

**Drought Risk Reduction in Pakistan,
A Case Study of Quetta City**



By

Shehroze Shah

(Fall 2017-U&RP 00000205517)

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The requirements for the degree of

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In

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ISLAMABAD

AUGUST, 2021

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Abstract:

The forms and manifestations and global horrific trends such as migration from the rural areas to the urban areas, urbanization, the ticking bomb of population, global warming, earth thermos state and climate change, desertification, urban growth and economic restructuring have been culminating in water scarcity and deficiency to the point of starvation and survival in many a cases of the contemporary world. These are, by and large, the driving risk factors that prepare the ground for drought to strike any terrain of the world. It merits a mentioning here that in comparison with rural areas where the flora, fauna, natural vastness and resources are teeming with bounties, cause less water shortage and thus a drought like situation is lesser in frequency and severity, it is the urban area that is at the standing danger of water shortage and drought. Most significantly in such a straight, severe and stressed situation, it is the poor, down-trodden, resource-less, voiceless and marginalized people and the lowest strata of the civil society who are badly affected in the process. The aim of this research is to articulate the drought risk reduction strategies and provide solutions to the policy makers and regional planners to help create water resources conserve them and supply water to the urban areas, particularly the poor sections of the society. Research and development organizations and academia are focusing research on the rural areas in most of the cases as the word "rural masses" is a buzz and catchy one and little research is conducted on the plight of the rural poor in the wake of chronic and intimidating water shortage and drought situation. This sorry state of affairs in the realm of research conducted and carried out inadequately and insufficiently on the very theme and focused on the urban areas hints to a research gape in Pakistan. This gape is further reflected by lack or least research in the poor water deficient and drought prone cities of the country including Quetta. Quetta city is, therefore, is focus of this research. Thus a timely necessity is felt to conduct this thesis on the subject. In light of the objectives of this research study it is concluded that the present world is prone towards the risks of droughts due to the driving forces

that precipitate them such as global warming, lack of planning and water preservation strategies, population, forest decline, land erosion, lack of timely and robust institutional response and absence of this issue prioritization to deal with it. Moreover, the entire world, regional countries and Pakistan are equally facing its ramifications in the urban areas in the form of ill effects on the victim population, agriculture, small medium enterprises, economic development and the common life. Zarghoon and Chiltan Towns of the Quetta City as urban areas have being the study area are also badly facing drought situation every now and then that has badly fractured local life in numerous ways. Thus drought risk mitigation measures are empirically unveiled and proposed towards the policy makers and implementers as one of the objectives of this study.

Chapter # 1

Introduction

1.1 General

Drought is a characteristic risk and viewed as unpredictable meteorological calamities principally impacting water assets, agribusiness, creatures and financial status of a specific zone. Drought expectation is very difficult task and it can be checked through climatological data (Humphries & Baldwin, 2003). As a matter of fact, dry season spreads steadily and delivered extreme impacts on nature and people. In some cases, drought is called as “crawling phenomenon or crawling disaster” due to trudging actual interaction and its effects may vary (M. Sheikh, 2009).

Pakistan is one the regions which is influenced seriously by dry season. In recent years, Pakistan confronted one of the most exceedingly awful dry spell length dry season in a long time from 1998 to 2003 which brutally influenced socially and financially status of people (Jamro, Channa, Dars, Ansari, & Krakauer, 2020). Therefore, the public authority of Pakistan has executed a relief program for the dry spell influenced zones with the target of moderating the impacts of dry season on the business of country networks. The significant trouble looked in the starting of a need based undertaking is the turn of development or assessment criteria, which is in accordance with the prerequisite of the influenced regions (Ahmad, Hussain, Qureshi, Majeed, & Saleem, 2004).

Dry spell is a drawn out dry period in the common environment cycle that can happen anywhere on the planet. It is a lethargic beginning catastrophe portrayed by the absence of precipitation, bringing about a water lack. Dry season can truly affect wellbeing, horticulture, economies, energy and the climate. An expected 55 million individuals are influenced by dry spells each year globally and they are the most serious danger to animals and crops in virtually

all aspects of the world. Drought compromises individuals' occupations, builds the danger of illness and demise, and powers mass relocation (Naz, Dars, Ansari, Jamro, & Krakauer, 2020).

Water shortage impacts 40% of the total populace, and however numerous as 700 million individuals may be in danger of being uprooted because of dry season by 2030. Dry locales drier and wet areas wetter due to rising temperatures brought about by environmental changes. In dry places when temperatures rises water dissipates more rapidly and consequently expands the danger of drought or prolongs time of drought. Between 80-90% of all reported catastrophes from characteristic dangers during the previous 10 years have come about because of floods, dry spells, tropical cyclones, heat waves and extreme tempests (K. Ahmed, Shahid, bin Harun, & Wang, 2016).

At the point when dry season causes water and food deficiencies there can be numerous effects on the wellbeing of influenced populace, which may expand the danger of sickness and passing. Drought may have intense and ongoing wellbeing impacts including 1) malnutrition because of diminished accessibility of food or micronutrient lack such as iron-insufficiency, paleness 2) increased danger of irresistible sicknesses (e.g. cholera, looseness of bowels, pneumonia, intense unhealthiness (Shafiq & Kakar, 2007) 3) psycho-social pressure and psychological wellness issues, 4) disruption of nearby wellbeing administrations because of an absence of water supplies as well as loss of purchasing power and 5) relocation and wellbeing laborers being driven away from neighborhoods. Moreover, serious drought seasons can influence air quality by making fierce blazes and residue storms more probable expanding wellbeing danger in individuals previously affected by lung illnesses (e.g. asthma, COPD and coronary illness) (Islam, Ahmad, & Afzal, 2004).

The consistent dry spells in Pakistan have been influencing the Indus-Basin since the nineteenth century. As one economic survey of Pakistan has been reported that financial

development of the nation has been impeded because of numerous components and drought is being a significant one. The drought between years of 1998 to 2002, was the most exceedingly awful dry spell to hit Pakistan since its 50 years of presence. The region of Balochistan and Sindh were most gravely influenced, where 26 regions of Balochistan experienced serious starvation (Ashraf, Routray, & Saeed, 2014).

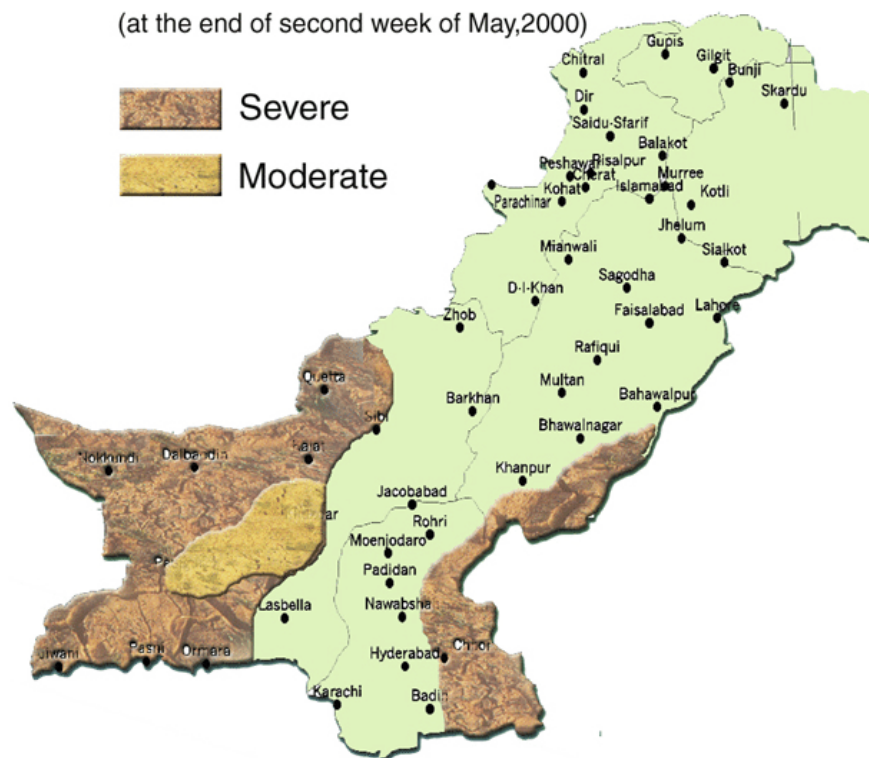


Figure 1: Drought situation in Pakistan (May, 2000)

In Sindh, Tharparkar was the most influenced region at that time. A huge number of houses were harmed, thousands of acres of farms obliterated and animals murdered. This dry season was assessed to have influenced about a sum of 3.3 million individuals, many which kicked the bucket of thirst and starvation and thousands were left homeless. It was additionally detailed that around 30 million domesticated animals were influenced that included roughly 2 million demises (Jamro et al., 2020). Due to these intense effects, accessibility of milk items and meat either completely disappeared or diminished fundamentally which brought about lack

of healthy sustenance and poor actual wellbeing particularly among kids. The costs of domesticated animals and related items likewise rose forcefully due to the restricted accessibility of stock in the area. There was loss of occupations for some, individuals associated with cultivating. With this all, eating schedules of individuals additionally changed to one dinner daily rather than two (Adnan, Ullah, & Gao, 2015).

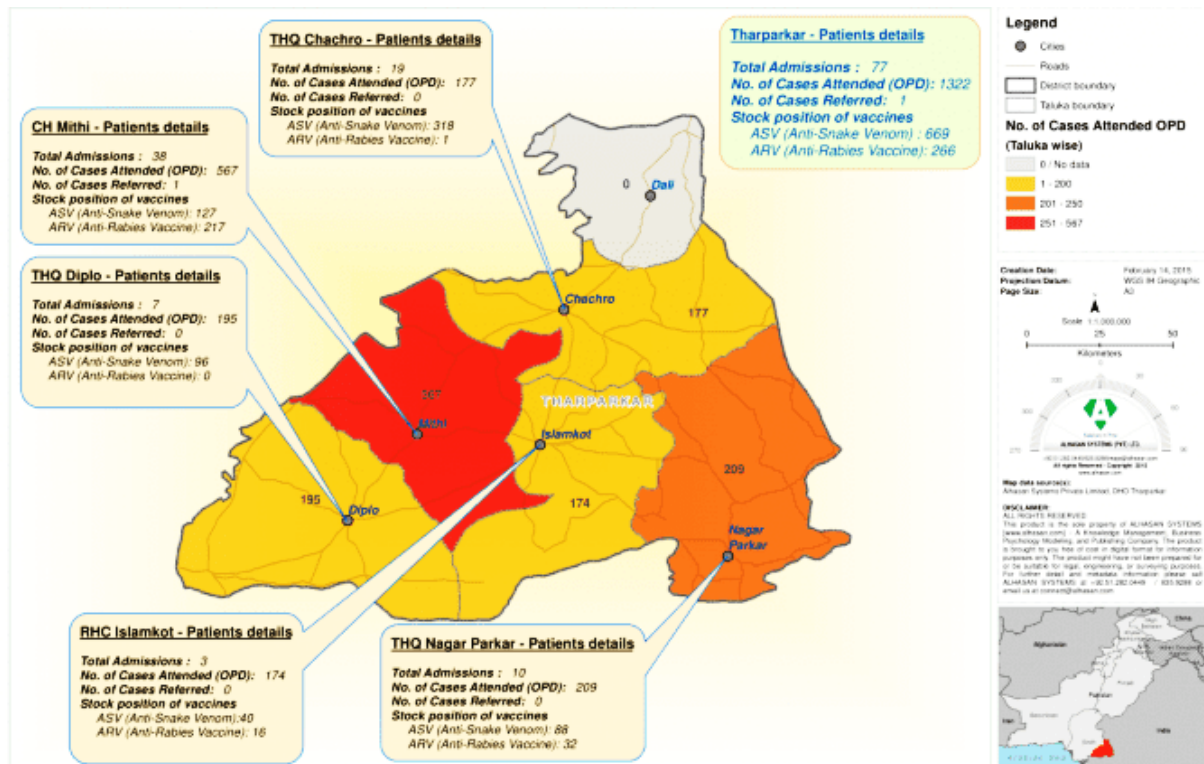


Figure 2: Tharparkar drought situation map (1998-2002) (Adnan et al., 2018)

A minor dry spell occurred in pieces of Sindh and Balochistan during the year 2004-2005 however, droughts of 2009-2010 seriously influenced the territory of Khyber Pakhtunkhwa and Punjab gravely influencing the nation's harvest creation. Since 2013, Sindh has seen serious dry season in the “desert territories” of Nara, Achhro Thar and Thar, Kohistan and the Kachho. In the beginning of 2014, an evaluation done by UN, 67 grown-ups and 99 youngsters were died in Thar due to constant ailing health and other dry-spell stimulated waterborne infections (Anjum, Saleem, Cheema, Bilal, & Khaliq, 2012). The quantity of

passing's of kids < five years was recorded at 326, 398, and 476 of every 2014, 2015, and 2016 respectively. In 2016, Thar district confronted 100% water shortage as it confronted dry season from previous four years continuously. Likewise, Jamshoro was at 62% water shortage level while a radical decrease in yield reap of up to 53 percent and domesticated animals had diminished to 48% adding to further unhealthiness and food insecurity (Memon, Aamir, & Ahmed, 2018).

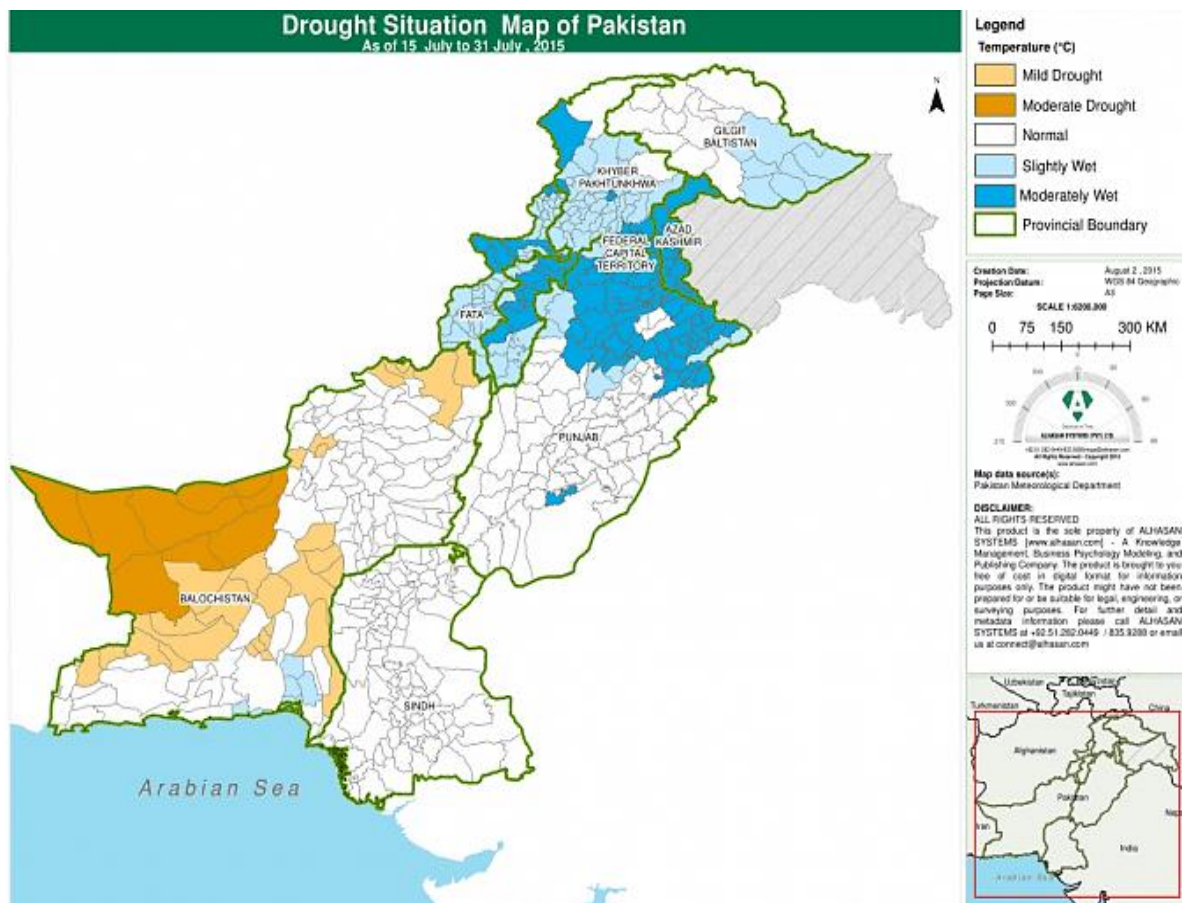


Figure 3: Drought situation map of Pakistan (2015)

Dry season is special among the wide range of various natural perils. Its uniqueness is regarding the timeframe between the primary signs that a dry season is creating and where it starts to affect altogether upon the number of inhabitants in the influenced zones. Dry spell assumed a huge part in diminishing creation of different areas particularly agribusiness which affects the

development of the economy and fares. In any case, presently it appears to be that it might reoccur and endeavors should be made, to empower the framework to adapt successfully. Effectively, the two dry seasons in 1999-2000 and 2000-2001 have extended the adapting capacities of the current frameworks as far as possible and it has scarcely had the option to check the circumstance from turning into a disaster (Jamro, Dars, Ansari, & Krakauer, 2019).

Besides this, round about 3/4th of Pakistan has under 250 mm precipitation yearly, and a little part with in excess of 500 mm adds up to around 7% of the region and generally that is mountain slants. Around 20% of the complete region has under 125 mm. Dry season has various short and long haul consequences for the environment of the influenced zones in Pakistan. Rural profitability in many regions of Pakistan is exceptionally subject to precipitation (Siddiqui & Safi, 2019). In Pakistan, the effect of dry season in many territories has been controlled through its enormous and interesting channel organization. In the dry spell inclined zones of Baluchistan Province, the customary frameworks of water system have been created. Nonetheless, there are some particular reason specialists generally under Provincial Government which embrace studies and examination projects for the improvement and up-degree of the climate in their territories of ward. The Provincial and Federal Government has different short, medium and long haul programs for dry spell hazard decrease in different regions (Jamro et al., 2020).

1.2 Problem Statement

Drought is one of the environmental problems the world is facing dearly for enough time now. Due to the climate change problem, environmental degradation, unplanned development and progress, institutional failure, lack of awareness and workable strategies and measures to adopt the associative risks of drought are all imminent causing droughts every now and then worldwide and in Pakistan. Research to unveil the causative factors behind and fix the problem

is in plethora but ironically with a focus on the rural areas. This practically signifies that urban areas are not focused nevertheless life of urban people face more or less the same severity and problems when they are in the midst of drought and its longer spells. Moreover, in Pakistan there are urban and metropolitan areas that are poor in infrastructure, treatment and often than not discriminated against in regard to the services provision in a situation of droughts such as Quetta city and its premises. At several levels drought impacts the life in urban life and case study based research to end calls for an action to carry it out. Based on the research at hand the policy framers are in dire need to take informed decision that is not possible in the absence of evidence based thorough research. Key measures to adopt and strategies to embrace in mitigating the drought risk reduction in the urban areas including Quetta city is the main aim of the very research I context of problem of drought risks so stated.

1.3 Research Justification:

The manifestation of climate change, earth thermo-state and global warming have created and promoted the problem of drought and its prolonged spells in Pakistan. The country has least contributed to the carbon emissions that are the main driver behind climate change but it is 12th worst country amidst climate change and its consequences according to the editorial of Dawn. Drought impacts badly every facet of life necessitating the attention of policy makers and implementers. Farmers, daily wagers, the runners of Small Medium Enterprises (SMEs), businessmen, agriculture, transportation, and health functionaries so on so forth receive an inconceivable impact amidst drought particularly when the spell is prolonged and more devastating in the sense that the available infrastructure to counter the impact in some way is fragile and weak. This presupposes evidence based research so that the measures put in place yield the desired results. Urban areas have had attracted least focus in the backdrop of drought, its ramifications and risk reduction strategies to base upon the scientific research. Besides, Pakistan is one of the countries that is hard hit by the phenomenon of drought. These reasons

have moved us to conduct the research upon the drought risk reduction in Pakistan in the urban and metropolitan areas that are more prone, fragile and susceptible to drought. Quetta district and its urban areas have thus been the focus of this research. Moreover, both the Sustainable Development Goals and Millennium Development Goals require Pakistan to take concrete steps and conduct the prior research in the domain of drought to mitigate it and reduce its risks.

1.4 Research Questions

- ❖ How to identify the preparedness and coping measures mitigate the drought vulnerability of the areas under research investigation
- ❖ How to identify the challenges faced by institutions in providing water to all the consumers.
- ❖ What are the suggested drought reduction measures

1.5 Research Objectives

- ❖ To identify the preparedness and coping measures regarding drought.
- ❖ To identify the challenges faced by institutions in providing water to all the consumers.
- ❖ To suggest drought risk reduction measures.

1.6 Scope of the Study

The Study area is restricted to Quetta City, A detailed questionnaire was developed and filled from local residents to understand the perception of about their preparedness and coping measures regarding drought. Institutions were visited and open ended questionnaire was filled regarding challenges faced in providing water for all consumers. Based on the perception of consumers and discussions from institutions drought risk reduction measures will be suggested.

CHAPTER # 2

2.1 Literature Review:

There are many definitions of drought risk but themes of all of them somewhat remain the same. Going by all of the definitions their essence can be recapitulated as the likelihood and the potentiality to incur and precipitate the indemnities and financial losses during and in the aftermath of the drought being struck. The severity of the drought highly depends upon the interactions between three dimensions: 1) the severity and the probability of occurrence of a certain drought event, 2) the exposed assets and people, and 3) their intrinsic vulnerability (Crausbay *et al.*2017). 21st century owing to the earth thermo state, global warming and dreaded phenomenon of climate changes every now and then are characterized by warmer temperatures, prolonged duration of the drought and spatial extensity being hugely exacerbated by the human demands for water particularly drinking and potable water. Moreover, this sorry state of affairs renders today's ecosystems prone towards drought encompassing forest and damages to the trees that are so vital for a salubrious living environment including in urban areas of poor parts of the world (Allen & Hoekstra.2015).

2.2 Types of Drought

On the basis of drought origin and their respective impacts on people they are classified into following types such as meteorological drought (below average rain or snowfall e.g. Swat of parched cracked earth), agricultural drought (lack of soil moisture or ground water that affects crops/livestock), hydrological drought (lack of precipitation decrease streamflow, lack/reservoir and ground water levels), ecological drought (lack of precipitation impacts native plants or animals) and socio-economical drought (when food/eater supply does not meet demands due to lack of water) (Wang, Ertsen, Svoboda, & Hafeez, 2016).

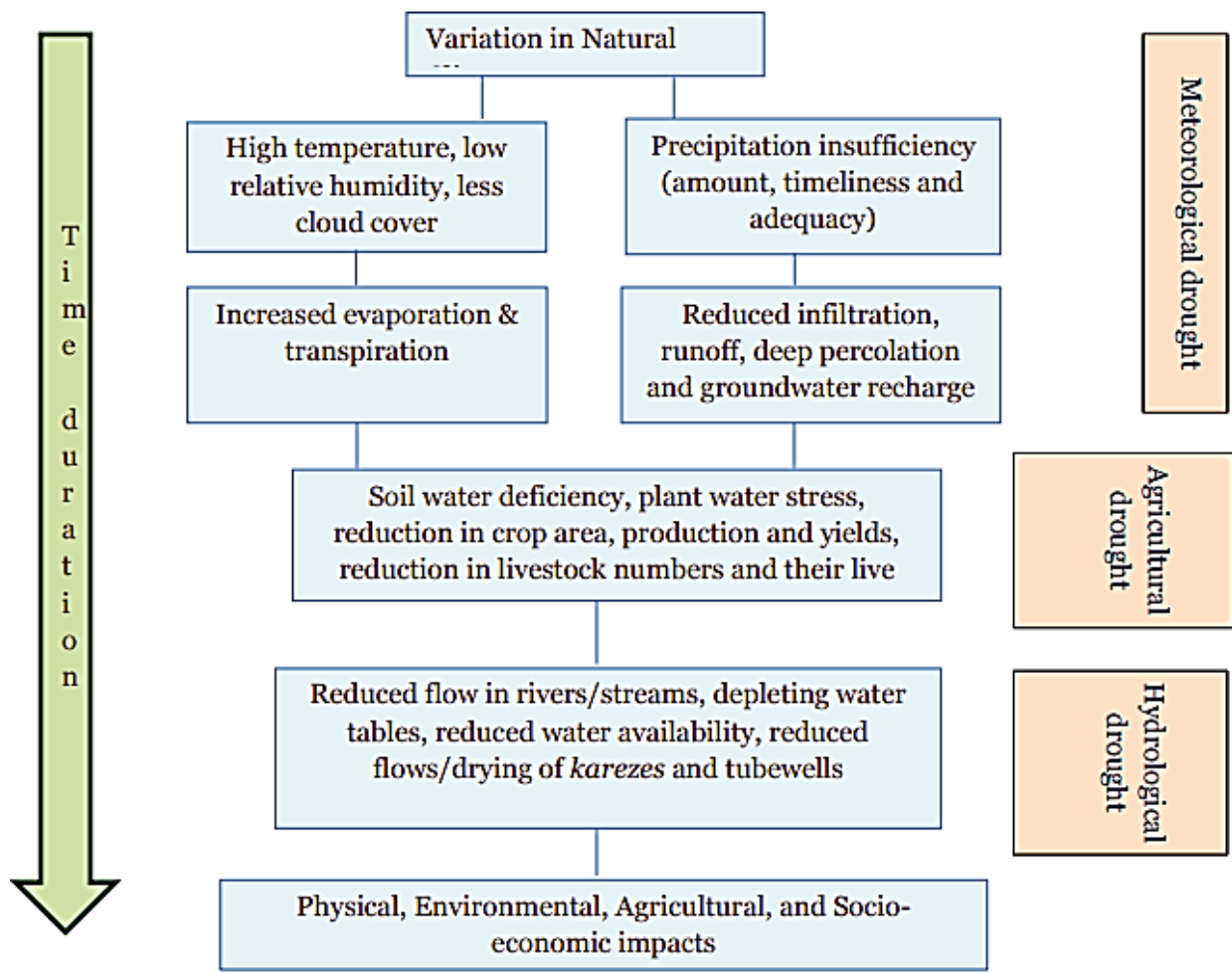


Figure 4: Different Linkages between drought its types and various socio-economic, agriculture, physical and environmental factors

2.2 Causes of drought

2.2.1 Natural reasons

From few previous decades to recent time, droughts have tormented mankind. This natural phenomenon may trigger by repeating climate designs, for example, the measure of dampness and warmth noticeable all around land and ocean (Vargas & Paneque, 2017).

2.2.2 Changing Patterns in Land and Sea Temperatures

Sea temperatures generally direct worldwide climate designs, remembering dry and wet conditions for land and even minuscule temperature variances can have colossal far reaching

influences on environment frameworks. Different researches have shown that sensational and delayed change in temperature of North Atlantic and North Pacific relate straightforwardly to extraordinary “weather patterns” on land, remembering tireless dry seasons for North America and the eastern Mediterranean the last of which has been depicted as the area's most noticeably awful dry spell in 900 years. Then, more blazing surface temperatures ashore on land to more noteworthy vanishing of humidity from the ground can expand the effect of dry season (Trenberth et al., 2014).

- **Changing patterns in weather**

The dispersion of precipitation (rainfall) around the planet is likewise affected by how air circles through the environment. When there is an irregularity in surface temperatures especially over the ocean air dissemination designs are modified, changing how and where precipitation falls around the globe. Innovative weather patterns can throw water supply-demand out of synchronization, just like the situation when sooner than-expected snowmelt decreases the measure of water accessible for crops in summer season (Huiping, 2010).

- **Decreasing Moisture of Soil**

Soil dampness can affect cloud arrangement, and thus precipitation. At the point when water from wet soil vanishes, it adds to the development of rain clouds which return the water back to the earth however, when land is drier than expected, dampness actually vanishes into the air, yet not in sufficient volume to frame downpour mists. The land successfully prepares, eliminating extra water and further achieve dry conditions (Fatemi & Karami, 2011).

2.2.3 Synthetic/Manmade causes

While dry season happens normally, human movement from water use to ozone depleting substance emanations is producing a growing impact on their severity and possibility (Huiping, 2010).

2.2.4 Environmental change

Environmental changes and global warming, explicitly influences dry spell in two essential ways such as increasing temperatures commonly make misty areas wetter and dry locales drier. Wet regions warm air gets water more prompting bigger occasions for rain. However, in case of arid areas, hotter temperatures allow water dissipation more rapidly. Moreover, environmental change adjusts enormous scope climatic dissemination designs, which can move storm tracks off their regular ways, thusly, can amplify climate boundaries which is also the important reason behind the dry environment will keep on getting drier (Lockwood, 1986).

2.2.5 High water demand

Dry spell frequently mirrors disparity between water demand and supply. Provincial populace booms serious strains on horticultural water, in any event, steering the result enough to make the danger of dry season a reality (Naz Mirza, Athar, & Qayyum, 2009). Also, when precipitation wanes and dry season conditions grab hold industrious water interest as expanded pump from ground water level, the waterways takes a lot time in recharging the ground water level. Then, interest for water provided by upstream lakes and waterways, especially as water system and hydroelectric dams can prompt the reducing or drying out of downstream water sources which may add to dry season in different districts (Fatemi & Karami, 2011).

2.2.6 Deforestation and soil degradation

Clouds formation take place when trees and plants discharge moisture ultimately water mists return to the soil as rain. At the point when woods and vegetation vanish, less water is accessible to take care of the water cycle, making whole areas more vulnerable against dry season. Then, deforestation and other helpless land-use practical approaches, for example “serious cultivating” can lessen soil quality and decrease the land’s capacity to assimilate and hold water (M. Sheikh, 2009). Accordingly, it dries out soil quickly (it can instigate

horticultural drought) and less groundwater is recharged (which can cause hydrological drought). Surely, experts accept that the Dust bowl in 1930s was caused in enormous part by deprived rural practices joined with the warming of the Atlantic and cooling of the Pacific by as insignificant as a couple of tenths of a degree (Lockwood, 1986).

2.3 Discussion

In this perspectives are worldwide cases of drought risks and associated phenomena with diversity of nature, forms and manifestations in the local contexts. Bangladesh experiences seasonal drought to the extent of crops destruction, rendering the local farmers to face the associated difficulties and the repercussions of drought that make them unable to find alter source of livelihood and earnings. The northwestern part is vehemently and hard-hit of that country with less rain-fed capacity in comparison with rest of the parts of country where there is huge precipitation and rain fall. Results of the study to ascertain current drought level with resilience with Institutional, Physical (SIP) and socio-economic conditions as major and prime indicators in two districts of Chapai and Rajshahi showed the variation of lowest and highest resilience that need improvements in the fields of education, policy enhancement, awareness of the masses, coordination among stakeholders, conflict resolution on water usage and proper land-use pattern. Most importantly, SIP methodology via the research findings can be the potential weapon to mitigate the risks of drought in the prism of policy and its effective implementation via an inclusive and participatory approach particularly for the local farmers and urban small medium enterprisers and entrepreneurs in the days to come (Habiba.2011).

There are a number of causes that precipitate the risk to drought. Studies in this regard abound. In the districts of O.R. Tambo in the Eastern cape province of South Africa the assessment and identification of social vulnerability of communal farmers to drought through the use of survey data and index of social vulnerability some indicators were identified with the help of using Bogardi, Birkman and Cardona conceptual framework that found out that cultural values and

practices, security or safety, social networks, social dependence, preparedness strategies and psychological stress were the causative factors behind social vulnerability with regard to drought. Moreover education level, awareness level in the process also played a role as regards drought resilience. Most importantly government played a lips service to bring down the severity of drought in the district that recommends an active involvement of the government to for effective plan in this regards at the all the administrative units of the study area in order to mitigate the risk to drought in the area that can be equally applied on other parts of South Africa ((Muyambo.2017). Moreover, in terms of recommendations to bring down the risk towards drought step wise guidelines ought to address the situation in the best interest of all and sundry as regards the negative impacts of the drought once it hits a particular region susceptible to drought. One of the recommended steps must be the one to bring in the best people to state machinery vested with informed drought situation and the likelihood of the associated ill impacts of the drought so that they are able to decide in best of ways in light of that data and information that evidence based. Identification of high priority drought-related impacts must be the next step so that an adequate response is timely initiated to meet the situation in light of that identification. Next step in regards to high impacts it is necessary to know how to reduce those impacts under the banner of environmental, economic, and social causes that lead to this sorry state of affairs. Last of the step ought to be based upon that stated informed knowledge with regard to drought, the causative factors behind and the consequences there to in order to help mitigate the risk to drought and timely respond to the situation. This thorough approach will surely yield in reduction of drought-related impacts and risk (Knutson. 1998).

Moreover there is another study that deals with drought and risk situation in terms of the factors that increase the vulnerability to drought. Economic reliance on agriculture and the depletion of resources increase their vulnerability to drought. The most important factor is the lack of adequate resources with those who are affected by drought such as farmers. This renders them

unable to respond towards drought particularly when the consequences are sharp. This situation in mind the study focuses upon the perception of farmers and other stakeholders towards drought. With the help of research tools of structured questionnaire survey, purposive sampling method procedures, and the creation of a perception index the findings revealed the following: They perceive that lack of government support render them prone to the drought situation and thus the drought risk reduction public actions are either lacking or do not work properly. They further perceived that the role of social networks is not positive in this regard. Thirdly, they were found to perceive that gender discrimination in the region and in the process further exacerbate the drought situation that poises a standing menace in this whole picture. It is further revealed that in the event of drought their assets are stolen that render them insecure further.

In light of this situation that the study revealed the suggestions that there ought to be coordination and cooperation among all key stakeholders. This remembers coordination between responsible line departments for terms of dependable early notice information, conveyed in an extensive method to leaders, rancher's associations and private area. Coordinated effort with government divisions at public and common level ought to likewise be reinforced. This consists of collaboration with the Department of Agriculture, Forestry and Fisheries (DAFF) at countrywide level, provincial Departments of Agriculture, National and Provincial Disaster Management Centers (NDMC and PDMC), Department of Water Affairs (DWA), South African Weather Service (SAWS) and the South African Police Service (SAPS). This coordination will assist to cope with the state of affairs via way of means of giving attention of the importance of social networking, governmental, safety level, and pressure and gender equality. Study defines hows that it's going to make a contribution to the improvement of South African drought plan that's presently under formulation. (Bahta.2016).

Drought Risk is a standing menace to some of the African countries where there is huge severity and presence of drought risks such as South Africa. The Northern Cape town Province has been

found to be especially susceptible vulnerable to droughts and developing and implementing a drought risk reduction strategy is their core part for future sustainable food production. The hazards and potential consequences have been studied in particular that evidently interact with different vulnerabilities, and risk is only relevant in context of specific vulnerabilities besides the potential of suffered individuals in coping with the specific risk. The interaction between the hazard, environmental vulnerability, social vulnerability and economic vulnerability was aimed at calculating the risk. This study relied on qualitative and quantitative tools and stress was laid upon the significance for economists, sociologists, environmentalists so on so forth in order to integrate and coordinate original thinking for solution of the problem. It is thus found and recommended that they are hard to continue valuing the disaster consequences from their own respective fields of expertise. That being the fact integration is necessary imperative and the present day scientists do s need to have a huge knowledge of the problems, even if it is does not fall in their respective domain of expertise. Take into account the SPI indicator to declare drought declaration and do limit the unilateral decisions to take on the part of political representatives and persons with scientifically-based criteria. Drought risk policy and planning, ensuring timely and sufficient assistance to the vulnerable and affected groups of the people. Take cognizance of the difference in vulnerability to drought amongst various groups. Must explore the potential likelihood for index insurance and use the Mean Annual Loss (MAL) being criteria as regards drought insurance coverage. Lastly, drought relief applications ought to be aligned with cost-benefit-analysis (Jordaan.2012).

Drought risk and the phenomenon of global warming have a co-relation. In fact global warming, earth thermostat and climate change has resulted in droughts around the globe. Evidence based research proves that the Earth Planet is warming up steadily but continuously. Greenhouse gases such as CO₂, CFCs, cloro floro carbons (CFCs) and other gases have been filing up in the universe that has foretold that global average temperature by 2100 will range

between 1.1 and 6.6 °C higher than the 1990 levels. In addition to increase in the sea levels amidst the past century, huge global warming, ice polar depletion and glacial retreat extreme weather conditions have been caused including worldwide drought. . The recent El Nino activities have been held responsible to have caused many droughts in Asia that have in addition suffered a large number of cities in terms of water deficient and crises and huge floods ever since 2000. Most significantly, urban areas, characterized by increased concentration of population, economic activities and infrastructural facilities are likely to bear the most severe impacts of climate change.

Certain case studies abound in terms of the results of global warming such as drought. There are limitations to urban climate resilience of the city region of Udon, Thani province in Thailand that is growing rapidly and face climate change issues of drought and floods. The study reveals institutional poor response being responsible for the climate change with poor responses and drought risk reduction measures and strategies thus exacerbating Udon Thani's vulnerability to droughts and floods. The study inspects plans and strategies of land use and water supply administrations at public, local, and (The suburbs and exurbs continue to dominate population growth in the nation's 53 major metropolitan areas, according to a City Sector Model, analysis neighborhood levels in regards to the common improvement methodology and the spatial coordination of public organizations at a similar degree of administration to analyze the vertical and flat institutional course of action, lawful structure, strategy drivers, and different limits to the mainstreaming of environment flexibility into metropolitan advancement arranging. Meetings were additionally held with pertinent public authorities and experts. The discoveries uncover that there are limits brought about by formal institutional plans and holes which have brought about the absence of coordination between offices at various levels or organization or offices working under various services. There are additionally errors of obligation and data and monetary assets which altogether subvert the

proficiency of the two metropolitan administrations, and, thus, Udon Thani city district's environment strength and capacity to oblige spatial and financial development (Marome.2019).

Delhi is at loss to provide solution in prism of the risk of drought. Delhi has pioneered to table its climate change adaptation action plan back in 2009–2012 with a Water Mission to conserve, recycle and then distribute water to all and sundry. This action-plan is dealing with river water sharing pact with other neighboring states, decentralization of wastewater treatment system, connections, and treatment of drain water through interception sewer project. These facts have been brought to the fore by this research conducted caring for the trends of rise in temperature, rainfall intensity, storms and cloud bursts. The findings also revealed that global warming related events such as droughts and their prolonged spells are on the rise increasingly as regards their happenings and size. It is also revealed that the country's economy is mostly agrarian and therefore droughts and floods caused by climate change have been focused. This is found and stressed by the Ministry of Agriculture as a nodal ministry to contain and mitigate droughts. Moreover, urban water scarcity also leads to “urban drought” which must be the responsibility of regional planners and urban municipal services providers. It has been observed that scarcity of water and sanitation supply global warming and climate change did the worse effect through change in the patterns of rainfall and groundwater resources to diminish. This thorough and challenging situation has badly affected 16.78 million people with population density of 11,320/km² that reside is housed in Delhi. Moreover, demand of water has furthermore increased due to the floating of the people and tourist visitors to city as a historic place to visit. To add fuel to fire there is migration influx from the rural parts of the country for search of jobs and facilities. Owing to the geographic and environmental position of Delhi, water during the summer season is especially in the urban slums need urban drought regulation with legal assistance, Standard

Operating Procedures (Sops) and regulations on how to use water in such a standing situation. Such an approach towards addressing drought situation can be well replicated by other cities of the country that are also at the later of drought situation in provision water security and safety to the urban masses who direly need water to be had in the face of droughts every now and then ((Singh & Sharma.2019).

In India the disaster risk reduction is a vital pledge and number of ministries, like ministry of water asset, ministry of urban development and ministry of agriculture the nodal ministry can altogether increase the technique for city drought mitigation (Ghosh.2013).

Gradually many urban center in India are extracting water through large diameter water pipelines by pumping from water resources far away from the city centers. The rate of augmentation works is replaced by over-population in the city territories owing to migratory increasing trends. Therefore, meeting and catering to rapid urban mass conversion and migration, reduce demand via conserving the water being long-term measures provides the key solutions to meet and defeat the contemporary crisis. There is a dire need and demand of the diversified water-conservation measures such as water conservation devices, leak detection and repair, water reuse, metering and incremental rates that must be put in place to encounter the drought situation that the areas direly are facing and to address the water deficiency via continuous supply and availability. Besides, side by side there are two other options and application that this study reveals will address the situation of drought and water shortage the rainwater harvesting and wastewater reuse (Gupta and Nikam.2018).

Droughts are striking Pakistan every now and then. Hardest-hit areas are Baluchistan, and parts of Sindh and Punjab which are experiencing drought for the last three consecutive years. Rainfall during the 2021 winter cropping season (January-March) was between 50 and 80 percent below average in most parts of the country. (Ahmed, et al.2004). Consistent with the survey consequences, about 60-70% of the populace is projected to be at direct and indirect

chance to drought in Baluchistan. Some 50-60% of the population is affected by a moderate drought and is at hazard in Pishin, Killa Abdullah, Mastung, Kalat, and Loralai districts. . Provincial Disaster Management Authority (PDMA) and United Nations Development Program (UNDP) identified the following districts affected by drought:

- 1) Kohlu
- 2) Loralai
- 3) Dera Bugti
- 4) Zhob
- 5) Pishin
- 6) Noshki
- 7) Kharan
- 8) Qilla Saifullah
- 9) Awaran
- 10) Mastung
- 11) Kalat
- 12) Kharan
- 13) Lasbela
- 14) Khuzdar

Evidence suggests that four forms of drought, namely meteorological, agricultural, Hydrological and socio-economic, exist in Baluchistan with unique intensities. A Standardized Precipitation Index (SPI) revealed that out of the preceding fifty years, twenty years faced mild drought, seventeen near every day, 3 mild and two years were extraordinarily moist. SPI indicates that in the year 2014, moderate drought prevailed. A few 50-60% of the population is stricken by a moderate drought and is at chance in Pishin, Killaabdullah, Mastung, Kalat, and Loralai districts. Loralai district is the worst-affected and the socioeconomic effect of

drought is evident in the shape of livelihood loss, unemployment and forced migration. The degree of drought that influences the population of Killa Saifullah, Zhob, Sherani, Kohlu, Lasbela, Gawader and Kech districts turned into estimated to be 30-55%. In the meantime, in Noshki, Chagai, kharan, Quetta, Ziarat, Sibi, Nasirabad, Jaffarabad, Bolan, Dera Bugti, Musa Khal, Barkhan and Jhal Magsi districts 40-65% of the populace are at threat because of differing types and ranges of drought. The steepest average water desk decline was reported by 2 to 5 meters in Killa Saifullah followed by using Pishin, Mastung, Noshki, Lasbela and Loralai districts. The reasons for such an extended rate of decline have been the meteorological drought prevailing over the last few years and massive pumping of groundwater. The absence of political will in addition to lack of financial support are main constraints to deal with the impacts of drought is chronic threat, specifically in the arid regions of Pakistan like Baluchistan. Federating unit Research was carried out to analyze the trends of drought via utilizing Standard Precipitation Index (SPI) at the 3-month accumulation timescale. The analysis of drought through SPI reported the extreme nature of drought happenings in 1996, 2001, 2002, 2004, 2009, and 2014. Barkhan remained one of the districts that time and again experienced extreme to severe drought events, according to the method and findings of SPI. A figuratively important decreasing precipitation trend was noticed found in Dalbandin, Jiwani, Quetta, and Zhob areas and districts. However, research findings revealed that drought characteristics manifested it in Barkhan will longer spells and cycles spanning 22 months period from 1999 to 2001. The Global Climate Risk Index (GCRI) ranks Pakistan among top ten countries where drought happens and with most severity and severe consequences to all sundry. These trends of droughts in the main call for thinking and policy implementation with regard to water resources management to tailor it in accordance with changing patterns of drought (Naz, et al.2020).

Drought played a sizeable role in lowering manufacturing of various sectors particularly agriculture which has additionally its effect on the growth of the economic system and exports. Already, the 2 droughts in 1999–2000 and 2000–2001 have stretched the coping skills of the existing systems to the restriction and it has slightly been able to check the scenario from turning into a disaster. In all more than three fourth of Pakistan has less than 250 mm rainfall yearly, and a small component with extra than 500 mm amounts to approximately 7 % of the region, and basically that is mountain slopes. Approximately 20 % of the entire region has much less than 125 mm. Drought has a number of short and long-term effects on the ecosystem of the affected areas in Pakistan. Agricultural sector amongst all the sectors affected by droughts is noticeably dependent upon rainfall. In Pakistan, the effect of drought in maximum areas has been managed through its large and precise canal system. In the drought susceptible regions of Baluchistan province the traditional systems of irrigation had been adopted that in most of the cases don not work when a calamity struck by prolonged drought is to meet (Khan & Khan.2015).

Quetta is the capital city of Baluchistan province. It has a number of issues. Generally it sounds to be a developed terrain being the capital of the province of the country. Poverty, hunger, disease, illiteracy, social problems such as feuds and factions, terrorism, extremism are some of the issues emanated from the weak and unjust federal character, governance system and institutional failures. The city has historically been suffering from both manmade and natural catastrophes and emergencies. Global warming, climate change, earth thermo state, pollution via bricks industry etc have caused havoc with the lives of such areas. Drought situation and phenomenon is well entrenched here and further risks of drought are present since climate change and the issue of global warming are becoming more intense and chronic.

Local government, district administration and Quetta WASA, department of agriculture, public health engineering department, and nongovernmental organizations are responsible to provide

for water and mitigate the ill effects of drought via various initiatives in context of Baluchistan and Quetta. Nevertheless, they have failed to resist successfully the risks and presence of drought in the region and elsewhere.

Due to this state of affairs neither the Millenium Developmental Goals (MDGs) were met neither that ended during 2015 nor meeting the environmental nor are drought risk reduction goals as addressed in accordance with Sustainable Developmental Goals (SDGs). Government, responsible institutions and political leadership must realize the terrific consequences of drought that how it impacts the domestic peace, health and the livelihoods of the people. This standing and dire situation in the wake of climate change that has badly struck parts of Quetta and other regions in the country, calls for robust, effective, working, sincere and most technically sound program to be put in place in order to put an end to the consequences of drought whose spill is always present with more or less severity in Quetta and other parts of the country that suffer the most due to drought and the diverse issues that drought unlock for the people. This program becomes more necessary in context of the socio-economic deplorable indicators for the entire country.

Pakistan has encountered an expansion in the recurrence and seriousness of dry season due an ascent in temperatures, antagonistic impacts of El-Nino and a lessening in precipitation during the rainstorm season. According to the Pakistan Meteorological Department (PMD), serious dry spell like conditions have arisen over a lot of southern Pakistan, with an assumption for additional decay throughout the following 4 years (Moe & Pathranarakul, 2006). In 2018, Pakistan got diminished precipitation during the storm season (May to August), with Sindh 69.5 percent less than ideal, and Balochistan 45 percent underneath. This has brought about intense deficiencies of water, food and feed. The Government of Pakistan appraises somewhere in the range of 5 million individuals are influenced by the dry spell in 26 locale in Sindh and Balochistan (Comfort, 2005).

There is a genuine need to pull together our drought management strategies from present catastrophe moderation endeavors on pre-calamity arrangement mechanism, in order to make networks strong to climatic disasters. Quick endeavors should be guided towards giving transient alleviation to individuals in dry season influenced districts as immediate new water food supplies and clinical help. For the long run, the government needs to invest in research and development, to come up with sustainable solutions to tackle the problem of droughts (M. M. Sheikh, 2001). To ensure food security, there is a need to produce drought resilient seeds for crop production, adoption of modern methods of irrigation, and specialized veterinary services to ensure health of cattle. There is an urgent need to prioritize, and devise proper water storage infrastructure, and an advanced water management system that can store and transfer water from regions where there is enough water in areas that are affected by drought (Ahmad et al., 2004). The government can use examples of various countries that are already implementing an effective water management system, and apply an indigenized model in Pakistan). With a proper plan, investment, and a little will power by the government, it can play a significant role in dealing with droughts and in building climate resilient communities (Salter, 1997).

The Government of Pakistan appraises somewhere in the range of 5 million individuals are influenced by the dry spell in 26 areas in Sindh and Balochistan (Z. Ahmed, 2013). The Government of Sindh pronounced some southeast and western regions as disaster hit regions and started food circulations. In Balochistan, the public authority has pronounced a dry season crisis across the whole territory. In spite of government alleviation activities, countless influenced zones stay out of luck. (Ainuddin & Routray, 2012).

Chapter # 3

Research Methodology

3.1 Research Tools

In line with the research questions and research objectives to address and meet them, evidence and research-based, both thematic (Secondary/qualitative data) and quantitative approach (Primary data tools) are applied. Literature, cased study expert opinions are reviewed critically from the previous research conducted so far. Those sources are extracted from Google Scholar, Z-Library, databases, archives and libraries and patent website sources and are approached systematically and critically to know the research work conducted on the subject matter and how, in what ways and why these sources have contributed to reduce the drought in Pakistan. These sources are focused in the literature review of the thesis. The research at hand does propose the data collection, interpretation of the data in various hues and colors besides the ethics of data collection and interpretation with reliance on the primary and secondary data collection sources as research methodology and research tools. It is detailed below:

The relevant literature and study as secondary source of data, has been read through the relevant articles, books, journals, thesis, websites, databases and archives conducted from academic websites; collect the application of relevant articles books, journals and thesis aimed at the key connected areas of this research that are reflected by the objectives and thus the research questions, work in order to determine the right direction for the carriage of this research work forward via consulting the information about the subject matter. This thematic approach as part of research methodology that can potentially well sort out relevant information, knowledge, statistics and data to help analyze the current situation and provide reference for this research work in the prism of future measure of drought risk reduction. Furthermore, Qualitative research will also applied for the conduct of research, encompassing, key texts, quotes, reviews, books, journals, interviews, opinions, arguments, official record,

articles, editorials and electronic media. Given the nature of the research, this tool is the viable one to make, the research an interesting, reference, guiding and purposeful read (Queirós, et al.2017).

Besides thematic and qualitative approach discussed above, quantitative method as the primary source of data collection will also be relied upon in the course of conducting this research work. Two questionnaires were developed focusing all the key points and aspects of the research title. Once developed the questionnaire, it will be pre-tested. After that necessary changes will be re-arranged and incorporated.

Yamane Formula is applied to take the sample size at the accurate and recommended level. Following this formula 385 sample size was required.

Moreover, certain case studies from different countries and cities are reviewed critically through the case study tool of the research. All these tools of primary data collection revolve around the key requisite themes of drought risk reduction in Pakistan in the target urban areas of Quetta city such as Zarghoon and Chiltan towns of the city to ascertain how these areas are poised with regard to drought situation; how the people do handle this situation within the given resources and how they make for it individually and collectively. Similarly, the key official stakeholders that are vested with the official and public responsibility will be known in the sense how they respond, whether they make for it successfully or otherwise, what are the weaknesses and the challenges they face in addressing of the drought situation. Risk reduction measures to adopt will be known from the respondents identified in the two questionnaires.

3.2 Research Detailed Methodology and Significance

Research can broadly be defined being a systematic gathering of data and information and analysis thereto for advancement of knowledge in any subject. Research Endeavour in finding

out certain key answer intellectual and practical queries via the application of systematic methods. Webster's Collegiate Dictionary defines research as "studious inquiry or examination; especially investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws". Some people consider research as a movement, a movement from the known to the unknown (Kothari.2004).

Research methodology is an immense and regularly repetitive interaction with no make way from A to B. In any case, likewise with any sort of investigation, it is consistently worth after a way or some likeness thereof, the one that you believe is generally proper and you realize that you can adhere to. The meaning of the research methodology is a composed explanation that clarifies why your exploration was required. It's a support of the significance of your work and effect it has on your examination field, it's commitment to new information and how others will profit by it (Goddard & Melville.2004).

3.3 Questionnaire Development

Two questionnaires were developed. One: Respondents questionnaire. This questionnaire was developed on the basis of indicators extracted from Literature. It included a number of questions on the research topic and the responses were individually noted. Institutional Questionnaire. It specifically was devoted to know the responses of the employees, their capacity, over all response to the drought, their deficiencies, and internal issues and recommendations for the situation improvement.

3.4 Data Sampling

The total number of respondents interviewed was 385 after calculating from Yamane Formula. These respondents represented both the civil society as the direct consumers. They were hailing from there kinds of backgrounds in terms of livelihood/employment: government employees, private employees and otherwise. The respondents were the residents of two towns of the urban

center Quetta city: To elaborate further, Data for the evidence based research was collected through the stated two questionnaires one is run in the field and another one is applied in the institutions. The requisite data via these questionnaire tools from two layered respondents: One the employees of the relevant and responsible departments, corporations, agencies and organizations; two: the direct respondents of the urban areas of Quetta City from both Zarghoon and Chiltan towns. The following organization staff were interviewed

- PDMA, Balochistan
- Quetta WASA
- Irrigation Department, Quetta Division.

The entire data was collected from these two kinds of respondents from March to May 2021. Questionnaires as research tools for data collection were used as they are much useful to collect demographic information, personal opinions, facts, or attitudes, reasons behind a phenomenon or inquiry, the impact level and the possible suggestions from the respondents.

3.5 Significance of this Data Collection

In fact, these tools are significant in the sense that research is uniform and standardized as every respondent is asked the same questions. (Day, D., & Evers, V. (1999, May). Moreover, the institutional questionnaire was developed and data collected through it in order to know the opinions from the closer quarters and more responsible respondents. Besides, such approach to data collection provides comparatively easy, prompt and most efficient method of data collection from a plethora of information from larger groups of people. It also provides for reliability in the absence of the actual researcher (Haugejorden, O., & Nielsen, W. A. (1987). This is, moreover, a Comparative Technique (Abd-Razak, Goh Abdullah, et al., 2011; Khasnabis, Alsaïdi, Liu, & Ellis, 2002) used to analogically collect the data from two sorts of

respondents in a compare and contrast manner of the thematic areas of the various questions of inquiry. This can create a combine image to recognize the strengths and flaws upon which work needs to be done (Ramísio, Pinto, Gouveia, Costa, & Arezes, 2019).

3.6 Analysis of the Data

Mean Values have been analyzed in order to examine the responses of the consumers, their perception and how they are coping against the drought vulnerability. The indicators were split into 8 parts in order to understand their perception. The following questions were:

- General Household Characteristics
- Scaled consequences of the Drought
- Scaled Business Consequences
- Scaled Environmental consequences
- Scaled preparedness and coping measures regarding drought vulnerability
- Scaled coping strategies and measures to lessen and mitigate drought
- Institutional Response
- Miscellaneous

3.7 Data Standardization

In order to combine, accumulate and compute easily the data obtained from two kinds of questionnaires, it is standardized with a mean of 0 and a standard deviation of 1 known as *z-scoring*. The formula of z scoring is shown in the below equation;

$$z = \frac{X - \bar{X}}{s}$$

Where, X = the original value of score

\bar{X} = mean of all score

s = standard deviation

3.8 Research ethics

The ethical issues that are generally encountered in the conduct of the research work will be addressed with the following approach and plan. However, in any case, the researcher will conform to these mentioned below ethical codes (Israel & Hay 2006) whether data, research collection and organization, publishing possible issues or privacy of the respondents and study participants. Their belief in the fact that their research investigation is constrained and being defaced of that ethical practice of those regulators who do not in essence know the research in the social and other domains. In US, Canada, United Kingdom, New Zealand, Australia and other countries for example these researchers and scientists do urge that such regulators do act on the foundation of certain driven measures and arrangements making no appeal or essence to these researchers. So the question is that as to how did we reach at certain pass and point and that how they have caught themselves in certain situations that must be addressed (Israel & Hay 2006).

All the citations and data sources in this paper have been labeled, and the research does not contain published research results, which is authentic. This thesis shall be conducted in strict accordance with the socially recognized code of conduct and ethics, and shall not harm any individual or enterprise, or cause adverse impact on the society. It shall respect the privacy of others and conduct research within the scope of ethics (Bos, et al. 2009). No copy rights issue will emanate besides ensuring plagiarism free through research work. I will also ensure not to run this paper parallel with such other research and every effort will be made to make it purpose based, referring, serving, guiding to better adopt the guidance, wisdom, sagacity and empirical endeavor to reflect in their policies, practices, procedures and implementation taking all the stakeholders into account when they devise any program of developing working measures for drought risk reduction in any part of the country that is direly facing this issues and proves as a stumbling block of the lives of the locals to sustain life and local small medium enterprises.

Moreover, the participants as respondents during the phase of conducting and collecting the primary data research will be well-cared through protecting their privacy and unanimity, their physical and mental wellbeing (Sales.2000). For example, their bio-data will be collected without naming or locating their residence, institute, organization or any other status. The single purpose is academic pursuit, excellence and purpose orientation through the conduct of this fresh study with the caption:" Drought Risk Reduction in Pakistan with particular focus on the urban areas of Quetta city and its vicinity.

CHAPTER 4

4.1 Results, Analysis and Interpretation

To identify the preparedness and coping measures regarding drought. Mean Values have been analyzed in order to examine the responses of the consumers, their perception and how they are coping against the drought vulnerability. The indicators were split into 8 parts in order to understand their perception. The following questions were:

- General Household Characteristics
- Scaled consequences of the Drought
- Scaled Business Consequences
- Scaled Environmental consequences
- Scaled preparedness and coping measures regarding drought vulnerability
- Scaled coping strategies and measures to lessen and mitigate drought
- Institutional Response
- Miscellaneous

4.2 General Household Characteristics

4.2.1 Towns/City

Towns	Frequency	Percent
Chiltan Housing	185	48.1
Zarghoon Town	200	51.9
Total	385	100.0

Table 1: It illustrates the Percentages of towns.

Question no 1 to question number 2 deals with all-encompassing queries of respondents According to table 4.1, 48.1% respondents who took part in the survey belonged to Chiltan housing town whereas 200 respondents that is 51.9% of the entire respondents were from Zarghoon town.

4.2.2 Gender

Gender	Frequency	Percent
Female	145	37.7
Male	240	62.3
Total	385	100.0

Table 2: It illustrates the Percentages of Respondent Gender.

Table no 4.2.2 deals with gender of the respondents, showing that 145 out of 385 (37.7%) respondents are female and 240 (62.3%) are females. This representation is further illustrated by the flowing pie chart. Green depicts male respondents whereas blue represents the female respondents.

4.2.3 Relationship with household head

Relationship	Frequency	Percentage
Brother	40	10.4
Daughter	96	24.9
Father	25	6.5
Head	55	14.3
Husband	2	0.5
Mother	3	0.8
Sister	8	2.1
Son	123	31.9
Uncle	4	1.0
Wife	29	7.5
Total	385	100.0

Table 3: It illustrates the Percentages of Relationship with household head.

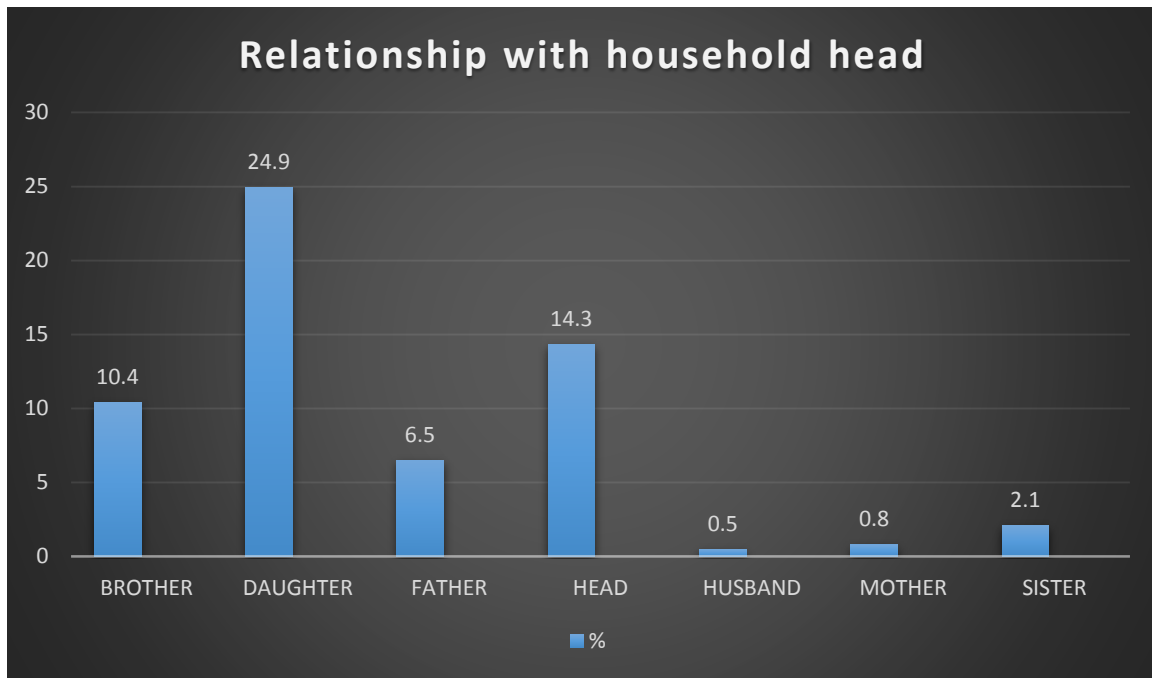


Figure 5: It illustrates the Percentages of Relationship with household head.

The table no 4.2.3 reflects upon the relationship of interviewee respondent with household's heading our survey 10.4% head's brothers are our respondent, 24.9 are head's daughter, 6.5% are head's father, 14.3% respondents are head, 0.5% are head's husband, 0.8% are head's mother, 2.1% are head's mother, 31.9% are head's son, 1.0% are head's uncle and 7.5 respondents are head's wife.

4.2.4 Main Source of Income

Nature of the Job	Frequency	Percentage
Company job	3	0.8
Daily wager	9	2.3
Govt. job	115	29.9
Industrial job	3	0.8
Others	92	23.9
Private job	133	34.5
Small business	30	7.8
Total	385	100.0

Table 4: It illustrates the Percentages of Main Source of Income.

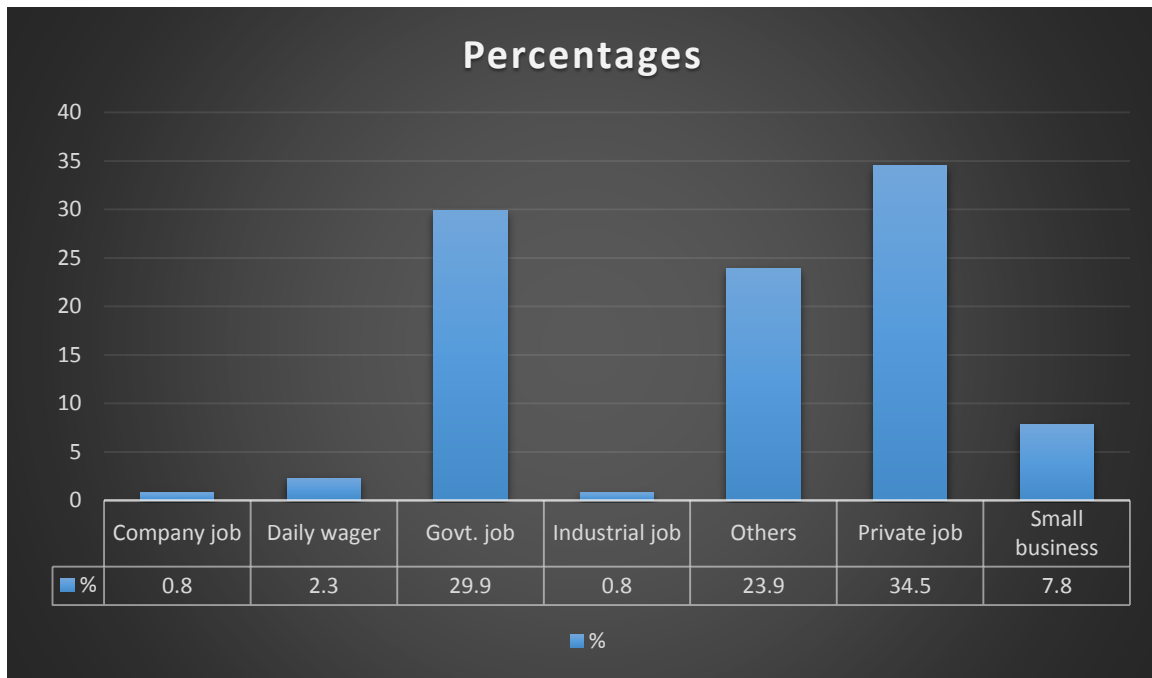


Figure 6: It illustrates the Percentages of Main Source of Income.

Table no 4.2.4 shows the respondents main source of income out of 385 respondents 3 respondents are doing job in company, 9 are daily wagers, 115 respondents doing government job, 3 respondents are working in industry, 113 respondents are doing different private jobs and 30 respondents have their own small business.

4.3 Scaled Consequences of Drought

To check the scaled consequences of drought 27 indicators were extracted from literature review and analyzed through their mean data, being 5 the highest and 1 being the lowest, the respondent who doesn't agree with the indicators.

Sr No	Description	Mean
1	Drought causes feminine	3.43
2	Drought causes poverty, hunger and diseases	3.25
3	Drought increases cost of business and unavailability of goods and services	3.24
4	Drought threatens household food insecurity and causes food scarcity	3.16
5	Drought reduces production outputs and thus causes unemployment and lower economic growth	3.15
6	Drought causes health, hygiene & Psychological issues	3.14

7	Drought lowers Imports and contract exports	3.12
8	Drought destroys habitats, degrades environment	3.07
9	Drought causes inflation and decreases People purchasing power	3.06
10	Drought increases transportation costs	3.03
11	Number of job opportunity decreases due to drought	3.02
12	Sensitivity of drought vulnerable areas is increased	3
13	Drought causes limited choices in food preferences	2.95
14	Drought causes demographic changes, migration and urbanization	2.91
15	Death rate increases due to drought	2.9
16	Drought stays longer in urban areas	2.89
17	Drought causes conflict, enmity, feuds and factions for water in society	2.88
18	Drought puts an end to developmental activities	2.83
19	Children growth problems arise	2.83
20	Drought causes reduction in household income	2.8
21	Drought causes reduction to spend on festivals, outing and recreational activities	2.77
22	Drought affects schooling of children	2.74
23	Drought worst effects are in urban and posh areas in comparison to rural areas	2.67
24	Drought causes hopelessness and sense of loss	2.57
25	Drought causes mental stress leading to possible suicidal tendency	2.57
26	Drought affects transportation	2.5
27	Urban areas have less capacity to bear drought scenario on yearly basis	2.4

Table 5: It illustrates the Mean Values of Consequences of drought.

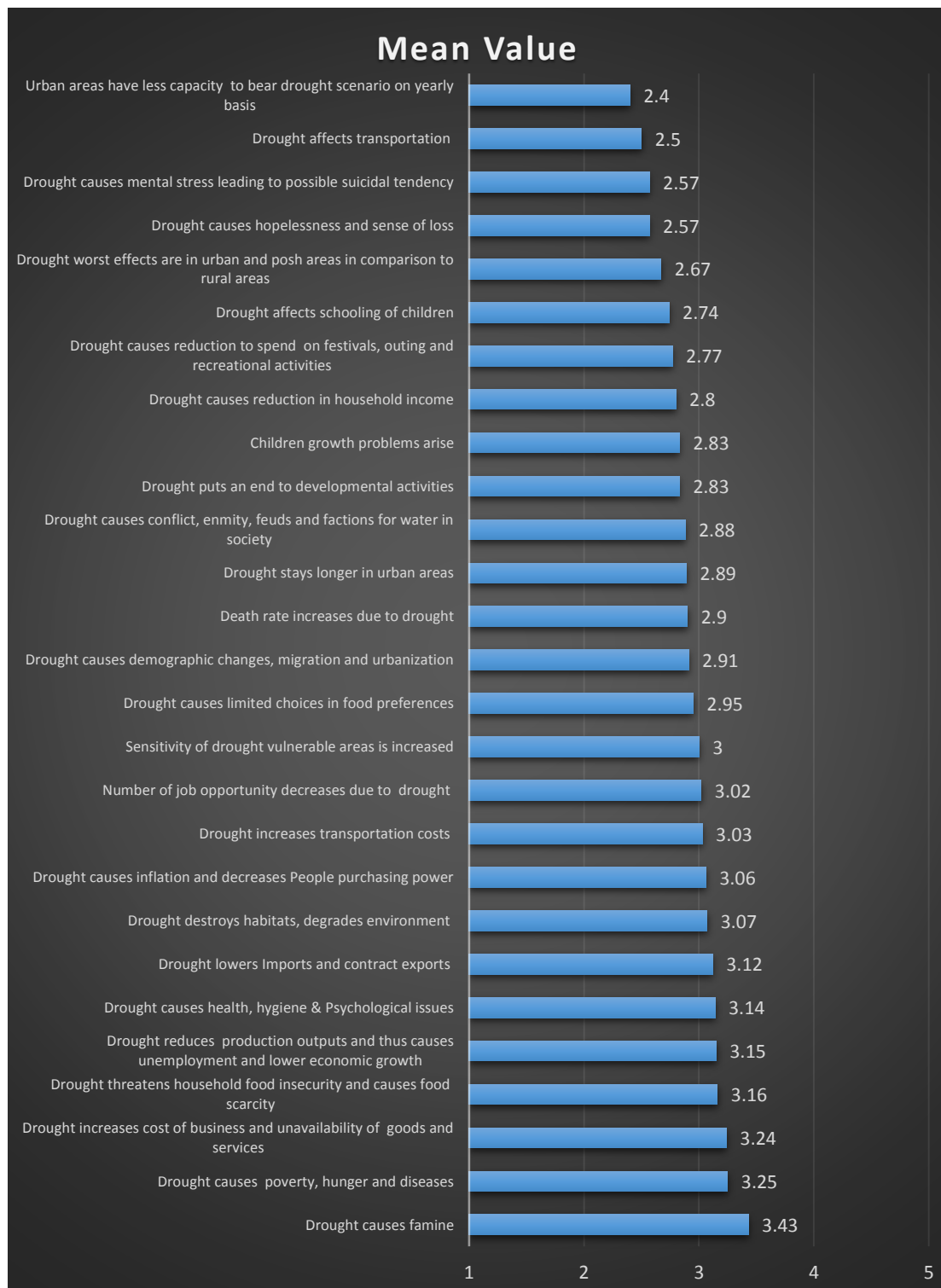


Figure 7: Illustrates the Consequences of drought

The table 4.3 describes that respondents emphasis that drought causes famine as its mean value is 3.43, they believe that due to drought poverty, hunger and diseases increases. The majority of respondents believed that Drought increases cost of business and unavailability of

goods and services as its mean value is 3.24. The respondents agreed that Drought threatens household food insecurity and causes food scarcity, it reduces production outputs and thus causes unemployment and lower economic growth, it does cause health, hygiene & Psychological issues. Respondents agreed that drought lowers Imports and contract exports as the mean value was 3.12. The respondents agreed that drought destroys habitats, and degrades environment, it also causes inflation and decreases People purchasing power. It also effects on increases on transportation costs. The respondents valued that drought affects the number of job opportunity decreases. Drought also increases sensitivity to vulnerable areas. However the majority of respondents didn't agree that drought affects transportation. The respondents didn't agree that drought causes mental stress leading to possible suicidal tendency or schooling of children's.

4.4 Scaled Business Consequences

To analyze the scaled business consequences of drought, the consumers were asked different questions regarding their business and how does it effects if drought occurs. 10 indicators were extracted from literature review and analyzed through their mean data, being 5 the highest and 1 being the lowest, the respondent who doesn't agree with the indicators.

Sr. No	Description	Mean Value
1	Do industries get sufficient water in drought year?	2.48
2	Due to drought skills decreases	2.90
3	Business Growth level decreases due to drought	2.96
4	Drought harms their customers	2.99
5	Does drought affect in less production	3.02
6	Drought reflects in poor condition of industry	3.04
7	Drought affects in lack of market	3.12
8	It affects in loss of business	3.14
9	Due to drought consumers item prices Increases	3.31
10	Business failure chances increases due to drought	3.35

Table 6: It illustrates the Mean Values of Scaled business Consequences of drought.

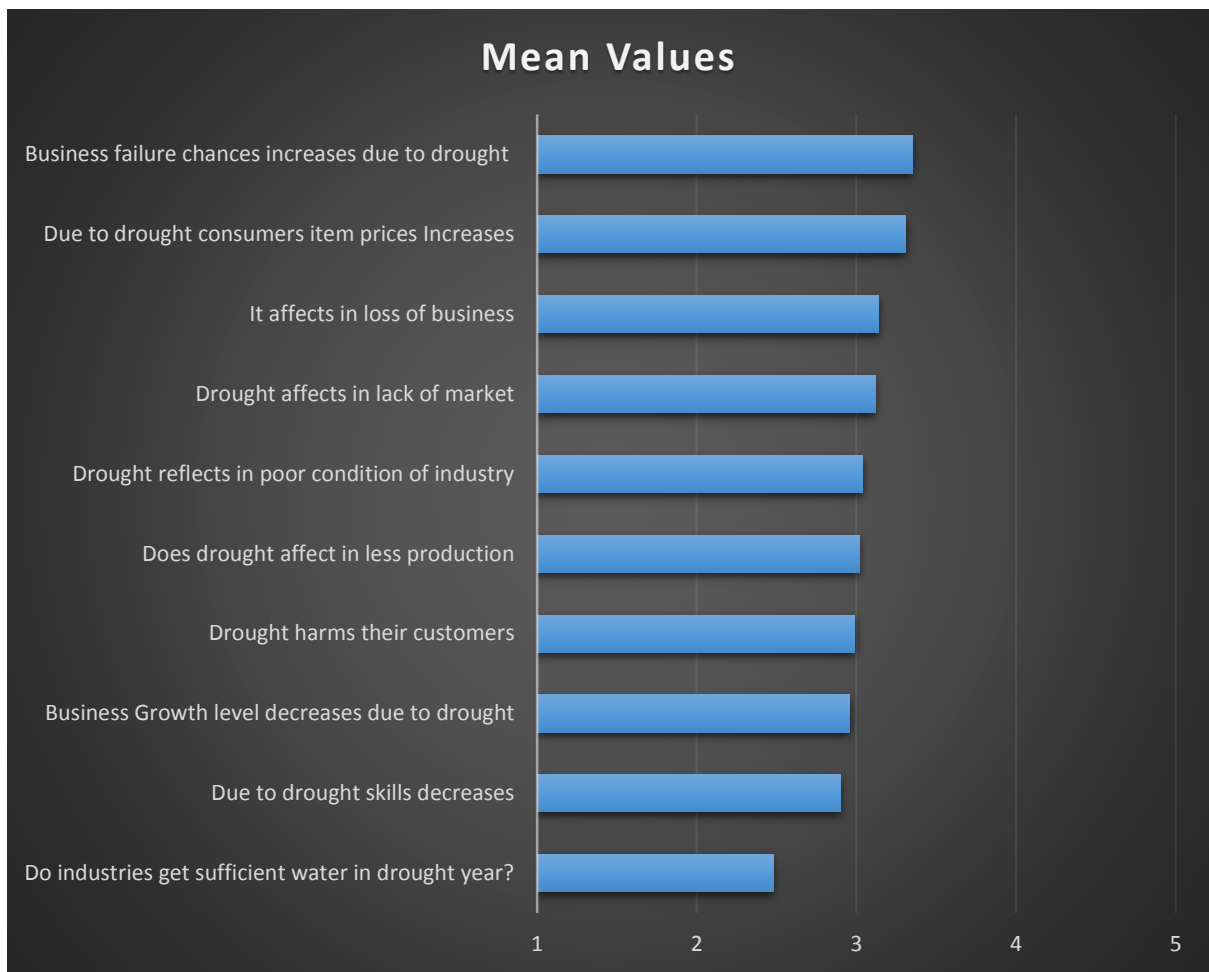


Figure 8: Illustrates the Mean Values of Scaled business Consequences of drought.

The above table depicts that business failure chances increase due to drought, the respondents had a perception that due to drought consumer item prices increases and if reflects in poor condition of drought. The respondents did agree that due to drought industries doesn't get sufficient water. Overall it can be perceived that in drought year business does effect, it had effects on business and overall economy of the city.

4.5 Scaled Environmental Consequences

To analyze the scaled environmental consequences of drought, the consumers were asked different questions regarding environment degradation and how does it effects if drought occurs. 5 indicators were extracted from literature review and analyzed through their mean

data, being 5 the highest and 1 being the lowest, the respondent who doesn't agree with the indicators.

Sr. No	Description	Mean Value
1	Does drought impacts in forest degradation	3.14
2	It Creates Water scarcity in surface water bodies	3.21
3	Does it effect in decline of groundwater levels	3.26
4	Due to Drought the water quality Deteriorates	3.31
5	Drought affects in Increase in average temperature	3.48

Table 7: It illustrates the Mean Values of Scaled Environmental Consequences of drought.

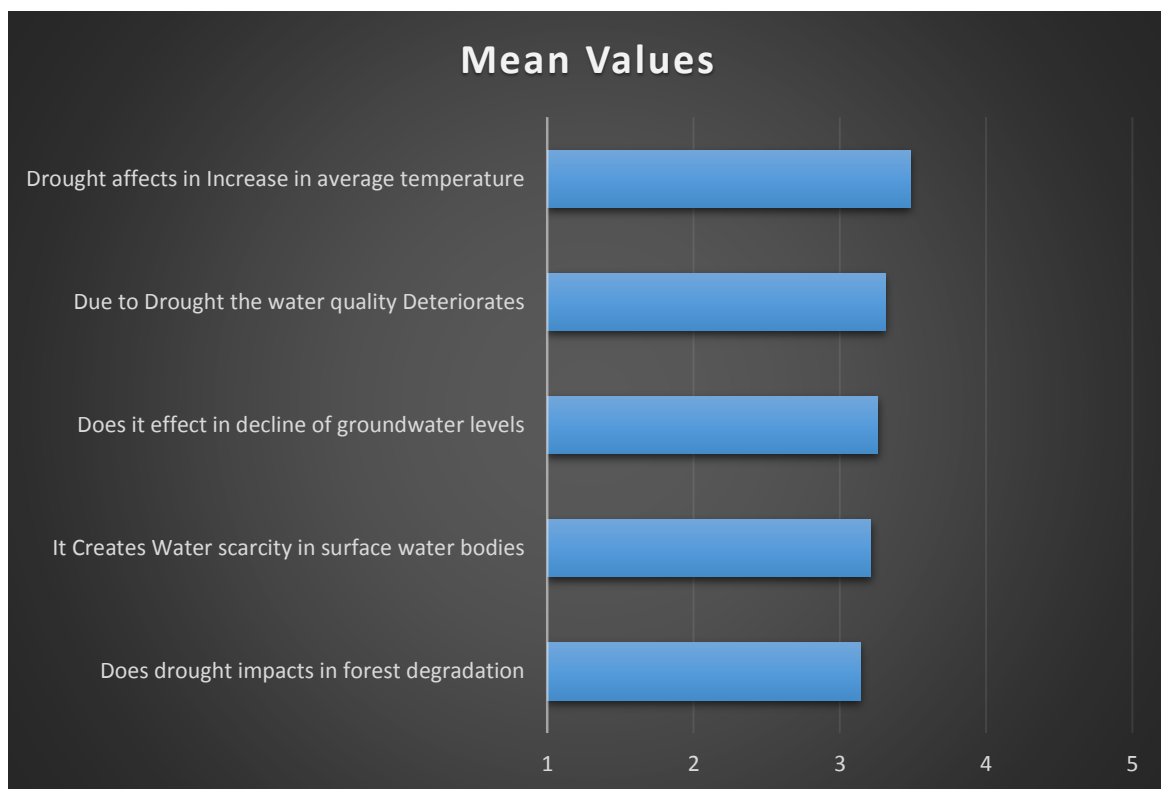


Figure 9: Illustrates the Mean Values of Scaled Environmental Consequences of drought.

The above figure depicts the scaled environmental consequences of drought as per the consumers' perception. The respondents agreed that drought does affects in increase in average temperate, the water quality deteriorates. It does affect in decline of ground water level. The respondents also believed that due to drought the water scarcity increases in

surface water bodies and it have impacts in forest degradation. The respondents agreed that drought have adverse effects on the environment.

4.6 Scaled preparedness and coping measures regarding drought vulnerability

To analyze the scaled preparedness and coping measures regarding drought vulnerability, the consumers were asked different questions regarding their preparedness level and how does they cope up with drought effects. 15 indicators were extracted from literature review and analyzed through their mean data, being 5 the highest and 1 being the lowest, the respondent who doesn't agree with the indicators.

Sr. No	Description	Mean Value
1	How is your Preparedness level to drought vulnerability	1.83
2	Have you taken any coping measures/ capacity building regarding drought vulnerability	1.87
3	Do you think droughts are becoming less frequent in last 10-12 years?	1.92
4	Does your preparation work has lessen or able to counter the worse impacts of drought?	2.04
5	Did the government has given any Incentives for improving capacity building regarding drought vulnerability?	2.18
6	Have you attended any General public education seminars on saving water	2.21
7	Have you ever experienced any other droughts	2.22
8	The government should completely reorganize the water delivery into centralized authority with obligation to provide water in return for agreed price, keeping in view the environmental safeguards, do you agree?	2.23
9	The water supplier authority is Purchasing new water rights, do you agree?	2.28
10	Do you have any Water supply schedules	2.3
11	The government is Upgrading infrastructure to cope up with drought vulnerability?	2.3
12	The water suppliers have introduced New pumping connection, new way to alternate between sources, do you agree?	2.31
13	The authorities have introduced New ways of reusing wastewater, do you think it's effective?	2.32

14	Diversifying water sources will help in mitigating drought vulnerability	2.35
15	In drought situation people Migrate for employment to other cities	2.75

Table 8: It illustrates the Mean Values of Scaled preparedness and coping measures regarding drought vulnerability .

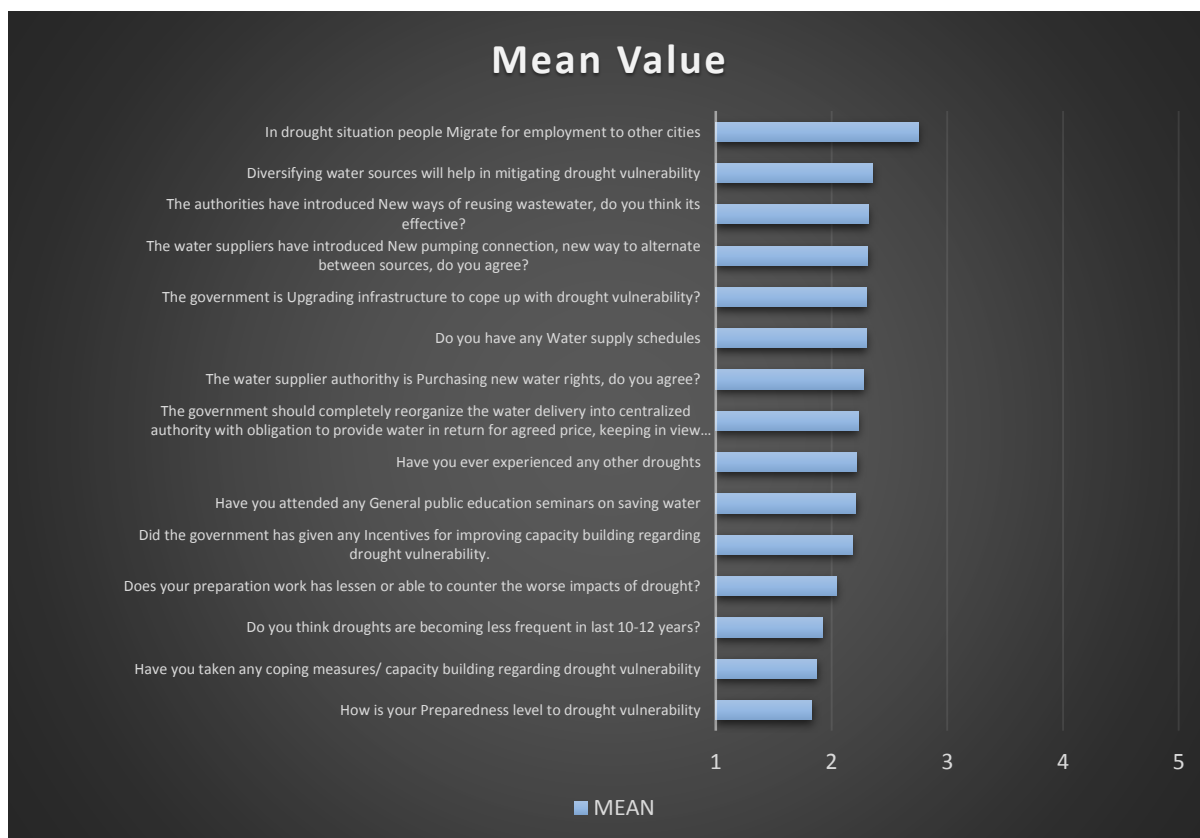


Figure 10: Illustrates the Mean Values of Scaled preparedness and coping measures regarding drought vulnerability .

The above figure illustrates the mean value of scaled preparedness and coping measures regarding drought vulnerability, the respondents were asked about their preparedness level towards drought vulnerability, majority of respondents didn't have any preparedness as their mean value was 1.83. They were asked regarding coping measures or capacity building regarding drought at which they respondent that they haven't done anything about it. The respondents replied that they haven't done any preparation work to counter impacts of

drought. They haven't attend any seminars or government didn't arranged any awareness programs regarding drought affects. The consumers didn't have any knowledge if the water supplier authority is purchasing any new rights for water distribution or to cope up with water deficiency. They respondents replied that they didn't have any water schedules. They weren't even sure that if government is upgrading overall infrastructure of water and sewerage lines to cope up drought vulnerability. Although they did agree that diversifying water sources will help in mitigating drought vulnerability.

4.7 Scaled coping strategies and measures to lessen and mitigate drought

To analyze the Scaled coping strategies and measures to lessen and mitigate drought (at administration/official level), the consumers were asked different questions regarding coping strategies level and how they measure to lessen and mitigate drought effects. 8 indicators were extracted from literature review and analyzed through their mean data, being 5 the highest and 1 being the lowest, the respondent who doesn't agree with the indicators.

Sr. No	Description	Mean Value
1	Are you satisfied with (WUAs) water supply tankers	1.59
2	Encouraging the improvement and application of seasonal and shorter-term forecasts	1.9
3	Developing preparedness plans at various levels of government	1.91
4	Adopting mitigation actions and programs	1.95
5	Creating a safety net of emergency response programs	2.01
6	Timely and targeted relief	2.02
7	Providing an organizational structure that enhances coordination within and between levels of government	2.08
8	Institutional faces challenges in water provision	2.14

Table 9: It illustrates the Mean Values of Scaled coping strategies and measures to lessen and mitigate drought

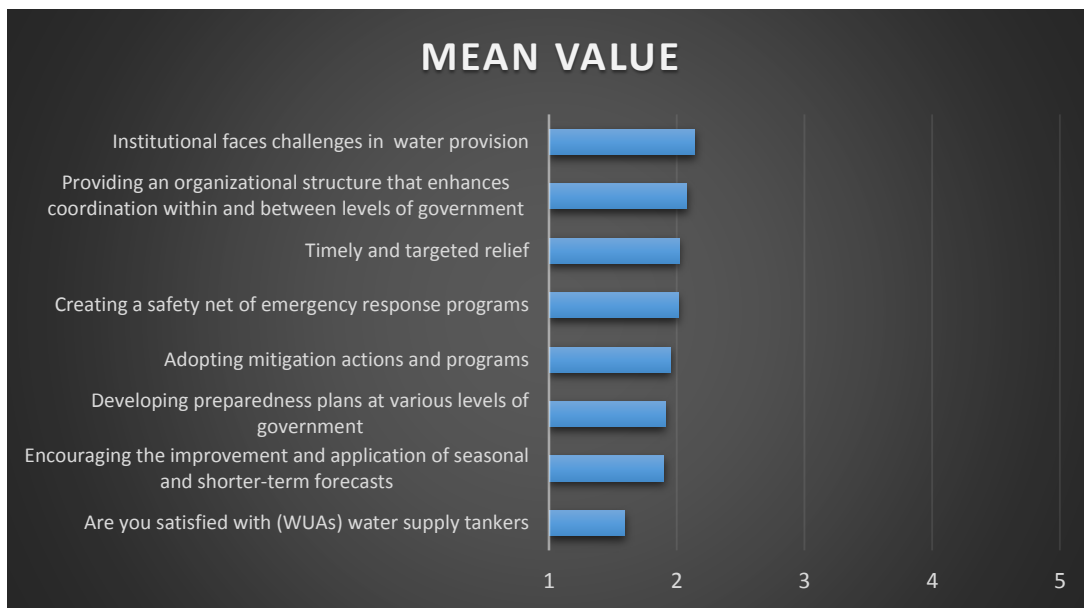


Figure 11: It Illustrates the Mean Values of Scaled coping strategies and measures to lessen and mitigate drought.

The above figure illustrates the mean values of indicators rated by consumers as how coping strategies and measures to lessen and mitigate drought are carried out by institutions, the figure illustrates that the respondents aren't satisfied with institutions as how they are dealing with drought situation. The respondents aren't satisfied with water supply tankers, they responded that the institutions are encouraging the applications of seasonal or short term forecasts. The institutions are lacking preparedness plans at various levels. The respondents believed that the institutions are lacking an organizational structure that will enhance coordination within and between levels of government. Overall the respondents weren't satisfied with the institutions as how they are building capacity and measure to lessen and mitigate drought.

4.8 Institutional Response

To interpret the institutional response, the consumers were asked different questions regarding how institutions will respond in drought effected areas. 7 indicators were extracted from literature review and analyzed through their mean data, being 5 the highest and 1 being the lowest, the respondent who doesn't agree with the indicators.

Sr. No	Description	Mean Value
1	PMD should collect and analyze drought-related information in a timely and systematic manner	3.5
2	District Disaster Management Authority should be effective to counter drought situation	3.35
3	Drought assistance should be provided through emergency response	3.34
4	Inventory data and financial resources available and identify groups at risk	3.27
5	Does NDMA provide assistance and coordinates well with PDMA	3.24
6	Does Pakistan Meteorological Department (PMD) generate information related to drought hazards	1.23
7	Will Monitoring, early warning and prediction; risk ,impact assessment and mitigation and response will be effective	3.84

Table 10: It illustrates the Mean Values of Institutional Responses

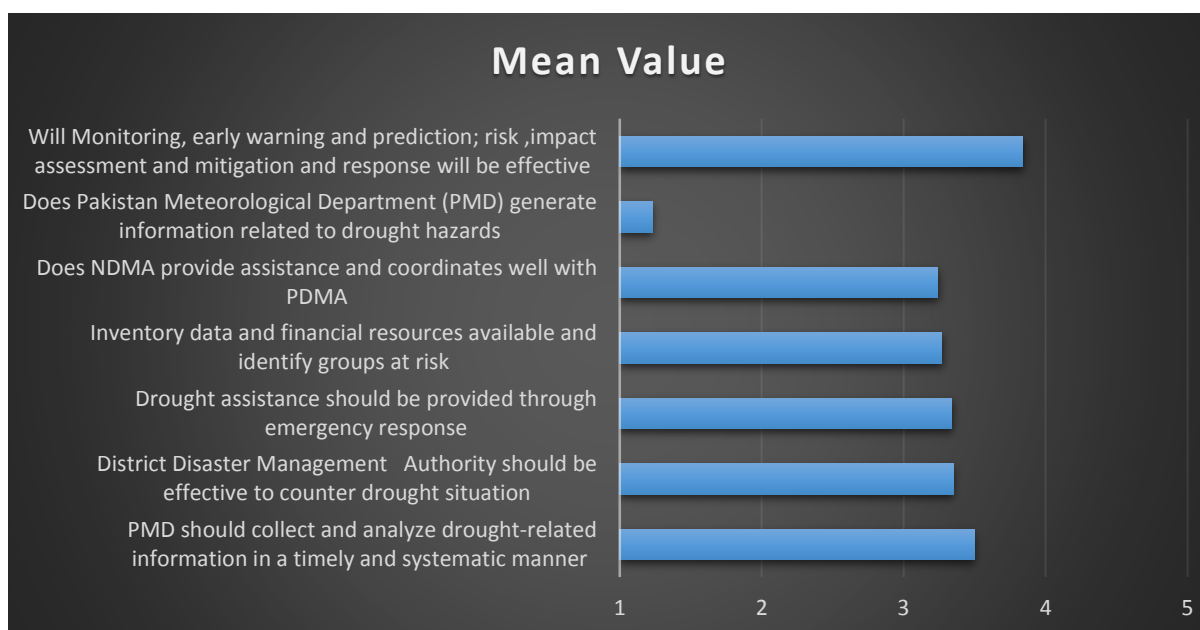


Figure 12: It Illustrates the Mean Values of Institutional Responses

The above figure illustrates how institutions should response as per consumer's response. The respondents reacted that if Monitoring, early warning, predictions, risk, impact assessment and mitigation and response will be effective if institutions responds timely. They had concerns that Pakistan Meteorological Department (PMD) doesn't generate information related to drought hazards. They respondents believed that Drought assistance should be provided

through emergency response. The consumers insisted that PMD should collect and analyze drought-related information in a timely and systematic manner with an overall mean value of 3.34. The respondents believed that National disaster management authority provide assistance and coordinates well with PDMA provincial disaster management authority.

4.9 Miscellaneous

To improve the institutional response, the consumers were asked different questions regarding how these below stated factors will be effective in mitigating drought. 5 indicators were extracted from literature review and analyzed through their mean data, being 5 the highest and 1 being the lowest, the respondent who doesn't agree with the indicators.

Sr. No	Description	Mean Value
1	Water and Power Development Authority (WPDA) maintain collection of river flows	3.05
2	Establishment of a legal framework to ensure continuous drinking water supplies during droughts.	3.02
3	Identify drought-prone areas of the state and vulnerable economic sectors, individuals or environments.	3.09
4	Raise awareness at the basic level and develop a host of preventive and mitigation measures against droughts.	3.15
5	Formulation and implementation of measures to prevent and mitigate drought impacts, including monitoring and early warning.	3.32

Table 11: It illustrates the Mean Values of Miscellaneous Questions

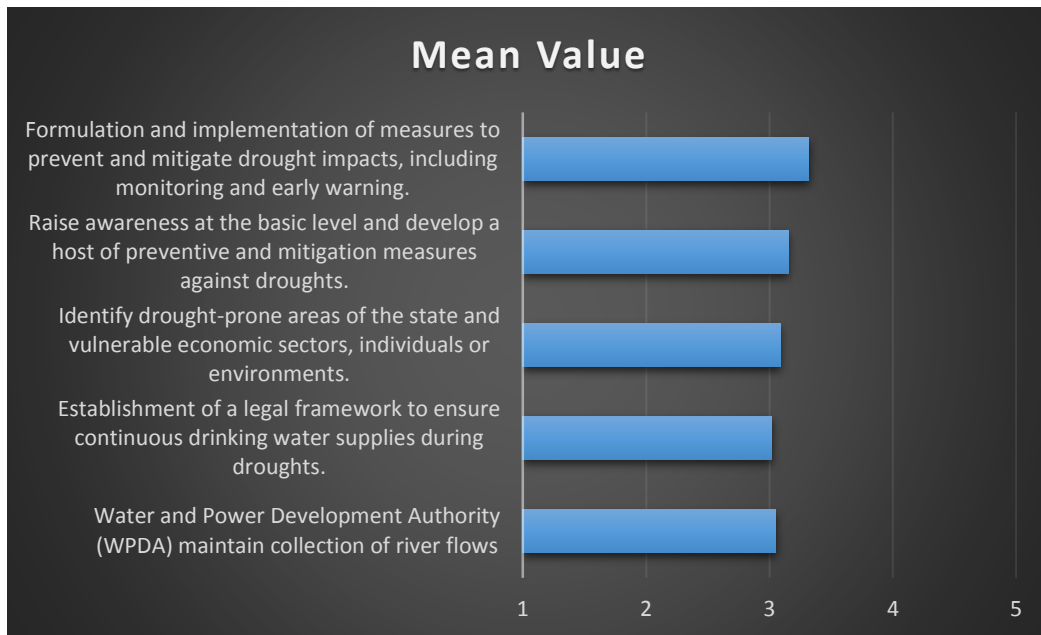


Figure 13 It illustrates the Mean Values of Miscellaneous Questions

The above figure illustrates about what step institutions should follow based on the relevant literature, the questions were asked from the consumers to record their responses. The respondents believed that the institutions should work on Formulation and implementation of measures to prevent and mitigate drought impacts, including monitoring and early warning. They agreed that at local level we should raise awareness at the basic level and develop a host of preventive and mitigation measures against droughts. The government should establish a legal framework to ensure continuous drinking water supplies during droughts. The respondents agreed that the institutions should identify drought-prone areas of the state and vulnerable economic sectors, individuals or environments. Overall it will improve to mitigate drought vulnerability and help in capacity building.

4.10 The Challenges Faced By Institutions.

To identify the challenges faced by the institutions, the following institutions were visited and a detailed questionnaire was filled from relevant heads of the institutions are

- Quetta WASA
- Irrigation Department, Quetta Division

- PDMA Balochistan

4.10.1 Quetta WASA

The office of Quetta WASA was visited and had a meeting with Director Technical Engineer Dr. Imran Durrani, they conveyed that Quetta city water requirement is 61 Million gallons for every day and they are fulfilling only 34.8 million gallons. The rest are covered by unauthorized tube wells, depleting the water level to below 1000 feet. He further stressed that they need capacity building of their staff, they have required number of staff but mostly are untrained and emphasized that many if steps aren't taken then they have to relocate the city population.

Area of Deterioration and Area of Improvement

- Timely new dams and water reservoirs were not built.
- Unauthorized tube wells in the city depleting the Ground Water Level.
- Institutional jurisdiction in taking actions against Tanker mafia.
- Haphazard expansion of the City outskirts.
- Zoning and Land use planning should be implemented.
- Decentralized waste water treatment plants to be implemented in every housing society.
- Rain water storage tanks should be in policy for Approval of buildings.

Key Policy Issues

- Jurisdiction issues in implementing plans
- Disparity in water distribution
- Reuse of Waste Water

Suggestions for Mitigating the Drought Risk Reduction

The government and WASA is already working on mitigating the issues of drought and water related issues for that:-

- 100 dams project have been initiated to cater the need Quetta as well as to comply the needs of water in the whole province.
- Decentralized waste water treatment plants have been installed in 3 places and are operational, furthermore we are in need of expanding it in the whole city.
- Improvement of Sewerage and Water supply lines needs to be addressed, so it can be utilized in the best of manner.
- Land Use zoning are in process and needs to pace up before we face drought situation
- Constructions activities needs to be controlled.

Key Implementation Issues

- Lack of Financial issues and skilled human resource
- Community based trainings are required to educate the people for Usage of Water.
- Escalation of Cost of construction in building Decentralized waste water treatments and Dams, which causes delay in timely completion of these projects.
- Non submission of Water and sewerage utility bills by the end users.

Future Planning and Contingency

- 100 dams have been proposed in which 40 dams are tendered by Irrigation department in coordination with Quetta WASA.
- Action against unauthorized tube wells will be taken, it is already presented to the higher management.
- Sewerage and Water distribution networks is being addressed and research work is in progress as how to mitigate the flaw
- Decentralized waste water treatment plants have planned to re-use the waste water of the whole city and can be utilized for agriculture purpose or for plantation.

4.10.2 Irrigation Department, Quetta Division

The Irrigation department was visited and had a meeting with Executive Engineer Quetta Division Ahmed Jamali, Mr Jamali conveyed that this department was formed in 1970s and aim of the department is monitoring/ collection, compilation of water quality and hydro meteorological data planning design and construction of delay action dams, storage dams, perennial and flood irrigation drainage schemes. The institution have been able to provide water supply schemes either by installing tube wells or small dams. Quetta has a Semi-Arid Cold weather, but due to climate change the temperature have of Quetta have risen drastically. The city is dependent on tube wells, previous the water was supplied from Wali Tangi Dam, but due to exponential growth in population and rise in climate change the water requirement boosted. Right now we have more than 100 tubewells operated in the urban center. Amid the alarming situation of depleting ground level, the government initiated 100 dams project for the whole province to cater the needs to drinkable water as well as for agriculture use. The department has the required technical staff as well as the capacity to look after these projects and make sufficient.

Area of Deterioration and Area of Improvement

- Public Awareness
- Negligence in Maintenance of existing dams and reservoirs
- Drip irrigations needs to be promoted and training of farmers are required.

Key Policy Issues

- Proper scheduling of programs
- Financial issues due to escalation of materials
- Governance
- Integrated approach is required in water resource management
- Reform water tariffs and cost recovery

- Increase investment in water infrastructure

Suggestions for Mitigating the Drought Risk Reduction

- Develop delay action dams, storage dams where possible, built storage for reserve tanks.
- Improvement of livelihood resources to the advanced studies
- The residential houses should be designed in accordance with climate and water scarcity of the locality
- Improvement of forestation
- Trainings required to the community so they utilize water in efficient manner.

Key Implementation Issues

- Financial/Resource Issues
- Jurisdiction issues
- Transportation to the site
- Land infrastructure is not present to many water reservoirs
- Cost of supply from source to distribution

Future Planning and Contingency

- De centralized waste water treatment plants to be installed in whole balochistan
- Drip irrigation system should be introduced and
- Introduction to Disaster management policy

4.10.3 PDMA Balochistan

The office of PDMA Balochistan was visited and had a meeting with Manager Disaster Management Ahad Ali, he conveyed that they have a total 354 people staff. They right now need capacity building of their organization, technical staff is lacking. The key institutional issues were their requirements are not fulfilled by the organization, they don't have required

human resource, and they receive a 40 percent deficient budget to carry out disaster mitigation works. The drought situation have already been discussed with related departments and mitigation strategies are in process. The other issues are as under

Area of Deterioration and Area of Improvement

- They need human resource building
- Rational utilization of available budget
- Lack of technical human resource
- Lack of research based studies

Key Policy Issues

- Preparedness of Pre disaster measurements
- Training of Technical Staff to advancement of efficient rescue/ relief activities
- Advanced rescue center development in each district of Balochistan
- Development of Disaster villages at divisional level

Suggestions for Mitigating the Drought Risk Reduction

- Develop delay action dams, storage dams where possible, built storage for reserve tanks.
- Improvement of livelihood resources to the advanced studies
- The residential houses should be designed in accordance with climate and water scarcity of the locality
- Improvement of forestation
- Immerge trainings to the community so they can meet the situations of drought

Key Implementation Issues

- Financial/Resource Issues
- Lack of Pre disaster studies
- Lack of technical staff

Future Planning and Contingency

- Disaster issues trainings and studies are planned
- Introduction to Disaster management policy

4.11 Drought risk reduction measures

- **Drought Preparedness**

This segment of the task will set up the networks to react during the crisis for convenient help to save human lives, job/domesticated animals, and framework. The significant exercises incorporate neighborhood limit building/institutional turn of events, mass scale instruction and mindfulness raising, school wellbeing plans and mindfulness raising, local area early admonition frameworks, help (Shrestha, 2018) and coordination with government line divisions and key entertainers for calamity hazard decrease and support exercises with government at tehsil, region, common and public level, preparing of chosen local area individuals on CBDRM, medical aid preparing, search and salvage preparing, improvement of catastrophe, the executives plans at UC and town level, recreation works out, mock drills, mix of debilitated individuals, ladies, kids and minorities in the CBDRM exercises (Nareth, 2016).

An established policies and specified plans and activities should be taken before drought to prepare people and enhance institutional and coping capacities, to forecast or warn of approaching dangers, and to ensure coordinated and effective response in a drought situation (contingency planning)

- **Drought Mitigation**

Any structural/physical measures (e.g., appropriate crops, dams, engineering projects) or non-structural measures (e.g., policies, awareness, knowledge development, public commitment, and operating practices) undertaken to limit the adverse impacts of drought.

- **Drought Response**

Efforts such as the provision of assistance or intervention during or immediately after a drought disaster to meet the life preservation and basic subsistence needs of those affected people. It can be of an immediate, short-term, or protracted duration

- **Drought Recovery**

Decisions and actions taken after a drought with a view to restoring or improving the pre-drought living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce drought risk.

Furthermore early warning system and information delivery system should be incorporated at the institutional level. An integrated monitoring system of depleting ground level water should be adopted. Research studies should be conducted on risk and impact assessments of vulnerable areas. Coping capacity should be increased by incorporating installing de centralized waste water treatment plants, rain water storage tanks should be incorporated in the bylaws of any building. Solar and wind powered water pumps should be introduced for wells and boreholes. Maintenance and improvement is required of the existing canals and karez (impervious linings, covers). The government should introduce drought resilient crops and livestock for food, fiber and forestry. Modern agriculture techniques such as drip irrigation, cover crops and stone mulch, integrated crop-livestock production and agro-forestry should be introduced.

- **Estimation of drought**

Aridity index is a proportion of half likelihood of precipitation and yield evapotranspiration. In light of the aridity index, aridity classes were sorted as “humid, sub-humid, semiarid, arid and hyper-arid and agro-climates”. The “GIS programming Arc” information was utilized for data-

set development and spatial investigation. In light of the aridity, four classes of dry season inclined territories serious, high, moderate and low were recognized. The dry spell inclined regions were grouped dependent on the aridity list of each region. Another model, percent family units, approaching funneled water supply was utilized to additionally describe the dry spell inclined regions. Regarding the two measures, the Baluchistan and parts of Sindh regions were positioned as “severely affected” (Adnan et al., 2018).

- **Water harvesting and preservation strategies**

Water gathering is a typical practice in bone-dry zones of both Sindh and Baluchistan areas. Water gathering catches precipitation and overflow and uses it for drinking and cultivating either straightforwardly or by solid it in little surface and subsurface supplies. The reserved water can be utilized for supplemental water system and other consumptive uses as well (Sivanappan, 2006).

- **Water ponds and capacity tanks**

The accessible water sources in mountains and deserts of Baluchistan have regularly a little release and the immediate utilization of this low stream brings about higher movement and application misfortunes. A standard size water lake is a fundamental part of a corps’ framework all through Baluchistan (García-Ávalos et al., 2018).

- **Urban water preservation and effectiveness**

Maturing framework broken meters, disintegrating pipes, flawed water mains costs the trillion gallons loss of drinkable water annually. Meanwhile, a solitary broken fixture delivering only three trickles per minute squanders > 100 gallons of water in a year. States, urban communities, water utilities, organizations, and residents can control water squander by putting resources into environment savvy procedures (Farsani, Jamshidi, Mortazavi, & Eslamian, 2021). These incorporate fixing defective infrastructures, boosting water productivity with the utilization of water and energy effective advances and apparatuses, (for example, garments washers) and

embracing landscape design that utilizes dry spell open minded plants and water-efficient water system methods. Most of the developing countries in utilize these procedures alone could diminish water use by as much as 60%. For individuals, there are also numerous alternate approaches to ration water too (Bello, Michael, Maliki, & Azor, 2020).

Chapter 5

5.1 Conclusion and suggestions

In light of the study results shown above based on household survey the results indicated that they have the knowledge about drought they do but aren't prepared for any catastrophe. The institutions are already working on drought mitigating strategies building dams and decentralized waste water treatment plants and will be able to cope up any situation of drought in the coming years. The water scarcity issues will also be resolved in the near future. They institutions are lacking skilled human resource and have financial constraints, and jurisdiction issues.

5.2 Suggestions

To trace the genesis of drought in the urban areas of Pakistan including the urban areas of Quetta as our study area is the most comprehensive and effective way to bring under control drought in these metropolitan areas. As a matter of fact this requires a world and national response to mitigate climate change through the introduction and application of replenish-able sources of energy such as kinetic, solar and bio-diesel. Green businesses in the domain of energy must be a worldwide drive and goal. The world must honor Koyoto protocol and Paris Agreement to bring to the least level CO₂, CFC, methane and profane to produce energy. A thorough worldwide transformation of energy production will meaningfully address the climate change issue and thus drought will end.

At the local level and in context of Pakistan adopting the measures of careful use of water, exploitation of groundwater, purchase of water from tube wells, improvements in cultural practices, and better overall management such as judicious distribution of water to all the consumers of the urban areas of Quetta will partly address the issue. Moreover, small dams at

local level that can contain and sustain rain water are the noble idea to counter drought in the target area.

Gaps identification in the institutional and policy domains is a must to effectively deal drought situation in the urban areas of Pakistan. The remedial measures suggested thus must be backed up by authentic and case to case and area to area research for which special and specific but integrated solutions should be there. Then a whole package signifying the key set of actions of drought mitigation must be applied in drought affected areas including the target areas of this research. Internally the lessons learnt must be documented through which further rectification and improvement can be effected. As part of this approach there is a need to develop a policy for access to information related to drought and water management. India and Iran have succeeded much in this regard and Pakistan can emulate her practices.

Institutional remedial measure also necessitates the availability of a comprehensive drought-mitigation infrastructure and strategy at the federal and provincial levels. Institutional arrangements and their capacities must be inadequate at both the federal and provincial levels to meaningfully put in place the early warning systems, preparedness and contingency plans, and rehabilitation measures once drought strikes the study areas. These arrangements are the most important as at district and divisional level where our target areas do fall have no existence of these arrangements. In fact in terms of these arrangements our study areas have been the weakest ones. Moreover, a national, provincial and district level initiative is a must to further assess on regular basis the present institutional setups and mechanisms for drought mitigation and build an effective structure and mechanisms. More importantly a National Drought Policy must be formulated and implemented with an apex firm to plan, coordinate and monitor the policy interventions at all the levels. The firm must be empowered to enable framework to the provincial and district governments with a purpose of motivation to further trickle down the program of drought mitigation at sub division,

union council and village council levels to provide linkages and coordination among the line departments and the district governments that are directly responsible for drought mitigation.

Quetta urban areas are not developed and there are packs of agricultural lands affected by drought that has further reinforcing impact owing to the excessive exploitation of groundwater. Moreover, water tables of the area declined massively. Communities that are involved in agricultural practices must be locally involved in the campaign of recharging the aquifers and in the conjunctive use and management of surface water and groundwater resources. This will lessen the severity of drought. Moreover, endeavors are necessary to assist farmers in efficient conveyance and application of pumped groundwater. They need encouragement to utilize locally waters harvesting technologies for sailaba (spate irrigation) and khushkhaba (localized runoff farming) areas. Such system of water distribution if connected with recharging the groundwater potentially provides cost-effective interventions to mitigate the impacts of drought shown above in the scaled consequences.

Moreover, in our target areas wherefrom the data has been collected a number of drought mitigation steps can be effectively undertaken such as, but not limited to, watercourse improvement program, laser leveling, furrow-bed irrigation, skimming wells and salinity management. Sprinkler and drip irrigation systems can further reinforce the drought mitigation strategy in the local context. India, Iran, China and other countries have been the successful models that Pakistan can also successfully emulate. This experience can be applied in other parts of the country as regards the urban, posh and metropolitan areas. Pakistan can ally with other countries to have regional research and development program for drought and water management.

Moreover, Quetta urban areas of this research are fertile for orchard development owing to its humidity level, topography, sun rays, and topography so on so forth. Drip and sprinkler

irrigation systems can be allied with alternative sources of energy in the form of submersible pumps to pump out water and irrigate the proposed orchard development initiatives. These orchards must also require drought resistant and water resistant species such as pomegranate, walnuts, pistachio so on so forth. Jatropha or the bio-diesel plant is the water and heat resistant specie that can be introduced in the target areas. Bio-diesel plants can be imported from Brazil that has successfully planted these plants in the likewise environment. This orchard development initiative can be termed as Sustainable Plains, Development Program (SPDP). This will address the drought mitigation issue by bringing greenery and plantation and will use least water with the application of the said strategy.

Institutional response can further be improved via empowerment, recruitment of the best learning hands and minds, funds allocation, transparency, accountability, efficiency and good governance. The responsibilities must be fixed and parts and components of drought risk reduction must be shouldered as per that fixation of responsibilities. The issues of promotion, transfer, capacity development and gape filling must be seriously looked into. Political involvement must be checked. A performance tracking system via the system of interval monitoring and evaluation must be in place.

The federal government has embarked upon the Billion Trees Tsunami program. This is a timely initiative that can check drought by leaps and bound. This also promotes anti climate change initiatives that in turn spur drought and the likewise scenarios. This program must be extended to the urban areas of Quetta as so far its focus is hilly areas and areas that are rural and remote. So this program must be extended to the target area to mitigate the risks of drought in the areas.

6) Appendix

Research Brief Letter and Research Questionnaire

Form no.....

Date:/...../.....

Research Brief:

I am Shehroze Shah, a student of NUST H-12 Campus in Department of Urban and Regional Planning (URP). I am conducting Master Research captioned:" Drought Risk Reduction in Pakistan" with the following Research Objectives:

- To identify the preparedness and coping measures regarding drought.
- To identify the challenges faced by institutions in providing water to all the consumers.
- To suggest drought risk reduction measures

This will help assess drought vulnerable areas; identify the preparedness and coping measures to mitigate the drought risk in urban poor and vulnerable areas; identify the key challenges that the responsible institutions direly face in provision and distribution of water in water-scare terrains and will help urban and regional planners to meaningfully propose and implement the drought risk reduction measures. I am collecting the primary data on the below research tool to all these ends.

Questionnaires

General household characteristics

1. Village details:

Name:Block/Taluka:

District:

2. Respondent details

Name: Gender: (M/F).....Age:

Education: Relation with house head:

Category:Housing:..... Mobile:

.....

3. What is the main source of income?

Govt Job	Private Job	Industrial/company Job	Laborer, Daily Wager	Small Business Enterprise	Other

4. Employment amongst different age groups

	Gender	Male			Female		
Employment							
	Unemployed						
	Unpaid family worker						
	Self-employed/small business						
	Wage/salaried						
	Others						

5. Scaled consequences of the Drought

Sr. No	Scale	Higher	High	Medium	Low	Lower
1	Drought cause famine					
2	Drought longer spill occurs in urban areas					
3	Sensitivity of drought vulnerable areas					
4	Urban vulnerable areas' capacity to bear drought scenario yearly					
5	Drought worst effects are in urban and posh areas in comparison to rural areas					
6	Drought affects transportation					
7	Drought increases transportation costs					
8	Reduces production outputs and thus causes unemployment and lower economic growth					
9	Lowers Imports and contracts export					
10	Drought increases cost of business and unavailability of goods and services					
11	Drought causes inflation and influences People Purchasing Parity					
12	Drought causes poverty, hunger and diseases					
13	Drought destroys habitats, degrades environment					
14	Drought causes health, hygiene Psychological issues					
15	Drought puts an end to developmental activities					

16	Number of opportunity decrease due to drought					
17	Drought threatened household food security and causes food scarcity					
18	Drought caused no choice in food preferences					
20	Drought caused reduction in household income					
21	Drought causes reduction to spend on festivals, outing and recreational activities					
22	Drought causes demographic changes migration and urbanization					
23	Drought affected schooling of children					
24	Drought caused hopefulness and sense of loss					
25	Drought causes conflict, enmity, feud and faction for water in society					
26	Death rate increase due to drought					
27	Children growth problem arise					
28	Drought causes suicidal tendencies					

6. Scaled Business Consequences

Sr.No	Scale	Higher	High	Medium	Low	Lower
1	Business failure chance increase					
2	Loss of business					
3	Increased prices					

4	Harm their customers					
5	Poor condition of industry					
6	Do industries get sufficient water in drought year?					
7	Less production					
8	Growth level decreased					
9	Skill decreased					
10	Lack of market					

7. Scaled Environmental consequences

Sr. No	Scale	Higher	High	Medium	Low	Lower
1	Increase in average temperature					
2	Forest degradation					
3	Water scarcity in surface water bodies					
4	Decline in groundwater levels					
5	Deteriorated water quality					

8. Scaled preparedness and coping measures regarding drought vulnerability (Personal/individual level)

Sr. No	Scale	Higher	High	Medium	Low	Lower
1	Have you ever experienced any other droughts					
2	Do you think droughts are becoming less frequent in last 10-12 years?					

3	Preparedness level to drought vulnerability					
4	If yes what individual coping measures regarding drought vulnerability					
5	Does your preparation work to lessen and counter the worse impacts of drought?					
6	Migration for employment					
7	Seek alternative source of income					
8	Watering schedules					
9	Incentives for Permanent fixture or landscaping changes					
10	General public education on saving water					
11	New pumping connection, new way to alternate between sources					
12	Diversifying water sources					
13	Upgrading infrastructure					
14	Purchasing new water rights					
15	New ways of reusing wastewater					
16	Complete reorganization of water delivery into centralized authority with obligation to provide water in return for agreed price, and environmental safeguards					

C

9. Scaled coping strategies and measures to lessen and mitigate drought (at administration/official level)

Sr. No	Scale	Higher	High	Medium	Low	Lower
1	Institutional challenges in water provision					
2	Are you satisfied with (WUAs) water supply tankers					
3	Encouraging the improvement and application of seasonal and shorter-term forecasts					
4	Developing preparedness plans at 5 various levels of government					
5	adopting mitigation actions and programs					
6	Creating a safety net of emergency response programs					
7	Timely and targeted relief					
8	Providing an organizational structure that enhances coordination within and between levels of government					

10. Institutional Response

Sr No	Scale	Highly Satisfied	Satisfied	Neutral	Unsatisfied	Highly Unsatisfied

1	Does Pakistan Meteorological Department (PMD) generate information related to drought hazards					
2	Does PMD collect and analyze drought-related information in a timely and systematic manner					
3	Is drought assistance provided through emergency response					
4	Does NDMA provide assistance and coordinates well with PDMA					
5	Is District Disaster Management Authority effective to counter drought situation					
6	If no, does this challenges provincial harmony					
7	Will national Drought Management Policy Commission (DMPC) work					
8	Inventory data and financial resources available and identify groups at risk					
9	Will Monitoring, early warning and prediction; risk ,impact assessment and mitigation and response will be effective					

11. Miscellaneous

Sr No	Scale	Highly Satisfied	Satisfied	Neutral	Unsatisfied	Highly Unsatisfied
1	Water and Power Development Authority (WPDA) maintain collection of river flows					
2	Raise awareness at the basic level and develop a host of preventive and mitigation measures against droughts.					
3	Formulation and implementation of measures to prevent and mitigate drought impacts, including monitoring and early warning.					
4	Establishment of a legal framework to ensure continuous drinking water supplies during droughts.					
5	Identify drought-prone areas of the state and vulnerable economic sectors, individuals or environments.					

Institutional Questionnaire

B) Research Brief:

I am Shehroze Shah, a student of NUST H-12 Campus in Department of Urban and Regional Planning (URP). I am conducting Master Research captioned:" Drought Risk Reduction in Pakistan" with the following Research Objectives:

- To identify the preparedness and coping measures regarding drought.
- To identify the challenges faced by institutions in providing water to all the consumers.
- To suggest drought risk reduction measures

This will help assess drought vulnerable areas; identify the preparedness and coping measures to mitigate the drought risk in urban poor and vulnerable areas; identify the key challenges that the responsible institutions direly face in provision and distribution of water in water-scare terrains and will help urban and regional planners to meaningfully propose and implement the drought risk reduction measures. I am collecting the primary data on the below research tool to all these ends.

C) Personal Informatics

Age bracket you do fall in?

20-29

30-39

40-49

50-59

60 plus

C.A) Gender

- ❖ Male
- ❖ Female

C.B) Institution

Name	Quetta WASA	Irrigation	Other

C.C) Characterization of Occupation

Engineer	Manager	Programmer	Implementer
Admin/Officer	Water Distributor	Repairer	Other

D) Institutional strength

Total Staff	Further Requirement	Nature of Staff Requirement	Water Distribution capacity in cusecs or cubics
Household it covers up %	Daily Supply Requirement	% they meet	

E.2) what are the key institutional issues?

Does not fulfill the requirement	Lack of institutional capacity	Human resource/capital needs	Corruption & Lethargy
Resource scarcity/deficient annual budget	Lack of responsibility streamlining	Lack of proper coordination	

A) Areas of deterioration and areas of improvement

- 1)
- 2)
- 3)
- 4)
- 5)

B) What are the key policy issues of your institution?

- 1)
- 2)
- 3)
- 4)
- 5)

C) What are the key implementation issues of your institution?

1)

2)

3)

4)

5)

D) Future planning and contingency?

1)

2)

3)

4)

5)

E) Your suggestions for mitigating the drought risk reduction?

1)

2)

3)

4)

5)

F) What challenges faced by institutions in providing water to all the stakeholders

Governance	Financial	Planning
Political middling	Corruption	Lack of Human Resource

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