coping mechanisms when they stay within their own houses in extreme drought situations. They informed through socio economic survey and focus group discussions that they adapt a few measures on their own to cope. The mitigation strategies are discussed below:

4.33 Adaptation through Previous Droughts

The local residents informed that they retain their crops from droughts in the upcoming year by following some local strategies. One of the highest believed and adapted strategies (60.3%) was the rain ceremony performed by the people of the area to request their Almighty for rain in the area. While, a rich amount of people (32%) migrate their livestock from one place to another to prevent it from being affected by the drought. Only a few (7.7%) of the population are capable of purchasing and yielding drought resistant crops. The following graph represents the situation of these measures:

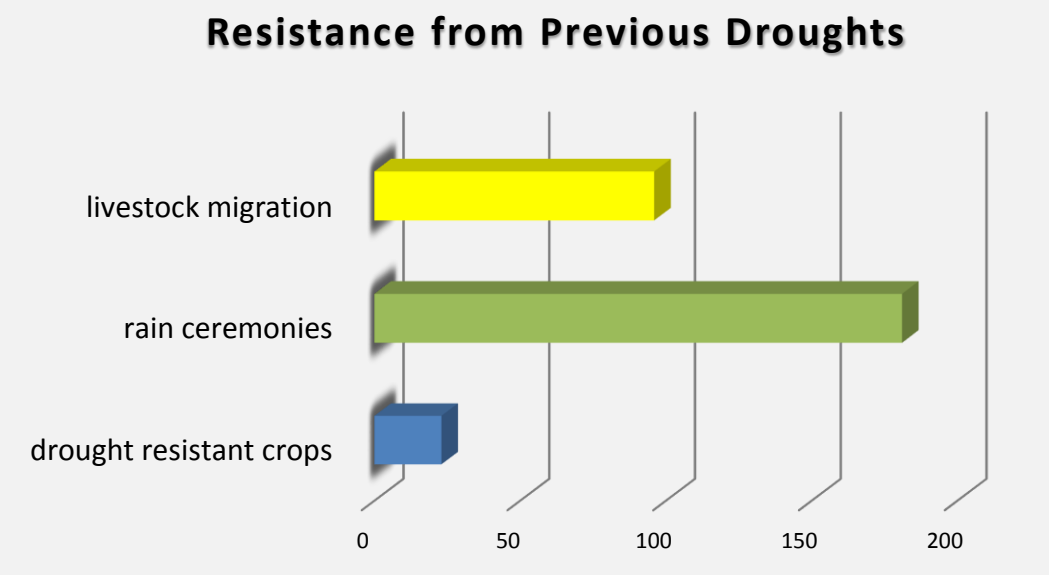


Figure 27: Drought Resistance

This information helped us to identify the resistance and capacity of residents as well as their livestock & crop yields to the previous drought. We also came to terms with the fact that these people rely too on their religious beliefs for a better and sustainable environment.

4.34 Coping Mechanisms in Previous Droughts

When discussed about their coping mechanisms in the previous droughts; the residents informed that to keep themselves safe during famines they adapt a few measures which include migration being the highest (51%) of the total population as discussed above in this chapter too. 15% of the population says that they find off farm employment during droughts to cope up with their vulnerable condition. 15% mentioned that they were provided with humanitarian aid. 6% of the residents said that they traded grain during drought to cope with the unemployment and poverty. All the tools mentioned by the local residents are graphically represented below with their respective frequencies as identified through the survey:

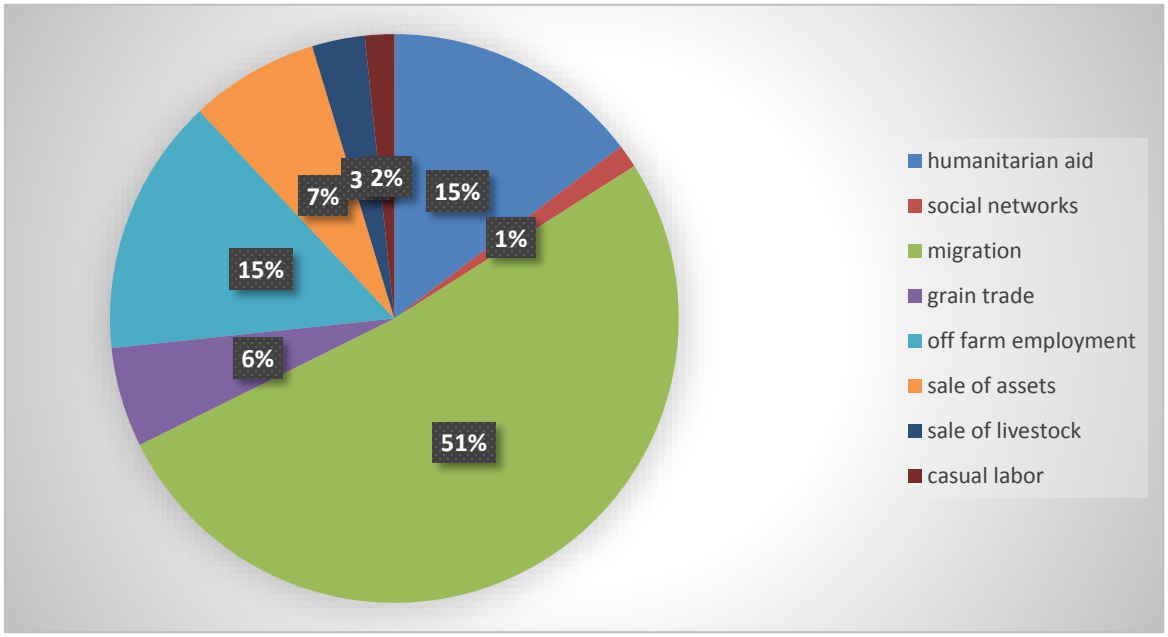


Figure 28: Coping Mechanisms

This result shows that people already rely on migration as an escape strategy so there is a wide chance to work on other coping strategies that are still unattended by the locals as shown in the graph above. It is quite obvious that social networking, more casual labor

opportunities, grain trade as well as livestock condition can be enhanced locally through support from both internal and external factors.

4.35 External Help from NGOs

The residents were asked about the support that they receive from NGOs and it was astonishing to see more than 86% people said that there was no support being received from any NGO in the area of Nagarparker.

It is why the situation in this area has not improved at all and keeps getting worse every year when drought hits the people. NGOs do mention there mandates and try to follow the MDGs but the help does not reach the poor and needy. More than 60 NGOs and Civil Society Organizations (CSOs) work in Tharparkar district. But, as the population is increasing every passing day it is becoming impossible for the NGOs to maintain their help standards well and aboard in all the areas of the district,

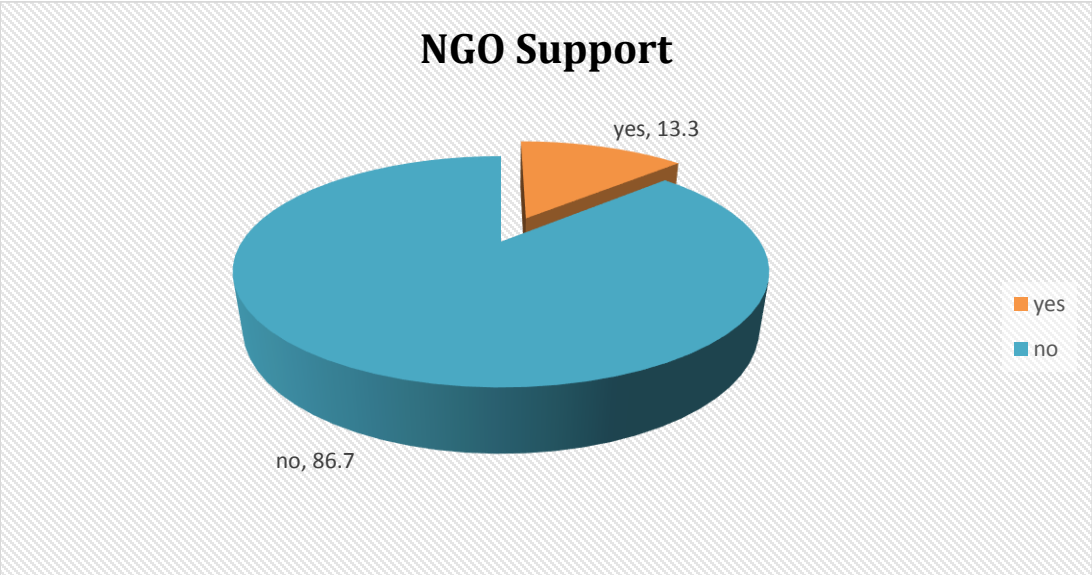


Figure 29: Support through NGOs

4.36 Mitigation Strategies by Government

The local people were quite satisfied with the level of response from Government. When asked about the government involvement during the occurrence of drought 68% of the people said that government responded to their issues and the intensity of drought in their area. While 32% said that Government organizations did not respond to drought happenings.

Similarly, when asked whether the Government had any means and measures established to support the drought victims almost all of the people (78%) replied positively and only a few (22%) said that they didn't receive any support from the government. The government opinion was also sought to identify timely provision of government support in their respective areas. 91% people strongly agreed to this statement and mentioned that government organizations had readily available means to cope up with the drought conditions for them. The same number of people (91%) also agreed that help provided from government was helpful for them in need.

The following graphical representation depicts the situation identified through socio economic survey:

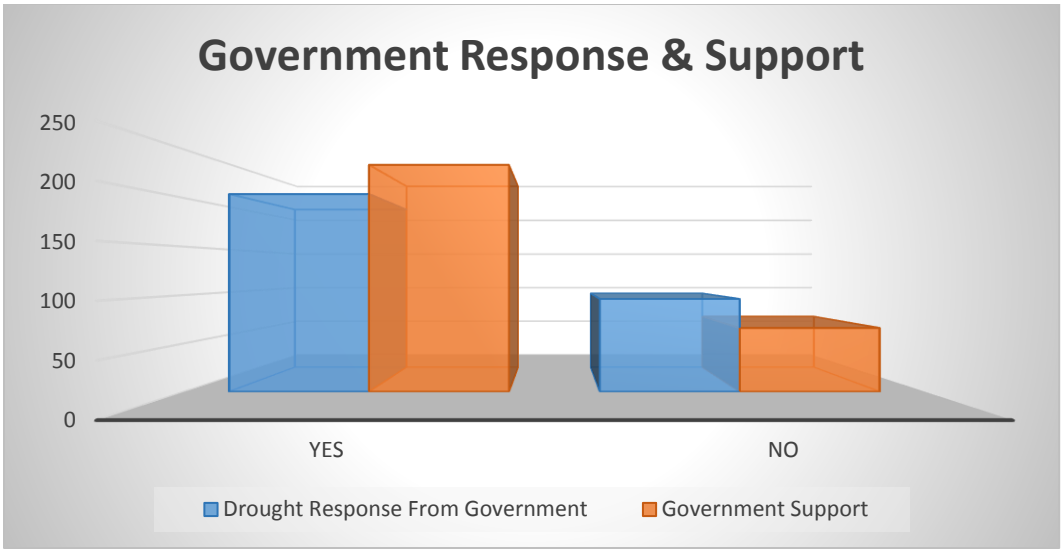


Figure 30: Response & Support from Government

It is quite evident from the graph above that people in Nagarparker are quite satisfied with government response and are also confident that government is providing them enough support to cope with the droughts. Similarly, most of the informers strongly agree that they are attaining timely and helpful support from the government as depicted in the graph below:

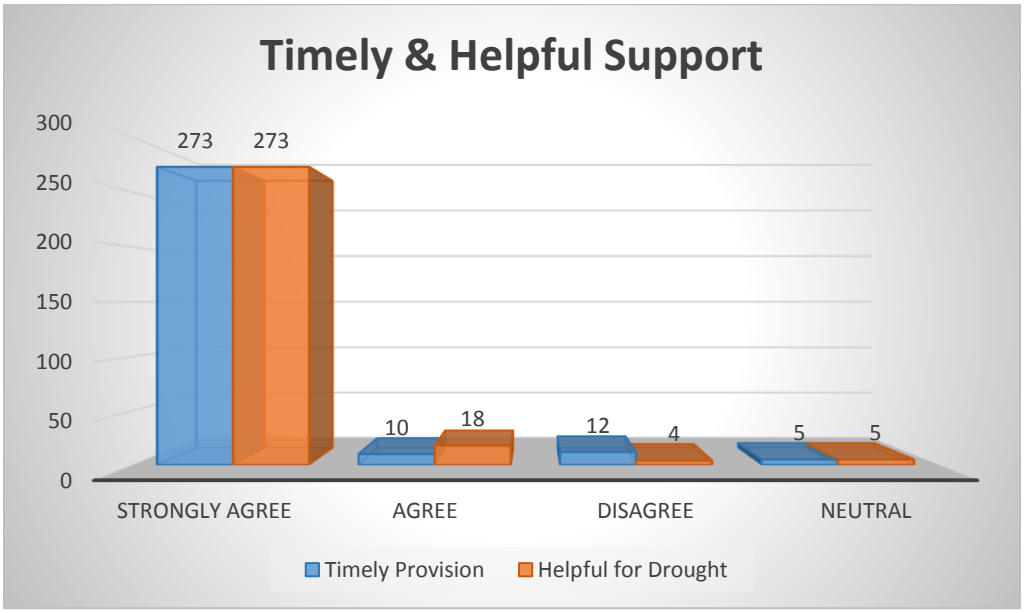


Figure 31: Timely Provision of Helpful Support

4.37 Capacity Building

Capacity building is considered the most important factor in achieving sustainability and improve standard of living in the area. The more the residents are aware of their potentials the more they can cope with their problems. It has been recognized with the help of this research that local people have their own ways of capacity building in Nagarparker through both internal and external factors. The same are discussed in detail below:

4.38 Ensuring Local Capacity

The residents were asked what measures they were adapting to ensure their capacity as a mitigation measure towards drought. Most of the informers (55.3%) stated that they rely on off farm activities while 44.7% mentioned livestock diversification as a means to protect themselves from drought. However it was quite strange to notice that none of the residents were adapting crop diversification and agricultural education although both of these are a major requirement as the locals depend mostly on agriculture for their income generation.

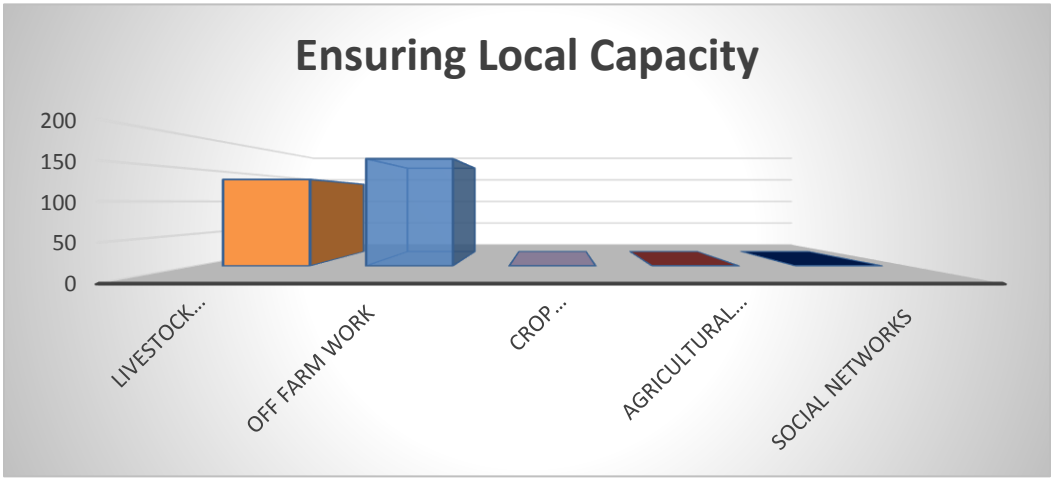


Figure 32: Ensuring Local Capacity

4.39 Capacity Enhancement through Government Support

It has also been identified that the people are of the view that government support enhances their capacity and helps them survive the difficult time.

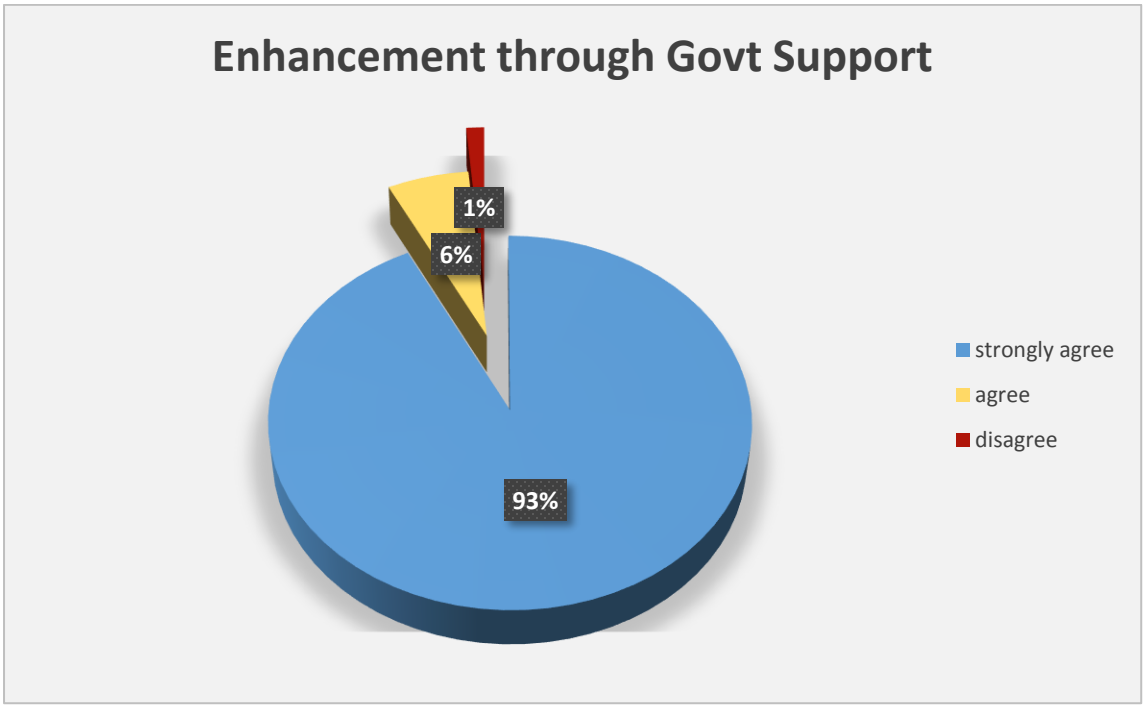


Figure 33: Government Support for Capacity Enhancement

As shown in the graph above 93% of the population strongly agrees that government support has enhanced their local capacity to deal with the weather conditions.

4.40 Conduction of Workshops & Presence of Local Communities

Workshops by different government organizations and heads of local communities are also conducted in Nagarparker to ensure capacity building of the locals. Although the number of workshops is quite less and only 13% of people attend the workshops and rest (87%) said that no workshops are conducted in their areas.

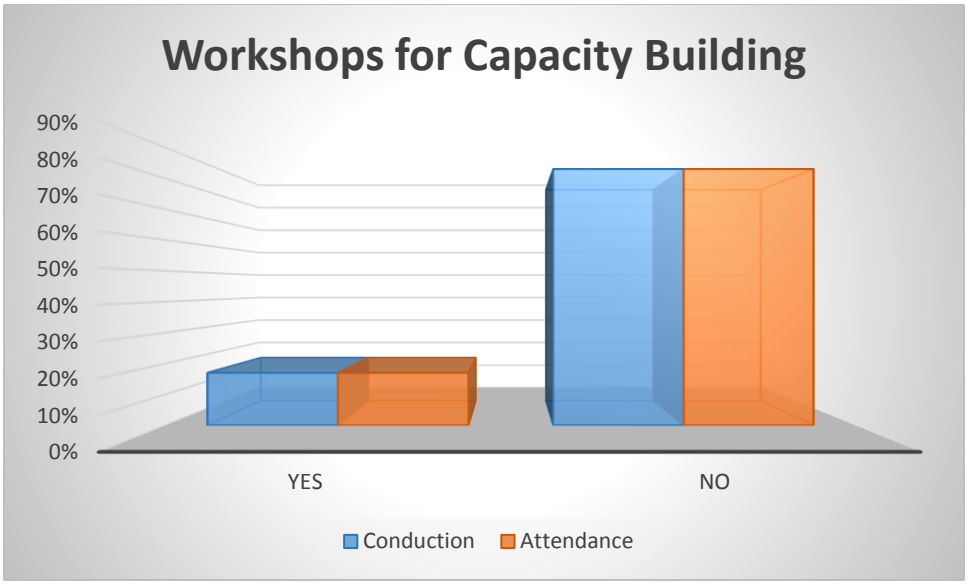


Figure 34: Workshops conducted and the attendance of community

4.41 Proposed Adaptation and Mitigation Strategies

Based on the findings of this study, it is recommended to the local authorities to focus on proactive strategies rather than reactive strategies to minimize the impacts of drought on local communities and their livelihood activities. It is recommended to civil society organizations and government authorities to create awareness about drought hazards and improve resilience of communities against drought. It is further recommended to develop, introduce and implement water harvesting practices at community level to promote drought

resistant crops. All these different mitigation mechanisms are therefore discussed in detail as under:

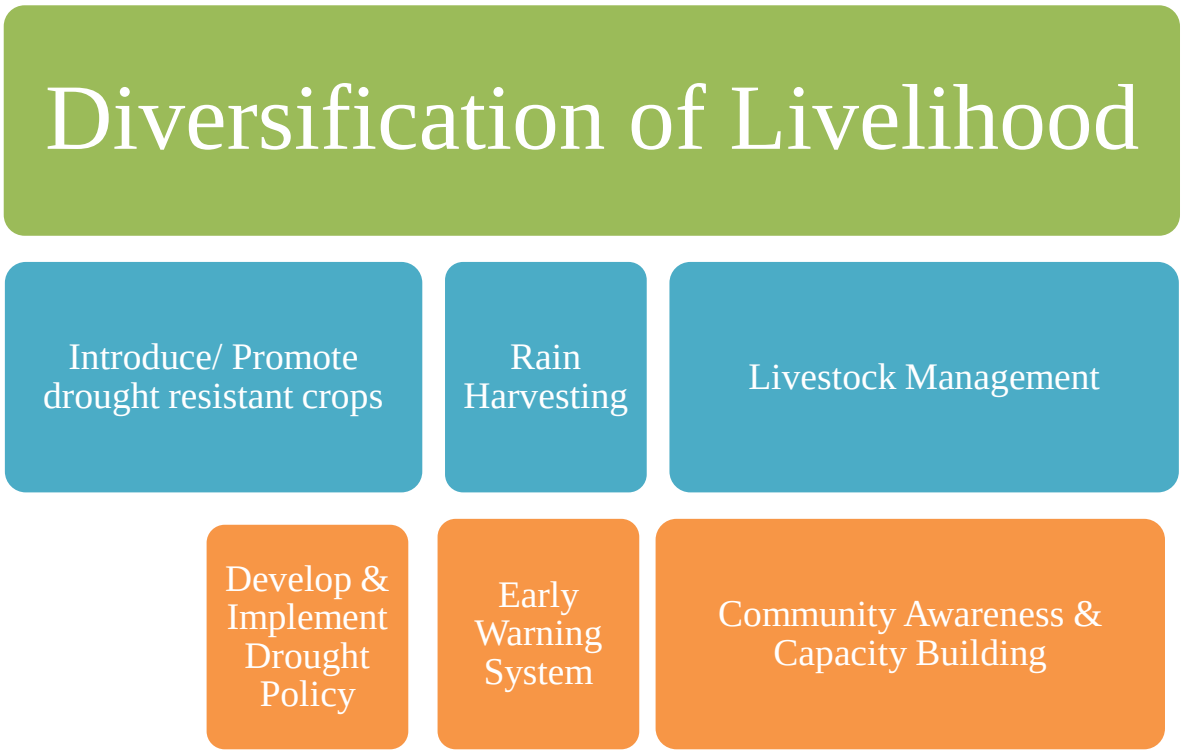


Figure 35: Mitigation and Adaptation strategies Recommended

4.42 Diversification of Livelihood

The study revealed that there are very limited livelihood opportunities in the study area. Drought is not a new phenomenon for the local communities of Nagarparkar, the people are being exposed to the impacts of this calamity since 1980s due to their dependence on agriculture and livestock as only source of income. It is recommended that government should help the local communities to diversify their income generation activities by providing interest free loans and technical trainings. Provision of technical trainings would

aid communities to start home based businesses like soap making, carpet making and kitchen gardening.

4.43 Introduce and promote drought resistant crops

Agriculture of Nagarparkar is completely dependent on rainfall which has been disturbed by global warming which has further resulted in famine and food shortage. Drought-tolerant crop and variety> provision of drought resistant crops> species like onion, cumin, potato and tomato should also be cultivated on large scale under government's supervision as they require less watering.

4.44 Rain Harvesting

Government should construct water storage bodies for rain harvesting. Rainwater tanks must be introduced in abundance in the area of Nagarparker to ensure that rain water does not go to waste if rain should happen in that area. Also, proper training of community should be done to ensure the storage of rain water and its use later on. People should also be educated to build hard surfaces above ground for collection of rain water.

4.45 Livestock Management

Livestock management through movement of cattle to pastures maybe done. It may also be done through a selling policy of the cattle. Keeping the herd in groups is also a good strategy. The more the animals are exposed to droughts the more they are vulnerable and get sick. So, strategies should be made to keep them secure during drought.

4.46 Develop Implement Drought Policy

Designing an appropriate drought policy is one of the key responsibilities of the government. So, it must be ensured that an applicable policy is not only designed but also

strictly implemented in Nagarparker to avoid such adverse effects that already exists in the area.

4.47 Early Warning System

Early warning system must be introduced in the local communities to keep the residents aware of the upcoming catastrophes. This shall enable the locals to validate their coping mechanisms and migrate to neighboring areas if and when necessary.

4.48 Community Awareness & Capacity Building

Community about droughts and ways to cope with it is also an important mitigation measure. As discussed earlier local capacity building through workshops and NGO support must be ensured so the local residents can be self-sufficient for themselves and create opportunities in their own available resources.

Chapter 5

CONCLUSION AND RECOMMENDATION

Drought, poverty and vulnerability are interlinked. It has been observed through our study that the incidence of drought has stricken the poor communities of Nagarparkar very severely as more than 60% of population was dependent on agriculture. Lack of livelihood opportunities have force families to migrate to nearby villages and towns in search of employment leaving behind their loved ones. Sweet water is scarce throughout the district and people have to people consume brackish water which has caused various diseases. Thousands of families have lost their infant due to malnutrition and unavailability of proper medical facilities. Government has failed to provide a proper medical and educational facility that is why innocent children are involved in income generating activities helping their parents so that they can have enough food to eat.

Communities have not undertaken any appropriate adaptation strategiesto minimize adverse effects of the drought; they are entirely dependent of support from government and external aid for survival. Increase in population, limited livelihood opportunities, caste system, lack of interest from government sector, unawareness shaped their vulnerability to drought and other social issues. Based on the results of this study, it issuggested to the local authorities to create awareness about drought hazards and improve resilience of communities against drought. It is further recommended to develop, introduce and implement water harvesting practices at community level to promote drought resistant crops.

RECOMMENDATIONS

The local community of Nagarparkar must build their resilience, including adopting suitable strategies, to diversify their livelihoods in order to cope with drought stress. Local mitigation practices and knowledge shall be used along with government interventions. To ensure practical and efficient adaptation strategies, government agencies, civil societies must integrate climate change in their planning and budgeting in all levels of decision making.

- To develop, implement and maintain effective drought policy for drought risk management and enhancing capacity at community level and government level to mitigate the effects of drought.
- To streamline a systematic approach for establishing drought, monitoring and early warning systems to improve drought resilience in the community.
- To identify drought vulnerability and risk assessment and improve community awareness about risk management
- To enhance community capacity and introduce best practices for livelihood diversification, livestock management and drought resilient cropping.
- To strengthen partnership and coordination between local governments, civil society, donor organizations and local community for enhanced drought resilience.

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ANNEXURES

ANNEXURE 1

DEPARTMENT OF URBAN & REGIONAL PLANNING,
NATIONAL UNIVERSITY OF SCIENCES & TECHNOLOGY-PAKISTAN
SOCIOECONOMIC QUESTIONAIRE SURVEY

Introduction:
I am an MS Urban & Regional Planning student at the School of Civil & Environmental Engineering (SCEE), National University of Sciences & Technology (NUST), Islamabad. As part of my education, a research is being carried out on Situational analysis of existing drought conditions &mitigation strategies in Thar: A Case Study of Nagarparker.

This questionnaire is designed to collect the data on above mentioned topic which will be used in the research work. Results of the study will be share with you. You are therefore requested to participate in this survey. I would be very grateful for the valuable time you will spend to complete this questionnaire.
Please be reminded that the data will be used STRICTLY for educational purposes and NO personal information will be disclosed at any forum

Village Name: _____ Household: _____
Name: _____ Age: _____
Gender: _____ Highest level of education:_____
No of family members: _____ Family type: Joint/Single

1- What are major sources of livelihood in this village?
_____
2- What is your occupation?
_____
3- Is your occupation different from the one you were having before drought?
_____
4**- What is your monthly income? Before and after drought?**

Expense on health
Expenses of education
_____
5- What you consider yourself?

Rich	Middle class	poor

6- Does your family have any livestock?

Yes	No

7-No of livestock your household own:

Cattle	Goats	Sheeps	Poultry

8- What is source of food you eat?

Grow yourself	From market

9. If you fetch from market how far is the market from household?

_____

_____

10 If you grow yourself- What type of crops you grow?

11. Is your crop drought resistant? Yes/NO

12. What is impact of current drought conditions on your crops?

_____

_____

13- On Scale 1-5(=lowest, 5= best yield), How do you rate your last season's yield comparing with what you are capable of producing?

1	2	3	4	5

14- What were reasons for yield to be at level it was last season?

Low rainfall	
High Rainfall	
High cost of inputs	
Late cropping	
Low cost of inputs	
Easy accessibility to inputs	

15-Has the drought effected your on-farm and off- farm activities?

Strongly agree	Agree	Disagree	Strongly Disagree	neutral

16- What do you think the cause for drought you have been experiencing in recent history?

Poor rainfall	
Poor soils	
Lack of appropriate agricultural inputs	

Pests	
Plagues	
Crop diseases	
Others	

17- What were effects of droughts you have experienced?

Loss of Human Life	Livestock loss	Malnutrition	Diseases	Degraded Soil
Vegetation Loss	School drop outs	Migrations	Depleted water resources	Others

18- If deaths occurred? No

_____

19- If disease occurred? Which diseases and no of cases?

_____

20- Do you think you are particularly vulnerable to droughts?

Strongly agree	Agree	Disagree	Strongly Disagree	neutral

21- Give reasons if your answer is yes

_____

_____

_____

_____

22- Which one of the following groups in community is particularly vulnerable to droughts?

Children	Elderly	Disabled
Landless	Orphans	Others

23-Which group of household member is responsible for following?

Fetching water	Daughters	Sons	Mother	Father
Hunting	Daughters	Sons	Mother	Father
Ploughing	Daughters	Sons	Mother	Father
Sowing	Daughters	Sons	Mother	Father
Herding Livestock	Daughters	Sons	Mother	Father
Migrations	Daughters	Sons	Mother	Father

24- How did you prepare for previous droughts?

Early Cropping	Drought resistant crops	Rain ceremonies	Livestock migration	Others

25-How did you cope with previous droughts?

Humanitarian Aid	Remittances
Social Networks	Sale of assets
Migration	Sale of livestock
Grain Trade	Informal trade

Off-Farm employment	Casual labor
Others	Hunting

26- Have you received drought response support from?

NGOs	Yes	No
Govt	Yes	No
Social Networks	Yes	No

27- If yes what type of support it was?

28- What are you doing to ensure that your capacity to cope with drought is strong ?

Agricultural Education		Crop Diversification	
Social Networks		Off Farm Work	
Livestock diversification		Others	

29.Did government provide any support for this drought?

Yes	No

30. Was the government support provided on time?

Strongly agree	Agree	Disagree	Strongly Disagree	neutral

31. Was the government support helpful during drought period?

Strongly agree	Agree	Disagree	Strongly Disagree	neutral

32. Do you think Government and NGOs should provide you with any form of support to enhance your capacity?

Strongly agree	Agree	Disagree	Strongly Disagree	neutral

33. If yes what type of support you want from government or NGOs?

_____

_____

_____

_____

34. What do you think you should do as a community to protect yourself from drought and its impacts?

35. At any time in the last year did your household have to move to another location as a result of the recent droughts?

Yes	No

36. What was the main reason your household had to move?

To access medical treatment.....
To find income opportunities.....
To be with/care for affected relatives.....
Others

37- For how long were you displaced from your home due to the droughts?

Less than 1 week.....
Between 1 and 3 weeks.....
Between 3 and 6 weeks.....
More than 6 weeks.....

38. If still displaced from your home, when do you think you will be able to return?
_____

SECTION 3: HOUSEHOLD
39. Who is the head of this household?

Male.....
Female.....

40 How old is the head of household? Years_____
42**- Is this household currently hosting people as a result of the droughts?**
That is, people who are staying here now but were not members of the household over the past 6
months.
Yes.....
No.....

41. Are children in household attending school? Yes / No

42. If Yes? How many children aged between 5 and 14 years are currently attending school (including pre school)?
Male _____Female_____

43. If No, What is the main reason why these children are not currently attending school?

- School still closed
- Child working to support income activities
- Still displaced from household/community
- Cannot pay fees
- Other (specify)

44. Village roads are

- 1 ( ) paved-made of asphalt
- 2 ( ) stabilized
- 3 ( ) unpaved
- 4 ( ) other (please specify)…….....**..**

45. Is there any of following public or private socio-economic infrastructures in your quarterand how many?

Socio-economic infrastructures How many	If no structure,	Where is the	nearest, at how
Schools			
Health care unit/hospitals			
Police station			

WATER & SANITATION

46. What are the main sources of water in the village? Is it enough for the village?

_____

47. Do you experience any problems with water supply? Has there ever been an incidence of water born diseases?

_____

48. - What is the current main source of drinking water for members of your household?

PIPED WATER
TUBE WELL OR BOREHOLE
DUG WELL
WATER FROM SPRING
SURFACE WATER (RIVER/DAM
BOTTLED WATER

49. Where is this current water source located?

In own dwelling.....
In own yard/plot.....
Elsewhere.....

50. How long does it take to go there, get water, and come back?

---

51. Is drinking water clean and safe to consume?

Yes / No

52.Are you doing anything to the water to make it safer to drink?

Yes …….. NO……

53. If Yes? What are doing to make the water safer to drink?

Boil..... A
Add bleach/chlorine..... B
Strain through a cloth.....C
Use water filter (ceramic/sand/etc.).....D
Solar disinfection.....E
Let it stand and settle.....F
Other (specify):_____G

AWARENESS & EDUCATION

54 - What do you know about disaster?

---

55. **Is there any workshop conducted on community level for awareness building regarding disaster and resilient communities?** Yes/No

56. - Have you participated/attended that workshop?

Yes_____ No_____

57. is there any crime occurred in this village? Yes / No

58. No of crimes occurred per day? _____

ANNEXURE 2

DEPARTMENT OF URBAN & REGIONAL PLANNING,
NATIONAL UNIVERSITY OF SCIENCES & TECHNOLOGY-PAKISTAN

INSTITUTIONAL SURVEY

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Name: _____ Designation: _____

Organization: _____ Village: _____

1. How are risks identified and expressed?- Reports, database, maps, GIS etc?

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2. Which organizations keep records of past disasters?
   _____
3. Are villages prone to drought identified?
   _____
4. Which historical disaster had the severe impacts on village and the community
   _____
5. What is the level of awareness of drought and its impacts at community level?

---

6. How ready are the communities to understand the official warnings and react?
   _____
7. Is there any drought management policy, act or related legislation? Specify?
   _____
8. Are there any drought management plans and procedures? Specify?

_____

9. Are there any drought awareness and community information projects or programmes being undertaken in village?

_____

10. What is current drought management training strategy to address current drought conditions?

_____

11. Has drought management training has been undertaken in the village? Is so by which organizations? Who has been the audience?

Type of organizations	Audience	Trainer

12. Is there training at the community level?

_____

13. List of other NGOs, International Organizations etc working in different aspects of drought management?

Name	Area of work	Location of Work

14. What are the challenges for drought management at community level?

_____
_____

15. Does your Organization have CBDRM projects or programme? Yes No
16. What is/are the objective/s of your Organization's CBDRM projects or programme?

_____
_____
_____

17. How do government bodies or other organizations participate in your CBDRM projects orprogramme?

_____
_____
_____

What were/are the gaps in the implementation of your CBDRM project or programme in collaboration with government bodies or other organizations?

_____
_____

18. How can the identified gaps be addressed?

_____
_____
_____

19. How can we enhance the institutionalization of CBDRM in the Pakistan throughnational government support?

_____
_____