Critical Evaluation of Agriculture Damages and Food Security Issues in The Context of Recent Floods

Muhammad Iqbal Khan[1], Muhammad Ali[2], Zia ur Rehman[3], Muhammad Javed Alam[4], Asjid Rashid[5], Dr. Muqeem ul Islam[6]

Citation:
Khan, M. I., Ali, M., Rehman, Z. U., Alam, M. J., Rashid, A., & Islam, M. U. Critical evaluation of agriculture damages and food security issues in the context of recent floods. Khyber Journal of Public Policy, 1*(1), Winter(2022).*

Article Info:
Received: 24/09/2022
Revised: 25/10/2022
Accepted: 01/11/2022
*Published:*03/12/2022

Abstract:

Agriculture is the largest sector of the economy, contributing 24% of GDP, and supports the livelihoods of both urban and rural populations. It plays a critical role in economic growth, food security, job creation, and poverty reduction. The recent floods, particularly in Sindh Province, have severely impacted agriculture, with standing crops destroyed due to prolonged water stagnation. An estimated 2 million acres of land, or 80% of the country's agricultural area, have been affected. This disaster has resulted in significant financial losses and food insecurity, especially due to damage to wheat crops, which are essential for household consumption. Although relief efforts were initiated, better coordination between federal and provincial governments could have alleviated the situation further. Key issues, including inadequate flood mitigation strategies, poor infrastructure maintenance, and lack of water storage solutions, highlight systemic gaps. The post-flood rehabilitation phase is underway, aiming to address these shortcomings.

Key words:

Agriculture, Flood Damage, Food Security, Relief Coordination, Rehabilitation

[1] *Provincial Management Service-KP, Email: Iqbalkhanwazir072@gmail.com*
2 M/o Defence Production, Email: malimir73@gmail.com
3 Provincial Management Service-KP, Email: ziamarwat1@gmail.com
4 M/o Defence Email: mjavedalam@gmail.com
5 Pak. Railways (Engr.) Email: asjidrashid@hotmail.com
[6] *Chief Instructor, National Institute of Public Administration (NIPA), Peshawar Email: muqeemci@nipapeshawar.gov.pk*

Introduction

Recent floods, caused by unprecedented rainfall, have severely affected the entire country, resulting in the loss of hundreds of lives, property, infrastructure, livestock, and damage to the agricultural sector. Agricultural land inundated by flooding is expected to have long-term humanitarian and economic impacts in Pakistan. The devastation has affected over 33 million citizens, caused billions of dollars in losses, and severely damaged cash crops like rice, sugar, cotton, and wheat. Flooding has destroyed vast areas of agricultural land across all provinces. The country could soon face food shortages if thousands of acres of cropland are not restored. With over one-third of the country submerged under water, the damage to agricultural land has surpassed 2 million acres of crops and orchards, as reported by the United Nations.

In 2018, Pakistan introduced its first National Food Security Policy, aiming to increase food availability, accessibility, and sustainability by making the agriculture sector more productive, modern, and climate-resilient. According to the 18th Amendment, providing food security is the responsibility of the Federal Government, while agriculture, livestock, and dairy remain under provincial control. Pakistan, an agriculture-based country, generates 23% of its GDP from agriculture and related sectors, yet 80% of this sector has been damaged by the current floods.

Moreover, alarm bells were already ringing as 40% of the population faced chronic food insecurity before the monsoon. Pakistan ranks 99th out of 121 countries on the Global Hunger Index. Even before the floods, 38 million people were facing moderate to severe food insecurity, with many, especially women and children, going to bed hungry. According to the WHO, 18% of children in Pakistan are clinically malnourished. More than 1.1 million livestock have been reported as killed, including around 500,000 in Baluchistan, 428,000 in Sindh, 205,100 in Punjab, and 6,600 in Khyber Pakhtunkhwa. The FAO estimates that approximately 9.4 million acres of crop area in Pakistan were potentially inundated in August, with 4.8 million acres in Sindh, 2.7 million acres in Punjab, 1.2 million acres in Baluchistan, and 714,000 acres in Khyber Pakhtunkhwa.

Statement of the Problem

The agriculture sector is one of the major contributors to Pakistan's GDP, accounting for approximately a quarter of the total, making it a key component of the country's food security. Heavily reliant on weather, climate, land, and water for its ability to thrive, agriculture is particularly vulnerable to natural disasters. The 2022 floods have highlighted Pakistan's high vulnerability to climate change. Already ranked among the countries vulnerable to hunger, Pakistan now faces a severe food security crisis as a result of the damages to its agricultural sector caused by the recent floods. This type of vulnerability requires an in-depth evaluation of the economic and production losses, the arising food security issues, and an analysis of the performance of both federal and provincial governments, comparing them with global best practices and identifying gaps. This study will also offer plausible recommendations to address the challenges faced during the recent floods.

Scope and Significance

This study aims to assess the damages associated with agriculture-related departments and evaluate the flood response plans adopted at both federal and provincial levels. The study will develop a comprehensive strategy for the restoration and rehabilitation of the agriculture sector to ensure food security, revitalize livelihoods, restore services provided by agriculture departments in flood-affected areas, and develop future resilience plans for flood-prone districts with damaged infrastructure. The study will focus on the impacts of the recent floods in Khyber Pakhtunkhwa Province.

Literature Review

The literature on this topic, including articles, journals, magazines, research papers, and newspaper clippings available on various websites, was useful in the research process. Data were also collected from various Federal and KP departments. The roles and functions of these departments, along with their coordination at inter-departmental and intra-departmental levels, were analyzed in the context of the recent floods.
The assessment of damages to Pakistan's agricultural sector, conducted by the Ministry of Planning in collaboration with international agencies like the United Nations, the European Union, and the World Bank, was reviewed. Articles detailing the damage to various sectors and its impact on the national economy were also examined.

Federal and provincial contingency plans were studied to identify any gaps. An article by Muhammad Tariq-ul-Islam (2018) on how local governments cope with disasters in Bangladesh was studied to understand best practices used in other countries to handle emergency situations. Bangladesh has developed a centralized disaster management system that operates down to the level of tehsil and municipal committees.

The Consultative Group for International Agricultural Research (CGIAR), an international research organization, studies various methods for food security worldwide. The farming practices researched to enhance agricultural productivity, particularly flood-based farming systems practiced in Sub-Saharan African countries like Ethiopia, were explored for their potential application in Pakistan to improve productivity and reduce food scarcity.

Research Methodology

For this study, qualitative research methods were used, relying on secondary data. Qualitative analysis was conducted using various analytical techniques, including situational analysis, gap analysis, comparative analysis, and SWOT-EETH analysis. Secondary data was obtained through online articles, journals, and other documents available on the internet, as well as through visits to concerned offices by the group leader and members.

Organization of the Report

This study is divided into six sections. The introduction is followed by the statement of the problem, scope of the study, literature review, and methodology. Section I explains the situational analysis and preparedness of agriculture-related departments at the federal and KP provincial levels. Section II discusses the effectiveness and efficiency of the coordination mechanisms at both federal and provincial levels. Section III compares some of the best practices around the world and the lessons learned. Section IV details the economic losses, production losses, and food security issues. Section V contains the gap analysis and SWOT analysis to address the impact of calamities on the agriculture sector in KP. Section VI provides the conclusions, along with pragmatic recommendations and a log-frame matrix to propose practical and viable solutions to the issues and problems.

Situational Analysis and Preparedness

The recent floods in Pakistan have caused extensive damage to the agricultural sector, with over one-third of the country submerged under water. The total damage to agricultural land is estimated at over 2 million acres of crops and orchards, while approximately 0.8 million livestock have perished.

The devastation has impacted more than 33 million citizens and resulted in losses amounting to billions of dollars. Crops accounted for 82% of the total damage and losses in the sector, followed by livestock at 17%, and fisheries/aquaculture at 1%. Sindh and Baluchistan are the hardest-hit provinces, contributing 72% and 21%, respectively, to the total registered damage, followed by Khyber Pakhtunkhwa (KP) and Punjab.

The destruction of crops, livestock, and aquaculture infrastructure has led to the temporary collapse of livelihoods, employment, and agriculture-related income, as well as a potential decline in the exports of key crops such as cotton and sugarcane. Flood protection infrastructures, irrigation channels, and drainage systems were the most affected, with damages amounting to 36% and 32% respectively, followed by drainage systems at 14%, and dams, headworks, and weirs at 9%. Other supporting infrastructure accounted for 8% of the total damage. Overall, irrigation water supply systems, including canals and dams, suffered 41% of the total damage. If these issues are not addressed, crop production in the coming seasons will be severely impacted.

China has emerged as a major importer of Pakistani rice, especially lower-grade, broken rice for use as animal feed. In the first four months of 2022, China imported 350,000 tons of Pakistani rice, a 163% increase from the previous year. This damage to Pakistan's crops coincides with drought conditions in China, threatening half of that country's rice crop, and expected declines in rice production in India, the world's largest rice exporter. Other buyers of Pakistani rice include Malaysia, East African countries, and Saudi Arabia.

In Khyber Pakhtunkhwa, 25 districts were affected, with 32 types of crops destroyed by the recent floods, causing losses worth Rs. 16,171.48 million (Pakistani rupees). A total of 121,640 acres were damaged, and 384 government and private hatcheries were washed away by the flood. Additionally, the Water Management Department suffered damages to water courses and channels worth Rs. 967.33 million, with 1,311 water courses and channels destroyed. Soil and water conservation efforts also sustained damages amounting to Rs. 155.97 million.

Federal Agriculture Related Departments and their Functions

Ministry	Departments	Functions
Ministry of Agriculture & Food Security	National Agriculture Research Council (NARC)	Undertake, aid, promote and coordinate agricultural research
	Agriculture Policy Institute (API)	Conduct studies on emerging policy issues and periodically examine, processing, storage, and marketing costs of agricultural commodities
	Department of Plant Protection	Standardization and import of pesticides, Aerial Spray, Plant Quarantine & Locust Control
	Plant Breeder's Rights Registry	To ensure availability of high quality seeds and planting material to the farmers & development of new plant varieties
	Pakistan Agriculture Storage & Services Corporation (PASSCO)	To facilitate the Federal government in its quest to ensure National Food security by maintaining strategic reserves of different food grain commodities, providing same to deficit provinces/areas and Armed Forces
	Federal Water Management Cell (FWM)	Federal Water Management Cell (FWMC) deals with all the matters related to irrigation water management and agriculture mechanization.
	Fisheries development Board	To plan, promote facilitate and coordinate with private sector for accelerated development of and investment in the fisheries sector in Pakistan.
	Pakistan Oil Seed Department (POSD)	Seed Purity Laboratory performs the post check analysis of seed testing
	Economic Wing	
	Pakistan Centre Cotton Committee	
	National Fertilizer Development Centre (NFDC)	To provide objective and comprehensive advice to all levels of Government, to the fertilizer industry and to other parties as may be relevant, on all matters related in any way to the fertilizer sector of Pakistan and its relations with the international fertilizer community.

KP Province Agriculture Related Departments and their Functions

Department	Directorate	Functions
Agriculture Department/KP	Directorate of Agriculture Research	Development of new varieties of Crops, Fruits and Vegetables. Development of economical & sustainable production technologies for Crops, Fruits and Vegetables to increase productivity per unit area.

	Directorate of Agriculture Extension	Distribution and sale of pesticides, renewal of pesticides licenses, distribution and sale of fertilizer, Renewal of fertilizer licenses
	Directorate of On-Farm Water Management	Conduct feasibility studies of potential Projects, plan Water Management strategies for conservation of scarce available water resources
	Directorate of Agriculture Engineering	1. Augmentation of irrigation water supplies by the installation of Tube -wells/Dug- wells, Solar Pumping Machinery on Open-wells/Dug-wells/Tube-wells for productivity enhancement, Construction of Irrigation Structures in Rod Kohi areas of KP, to help the irrigation Department in the de-siltation of Canals
	Directorate of Crops Reporting Services(Extension)	Estimation of District wise area and production under all Crops grown in the Province and to release 1st, 2nd and Final Crops Estimates periodically both in Kharif and Rabi seasons
	Directorate of Soil Conservation	Soil Survey, comprehensive inventory of soil resources of the Province of Khyber Pakhtunkhwa and their proper utilization
	Directorate of Livestock and Dairy Development Research	Conduct Research for the control, prevention & eradication of Livestock & Poultry diseases
	Directorate of Fisheries	Preparation of regulatory measures and policies for the development, conservation and management of fisheries in the province.
	Directorate of Livestock & Dairy Development(Extension)	Establishment of veterinary health institutions and mobile veterinary clinics and keeping them in functional order
Food Department	Directorate of Food	Ensuring Food Security, Quality, Regulations of sugar mills, flour mills, wheat quota distribution, Procurement of wheat and other commodities
Irrigation Department/ KP	Chief Engineer/North Chief Engineer/South Director General/Small Dams	Approval of irrigational developmental schemes like construction of small dams, maintenance and repair of drains etc.
Relief, Rehabilitation &	Provincial Disaster Management Authority (PDMA)	Coordination with the NDMA on Relief activities, Planning for preventive and proactive

Settlement Department/KP		measures against disasters, relief and compensation to the affectees
	Rescue 1122	Responding to emergencies through a comprehensive and Communication Management System
	Civil Defence	Basic Civil Defence Training to general public (Firefighting, First Aid & Rescue Service) and bringing volunteers in disasters.

Response of Federal Government and International Agencies to the Flood-hit Areas in KP Regarding Agriculture-related Services

Federal Government Response:

The Federal Government of Pakistan established the National Flood Response and Coordination Center (NFRCC) to facilitate a coordinated multi-agency response in collaboration with the National Disaster Management Authority (NDMA). The government set up camps for populations displaced by the floods and provided cash assistance to those affected. Provincial governments were encouraged to redirect development funds toward flood relief efforts. Additionally, several fundraising agencies were verified, including those on platforms like GoFundMe, to support relief activities.

International Responses:

On August 30, 2022, the United Nations issued a Flash Humanitarian Appeal requesting $160 million to support the "Pakistan 2022 Floods Response," with 37% of the funds raised to date. The appeal highlighted that 5.2 million people urgently needed humanitarian aid, including food, water, sanitation, emergency education, health support, and protection. Separate funding appeals were launched by international relief agencies, and international financial institutions pledged funds for Pakistan's disaster relief and development, with the majority of assistance coming from the World Bank.

U.S. Response to Pakistan's Floods:

In mid-August 2022, the U.S. Ambassador to Pakistan issued a disaster declaration, and on September 2, the U.S. Agency for International Development (USAID) deployed a Disaster Assistance Response Team to assess the flood's impact. A Response Management Team based in Washington, D.C., coordinated U.S. government flood response efforts.

As of September 22, the U.S. government had provided over $48 million in humanitarian assistance, including support for food, safe water, sanitation and hygiene improvements, financial help, and shelter assistance.Of this, $20 million was announced by USAID Administrator Power in Islamabad on September 9.

Preparedness and Response of KP Province

KP Government Response

The Khyber Pakhtunkhwa (KP) Government conducted a comprehensive damage assessment in the agricultural sector through district administration in coordination with district agricultural offices. The primary objectives of the flood response were to devise a comprehensive strategy for the restoration and rehabilitation of the agriculture sector, ensure food security, reinstate agricultural services in flood-affected areas, and develop a resilience plan for future floods in flood-prone districts with damaged infrastructure.

i. Restoration Activities

During the recent floods, the Agriculture Department of KP played a crucial role by providing agricultural machinery to district administration for evacuating affected populations and protecting agricultural land. The Livestock Directorate set up 38 veterinary medical camps and 17 mobile veterinary clinics for the treatment of sick animals. Additionally, the Livestock Department distributed 33,400 kg of animal feed to livestock farmers and vaccinated 173,811 animals against various diseases in the region.

ii. Khyber Pakhtunkhwa Flood Response Plan 2022

The agriculture sector in KP, which employs nearly 40% of the workforce in the country, is particularly vulnerable to climate change. Extremely agriculture-dependent districts in the province face not only the loss of livelihoods but also increased food insecurity among the poorest households. To address these issues, a well-coordinated response strategy, including financial planning, has been developed by the Agriculture Department.

iii. Financial Plan

In the first year, the Agriculture Department will identify the costs associated with damaged public infrastructure and initiate the tendering process for civil works. The proposed budget for the first year is PKR 277.061 million, with an additional PKR 646.485 million allocated for the second year to complete all civil works.

This funding will be sourced through intra-sectoral re-appropriation within the Department. Additionally, approximately PKR 3 billion has been committed by the World Bank, with an approved work plan already in place. The Provincial Relief Department has committed PKR 19,100 million to compensate citizens for losses of crops and livestock.

Source of Financing	Amount (Rs. In million)
Intra sectoral re-appropriation from ADP allocation 2022-23	1000
World Bank funding from Khyber Pakhtunkhwa Irrigated Agriculture Improvement Project (KPIAIP)	3460
Relief Department compensation fund for crops & livestock losses	19,100
Total	23,500

iv. Re-appropriation:

The Agriculture Department will mobilize PKR 1,000 million through intra-sectoral re-appropriation to repair damages and cover the estimated PKR 923.5 million of damage to public infrastructure.

v. Implementation Plan:

The Department proposes the rehabilitation of public sector infrastructure over a two-year period, allocating PKR 1,000 million through intra-sectoral re-appropriation. Additionally, the Department has approved a work plan for the World Bank's commitment of approximately PKR 3 billion. The implementation will be overseen by a strict monitoring mechanism to ensure proper identification of sites and beneficiaries. The compensation packages for crops and livestock will be based on the Department's damage assessment.

FY	Activity Description	Expected Expenditure
2022-23	Preparation of DCEs, Tendering, Civil Work	30%
2023-24	Completion of Remaining Civil Work	70%

vi. Monitoring and Evaluation Plan:

A three-tiered monitoring system will be established to track the progress of the work and ensure quality control. The provincial-level Planning & Development (P&D) department, along with the departmental monitoring cell and respective district field formations, will oversee all rehabilitation

schemes. Monthly progress review meetings will be held under the chairmanship of the administrative secretary, while departmental progress review meetings will occur weekly. The results of these reviews will be presented during the monthly meeting at the secretariat level.

vii. Sector Resilience Plan:

Given the impacts of climate change on the agricultural sector, the Agriculture Department of KP has proposed flood strategies to mitigate the effects of climate change on agriculture and its subsectors in the province. Agriculture is vital to the country's economic growth, food security, employment generation, and poverty alleviation, particularly in rural areas. It contributes 23% to the GDP and employs approximately 38.5% of the labor force. More than 65-70% of the population relies on agriculture for their livelihood. However, agricultural productivity is being hindered by shrinking arable land, climate change, water shortages, and the large-scale shift of population and labor from rural to urban areas. To increase agricultural productivity, adopting new approaches is essential.

Critical Evaluation of effectiveness and efficiency of coordination mechanism both at federal and provincial level

Coordination between NDMA and PDMA/KP

The National Disaster Management Authority (NDMA) operates under Clause 9(a) and 9(b) of the National Disaster Management (NDM) Act of 2010, handling the full spectrum of disaster management (DM) activities in the PR3 paradigm—Preparedness, Response, Recovery, and Rehabilitation. NDMA issues directions and guidelines, as well as early warnings to federal and provincial departments and DM agencies, ensuring mitigation measures are taken for potential disaster risks. Additionally, the authority formulates contingency plans and issues yearly monsoon warnings.

The National Disaster Management Plan (NDMP) 2013-2022 is comprehensive, encompassing all disaster interventions. In 2019, the National Disaster Response Plan was introduced to provide broad guidelines for response activities. Every year, NDMA prepares a Monsoon Contingency Plan based on analysis from the Pakistan Meteorological Department (PMD) and the projected effects of climate change. This plan outlines explicit guidelines for all disaster management tiers and stakeholders to mitigate potential hazards, prepare for various scenarios, and respond effectively to monsoon-related events.

In the 2022 National Monsoon Contingency Plan, lessons from the 2021 monsoon were incorporated. The plan maps available resources, identifies the need for additional resources, and establishes a clear coordination mechanism for effective responses. NDMA works with all stakeholders, holding strategic coordination meetings to enhance collaboration with the United Nations and other humanitarian organizations.

As per the 18th Amendment, food security is the responsibility of the Federal Government. The Pakistan Agricultural Storage and Services Corporation (PASSCO) supports the KP Government by providing wheat as needed. KP places orders of approximately 0.2 million tons per request to meet the annual provincial wheat requirement of around 3.6 million tons.

The Pakistan Agricultural Research Council (PARC) plays a vital role in promoting and coordinating agricultural research across Pakistan. Its mandate includes conducting strategic research on national and provincial agricultural priorities and addressing emerging challenges. PARC also facilitates agricultural enterprises, supports provincial research systems, and provides services in germplasm conservation and supply.

Pre-Flood Coordination between Federal and KP Government

The Federal Government has been instrumental in constructing 24 small dams across KP, with a total storage capacity of 7,508 acre-feet and an irrigable command area of 49,523 acres. Notably, Pezu Dam (Lakki Marwat), Khattak Bandhan Dam (Kohat), and Makh Banda (Karak) were constructed by the Federal Government, while 21 other dams have been developed in collaboration with both the federal and provincial governments.

Additionally, seven medium-sized dams, including Bara Dam (Khyber), Tank Zaam (Tank), and others, are under construction or in the design phase. These dams, with a storage capacity of 520,884 acre-feet, will provide irrigation to 171,748 acres and generate 31.5 MW of power.

Inter-Departmental Coordination

The office of the Deputy Commissioner (DC) serves as the central hub for flood-related activities in each district. The DC coordinates with all line departments, including agriculture, to prepare contingency plans. In times of disaster, various departments, such as Agriculture Engineering, play a crucial role. For instance, the Agriculture Engineering Department provides excavators and tractors to farmers for land reclamation.

Additionally, departments such as C&W (Communication and Works), Public Health, Irrigation, and Local Government have been vital in assisting farmers during recent floods, providing necessary resources and support.

Role of Federal and Provincial Agriculture-related Departments in Flood Emergencies

Role at Federal Level

National Flood Response and Coordination Center (NFRCC)

The Federal Government established the National Flood Response and Coordination Center (NFRCC) after the 2022 floods to facilitate a multi-agency response in coordination with the National Disaster Management Authority (NDMA).

National Disaster Management Authority (NDMA)

NDMA organizes the assessment of damages and the volume of relief required. It coordinates with provinces and concerned departments to prepare for emergency response and mobilizes resources. NDMA also prepares a transition plan from relief to recovery programs.

Federal Flood Commission (FFC)

The Federal Flood Commission Implements Flood Risk Mitigation Projects, which include flood protection works as well as improvements in flood forecasting and warning systems. It is an affiliated organization of the Pakistan Meteorological Department (PMD), which disseminates warnings and river flow updates to relevant national, provincial, and district governments, as well as national response agencies, especially during the monsoon season.

Pakistan Meteorological Department (PMD)

PMD has a broad mandate that supports agro-based economic activities, air and maritime traffic safety, disaster mitigation efforts, and disseminating weather forecasts to NDMA, FFC, PDMAs, etc., along with flood information on a daily basis during the flood season.

Ministry of Water & Power

The Ministry is responsible for overall flood management and impact mitigation efforts through its attached departments (FFC, WAPDA, PCIW, IRSA). The ministry deals with monitoring preventive measures and allocating resources for flood protection works.

Ministry of National Food Security & Research (MONFSR)

The Ministry of National Food Security & Research is responsible for policy formulation, economic coordination, and planning in the fields of food grain and agriculture. This includes the procurement of food grains, fertilizers, price stabilization of agricultural products, international liaison, and economic studies to frame agricultural policies. The following organizations work under MONFSR:

- National Agriculture Research Council (NARC)
- Agriculture Policy Institute (API)
- Department of Plant Protection
- Plant Breeder's Rights Registry
- Federal Water Management Cell (FWM)
- Fisheries Development Board
- Economic Wing
- Pakistan Centre Cotton Committee
- National Fertilizer Development Centre (NFDC)
- Pakistan Agriculture Storage & Services Corporation (PASSCO)

These organizations help facilitate the Federal Government's efforts to ensure national food security by maintaining strategic reserves of various food grain commodities, providing supplies to deficit provinces/areas, and supporting the Armed Forces.

Role at Provincial Level

Relief, Rehabilitation & Settlement Department (RR&SD)

RR&SD is tasked with formulating policies, strategies, and guidelines for relief, rehabilitation, and emergency activities, which are then implemented through PDMA, Rescue 1122, and Civil Defence.

Provincial Disaster Management Authority (PDMA/KP)

PDMA's role is to coordinate efforts in tackling any emergency situation in the province. PMD/FFD provides early warnings of approaching weather systems, which are then communicated to all relevant parties by PDMA. In case of any shortfall in meeting humanitarian needs, PDMA assists by providing the required stocks. If the disaster exceeds the capacity of PDMA, NDMA is requested to provide additional stocks from national reserves. PDMA coordinates with PMD, FFC, Federal Agencies, District Disaster Management Units (DDMUs), and Line Departments for managing the entire spectrum of provincial disaster responses.

Coordination with Line Departments

PDMA facilitates horizontal coordination with relevant Provincial Line Departments and Headquarters Engineers-11 Corps. Vertical coordination with District Administration is also essential for effective early warnings, preparedness, and rescue and relief efforts at the district level.

Irrigation Department

The Irrigation Department is responsible for constructing and maintaining irrigation infrastructure in the district. It carries out detailed vulnerability assessments of irrigation infrastructure, rivers, streams, nullahs, and other waterways. The department monitors erosion of river/canal/nullah embankments and conducts necessary reinforcements and repairs. It also continuously monitors water flow and designates an emergency information officer to liaise with DEOC and PEOC during preparedness and response stages.

Agriculture and Livestock Department

Agriculture and livestock are the main sources of livelihood in rural areas. The Agriculture Department conducts detailed assessments of district flood-prone areas, reviews past disaster events, and identifies potential diseases affecting crops and livestock. The department also assesses the capacity of agricultural extension services and identifies gaps in staff, stock, and facilities. It establishes emergency response bases near vulnerable areas and follows PDMA advisories, including precautions for farmers during wheat harvesting and ensuring the safety of livestock. The following directorates fall under the Agriculture Department:

- Directorate of Livestock and Dairy Extension
- Directorate of Agriculture Research
- Directorate of Agriculture Extension

- Directorate of On-Farm Water Management
- Directorate of Agriculture Engineering
- Directorate of Fisheries
- Directorate of Crops Reporting Services (Extension)
- Directorate of Soil Conservation
- Directorate of Livestock and Dairy Development Research

Food Department

The Food Department is responsible for maintaining adequate food stocks in the district and regulating markets to ensure the availability of food items with the required quality and approved rates. It ensures food security, quality control, and regulation of sugar mills, flour mills, wheat quota distribution, procurement of wheat, and other commodities.

World Best Practices Regarding the Role of Agriculture-related Departments in Flood Emergencies (USA Model)

Bangladesh National Disaster Management Mechanism

- In Bangladesh, the National Disaster Management Commission operates directly under the control of the Prime Minister.
- There is an Inter-Ministerial Disaster Management Committee, headed by the Federal Minister for the Ministry of Disaster Management.
- The National Management Advisory Committee (NDMAC), comprising an experienced chairman and 8 members of parliament, is also involved. The chairman is selected by the Prime Minister.
- The National Platform for Disaster Risk Reduction (NPDRR) is led by the Federal Secretary, followed by the Director General and respective District Disaster Management.
- Other key committees include the Earthquake Preparedness & Awareness Committee (FPAC).
- The District Disaster Management Committee is chaired by the respective Deputy Commissioners.
- The Upazila Disaster Management Committee is headed by the Upazila Chairman.
- The Union Disaster Management Committee (UDMC) is chaired by Union Parishad members.
- The Pourashva Disaster Management Committee is led by the Mayor.
- The City Corporation Disaster Management Committee (CCDMC) is managed by the Mayor of the respective city.

Ethiopian Model of Flood-based Farming

While floods are often viewed as harmful and destructive, they can also have positive impacts and provide benefits for both people and nature. In sub-Saharan Africa, approximately 25 million hectares are already being irrigated using floods in various ways, benefiting about 50 million people who practice flood-based farming. Key elements of flood-based farming in Ethiopia and sub-Saharan Africa include:

1. **Water Distribution**: Floods can vary in intensity, duration, and unpredictability. Improving water distribution through control structures helps reduce erosion, waterlogging, and other risks.
2. **Field Water Management**: Techniques like dikes and soil bunds can protect fields from unexpected floods, while drainage ditches channel excess water away from fields.
3. **Groundwater Use**: Many areas where flood-based farming is practiced have shallow groundwater, which can be accessed through low-cost technologies like hand-drilled tube wells, treadle pumps, and solar-powered pumps.
4. **Agronomic Practices**: Introducing improved crop varieties, such as fast-growing floating rice varieties, which are grown in areas like Mali and Myanmar, can help increase productivity in flood-based farming systems.
5. **Floodplain Agriculture**: This is the most common type of flood-based farming in sub-Saharan Africa, where either receding or rising floodwaters provide water for crop cultivation.
6. **Spate Irrigation**: Floodwater from mountain catchments is diverted from normally dry riverbeds and spread over large areas for irrigation, improvement of grazing areas, filling of drinking water ponds, and groundwater recharge.
7. **Inundation Canals**: These are situated next to rivers or floodplains and are fed by water when rivers rise. The canals are then used to divert the water to nearby farmland.
8. **Depression Agriculture**: Shallow depressions are filled when the groundwater level rises on a seasonal basis. They provide enough moisture to support grazing in the dry season and crops grown without irrigation.

Evaluation of Economic Loss & Food Security Issues in the Context of the Flood

Economic Loss

Agriculture constitutes the largest sector of our economy. The majority of the population is directly or indirectly dependent on this sector. It contributes about 24 percent of Gross Domestic Product (GDP), accounts for half of the employed labor force, and is the largest source of foreign exchange earnings. It feeds both rural and urban populations. The agriculture sector is indispensable to the country's economic growth, food security, employment generation, and poverty alleviation, particularly at the rural and urban levels.

Economic Losses of Key Commercial Crops

Sindh is the province most affected by floods in terms of damage and losses to agriculture. It is estimated that the major kharif crops – rice, cotton, and sugarcane – lost 80%, 88%, and 61% of their forecasted production, respectively. These three crops alone suffered direct losses of USD 1.30 billion. There is a high likelihood of significant unreported losses in the production of other crops and livestock in the affected districts. The economic losses in agriculture extend beyond the estimated direct losses to crop production and livestock. Direct damages and losses to agricultural tools and machinery, infrastructure on farms and rural areas, and trees are likely to exacerbate the economic losses further. The indirect costs, such as draining and land rehabilitation, increased transportation costs due to damaged roads and infrastructure, losses in successive crops due to waterlogging, delays in sowing, and government rehabilitation and compensation efforts, are expected to have deeper and long-term impacts on Pakistan's agriculture.

	Sindh	**Punjab**	**KP**	**Baluchistan**	**Total**
Damages	280		16.171	20.387	640
1. Crops (Rice, Sugar, Maize, Vegetables, Fruits)					
2. Livestock	2.795		4.667		144
3. Water Management Damages			2.991		153
Total (Rs. in Billion)	282.5		19.265	20.4	937

Production Loss

	Damages		**Sind**	**Punjab**	**KP**	**Baluch**	**Total**
Crops	Total Area (Acre)		7.0		61147		
	Rice	Qty (MMT)	1.9			20.387	
		Value (Rs Billion)	116.745		1.541		
	Sugar / Maize	Qty (MMT)	10.5				
		Value (Rs Billion)	58.695		1.509		
	Cotton	Qty (MMT)	3.1				
		Value (Rs Billion)	104.275		-		
	Vegetable, Fruit)	Qty (MMT)					
		Value (Rs Billion)			9.514		
Live Stock		Value (Rs Billion)	2.795		3.711		
Water Management		Value (Rs Billion)			2.991		
			282.5		19.265	20.4	

Production Loss in KP Province

Crop	**Total Acreage**	**Damage Area**	**Production loss (Tones)**	**Estimated Financial Losses (Rs.) Million**
Maize	338061	29528	237211	1533.87
Rice	102487	20118	17825	1641.40
Tomato	8529	3797	17978	1842.29
Sugarcane	248006	42661	809663	2294.03
Vegetables	38543	5477	81942	1548.29

Fruits	21533	1053	2425	1143.60
Fruit Orchards	10808	860	296	891.89
Orchards	41540	1356	9067	1464.77
Fodder	28015	5373	438365	743.42
Cotton	2090	788	16	103.95
Mong Bean	3509	1764	10	42.34
Sesamum	1275	484	45	33.21
Date Orchards	3290	2860	371	2507.34
Wheat	8350	1568	3222	18.56
Potato	17994	2439	1494	92.54
Chillies	451	193	338	39.55
Sunflower	1681	245	201	13.41
Coriander	145	55	50	12.60
Total (Tons)			1,620,519	15967.06

Total Damages and Funds Gap (KP)

Damages (Millions)	**Intra-departmental Re-appropriation (Millions)**	**Donors' Commitment (Millions)**	**Gap (Millions)**
23,500	1,000	3,460	19,040

Food Scarcity

Pakistan is facing a crippling shortage of wheat after the devastating floods induced by record-breaking monsoon rainfalls damaged the crop in large quantities. Reports indicate that 300,000 tons of stored wheat were completely wasted due to the recent floods in Rajanpur and Fazilpur districts, causing a loss of billions of rupees. As a result, flour prices have skyrocketed, creating difficulties for citizens already burdened by the highest inflation.

According to a report by the Ministry of National Food Security and Research (MNFSR), the total losses to crops across the country have exceeded Rs. 320 billion. The report highlights that 2,845,046 acres of cropland in Sindh have either been completely or partially damaged. Khyber Pakhtunkhwa has lost 14,397 acres, and Balochistan has lost 108,295 acres. However, the extent of the damage in Punjab has not been revealed in the report.

Projected Wheat Requirement/Demand for 2022-23

Province/Territory	**Population (Million)**	**Consumption/Demand (Million Tons)**
Punjab	121.4	13.96
Sindh	52.8	6.007
KP	39.18	4.53

Baluchistan	13.62	1.57
Islamabad	2.20	0.253
AJK	4.79	0.550
GB	1.69	0.194
RFG's	1.529	0.175
Seed & Feed		1.5
Strategic Reserves		2.0
Grand Total		**30.739**
Net Production		26.39
Net Shortage		4.349
Carry Forward (2021-22)		2.048
Import Received (2022)		0.926
Provisional Shortage		**1.423**

Gap Analysis

Gap Analysis in the areas described in Section I to IV

i. Despite being the fifth richest country in water resources, Pakistan is estimated to be losing 13 million cusecs of water every year from its rivers into the sea, due to the lack of enough reservoirs or dams to store water.

ii. Owing to traditional methods of cultivation and harvesting, Pakistan has a low yield per acre. The average crop yield in Pakistan is just a quarter of that in advanced countries.

iii. There is no unified policy for disaster management in Pakistan.

iv. Disasters are often exploited for political purposes, leading to the suffering of the general public, who are the end-users.

v. The Agriculture Department lacks the authorization to spend budget funds in emergencies.

vi. Politicians are not involved in disaster management committees, so there is a lack of political vision, resulting in a lack of interest and proper attention to disaster management.

vii. The Agriculture Department does not possess modern machinery to assist farmers during disasters, except for a few excavators.

viii. There are no committees at the Tehsil and Union Council levels to address disaster-related issues.

ix. Surprisingly, the Irrigation (Flood) Department does not have a single boat in D.I. Khan District, indicating a lack of resources.

x. The C&W, KPHA, and NHA show little regard for natural water flow paths while designing and constructing roads and highways, leading to water submerging crops.

xi. Drains are full of weeds, which hampers the smooth flow of floodwater, resulting in crop damage.

xii. There is a lack of inter-departmental coordination between Agriculture, Irrigation, and CRBC, which exacerbates the flood impact on crops.

xiii. Surprisingly, Punjab has not conducted any assessment regarding flood damages to agriculture.

xiv. A large portion of land is owned by feudal lords, and the farmers working on the land are tenants. This situation of insecure land tenure neither encourages hard work nor attracts capital investment.

xv. Waterlogging and salinity are increasing day by day, and no effective measures have been taken to control them. The storage capacity of dams is decreasing due to the accumulation of mud at their basins, reducing the water availability per acre. As a result, farmers are increasingly relying on tube wells for irrigation, which worsens the salinity problem in parts of Punjab and Sindh.

xvi. The price policy for crops is weak. For example, sugarcane in Punjab is sold for 200 Rs. per 40 kilograms, which is then purchased and stockpiled by industrialists in their stores, reducing market prices.

xvii. The irrigation system of Pakistan needs improvement, as around 67% of the land is irrigated by canals. Modern irrigation techniques, such as drip and sprinkler irrigation, could solve many of the irrigation issues in Pakistan.

xviii. The government must embark on a crash program to build small dams. These dams would play a crucial role in improving land fertility, thus increasing per-acre yield.

Stakeholder Analysis

The key stakeholders in Pakistan's agriculture sector include:

1. **Government of Pakistan**: The government has the responsibility to develop policies, allocate budgets, and manage agricultural resources and disaster responses.
2. **Farmers**: They are the main producers, facing challenges like low yields, water scarcity, and lack of support during disasters. The majority are from the lower middle class.
3. **Public**: As the end-users of agricultural products, the public is affected by food security issues, inflation, and price hikes in essential food items.

Key Issues:

- Pakistan is recognized as an agricultural country, but its agricultural sector has one of the lowest growth rates.
- The budget allocated to agriculture is insufficient for research and extension.
- 95% of farmers belong to the lower middle class, using traditional farming methods.
- Illegal housing societies are taking over agricultural land, reducing farming areas.
- Public interest in agriculture is declining due to the energy crisis, low profits, and high labor costs in the sector.
- Farmers are in search of bumper crops, but this is often unrealistic, given the current conditions.

PESTLE Analysis

Political

Effective leadership and political acumen can drive significant progress in the agriculture sector. Strong governance and the implementation of disaster management policies can improve the sector's resilience and sustainability.

Economic

Agriculture requires relatively low investment compared to other sectors, making it accessible to many people. However, the sector needs better support and investment to improve productivity and infrastructure.

Social

Agriculture plays a crucial role in enhancing food security, which, in turn, improves public prosperity and social welfare. The sector has the potential to provide employment and alleviate poverty, especially in rural areas.

Technological

Adopting advanced farming technology can save time, increase productivity, and improve the overall growth of the sector. The use of modern irrigation systems, drones for monitoring, and automated machinery can significantly boost efficiency.

Legal

Although laws and regulations for the agricultural setup exist, their enforcement and execution are weak. There is a need for stricter implementation of these laws, particularly regarding land ownership, water rights, and environmental regulations.

Environmental

Farming, when practiced sustainably, benefits the environment by absorbing carbon emissions, enhancing soil health, and maintaining biodiversity. However, improper agricultural practices, such as overuse of pesticides and water, can lead to environmental degradation. Proper management of water resources and soil conservation techniques are vital to preserving the environment while maintaining agricultural productivity.

SWOT-EETH Analysis

SWOT_EETH Analysis of Agriculture Sector at Federal Level

Strengths	**Enhancing Strengths**
i. Controlling Authority ii. Strong Administration iii. Competent Staff iv. Foreign Loans v. Legal Cover	i. Proactive Approach ii. Accountability iii. Self-dependency iv. Meaningful involvement v. Needs more reforms
Weaknesses	**Eliminate Weaknesses**

i. Extended AOR ii. Political Instability iii. Provincial Autonomy iv. Weak Agriculture Policies v. Old Canal System	i. Seriousness in dealing the issue ii. Political maturity iii. Food security at Federal level iv. Needs strong decision v. Reconstruction/rehabilitation of canal
Opportunities	**Taking Advantage of Opportunities**
i. Best use of flood water ii. FAO involvement iii. Rescheduling of Foreign loans iv. NDMA v. NFRCC	i. Proper mechanism be initiated ii. To get benefit of it iii. Exploit the economic facility iv. NDMA be strengthened v. NFRCC be involved
Threats	**Hedge Threats**
i. Climate Change ii. Plain Areas iii. Small Scale Farming iv. No positive response from Foreign Donors v. Indian Control on rivers	i. Implementation of PEPA Act-1997 ii. Drains be constructed/ maintained iii. Chamber of Commerce involvement iv. Self-Reliance v. Construction of dams and small dams

SWOT-EETH Analysis of Agriculture Sector of KP

Strengths	**Enhancing Strengths**
i. Sufficient Human Resource ii. PDMA iii. District Administration iv. Legal Cover	i. Capacity Building ii. Sources be increased iii. ADC relief be increased iv. Reforms may be brought in laws for agriculture
Weaknesses	**Eliminate Weaknesses**
i. Encroachments on rivers/ drains ii. Food security dependence iii. Uncultivable lands iv. Housing colonies v. Traditional form of harvesting	i. Strong anti-encroachment drive ii. Surety from Punjab iii. Dams should be completed iv. Action against illegal housing society and ban on it v. Awareness about modern harvesting-tunnel forming
Opportunities	**Taking Advantage of Opportunities**
i. D.I Khan a Food Basket ii. Tea Plantation on mountains iii. Feasible for dams iv. Water abundance	i. KP Economic Zone be started soon ii. Hazara region may be exploited iii. Prioritized dams be constructed like Kurram Tangi dam iv. Proper use of it
Threats	**Hedge Threats**
i. Law and order situation ii. Soil erosion iii. Land sliding iv. Meager economy	i. Needs settlement ii. Protection bund iii. Tree Plantation iv. Federal Support

Conclusions

Agriculture constitutes the largest sector of our economy, contributing 24% to GDP. The majority of the population is directly or indirectly dependent on this sector, which feeds both the rural and urban populations. The agricultural sector is indispensable to the country's economic growth, food security, employment generation, and poverty alleviation, particularly at the rural and urban levels.

The recent floods have severely damaged the agriculture sector across the entire country, especially in Sindh Province, resulting in significant losses to standing crops. This situation has created a food security crisis, particularly in Sindh, due to stagnant water remaining for a prolonged period. The country has faced a financial loss of Rs. 800 billion and is also experiencing food scarcity due to the damage to wheat crops and stocks, which contribute to 90% of household consumption. A well-planned, integrated preparedness mechanism and coordinated efforts could have minimized the impact.

In KP and Balochistan, the agricultural sector was damaged due to flash floods in plain areas. Drains and canals have not been cleared for the last 15 years. This time, the response from foreign donors was not up to the mark. Political rivalry between the federal government and the provinces resulted in a low level of coordination.

While floods are often framed as harmful and destructive, they also have many positive impacts and provide benefits for both people and nature. In Sub-Saharan Africa, an estimated 25 million hectares have already been irrigated with floodwaters, and it can be assumed that 50 million people directly benefit from flood-based farming.

Recommendations

Short Term

i. The wheat stock system should be improved.
ii. Cess/royalty funds may be diverted to the agriculture sector for the rehabilitation and reconstruction of water channels and roads for transportation of crops like sugarcane.
iii. The Flood Early Warning System needs to be upgraded immediately to include catchment areas, update existing river and floodplain geometry, study radar calibrations, enhance the reliability of Quantitative Precipitation Forecasts (QPF) through meteorological studies, and train meteorological professionals.
iv. Ensure adequate conveyance capacity within drains/water channels by removing weeds and encroachments from the embankments.
v. The PPRA Rules of Exemption from tendering in the case of emergencies may also be applied to the agriculture sector in the event of floods.

Long Term

i. Develop an incentive program to preserve, increase, or improve climate-resilient agricultural land.
ii. Identify, create, or reallocate resources to develop educational materials and technical bulletins on climate change preparedness and adaptation for the agricultural sector.
iii. Implement flood-based farming systems. There are six ways to increase productivity: 1. Water distribution, 2. Field water management, 3. Groundwater use, 4. Agronomic practices, 5. Multi-functional use, 6. Internal governance.
iv. Ensure early approval of required funds for the rehabilitation of agriculture infrastructure damaged by floods.
v. Construct small dams to mitigate floods and prevent future flash flooding.
vi. Repair, strengthen, and upgrade existing flood protection works on an immediate basis to protect the population and infrastructure from flood threats.
vii. Pool agricultural machinery, especially tractors, trolleys, and implements, for the evacuation and shifting of people, livestock, grain stock, and luggage.
viii. Develop provincial zoning for livestock farming/rearing based on flood resilience.
ix. Promote intensive social tree plantation, desilting, and cleaning of watercourses.

References

1. ANI, A. N. I. (2022, October 17). Flood situation in Pakistan may threaten food security: Report. ANI News. Retrieved November 30, 2022, from https://www.aninews.in/news/world/asia/flood-situation-in-pakistan-may-threaten-food-security-report20221017231412/#:~:text=An%20estimated%2014.6%20million%20people,)%20Phase%204%20(emergency)
2. Blum, G., & Modirzadeh, N. (2022, March 2). The war in Ukraine and international law. Harvard Law School. Retrieved November 26, 2022, from https://hls.harvard.edu/today/the-ukraine-conflict-and-international-law/
3. Davis, D. G. D., & Slobodchikoff, D. M. O. (2022, August 1). Great-power competition and the Russian invasion of Ukraine. Air University (AU). Retrieved November 27, 2022, from https://www.airuniversity.af.edu/JIPA/Display/Article/3111129/great-power-competition-and-the-russian-invasion-of-ukraine/
4. FAS, U. S. D. A. (2022, November 9). Crop explorer country summary for major crop regions – United States Department of Agriculture: Pakistan Wheat Area, Yield and Production. Retrieved December 1, 2022, from https://ipad.fas.usda.gov/countrysummary/Default.aspx?id=PK&crop=Wheat
5. Hayder, H. (2022, September 6). Floods to cause severe flour crisis in Punjab. ProPakistani. Retrieved December 3, 2022, from https://propakistani.pk/2022/09/06/floods-to-cause-severe-flour-crisis-in-punjab/
6. Global Hunger Index. (2022). Global hunger index scores by 2022 GHI rank. Global Hunger Index (GHI) – Peer-reviewed annual publication designed to comprehensively measure and track hunger at the global, regional, and country levels. Retrieved November 30, 2022, from https://www.globalhungerindex.org/ranking.html
7. Flood-Based Livelihoods Network. (2022, September 12). Home – Flood-Based Livelihoods Network. Flood. Retrieved December 4, 2022, from https://floodbased.org/
8. Water, Land, and Ecosystems. (2020, November 20). Six ways to increase productivity of flood-based farming systems. Retrieved December 4, 2022, from https://wle.cgiar.org/solutions/six-ways-increase-productivity-flood-based-farming-systems