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A CASE STUDY OF FLOODS AND ITS IMPACT ON AGRICULTURE, LIVESTOCK AND INFRASTRUCTURE IN BALOCHISTAN, PAKISTAN

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ABSTRACT

Due to climate change, Pakistan is still under serious threats of floods causing severe damage to seeds, crops, and cotton including basic infrastructure like homes farmland, and irrigation infrastructure pushing away people from poverty causing some serious damage to the economy. This study aims to extensively examine the relationship between flood, agriculture, infrastructure, and livestock. Employing a random sampling methodology, we gathered data from a diverse sample of 381 individuals from Baluchistan province, mainly from district Killasaifullah and tehsil Muslimbagh. Data is collected through structured questionnaires and subsequently subjected to rigorous analysis utilizing the SPSS. The outcomes of this research highlight a meaningful connection between flood, agriculture, infrastructure, and livestock. research findings help enrich the literature review and policymaking.

Keywords: Floods; Impact; Agriculture; Livestock; Infrastructure; Balochistan.

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INTRODUCTION

Natural resources like Water Rivers and rain cannot be stopped. Flood occurs when rivers overflow due to heavy rainfall. Pakistan has faced several massive floods since its independence. Pakistan's main river' the Indus River connects Jhelum, Chenab, Ravi, and Sutlej and then flows into the Arabian Sea considered to be the only main river in Pakistan by which the land of Pakistan is considered to be settled. Without the Indus River Pakistan's land would have been totally drought. Flooding in the Indus River is caused by heavy rainfall in monsoon seasons supported by climate change. The floods in 2010 are considered one of the most massive and dreadful floods in the history of Pakistan. As per reports, 2000 deaths were reported during this incident (Dorosh et al., 2010). Around a loss of 765 billion \$ cost was reported (Arshad & Sahafi, 2010). The floods of 2010 caused some serious damage to crops like seeds, crops, and cotton including basic infrastructure like homes farmland, and irrigation infrastructure pushing away people from poverty causing some serious damage to the economy. Pakistan's economy is dependent on agriculture which shares 23% of GDP to the economy.

In the 21st century, Pakistan is still an underdeveloped country. Flood occurs when rivers overflow due to heavy rainfall. Its economy is crashing day by day. In this era of economic competition, no country would like to stay behind other countries. Floods of 2010, 2011, and 2014 destroyed the agricultural sector of Pakistan. Pakistan's agriculture is highly dependent on climatic conditions. Change in climate is mostly due to pollution and pollution is caused by gases like CO₂, CH₄, and nitrous oxide which cause changes in the

pattern of the rain, changes in temperature, negative effects on the water, and resources, and also bring drought. This study also reveals that increasing temperature and changes in the pattern of the rain directly upon the production of the crops. Study reveals that production of wheat will decrease by 50% in Asian countries (Sajjad et al., 2017).

In Pakistan climate change is considered one of the biggest disasters because of its vulnerabilities to climate change and reducing risk from occurring any natural event. Study reveals that Himalaya glaciers will melt by 2035 which may result in droughts and floods. Climate change is considered a globally challenged problem. Moreover, its impact is highly considered in the developed countries. This chapter commended with background of the research which shows that poverty has been the main issue for a long time among the world nations. For the development of any country, the first step for the country is to minimize poverty. This research will fill the gap in knowledge. Research questions and objectives are also described in this chapter that will determine the problems faced by Pakistan due to climatic change. Last but not least, this paper will also designate the possible outcomes of this research.

Pakistan has faced a lot of natural disasters like earthquakes, floods, and droughts but floods have caused a lot of damage to Pakistan's economy. Estimated loss is around 18 billion dollars caused by floods (Parker, 2014). Since 2010 Pakistan has been facing monsoon deadly floods and till now approximately 2.5 million people have been affected. Their homes were destroyed, their lively stock was killed, and their crops were destroyed (Sajjad et al., 2017).

Climatic change is due to the greenhouse effect mainly caused by carbon dioxide, nitrous oxide, and methane which cause the change of pattern in monsoon rainfall. Due to UN-balanced monsoon rainfall, it causes heavy rainfall which results in floods. Pakistan is one of polluted and densely populated countries in the world. Severe and late monsoon rainfall disturbed Pakistan's economy to an extent. Massive water from the Chenab River resulted in floods in AJAK, Baluchistan, Punjab, and Sindh (Rehman et al., 2016). Climate change is one of the biggest issues that is faced by the whole world but its impact is more on developing countries like Pakistan because Pakistan is very dependent on agriculture and most of its income is from crops like wheat, rice, and sugarcane. Since 2010, Pakistan has faced three major floods. Pakistan is still in competition with 3rd world countries but is still behind. Pakistan has faced massive and deadly floods since 2010. Floods in 2010, 2011, 2012, 2013, 2014, and 2015 have destroyed livelihoods, homes, agricultural farms, fisheries, and primary infrastructure across the country. Across the province homes and livelihoods were completely away (Rehman et al., 2016). Agriculture is the main source of income for most of the people in Pakistan. Around 70% lands of agriculture have been destroyed by floods since 2010. Not just in the 2010s but also in 2011, 2012, 2013, 2014, and 2015 floods had caused maximum damage. Hence this study explores the impact of floods on agriculture, infrastructure, and livestock. Heavy rains and floods are causing irreparable damage to both human lives and the environment in Pakistan. This loss has reached the extent of a distressing situation on a larger scale to restore life to a particularly viable position. The research study highlights the notion that only constructive paradigm shifts are necessary as a strategy to overcome this trend. Multiple levels of observation and on-site assessment of various disaster-prone locations were considered to investigate this scenario. Some locations in Sindh and Punjab were observed and necessary actionable measures were recommended to avoid harm to human life and to the environment. This research finds that constant strict management authority with adequate capacity and forecasting skills at the national level can reduce the damage to human life and the environment. Weather forecasting systems need to be installed in many cities and towns of the country with adequate manpower, funds, and technical resources. By implementing a proper flood prevention framework, a country can save huge cleanup and rehabilitation costs. This measure to restore life and the environment is expected to reduce the state's operational costs in GDP and GNP. This review shows that although climatically driven

floods are expected to increase under a changing climate, it is unwise to make accurate predictions about all floods as many types of floods are likely to occur under a changing climate (Baqir et al., 2012).

In 2010, floods in Pakistan affected around 20 million people and caused damage to 2.8 million hectares of cropland, resulting in agricultural losses of around \$3 billion. The same year, it was reported that more than 1.2 million hectares of crops were damaged, including cotton, sugarcane, rice, and maize, causing a food crisis and major disruptions to the country's economy. In 2011, the estimated population affected was 18 million people and damaged or destroyed more than 2.5 million hectares of cropland, causing agricultural losses of around \$2 billion. In 2012, monsoon floods affected more than 2.5 million hectares of cropland and caused losses of around \$1 billion to the agricultural sector. In 2014, floods in Pakistan affected around 1.5 million hectares of cropland and caused agricultural losses of around \$1 billion. In 2018, a series of heavy monsoon rains caused widespread flooding in Pakistan, affecting over 1.9 million hectares of cropland and causing agricultural losses of around \$2 billion (Doocy et al., 2013).

Problem Statement

More than half of the population of Pakistan is dependent on the agricultural sector. This study consists of the phenomena that affected livelihood in many different ways. Previous floods have affected the lively wood, affected the infrastructure, and and destroyed the crops lacking the forecasting system, planning the government, and lack of preparation for the floods. The agricultural sector was badly affected by the floods. This study also explains the economic growth on the assumption that floods are the major cause of disaster for the chief livelihood source which is agriculture, irrigation, and livestock channels where the main effects are farmers. The current research study determined the impact of floods on livestock, agriculture, and infrastructure in Pakistan.

Table 1. Research GAP.

Author Name and year of publication	Variables			
	Population	Livestock	Agriculture	Crops
Ahmad and Afzal (2021)	V	V		V
Arshad and Sahafi (2010)	V	V		V
Dorosh et al. (2010)		V		
Rehman et al. (2016)		V	V	
Rehman, Jingdong, Rafia & Shoaib. (2015).		V		V
Sajjad, Ying, L., Ishaq, & Shah. (2017)	V			V

Table 1 shows that Ahmad and Afzal (2021) mentioned in the research study population, livestock, and infrastructure are key variables of the flood. Arshad and Shafi (2010) studied population, livestock and crops. The current research study focused on additional variables of crops. This research study determined the impact of floods on agriculture, infrastructure, and livestock.

Research Question

RQ1: Is there any relationship between floods and agriculture?

RQ2: Is there any relationship between floods and infrastructure?

RQ3: Is there any relationship between floods and livestock?

Research objective

To examine,

RO1. The relationship between floods and agriculture.

RO2. The relationship between floods and infrastructure.

RO3. The relationship between floods and livestock.

Significance of the study

This research study will help and play a significant role in finding how floods have affected the livelihood of the people of Pakistan especially when more than half of the population is dependent on agriculture i.e. crops, livestock, and infrastructure. This research study will play an important role in entailing the importance of how to prevent floods in Pakistan and which steps have to be taken. This research paper will play a significant role in no matter how deadly is natural disasters, our economy has to be strong that much that we can help people when we face natural disasters like floods because floods affect agricultural crops very badly. As we all know Pakistan is vulnerable to floods and is a flood-prone area, this research will tell us how to prevent floods and what precautionary measures we have to take to prevent floods and to save the crops from destroying by floods. Ahmad and Afzal didn't mention the effects of floods on crops in their research article. Arshad & Sahafi didn't mention the effects of floods on infrastructure in their research article. Dorosh et al. (2010) didn't mention the effects of floods on infrastructure and population in their research article. Rehman et al. (2017) didn't mention the effects of floods on livestock and crops in their research article. Rehman, jingdong, rafia, & shoaib didn't mentioned the effects of floods on population and infrastructure in their research article. Sajjad et al. (2021) didn't mention the effects of floods on livestock and infrastructure in their research article.

LITERATURE REVIEW

Overflow of water is known as a flood that affects the land that is regularly dry. Floods can occur due to a variety of natural causes, such as heavy rainfall, snowmelt, and storm surges. They can also be caused by human activities, such as the failure of man-made structures, such as dams or levees, or the alteration of natural drainage patterns.

Floods are natural disaster which is caused by mostly changes in the pattern of the heavy monsoon rainfall because when the rain pattern is changed it causes heavy rainfall which causes the overflow of rivers and it causes floods. Overflow in excessive water is called a flood. Floods are caused by many things for example the sudden melting of snow can cause the excess in water in rivers and oceans. Heavy floods are called flash floods and flash floods are caused by too much rain in cities and mountains and when too much water gathers in a narrow space, they cause floods. Deforestation, pollution, climatic change, and emission of greenhouse gases, are the causes of heavy rainfall, and collapsed dams, massive rainfall, and overflowing of the rivers are the main causes of floods. Speaking of dams, dams that are built on old infrastructure can fail when the water level rises. When dams break the water, flow cannot be controlled and it causes floods. Floods can occur due to several different factors however one of the biggest factors is excessive water and heavy rainfall. Floods are dangerous in both predictable and unpredictable but the most dangerous ones are those that are unpredictable. Floods can cause significant damage to homes, businesses, infrastructure, and crops, and can also lead to loss of life. Due to the increased urbanization, industrialization, and population growth, the vulnerability of people and assets to floods has also increased. Governments and international organizations have been working on various mitigation and adaptation projects to minimize the damages of floods, such as building flood protection structures and promoting land use planning and management to prevent loss of life and property damage (Fischer et al., 2019).

Effects of flood

Floods can have significant impacts on agriculture, both positive and negative. In some cases, floods can provide needed water for crops and increase crop yields (Dorosh et al., 2010). However, in other cases, floods can damage or destroy crops, farm infrastructure, and soil quality, leading to reduced yields and financial losses for farmers. Floods can also lead to the spread of plant diseases and pests and can make it difficult for farmers to access their fields to plant, maintain, or harvest their crops.

Some ways that floods affect agriculture:

1. Direct damage to crops and farm infrastructure from floodwaters
2. Contamination of the soil and water sources with pollutants or pathogens
3. Loss of access to markets for farmers due to transportation disruptions
4. Spread of plant diseases and pests

Rivers are an important part of human life. Water is the essential part but it can cause serious damage too in the shape of floods. Due to rivers crops are cultivated and they provide facilities in the shape of drinking water which is used for growing crops. Flooding is the most common type of natural disaster and sometimes it is very dangerous. The floods in China in 1931 caused very serious damage and were one of the worst floods in the history of humans. Floods have a very bad effect on human life. They cause damage to crops, infrastructure, and livestock and badly affect human life. Floods only have a negative impact. It can affect both the individual and the community. Floods can depend on the location. In cities, they have the impact of floods can cause a greater impact and in villages, they can cause less damage. As people are aware, the impact of floods can cause loss of human life, damage to property, affect agricultural land and crops, give birth to diseases, can also affect clean drinking water, and affect transport services. It can also affect the psychological behavior of humans. The loss of a loved one has a very bad impact on humans and it can traumatize the lives of people. Floods have also a very bad impact on the life of wildlife causing deaths and drownings and also to aquatic life as they are misplaced (Whitfield, 2012).

Effects of Flood in Pakistan

Pakistan has faced a lot of natural disasters, especially floods. Pakistan is a flood-prone area and is ranked 9th in the world in the most affected flood-affected countries around the globe (Hashmi et al., 2012; Hyder & Iqbal, 2016). In 2010 KPK province received a very heavy monsoon rainfall which resulted in flash floods. Nearly 14 million people were directly affected and many were displaced. Nearly 1600 people died due to floods in the area. Many infrastructures were affected like schools, buildings, roads, and hospitals were closed. Poor standards of hygiene were set for the people in camps which resulted in severe kind of diseases (Baqi et al., 2015; Sadiq et al., 2022). Pakistan has welcomed many climatic disasters like earthquakes and floods. During the floods rise in poverty level increases. Floods have affected the lives and livelihoods of people directly and indirectly. More than 65% of the population of Pakistan depends on agriculture. Especially in the province of KPK, most people were affected as most of them were living near the banks of the river. Their infrastructure was damaged, and their homes were totally. Across the country, floods have washed out the crops and caused irritable damage to the crops, infrastructure, and roads which contribute to 11% of the GDP. "We have no dry land left" These words are of the people who have lost around 40 million PKR due to floods and have lost acres of crops of rice, wheat, and sugarcane. He stated that he had not seen that much rain in his life. Agriculture is the only main income resource for many people in Pakistan especially in Baluchistan. In Pakistan, around about 4m million acres of crops have been destroyed (Ali et al., 2017). Floods in Pakistan caused a wide range of damages, both to physical infrastructure and to the well-being of communities. Here are some specific examples of the types of damage that floods caused in Pakistan:

Damage to homes and buildings: Floodwaters damaged or destroyed homes and other buildings, leaving people homeless and without access to essential services such as electricity and clean water. Damage to roads and transportation networks: Floods damaged or washed out bridges and roads.

Effects of Flood in Baluchistan

Flooding is a recurrent problem in Pakistan, particularly in the monsoon season from July to September, and it has caused extensive damage to agriculture in the country, including in the province of Baluchistan. In Baluchistan, floods have affected mainly the districts of Jaffarabad, Naseerabad, Sibi, Jhal Magsi, Dera Bugti, Kohlu, and Killa Saifullah, which are mostly agricultural areas. Baluchistan is the largest province of Pakistan according to area and by the population it is the smallest. From the independence of Pakistan, Baluchistan has seen the heaviest rainfall and in addition seven dam have been collapsed. Acres of agricultural has been affected, thousands of lands have been destroyed, and homes, hospitals, schools, roads, livestock and infrastructure have been badly affected due to heavy rainfall and floods. Baluchistan has seen many natural disasters like floods and earth quake. These have raised the question about the credibility of the Pakistan and Baluchistan government regarding the crisis management and that is also a security threat to the country. In the pasts Baluchistan has witnessed deadly floods but now it is security threat to the country. Floods have not only disconnected the province from the state but also caused the network problems in the province. Total 1, 17,400 acres or 43% of the crops and vegetables were destroyed, livestock were drowned and infrastructure were totally destroyed. In recent floods totally 1700 people died due to floods, 1.2 million livestock were killed and 7.9 million people were displaced and people are badly in need of shelter food and clean drinking water. Due to climate change the risks of floods in Baluchistan have been increased because of the geo strategic location of the province and due to its location, the risk of the earth quake is more in the province. The areas of Killasaifullah, Jhalmagsi, Nashki and khuzdar were badly affected by floods (Akhtar et al., 2021). According to the stats overall 18600 of animals' shelters were destroyed mainly in Jhal magsi, Naushki, Killasaifullah and Kharan. Due to floods several villages have been cut from the rest of the province due to damages to the roads and bridges and are still not recovered. Roads are the very important part of the country's infrastructure which helps in travel but due to recent floods in Baluchistan two main road, one connecting Quetta to Karachi and secondly connecting Makran coastal highway and these both roads are very important for Baluchistan which helps in supply of the foods to Baluchistan and helps in transport. Baluchistan is a dry land where dry weather and droughts are normal and it receives lowest rainfall but due to recent floods the alarming situation arises in the country. Climate change has enhanced the risks of the floods in the province and due to geo strategic location and situated in the world's most active seismic zone and is on constant risk of earthquakes.

In 2010, heavy monsoon rains and flash floods affected more than 2 million people in Pakistan, with the province of Balochistan being particularly hard hit. Over half a million hectares of cropland were damaged or destroyed, causing losses of over \$1 billion to the agricultural sector.

In August 2019, monsoon floods affected more than 2.5 million people in Balochistan and caused damage to over 400,000 hectares of cropland, resulting in significant losses to the agricultural sector.

In 2020 Monsoon floods caused the damage to crops worth of billions in Pakistan where Balochistan was the most affected province, where over 100,000 hectares of crops were destroyed and millions of livestock were killed.

Floods have a significant impact on agriculture in the province of Balochistan, Pakistan. Some specific effects of floods on agriculture in Balochistan include:

Damage to crops: Floodwaters destroyed crops such as wheat, barley, cotton, and rice, leading to reduced yields and financial losses for farmers. Damage to farm infrastructure: Floodwaters can damage or destroy

irrigation systems, flood protection embankments and drainage systems, storage and market infrastructure, and other key components of the agricultural sector. Soil erosion and sedimentation: Floods can cause soil erosion and sedimentation, which can decrease the fertility of soil and make it difficult for crops to grow in the affected areas. Contamination of soil and water sources: Floods can contaminate soil and water sources with pollutants or pathogens, which can make it difficult for crops to grow and can be harmful to human and animal health. Loss of access to markets: Floods can disrupt transportation networks and make it difficult for farmers to access markets to sell their crops, resulting in additional financial losses. Loss of livestock: Floods can also cause significant damage to livestock, including loss of grazing land, loss of feed and forage, and direct loss of animals (Akhtar et al., 2021).

Effects of floods on Agriculture

Pakistan have experienced severe floods in 2010, 2011, 2012, 2013 and 2014. These disasters were on a massive scale Cumulative impact on Pakistan's economy in 2010, monsoon rains caused widespread flooding in Pakistan Nearly 2,000 people died, more than 20 million were affected and at least 7.8 million were food insecure and caused an economic loss of more than 16 billion US dollars. The share of agriculture in Pakistan's GDP is 21%, 45%. 60 percent of employment and exports. The disaster resulted in the loss of 2.5 million tons of rice, 7.5 million tons of sugarcane, 0.7 million tons of cotton and 0.3 million tons of maize (Ahmad & Afzal, 2020).

In September 2014, the late and the severe monsoon spell accompanied by massive water release Eastern rivers, particularly the Chenab River, resulted in massive flooding in Azad Jammu and Kashmir (AJ&K), Punjab and landsliding in Gilgit- Baltistan (GB) on an unprecedented scale, both in terms of volume and Heavy rains started in the first week of September 2014 despite the forecast of below average rainfall Crops, infrastructure and human settlements were damaged, thereby directly and adversely affecting the national economy Indirectly spatial coverage. According to sources, more than 25 lakh people were affected by it. 367 people lost their lives and 129,880 houses were completely destroyed by the floods and rains in September 2014. Over 1.0 million acres Farmland and 250,000 farmers were affected, in most cases standing loss of food, fodder or cash the estimated cost of crop restoration efforts was US\$439.7million (Posthumus, et al., 2009).

In the 2010 flood disasters, Punjab's crop area was 0.42 million hectares, Sindh's was 0.30 million hectares, KPK had 0.05 million hectares, Balochistan 0.05 million hectares and Azad Jammu and Kashmir. 0.01 Million hectares. The total area under affected crops in 2010 was 0.84 million hectares. Only Sindh in 2011 floods a total of 0.88 million hectares of crop area was affected. In 2012, the crops of Punjab and Sindh were affected by floods and the total area was 0.47 million hectares. In 2013, the area of crops in Punjab, Sindh and Balochistan was affected by floods. And the total affected area was 0.42 million hectares. Similarly, in 2014, only in Punjab, the area of crops was affected by floods and was 0.98 million hectares.

The 2010 floods left 20 percent of the country's total land under water, causing a total of \$10billion in damage Balochistan and KPK were the worst affected by the floods. While Punjab and Sindh were the most affected slowly rising river floods. In 2011, floods and landslides affected the district of Guanche in Gilgit-Baltistan Due to which hundreds of houses and crops were damaged. 5 million people, 14,270 villages and 1.1 million in 2012 Acres of crops were affected by the flood. A flash flood occurred in August 2 013 and caused extensive damage. The loss across Pakistan was about 1.5 million people, about 80,000 houses and 1.5 million acres of crops affected 2014, heavy monsoon rains and floods in catchment areas of Chenab, Ravi Rivers in eastern India. As a result of Sutlej and Jhelum, Gilgit-Baltistan, Punjab and Azad Jammu and Kashmir (AJ&K) were flooded gave the floods killed 367 people and affected more than 2.5 million people and damaged or destroyed 129,880 houses More than 1 million acres of crops and 250,000 farmers were affected in most cases resulting in stand loss Food, fodder or cash crops. Non-agricultural livelihoods and

services affected include many small businesses Loss of wage employment due to disruption in manufacturing and processing businesses and the economy (Rehman et al., 2015).

Effect of flood on livestock

As damage from devastating floods continues to mount in Pakistan, farmers and experts fear that millions of animals could die, leading to severe shortages of food in coming months The devastating floods have killed more than 1,300 people since mid-June, uprooted mountains, completely destroyed the buildings, bridges and roads, and submerged a third of Pakistan Historic floods and devastating rains also washed away millions of cattle, a major source of livelihood in rural Pakistan, which makes up 70 percent of the South Asian nuclear power (Khayyam, 2020). According to figures, more than 750,000 animals of various species have died due to rains and floods, which is a serious issue. There is fear of shortage of meat, milk and other dairy products in the country which is already facing severe food crisis.

Insecurity of the total, about 70% or 500,000 cattle have been swept away by floods in southwestern Balochistan province, followed by northeastern Punjab, where more than 200,000 animals have died since June 14, state-run National Disaster statistics are shared. Management said. Agriculture and dairy industry fear that the deaths of millions of animals could reduce milk and meat production by 30% to 40% in the coming months their houses have been damaged and (agricultural) lands are under water. they are definitely worried about it, who is currently living with his family are taking shelter in a school-converted shelter camp on the southern outskirts of the provincial capital Karachi. But they are more worried about (lost) cattle, which were the backbone of his economy. After the water recedes, the farmlands will be arable again, and they can even live in his damaged houses (Rehman & Alamgir, 2018)."

Baluchistan is the largest province by land area but the least populated region, where nearly 50% of people, especially in rural and mountainous areas, depend on livestock for their livelihood. The people of Baluchistan have suffered the most, where all agriculture sectors, especially livestock, which is the direct source of income for 50 percent of the local population, have been affected by the rains," says an agricultural expert from Baluchistan. And has been badly affected by the floods "It is not only the rains and floods that have killed livestock in every nook and corner of the vast province, which constitutes 42 percent of Pakistan, but various water-borne diseases and infections have also affected livestock are doing A large part of the population in the hilly areas of the province, which depends only on cattle, "has gone economically years ago". "There is a shortage of meat in many districts of Baluchistan. And wherever it is available, prices are higher than usual Even the surviving animals will not be able to produce milk due to non-availability of fodder. Due to this, their growth will also be affected (Ali et al., 2021).

Effect of Flood on Infrastructure

The 2010 monsoon floods in Pakistan were devastating Mass and unprecedented casualties, more than1, 700 people, affecting more than 20 percent land area, more than 20 million people, and due to which billions of dollars have been lost. Damage to housing, infrastructure, and other family assets. Necessary Infrastructure including roads, bridges and Markets have been hit hard and many remain invincible. According to one of United Nations survey estimated that some 10.1 million of people needed shelter and humanitarian aid. Number of people Dietary support is needed to aid in recovery and Recovery is estimated to be around 3.6. Million. There were over 1.1 million homes. Totally destroyed or rendered unlivable and impacts on people's homes, assets and livelihoods, most people don't know when they will be (Diakakis et al., 2020; Kirsch et al., 2012). Able to resume his livelihood. The 2010 floods have caused considerable damage Poverty reduction efforts and consequently Increase in poverty and vulnerability of affected people population there were flood affected areas. It is consistently lagging behind in socio-economic and educational indicators. In areas not affected by floods. Damage to Infrastructure and means of livelihood will be advanced further behind them. People are the toughest the victims were mainly small farmer's unskilled labor. The devastating flood caused a lot of damage Phone line, power supply disrupted in many

areas also the major cities of Swat, Lower and Upper Dir as Shangla Property was badly affected with 42 percent (Ahmed et al., 2014). Houses completely destroyed. 19 percent heavier Damaged and 28% lightly damaged. Only 9 Percentage of houses escaped damage. More than 30 million people are estimated to have been displaced, as water levels reached levels that made their homes uninhabitable. Initial damage estimates indicate that more than a million homes have been partially or completely damaged, making them uninhabitable until the water recedes, and reconstruction work is slow may begin. About 85 percent of all houses partially or completely destroyed are in Sindh, which has been hit hardest by the floods. It is estimated that more than 5 million people in Sindh have simply been displaced from their homes, making it an acute humanitarian crisis. Preliminary assessment also shows that more than 5000 km of roads have been destroyed. As roads in Sindh, Baluchistan and southern Punjab are still flooded, it is extremely difficult to get relief supplies to the worst-hit areas, further limiting the supply chain in an already devastated environment. Likewise, complete destruction of the road network, especially in Baluchistan, which is the fruit basket of the country, will make it difficult to send any fruit across the country as the supply chain will be disrupted and the people of the region will suffer huge economic losses. A complete breakdown of the supply chain due to the destruction of the road network will have a negative impact on recovery it is also estimated that more than 250 bridges have also been destroyed, mostly in Gilgit-Baltistan and Khyber-Pakhtunkhwa, further isolating the already remote areas. Many communities in remote areas are connected by such bridges. Its destruction means that many communities are cut off, making rescue and recovery activities more difficult the economic loss that can be attributed to households is staggering. As the devastating floods destroyed more than one million homes, it is estimated that more than US\$1.6 billion in wealth was potentially eroded, as people lost not only their homes but many of their belongings. Also lost the equipment. This has led to about US\$1.2 billion in wealth erosion in Sindh, the highest among all provinces. It is important to understand that these were already the most vulnerable sections of the country, most of whom lived at subsistence level, and often below the poverty line. Such large negative effects of wealth will set many households back for years, even if the government, multilaterals, or other organizations do not step in for recovery and reconstruction (Pyatkova et al., 2019). Reconstruction of these homes is estimated to cost around US\$2.5 billion, which will be very costly for households that have already lost much of their wealth and capital base. Similarly, it is estimated that about US\$2.5 billion will be needed to rebuild the roads, of which more than 5,000 km have been completely destroyed. This activity needs to be undertaken on a war footing, as roads will be critical in ensuring connectivity, supply of rehabilitation supplies as well as reconstruction. Any delay in this will further complicate the crisis and increase the suffering. The sooner the road reconstruction work is started, the sooner the problems of the people can end. More importantly for communities in mountain areas and remote areas, the reconstruction of bridges will be critical to enable access and initiate reconstruction activities. It is estimated that more than 1 billion US dollars will be needed to rebuild the more than 250 bridges damaged by the floods. A preliminary assessment suggests that reconstruction activities will require at least US\$6 billion over the next twelve months. Although about 70 percent of this amount will be from PKR, it is important that the government plans for it on a war footing to redirect the fiscal stimulus to the worst affected areas, to rehabilitate and improve can be built better. The country needs a grand infrastructure plan. This requires planning and construction that is climate resilient, and that can withstand extreme weather events, all on a priority and accelerated basis. The government's ability to rebuild better and faster is critical and will be tested in the coming days.

Research Framework

A research framework, also known as a research methodology, is a set of principles, assumptions, and procedures that guide the design and implementation of a research study. It provides a structured approach to conducting research and helps ensure that the study is valid, reliable, and credible. Research

framework demonstrates the dependent and independent variable and also moderator. In this study floods are independent variables and agriculture; infrastructure and crops are dependent variable.

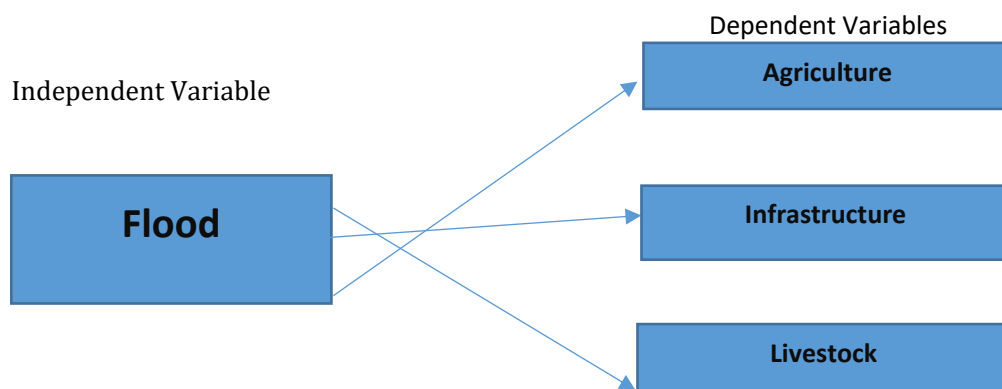


Figure 1. Research framework.

Research hypothesis

Based on the research objective and research question, following hypothesis are formulated

H1. There is significant relation between floods and agriculture.

H0. There is no significant relation between floods and agriculture.

H2. There is significant relation between floods and infrastructure.

H0. There is no significant relation between flood and infrastructure.

H3. There is significant relation between flood and livestock.

H0. There is no significant relation between flood and livestock.

Research Design

Methodology is defined by Wampold and Halloway (1997) as “Principles and philosophy on which researchers base their procedures and strategies, and the assumptions that they hold about the nature of the research they carry out.” Research is the determination to explore or investigate the result to an issue. Research process includes multiple steps which is organized and systematic (Sekaran & Bougie, 2016). The research methodology encompasses of methods, processes, statistical tools and collection of data and investigation. The investigation outcomes and results contribute to the knowledge body and enhance the knowledge in research domain (Nunamaker et al., 1990; Kerlinger et al., 2000).

This study was conducted by using survey method in Pakistan i.e., Balochistan and the areas of that province. The questionnaire was personally administered in the two districts of Balochistan and totally four weeks was selected as a benchmark of differentiate between early and late response. The time period of four weeks assumed to be suitable for the participants to complete the questionnaire.

This research paper will play a significant role to let us know how much loss is caused by flood. The estimated population of Pakistan 228,127,539 as of Saturday, March 12, 2022, based on World meter elaboration of the latest United Nations data.

Table 2. Target population of the study.

Country	Population	Province	Population	Targeted Province	Population
Pakistan	22,817,539	Balochistan	12335129.	District Killasaifullah	3428129
				Tehsil Muslimbagh	78711
Total	22,817,539	Total	12335129.	Total	421525

As this study is related to Effects of floods on agriculture in Pakistan that's why we have targeted the different areas of Pakistan and especially the province of Balochistan because it's the most affected area of Pakistan due to floods. In Balochistan the targeted area is District Killasaifullah tehsil Muslimbagh because in recent floods it was the most affected district of Balochistan. Targetted area of the study is Balochistan because it is one of the largest province of Pakistan and the most affected area by flood. The total population of Balochistan is total 12335129. Researcher selected the two districts of the province and are Killasaifullah and Muslim bagh. The population of Killasaifullah is 342815 and the population of Muslimbagh is 78711. The total target population is 421525. The target population is more than 40,000. According to Morgan (1970), if population is more than 40,000 the suitable sample size is 381. For current research study sample size was 381 and households are the unit of analysis.

Data analysis of the study was done by using "Statistical package of social sciences (SPSS)" was used describe the descriptive analysis to find the general understanding of respondents. SPSS was used for data summarizing, making presentation in tabular form and also measure the frequency of occurrence of the outcomes.

DATA ANALYSIS AND RESEARCH FINDINGS

Cronbach Alpha is a degree of internal consistency reliability for a set of items or questions in a research study or survey. It is a statistic that measures the degree to which a set of items or questions are interrelated and provide consistent responses to the underlying construct being measured.

10.1 Cronbach Alpha

This questionnaire was done by the help of 50 administrative staff. The participants were encouraged to be honest in their choices. When the questionnaire was completed, the respondents were asked if they understood the questionnaire which will give the researcher clarity about the questions (Kerlinger et al., 2000).

Table 3. Cronbach Alpha.

Sr. No.	Constructs	No. of Items	Cronbach Alpha
1	Floods	10	0.710
2	Agriculture	10	0.7015
3	Livestock	10	0.7348
4	Infrastructure	10	0.709

Descriptive Statistics

In descriptive analysis the collected data by the research was uploaded to the SPSS and statistics results have been used to explore the data. Table 4 shows the clear profiles of the respondents. Total of 381 respondents were put to analysis.

Table 4. Descriptive statistics.

Demography	Indicator	Frequency	Percentage
Gender	Male	321	84.3
	Female	59	15.5
Age	Below 30	27	7.1
	30-35	160	42.0
	35-40	193	50.7
Education	Bachelors	337	88.5
	Masters	43	11.3
Family Income	15000-2000	2	5
	20001-30000	171	44.9
	30001-40000	183	48.0
	40001-above	24	6.3
Number of households	2-3	2	5
	4-6	135	35.4

Descriptive analysis

Descriptive analysis refers to the process of analyzing and summarizing data in order to gain insights and understanding about the characteristics of a particular population or dataset.

Table 5. Descriptive analysis.

Construct	N	Maximum	Minimum	Mean	Standard deviation
Floods	380	5	1	4.24	0.285
Infrastructure	380	5	1	4.25	0.281
Livestock	380	5	1	4.256	0.262
Agriculture	380	5	1	4.240	0.277

The outcomes of the descriptive analysis depict that the mean of all the variables lies in between 4.240 to 4.256. These values are in a tolerable range as well as they are all above the average value.

Regression

The primary step for conducting the measurement model assessment is the determination of R^2 . The value of R^2 varies according to the discipline it is being used for (Sarstedt *et al.*, 2014). Table 6 states the difference between the two (R^2).

Table 6. Criteria for Assessing Coefficient of Determination (R²).

Hair et al. (2014)		Cohen (1988)	
0.75	Substantial	0.26	Substantial
0.50	Moderate	0.13	Moderate
0.25	Weak	0.02	Weak

This particular research followed Cohen (1988), according to which the coefficient of determination is substantial. The value of R² indicates that the agriculture, Livestock and Infrastructure. Table 7 shows the results of R² and adjusted R².

Table 7. R² and adjusted R².

Construct	R ²	Adjusted R ²	Beta	T	Sig.
Agriculture	0.066	0.061	0.245	3.935	Accepted
Livestock	0.063	0.060	0.251	4.495	Accepted
Infrastructure	0.111	0.108	0.333	6.124	Accepted

Hypothesis Results

H₁: It has been hypothesized in the study that floods have a significant impact on infrastructure ($\beta = 0.333$, $t = 6.124$, $R^2 = 0.111$).

H₂: The results ($\beta = 0.251$, $t = 4.495$, $R^2 = 0.063$) indicate that a significant relationship exists among the floods and livestock.

H₃: Third hypothesis of the study states that floods have a positive impact on agriculture. ($\beta = 0.245$, $t = 3.935$, $R^2 = 0.066$).

CONCLUSIONS

Floods have affected the district of Gilgit Baltistan causing damage to crops and infrastructure. In 2012 flood affected 14,270 villages, and 1.1 million acres of land, and a total of 5 million people were affected. Balochistan and KPK suffered more from flash floods whereas Punjab and Sindh were mostly affected by rising floods. In 2010 floods affected a total of 20% of the land of the country and caused damage of \$10 Billion. The data collected through this research study highlighted the importance of Agriculture, livestock, and infrastructure in Pakistan. Research studies found that floods have significantly affected agriculture which supports the research's first hypothesis (H₁). There is a significant relationship between Agriculture and floods in Balochistan, Pakistan. The study shows that floods have a very bad impact on standing crops, infrastructure, and livestock. It also affected the lives of small-scale farmers whose only source of income is agriculture. Wang, Zhanyan, and Huili, (2022) developed a framework for how floods have an impact on the production of crops. Research study also showed that there was a positive relationship between Floods and Infrastructure. The findings of the study supported the second hypothesis (H₂). There was a significant relationship between Infrastructure and floods in Balochistan, Pakistan. Finally, a research study concluded that floods have a positive impact on livestock. This research study supported the H₃.

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