



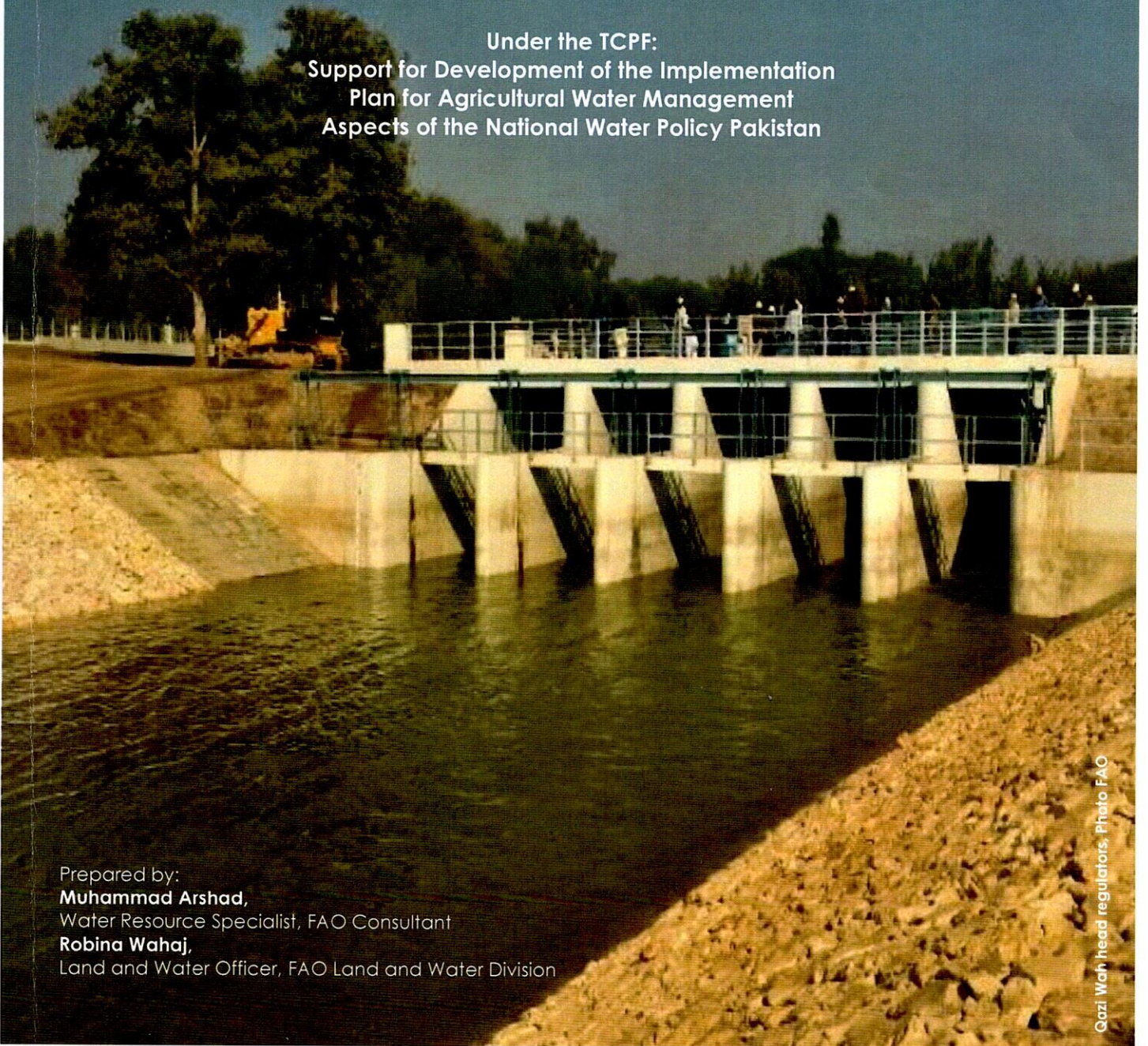
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A Stock-Take of Agriculture Water Management in Pakistan

Under the TCPF:
Support for Development of the Implementation
Plan for Agricultural Water Management
Aspects of the National Water Policy Pakistan



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About This Publication

The report has been prepared as part of the Technical Cooperation Agreement, Support for the development of road map and implementation plan for Agricultural Water Management aspects of the National Water Policy with the Ministry of National Food Security and Research. This stock-take report presents a description and a landscape analysis of the public investment in agriculture water management in Pakistan. The report will serve as a road map and primary input to the development of a National Action Plan for agriculture water management.

To make better comparisons with the National Water Policy targets, allocations in the irrigation and agriculture sub-sectors, are compiled in the following three major categories, that includes; allocations for;

1. Dams and surface storages,
2. Canal extension and improvement and
3. On-Farm Agriculture Water Management

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Executive Summary

The Background and Context:

The water crisis in Pakistan remains the biggest risk to its economy, water is becoming a scarce resource with each passing year. The National Water Policy, 2018 provides a framework and set of guiding principles for provinces to formulate strategies and action plans for sustainable water use and management of declining water resources. At the same time, the policy outlines several reforms and suggests targeted investments for a water-secure Pakistan. The Stock-Take report on Agriculture Water Management is a part of a Technical Cooperation Programme (TCP) of FAO with the Ministry of National Food Security and Research (MNFS&R). The Technical Cooperation will primarily include stock taking and support for the development of a road map for an implementation plan focused on the agricultural aspects of the National Water Policy. This report is a step towards this initiative that will provide an overlay of the investment requirements in the agriculture water management by looking at the past trajectory, over two decades, of public sector investments at the national level.

Section 1 of the report provides the context and background. Section 2 provides the National Water Policy priority areas, primarily the agriculture water management, with recommended allocations and to date progress. Section 3 is directed to the longitudinal analysis of Public Sector Investment over a 20-year period on agriculture water management. An outline of the method, data, and information sources is presented in Section 3. The sources of information and data for this Stock Take report have been compiled from the Federal Public Sector Development Programmes (PSDP) and data from the Provincial Annual Development Programmes (ADP) of four provinces.

One limitation of the report is that it did not take into full account of the investment and allocation data from the foreign-funded components of the irrigation water management projects, mainly grants and investments out of the Public Sector Development Programmes. However, the data and results presented in the Stock Take report provides an investment landscape for agriculture water management at the national level. Nonetheless, the Stock Take report provides a high level of confidence based on which water sector investment priorities can be readjusted with consideration to emerging challenges of climate change, population growth, and transboundary water issues which are becoming more challenging than appeared to be at the time when national water policy was drafted and finally approved in 2018.

Summary of Results

Longitudinal Analysis over two-time series, 20 years and last 5 years, of Public Sector Investment in agriculture water has been carried out and a summary of results is documented below for the Federal PSDP, provincial ADPs, and the total National Allocations;

Allocation Under Federal PSDP

1.1 In the last 20 years, Federal Allocation exceeded PKR 870 billion, averaging PKR 43.54 billion per financial year. The highest allocation (PKR 85.73 billion) is observed in FY 2019-20 and the lowest (PKR 9.00 billion) in 2000-2001.

1.2 Comparison of the Federal PSDP over two decades indicates that allocation averaged PKR 32.48 billion in the first decade (fiscal years 2001-2002 To 2010-2011) and PKR 48.30 billion in the second decade with nearly a 21 % increase (fiscal years 2011-2012 To 2020-2021).

1.3 **Under the Federal PSDP**, construction and raising of dams had been the priority investment, where a Total of PKR 304.71 billion were allocated from the Federal PSDP, including a foreign funding component of 1.37 billion PKR. The allocation included PKR nearly 200 billion on construction/raising of Dams (66%), followed by 79.31 billion on Canal extension and improvement (26%) and PKR 25.65 billion on Agriculture related on-Farm Water Management Initiatives (8%).

Allocation 2016-17 To 2020-21 Under Provincial ADP – Four Provinces,

- i. Over the analysis period Government of Balochistan's allocation to Agriculture, Water Management totalled PKR 88 billion of which 24% of funds were allocated to the construction of storage dams, 19 % to canal extension and improvement and 57% to Agriculture on-farm water management.
- ii. During the same period, the Government of Punjab made a total allocation of PKR 220 billion of which 5% of funds were allocated to the construction of storage dams, 57 % to canal extension and improvement and 38% to Agriculture on-farm water management.
- iii. The government of Sindh made a total allocation of PKR 226 billion of which 2% of funds were allocated to the construction of storage dams, 60 % to canal extension and improvement and 38% to Agriculture on-farm water management.
- iv. Khyber-Pakhtunkhwa Province made a total allocation of PKR 81 billion to the sector during the 5-year period. The respective shares of allocation to the construction of storage dams were 6% only, while a major share of allocation 49 %, went to canal extension and improvement and the rest 45% to agriculture on-farm water management. In addition to that, Khyber-Pakhtunkhwa Province, also received separate financing of PKR 9.6 billion in FY in 2020-21 for newly merged areas (former FATA, Federally Administered Tribal Areas) for the water and irrigation sector under the Accelerated Implementation Programme for newly merged areas.
- v. The four ADPs combined, allocated 7% to dams 51% to canal extension and improvement and 42% to Agriculture on-farm water management initiatives. This is almost an inverse of the Federal PSDP allocation priorities, where an allocation of 66% was made available to dams, 26% to canal extension and improvement and 8% to agriculture on-farm water management. In summary, the Provincial allocations are targeted towards medium to small-scale projects. While Federal allocations targeted financing for large infrastructure projects and national level programmes.

Total National Allocation Agriculture Water Management (2016-2021)

- i. This National Water Allocation PKR 919 billion constitutes 67% share from the provinces (combined) Annual Development Programmes ADPs and 33% from the Federal PSDP. The distribution of National allocations for each of the three categories, indicates that of the total PKR 919 billion (100%), allocation for dams included a share of PKR 200 billion (83%) from the Federal PSDP and PKR 41 billion (17%) from the Provincial ADPs. Similarly of the total PKR 396 billion (100%), allocation for canal extension and improvement constitutes a share of PKR 79 billion (20%) from the Federal PSDP and PKR 316 billion (80%) from the combined Provincial ADPs. Likewise of the total PKR 282 billion (100%) allocation to Agriculture on-farm water management, a share of PKR 26 billion (9%) came from the Federal PSDP and PKR 257 billion (91%) from the combined provincial ADPs.
- ii. The category wise analysis reveals that, overall, at the national level, canal extension and improvement is the highest National water spending priority (43%) followed by on Farm Water Management (31%) and lastly construction of dams (26%) of total national water allocation.
- iii. National Water allocation priority is in contrast to the Federal Level Spending priority where construction of dams received the highest allocation with (83 % share of the Federal PSDP), followed by canal improvement and extension (20% share of the Federal PSDP) and lastly agriculture on Farm Water Management (9% share of the Federal PSDP) during the analyses period.

Further analyses of subsectors allocation are carried to compare the allocation of each category with the other for the period 2016-17 to 2020-21 that is comparative analysis of dams versus canal extension and improvement, dams versus Agriculture on Farm Management, and canal extension and improvement versus Agriculture on Farm Management. Major conclusions of the comparative analysis are listed below;

Conclusion 1: Overall dams received PKR 155 billion (-17%) less than canal extension and improvement during the analysis period.

Conclusion 2: Overall dams received PKR 42 billion (-5%) less than the agriculture on Farm Water Management over the same period.

Conclusion 3: Overall Canal extension and improvement received PKR 113 billion (+12%) more than Agriculture on Farm Water Management during the same 5-year period.

In summary, a comparative analysis of the distribution of the National Water budget among three categories during the five-year period of 2016-17 to 2020-21 reveals that dams received PKR 155 billion

(-17%) less than canal extension and improvement during the analysis period. On similar lines, dams received PKR 42 billion (-5%) less than the agriculture on Farm Water Management over the same period. However, Canal extension and improvement received PKR 113 billion (+12%) more than Agriculture on Farm Water Management during the same 5-year period.

Category	Federal PSDP		Provincial ADPs		Total National Allocation	
	Amount PKR Billion	% of Total Water Budget	Amount PKR Billion	% of Total Water Budget	Amount PKR Billion	% of Total Water Budget
Storage/dams	200	83%	41	17%	241	26%
Canal extension and Improvement	79	20%	316	80%	396	43%
Agriculture/on Farm Water Management	26	9%	257	91%	282	31%
Total	305	33%	614	67%	919	100%

Data Source: Compiled from Federal PSDP and Provincial ADPs, Ministry of Water Resources, Ministry of Planning Development and Special Initiatives, PSDP Ministry of Agriculture and Food Security, provincial Irrigation, Agriculture and Planning and Development Departments

NWP Recommended Investment versus Actual Allocation for Agriculture Water Management 2018-2030

Table 2 is presented to highlight the difference in the recommended investment by the National Water Policy vis- a-vis actual National allocation made from 2016-17 to 2020-21, collectively from the Federal PSDP and all Provincial ADPs combined for the period 2016-17 to -2020-21.

Category	Total Commitment (2018-2030, 12 Years) PKR Billion	*Recommended/Planned Investment ¹ (2017-2021, 5 years), see foot note PKR Billion	**Actual Allocation ² PKR Billion	Difference (recommended-Actual) PKR Billion	Difference as of Planned (%)
Storage/dams	1600	667	241	-426	-64%
Canal Extension and Improvement including drainage, flood control, rehabilitation of existing system	666	278	396	118	43%
Agriculture/on Farm Water Management	800	333	282	-51	-15%
Total	3066	1278	919	-359	-28.8%

An overall deficit of PKR 359 billion is observed in the overall allocations, recommended by NWP viz a viz actual allocation during 2016-17 to 2020-21 at the national level. This is nearly 28% below the recommended level of investment in the overall irrigation and agriculture water sector for the analysis period.

Key Results, Thematic Analysis: Planned versus Actual National Water Allocation

Thematic, per category, analysis of Planned commitments versus Actual allocation is carried out (2016-17-2020-21) to track changes in allocations for the three thematic areas. Thematic analysis will guide

¹ *Recommended Total Commitment is calculated prorata till 2018-2030 (12 Years)

² **Actual Allocation are for 5 years FY 2016-17 to 2020-21 (5/12)

policy decisions for additional financing and realigning allocations to meet NWP targets. The analyses will also provide a space for active dialogue and discussions, revisiting targets to meet Agriculture Water Management needs and priorities in the forthcoming National Action Plan for Agriculture Water management.

- i. National Water policy Targets for the construction of small, medium, and large dams recommended a total allocation of PKR 667 billion, while the allocation of only PKR 241 billion were made during the 5-year analysis period, that is PKR 426 billion, 64%, under financing) against the planned investment stated in the NWP targets,
- ii. In contrast to the under-investment on dams, Canal extension and improvement, received the highest allocation among all three under consideration thematic areas and appears to be the highest national priority. Against the recommended level of investment of PKR 278 billion, canal extension and improvement received an allocation of PKR 396 billion, over financed by PKR 208 billion (118% over financing).
- iii. Next, National Water policy targets for on-farm water management recommended a total allocation of PKR 333 billion, while the allocation of only PKR 282 billion was made for the analysis period 2016-17 To 2020-21. This (actual) allocation for Agriculture on-farm water management is under financed by PKR 51 billion (15%) below the recommended allocation as stated in NWP subsector allocation (water conservation) for the period 2016-17-2020-21
- iv. The OFWM programme though highly inclined towards the lining of water courses is argued, whether the investment in the lining of water courses has resulted in substantial water savings. Seepage losses are controlled but research studies show that in Pakistan almost 43.5% of the water losses occur in lined watercourses and 66% in the unlined water course. This indicates that not necessarily lining of water course provide, the desired level of water savings. Thus, the need of a nationwide research study may identify and inform a set of farm-level interventions that provide the best social, economic, and environmental returns against the investment made.

The Way Forward

The National Water policy suggests several reforms and outlines investments to enhance national water security and its productivity. The policy also suggests the need for dialogues among stakeholders and water institutions at the national and province level for the implementation of priority actions identified. Thus, the need for the development of an overarching implementation plan of the National Water policy 2018, is seen as very important. While at the same time developing sub-sector plans, including Agriculture Water Management, is seen as highly important for achieving national water policy targets by the year 2030. This Stocktaking report has conducted a landscape analysis of the public investment in Agriculture Water Management in Pakistan. The report is expected to be used as the primary input to the development of a National Action Plan for Agriculture Water Management.

The description of data and analysis in this Stock Take report presents an overall funding landscape of the three thematic areas of Agriculture Water Management concerning the National Water Policy. The report provided a comprehensive overview of the Federal and provincial investment in the mentioned sub-categories since the year 2000 with greater focus and narrowing down analyses to the last five years. The analyses have assessed and examined allocations for national water policy milestones for the first five years, since its approval in April 2018. The report provided a comparative analysis of planned investments and actual allocations on water management priorities for the three thematic areas supported by secondary data from the public sector investments. This stock Take report is a step toward the development of an implementation plan for agriculture water management. The report compiled investment data and will invite relevant institutions to review this Stock Take report and jointly plan the road map and develop an implementation at the national level for management of agriculture Water.

Section 1: The Context and Background

Water and Food security nexus

Pakistan has an agrarian economy with nearly 70% of the population is directly or indirectly associated with the agriculture sector. The country is home to nearly 220 million people³ with the fifth largest population in the world. Planning and management of water resources in Pakistan is much emphasized because water is a primary input to agricultural production and an important resource for national food security. At the national level the use of surface water has already surpassed its consumptive limits and now ground water from many aquifers are over-exploited to supplement irrigation⁴.

The country is considered water insecure, as it's per capita water availability, since partition in 1947, has declined from over 5,000 to less than 1,000 cubic meters per person per year⁵. The declining per capita water availability may have serious implications for food security and on the livelihoods of small farmers. Because in coming years water shortages are likely to affect crop yields, resulting in reduced agricultural production and shrinking farm incomes. This reduction in water availability is mainly attributed to high population growth, projected to reach 230 million by 2025.

It is envisioned that declining per capita water availability is becoming a major challenge to ensure food security⁶ in Pakistan. The National Water Policy, 2018 provides a framework and set of guiding principles for provinces to formulate strategies and action plans for sustainable use and management of water resources.

In Pakistan, historically, much of the production gains in agriculture had been achieved by expanding the planted area. However, in the future additional food production is expected to come from higher yields through efficient use of water and a set of additional inputs to the cropland. The additional input to the cropland largely includes zero tillage, laser land leveling, and furrow bed planting⁷. There is growing scientific evidence that water efficiency alone does not necessarily lead to reduce the stress on water resources, as farmers have more demand to utilize the saved water to other consumptive uses such as increasing the crop area or planting more profitable high delta crops⁸. Research studies⁹ provide evidence that commercial-scale large farming systems in the Indus basin tended to use the field scale irrigation savings to increase cropped area. Thus, objectives of all Agriculture water and on-farm water management (AWM) programmes shall explicitly define whether the saved water is directed to reduce pressure on water resources by its allocations to other high demand uses or is the saved water directed to grow more crops with saved water?

There is broad consensus that the main pathways for managing irrigated agriculture are to increase the output per unit of water, reduce water losses to unusable sinks and reallocate water to higher priority uses (societal aspects)¹⁰. In summary this narrative advocates to the interventions leading to demand management of agriculture Water in parallel to the supply side enhancement.

Managing (agriculture) water demand is closely linked to water pricing. However, at present, there is no rational mechanism and legal framework to regulate water pricing in Pakistan¹¹. Unregulated and low water price has led to intensive and overuse of the limited water resources. In this connection, at the same time, conventional water-use allocations for agriculture need to be revisited based on economic returns, for example, more allocation of water for those sectors which are financially more viable and have higher productivity per unit volume of water consumed.

Further, global warming and climate change require immediate attention to review cropping patterns, crop rotations and cropping intensity. More storage of surplus water is needed during periods of water abundance such as monsoon and glacial and snow melts for use in lean periods and droughts. Promoting resource-efficient conservation technologies such as sprinkler, bubbler, drip, furrow-bed, laser-leveling and minimum tillage can help save valuable water in agriculture. However, in Pakistan,

³ Pakistan Bureau of Statistics, available from <https://www.pbs.gov.pk/>, accessed June 29, 2021

⁴ Qureshi A, S., 2000 DOI: 10.3390/w12113017

⁵ National Water Policy, 2018

⁶ Ahmed et al., 2015

⁷ erstwhile

⁸ Grafton et al 2018

⁹ Ahmed et al., 2015, erstwhile

¹⁰ Howell, Terry A, 2001

¹¹ Pakistan National Water Policy, 2018

such technologies have been tested on a limited scale in large and commercial farms only with some success.

Structure of the Report

This Stocktaking report presents the state of agriculture water management in Pakistan. It compiles secondary data and presents the allocation of public sector financing to agriculture water and its management over the last two decades. The report will be used as a source and primary input to the development of a National Action Plan for Agriculture Water Management.

Section 2 provides The National Water Policy Guidelines for Agriculture Water Management. It also discusses the significance and challenges of managing agricultural water within the context of national water policy.

Section 3 is directed to longitudinal analysis of public sector investment in agriculture water management over a period of 20 years. The public investments, both federal and provincial allocations, in the last two decades, are briefly discussed with a greater focus on financial allocations during the last five years to highlight national and provincial investment priorities in irrigation and agriculture water management. For a broad understanding, overall sector investment data is presented mainly allocations for building new storage dams, improving surface irrigation and canals, and increasing irrigation water efficiency through on-farm water management.

Section 4 provides an analysis of national water policy targets versus actual allocation from 2017-2021. The analyses have been carried out to assess the status of financial allocations towards National Water Policy targets as at June 30, 2021. The longitudinal analyses of the public sector investment are made for the following outcomes;

- i. Compare actual allocations vis-à-vis allocation (funds) commitments to meet targets of the national water policy (Section 4)
- ii. Inform investment gaps in agriculture water management to readjust future allocations for achieving and/or redefining national water policy targets

Section 5 puts together conclusions and next steps for the development of a road map and national action plan for AWM in Pakistan.

Section 2: The National Water Policy Guidelines for Agriculture Water Management

Pakistan's first-ever, National Water Policy was approved by the Council of Common Interests (CCI) in April 2018. At the same time, Pakistan Water Charter was signed by all four provinces, as a commitment towards cooperation for water reforms and implementation of the approved National Water policy.

"The Charter is a call to action and the declaration of Water Emergency". The charter proclaims as "We must now look beyond our differences and come together as a nation to rise to the challenge that is before us. We have done so before, and we can do it again. We will seize the day and secure our collective future. This is our promise to the coming generations". (Text adopted from the National Water Charter, 2018, pp 4.).

The implementation of the National Water policy is pivotal for water resource management and reforms at the national scale. However, the implementation of the NWP is hindered by several challenges. This is speculated that among others weak institutional setup for implementation of national water policy and insufficient financing of the major infrastructure projects are two major barriers to implement targets of the national water policy see Table 4.1. With this background, the development of National Action Plans for the six strategic areas¹² of the national water policy can provide a major response to the crawling water crises that are becoming more critical with each passing year.

The National Water Policy Prioritized Areas

The National Water Policy has identified *Relative Priorities of water use* with 33 policy objectives, six broad strategies, and six planning Principles. Among the relative priorities, priority 7 conservation of water resources, priority 8 impact of climate change, priority 10 irrigated agriculture, and priority 11 rainfed agriculture is most relevant to the context of this Stock-Take report on Agriculture Water Management. A full description of the NWP, priorities can be accessed from the NWP document, available from <https://mowr.gov.pk/index.php/national-water-policy-2018/>

¹² NWP, Priority Areas: Storage; Water conservation and efficient use; Drainage; Flood control; Rehabilitation of irrigation system; Research

The National Water Policy Guidelines for Agriculture Water Management

Para 10 of the National Water Policy is specific to irrigated agriculture, with emphasis on the development of strategies and action plans to ensure food security for the people of Pakistan. A 12-point agenda of the National Water policy aims at improved irrigation and agriculture practices, is summarized below;

10.1 Strategies and action plans shall be prepared to ensure food security for the people of Pakistan.

10.2 The concept of "More Crop Per Drop" shall be pursued by, the following actions:

A national plan for implementation of improved irrigation methods and practices;

Steps will be taken to promulgate a law banning flood irrigation throughout the country as early as possible

Extensive research and development for new varieties of crops with high yields, lower water consumption, reduced GHG emissions, resistant to heat stress, drought-tolerant, and less prone to insects and pests.

10.3 Modernize irrigation network.

10.4 The concept of participatory management of irrigation systems shall be promoted and monitored with reference to its outcomes.

10.5 Groundwater shall be managed in a more sustainable way to protect aquifers from pollution and overdraft.

10.6 Introduction of bio-fertilizers and bio-pesticides shall be encouraged to minimize ground water pollution.

10.7 IRSA (Indus River System Authority) to implement The Water Apportionment Accord of 1991, in letter and spirit as per provincial share stipulated in the Accord.

10.8 Equity of water distribution between head and tail reaches shall be ensured and water allocations between various canal commands shall be rationalized, without violating the Water Apportionment Accord allocations.

10.9 Huge reservoir of marginal quality of ground water shall be productively utilized with due diligence. Incentives may be offered to farmers for use of this water for salt-tolerant crops.

10.10 Use of treated sewage shall be promoted for non-edible crops.

10.11 Irrigation facilities shall be extended to new culturable command areas for growing low delta high-value crops through improved irrigation methods/ technologies.

10.12 Measures are required to enhance the water charges for agriculture and industrial use to a realistic extent for revenue generation to meet operational costs of the water systems.

At the same time, NWP sets time-bound targets to be achieved by 2030, illustrated in the next section.

The National Water Policy Targets 2030

The National Water Policy, 2018 provides a framework and set of guiding principles for provinces to formulate strategies and action plans for sustainable use and management of water resources.

It sets the following targets to be accomplished by 2030;

- 1 Reduction of 33 percent in the 46 MAF river flows that are lost in conveyance, through
- 2 an accelerated programme of water course lining especially in saline or semi saline areas.
- 3 The existing water storage capacity of 14 MAF to be increased by an additional 10 MAF, thereby immediately starting construction of the Diamer-Basha Dam with live storage of 6.4 MAF
- 4 Increase of at least 30 percent in the efficiency of water use by producing "more crop
- 5 per drop through the introduction and upscaling of water-efficient technologies such as drip and sprinkler irrigation, this should be augmented by realistic water pricing policy.
- 6 Gradual replacement and refurbishing of decades-old irrigation infrastructure in
- 7 accordance with an adequate asset management plan.
- 8 Real-time monitoring of river flows by IRSA to be ensured through inter alia, telemetric monitoring to maintain a transparent water accounting system before the end of 2021.
- 9 To establish and maintain a reliable assessment of water resources in the country, Federal and provincial water sector organizations would develop a standardized and uniform mechanism for data collection of various parameters of water resources including but not limited to rivers/canals

gauge and discharge, rainfall/snowfall, depth to the groundwater table, surface/ subsurface water quality parameters, river/canal, and reservoirs sedimentation.

- 10 National Water Policy recognizes the need to ensure that the water sector receives at least 10 percent of Federal PSDP allocation in 2018-19, gradually increasing to 20 percent by 2030. Correspondingly the Provincial Governments may also increase their development expenditure for this sector.

Sub-sector wise estimates of investment needed by 2030 are provided in table 2.1 below;

Table 2.1 Sub-sector wise investment needed by 2030 as per NWP (PKR. Billion)- Sub Sector Investment on Major Projects		
Sub Sector	Investment, PKR Billion	Major Projects
Storage	1,600	Diemer-Basha Dam, Mohmand Dam
Conservation	800	HEIS Projects, the lining of distributaries and minors, telemetric monitoring, improvement of conveyance efficiency
Drainage	150	RBOD-I, RBOD-II, and RBOD-III, new reclamation projects
Flood Control	186	National Flood Protection Plan-IV (NFPP-IV)
Rehabilitation of Irrigation System	300	Rehabilitation of barrages, headworks, and canals
Research 1% of total	30	IWASRI Research Program, GMRC, Hi-AWARE
Total	3,066	

Data Source: NWP, 2018

Progress Towards Implementation of National Water Policy Storages/Dams

NWP, 2018 identifies additional storage of water as one of the priority areas to overcome water deficit in dry years and to mitigate impacts of climate change. This is most relevant in wet years when surplus water is available for storage and subsequent use in dry years. The need for a national master plan for additional storage of water is seen as highly important for future water security. There is a great potential for small and medium-size dams in, Gilgit Baltistan, Khyber Pakhtunkhwa, and Balochistan, for which substantial allocations have been made in the last 5 years (See Table 2.2 List of dams funded by Government of Pakistan).

Under the category of large dams for national storage, currently, work on Diemer Basha Dam with a live storage capacity of 6.4 MAF and Mohmand Dam with a live storage capacity of 0.67 MAF has been started by the Government of Pakistan. NWP 2018 and several reports including FoDP (2012) emphasized that the most important objective of water security is to increase storage on the largest river, i.e., on the main stem of the Indus River¹³. For this purpose, the construction of Diemer Basha Dam has already started in 2020 with a live storage capacity of 6.4 MAF. At the same time, Dasu dam with a live storage capacity of nearly 1 MAF will further supplement national storage.

The WAPDA's immediate priority list of future dams includes Mohmand Dam on the Swat River and Kurram Tangi Dam on the Kurram river, which will add another 1.57 MAF to the National Water Storage capacity. These two projects are considered highly important for agriculture development in the newly merged areas of KP

¹³ FoDP 2012

The completion of Diamer Bhasha Dam is expected to irrigate 1.23 million acres of additional land, apart from adding 4,500 MW of electric power to the National Grid. Greater detail of planned water storage projects, proposed by WAPDA from 2020 to 2050 is presented in Table 2.2

Table 2.2 WAPDA's PROPOSED PLAN FOR WATER STORAGE PROJECTS				
Priority	Projects	River/ Tributary	Planned Completion Year	Live Storage (MAF)
2020-2030	Mohmand Dam	Swat River	2024	0.67
	Kurram Tangi Dam (Stage-II)	Kurram River	2026	0.9
	Chiniot Dam	Chenab River	2027	0.85
	Diamer Basha Dam	Indus River	2027	6.4
	Sindh Barrage	Indus River	2029	1.8
	Wazirabad Reservoir	Chenab River	2030	0.9
	<i>TOTAL</i>			<i>11.52</i>
2031-2040	Shyok Dam	Shyok River	2034	5.0
	Kalabagh Dam	Indus River	2038	6.1
	Akhori Dam	Indus River/Off Channel	2039	6.0
	<i>TOTAL</i>			<i>17.10</i>
2041-2050	Dudhnial Multipurpose Project	Neelum River	2043	1.0
	Mid Ranjha storage project	Chenab River	2043	1.2
	Shah Jiwana Dam	Chenab River	2045	1.2
	Dhok Abaki Dam	Soan River	2047	1.0
	Skardu Dam	Indus River	2050	3.2
	<i>TOTAL</i>			<i>7.60</i>
	GRAND TOTAL			36.22

Source Compiled from Draft NWP Implementation Framework 2018-2030, Ministry of Water Resources, GoP, Office of Chief Engineering Advisor/Chairman Federal Flood Commission

Conservative estimates show that these new storage dams will provide availability of an additional 11.52 MAF of live storage of water until 2030, reaching over 36 MAF by 2050.

This is evident that after approval of the National Water policy in 2018, the funds' allocation for large, medium and small dams have been increased substantially from 10.5 billion in 2017-18 to 84.14 billion in 2019-20, mainly from the federal PSDP.

Canal Extension and Improvement Federal PSDP Allocation 2016-17 To 2020-21

A visible trend is seen in the decline of allocation in the Federal PSDP for canal extension and improvement, this is primarily due to the shifting of priorities toward building large storages outlined in the NWP 2018. However, the provincial allocations for canal extension and improvement have been increased substantially, during the analysis period. Overall, at the National Level, Canal extension and improvement is the highest national Agriculture water spending priority, receiving 43% of the national agriculture water allocations, from the combined Federal and provincial sources, see section 3 for details.

For canal extension and improvement, during the last 5 years (2016-17 to 2020-21) a major investment was made on completion of Kachhi Canal Phase 1, enabling Balochistan to irrigate 72,000 acres of additional land. Water and Power Development Authority (WAPDA) has initiated the process for construction of the remaining works of Kachhi Canal Project Phase-I. This includes the construction of a 40-Kilometer-long main lined canal and 32 Km-long water distribution system that will irrigate an additional 30,000 acres of land in Dera Bugti District of Balochistan. In addition to that, the process for

carrying out feasibility studies of Kachhi Canal Project Phase-II and Phase-III has begun. The total estimated cost to the 2nd revision of the PC1 is estimated as PKR 80.35, which has been approved in FY 2019-20.

During the last 5-year canal extension and improvement received an allocation of PKR 396 billion. This allocation constitutes a 20% share from the Federal PSDP, PKR 79 billion, and 80% from the provincial ADPs mainly from Punjab PKR 125.48 billion and PKR 134.62 billion from Sindh. The high actual allocation on canal extension and improvement primarily accounts for expenditures incurred on developing new canals such as the Kachhi canal in Balochistan and ongoing operation and maintenance of a large network of existing irrigation canals and barrages in the Indus Basin River System.

Agriculture On-Farm Water Management

Under the National Agriculture Emergency Programme, the Federal and the Provincial Government have initiated the three major agriculture on-farm water management projects;

National Program for Improvement of Watercourses in Pakistan: Phase-II:

Total Cost **PKR 155 billion**

National Program for Improvement of Watercourses Phase II has been started in 2019. Implementation of the project has been executed by Federal Project Management Unit (FPMU), MNFS&R, provincial agriculture departments (including AJ&K, GB & ICT), farmers organizations, water users' associations, and provincial directorates of On Farm Water Management (OFWM).

The proposed project is aimed at Improving productivity of irrigation through

- i. Efficient water conveyance, storage and application by improved infrastructure and adopting water conservation techniques;
- ii. Strengthen private sector service delivery capacity and sustainability for supporting irrigated agriculture;
- iii. Build capacity of stakeholders in better management of irrigation water for higher crop yields;

National Program for Enhancing Command Area in Barani Areas of Pakistan:

Total Cost **PKR 25.35 billion**

The program aims at enhancing the agriculture productivity in arid (Barani) areas of Pakistan. The project covers land development and other small infrastructure interventions across all the four provinces including outskirts of Islamabad Capital Territory, Gilgit Baltistan and Azad Jammu & Kashmir. The project targets the development of farm ponds, dug wells, improvement of watercourses and land leveling. MNFS&R and provincial OFWM Cells are responsible for implementing of this project

Water Conservation in Barani Areas of Khyber Pakhtunkhwa province

Total Cost **PKR 14.18 billion**

The physical objectives through this phase will be gained by creating water ponds, check dams, small water reservoirs, contour terracing, sand dunes stabilization, installation of tube wells, and other agronomic interventions & capacity-building measures. MNFS&R and provincial agriculture departments are responsible for implementing this project.

The stated three projects, as part of the national agriculture emergency program, will contribute to the national water policy targets thematic areas 2, *water conservation*, and *efficient use* through multiple interventions.

Section 3: Longitudinal Analysis of Public Sector investments in AWM

In Pakistan major portion of the development expenditures come from the public sector development programmes (PSDP), divided into Federal and provincial shares. The provincial share is distributed according to the population, high priority, and strategic development needs. Young et al 2019 estimated that national development expenditures are just one-fifth (only 20%) of the total national budget. In addition to financing from the Federal PSDP, irrigation and the agriculture water sub-sector is financed through various sources that include, Provincial Annual Development Programmes (ADPs), irrigation tariffs, donor contribution, and private sector investments¹⁴. Irrigation tariffs (*Abiana*) is only a fraction of overall investment and covers only a small percentage of overall operation & maintenance expenditures of the Indus Basin Irrigation System, which is one of the world's largest irrigation systems.

This section provides a funding landscape of the national water policy and a breakdown of the public investment, federal and provincial allocations, on Agriculture Water Management at the national scale. The analyses disaggregate financial allocation (data) of public sector programmes in three major categories, which include Storages dams, Canal extension and Improvement including flood control & surface Irrigation and Agriculture on Farm Water Management.

To be explicit Section 3 is the core of this Stock Take report and presents a longitudinal analysis of public sector investments for agriculture water management in Pakistan. The longitudinal analyses are carried out over two-time series, that is over the long run with twenty years of financial allocation data from FY 2000 to 2020¹⁵ and for short-run with five years, most recently, financial allocation data from FY 2016-2020.

The longitudinal analysis of the public sector investment is made for the following outcomes.

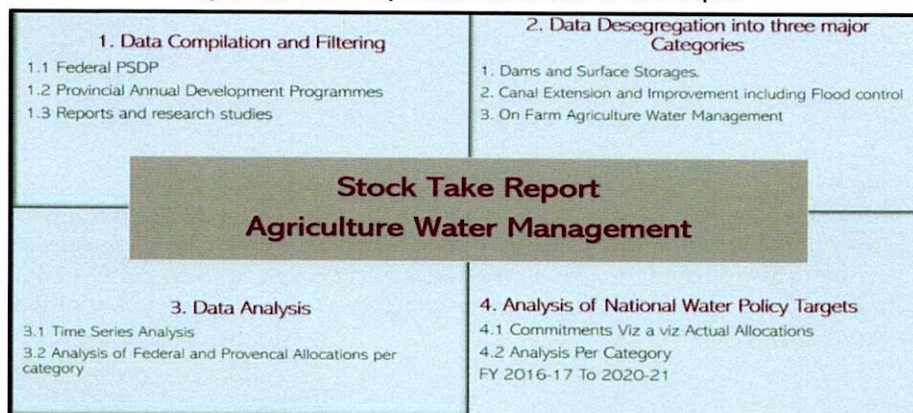
- i. Inform investment gaps in Agriculture Water Management to assess and readjust future allocations for achieving and/or redefining national water policy targets;
- ii. Compare actual allocations vis-à-vis fund commitments to meet targets of the National Water Policy (detail appears in section 4)

Method, Data and information sources

The sources of information and data for this Stock Take report have been compiled from the Federal Public Sector Development Programmes (PSDP)¹⁶ and data from the Provincial Annual Development Programmes (ADP) of four provinces. In addition to that secondary data on financial allocation from several recent reports¹⁷ and research studies on the subject are reviewed and consulted with due referencing made in the text, see footnotes and a complete list of references.

The Analytic Framework for the preparation of this Stock Take report is presented in Figure 3.1 outlining each step, data sources and analysis performed.

Figure 3.1 The Analytic Framework Stock Take Report



¹⁴ Irrigation tariffs, donor contribution (that are not reflected in the PSDPs) and private sector investments are excluded in the analysis, as validated data is not available and they are small and insignificant allocations compared to Public Sector Financing)

¹⁵ The 20-year data looks only into the allocations for federal PSDP, as long-term allocation data of provincial ADPs is not available

¹⁶ See Annex 1- Summary tables Federal and Provincial PSDP/ADP, 2016-17 to 2020-21.

¹⁷ Young et al. 2019

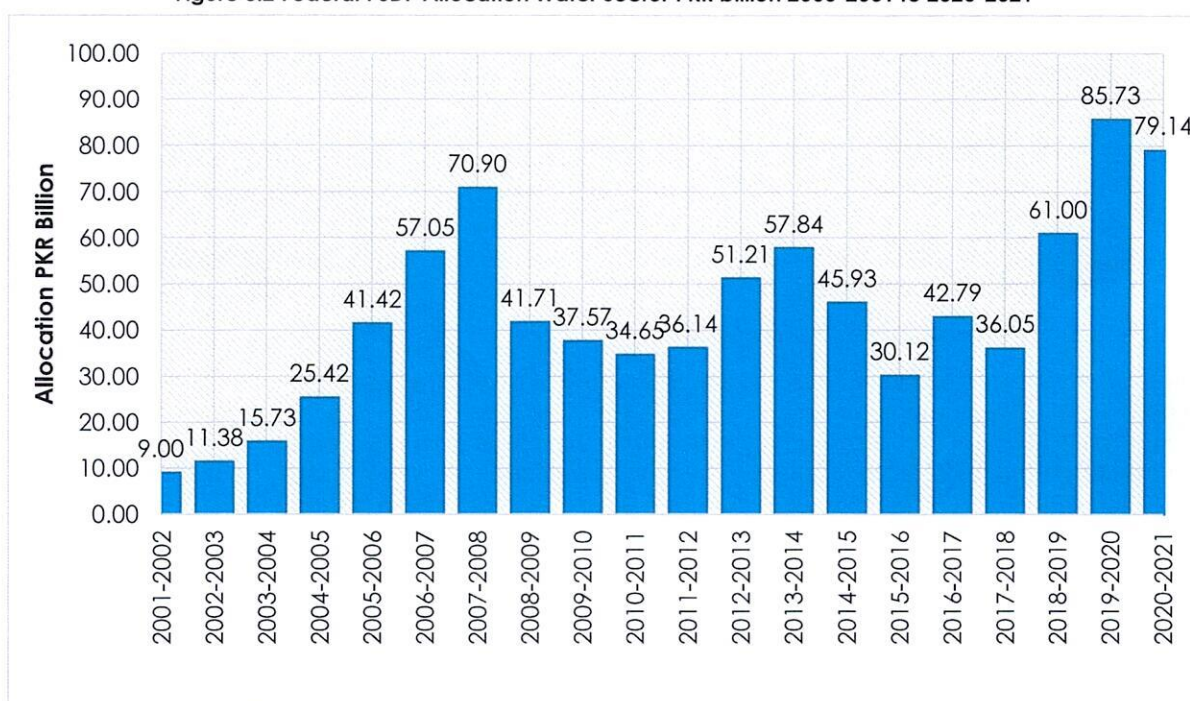
One difficulty in financial data compilation was to desegregate financial allocations for the water and energy sectors in multipurpose hydropower projects, serving energy production and supply of irrigation water. Thus, allocations entirely targeting hydropower generations are excluded in the analyses. To make better comparisons with the national water policy targets, allocations in the irrigation and agriculture sub-sectors, are compiled in the following three major categories, that includes; allocations for;

- i. Dams and Surface Storages,
- ii. Canal Extension and Improvement including Flood control
- iii. On-Farm Agriculture Water Management.

Federal PSDP Allocation: Agriculture Water Management 2001-2002 to 2020-2021.

In the last 20 years, Federal Water Allocation exceeded 870 billion PKR, averaging PKR 43.54 billion per financial year. The highest allocation (PKR 85.73 billion) is observed in FY 2019-20 and the lowest (PKR 9.00 billion) in FY 2000-2001. **Figure 3.2** provides an overview of the allocation from the Federal PSDP from 2001-2002 to 2020-2021.

Figure 3.2 Federal PSDP Allocation Water Sector PKR billion 2000-2001 to 2020-2021



Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives¹⁸

Comparison of the Federal PSDP allocations over two decades indicate that allocation averaged PKR 32.48 billion in the first decade (fiscal years 2001-2002 To 2010-2011) and PKR 48.30 billion in the second decade (fiscal years 2011-2012 To 2020-2021), with nearly a 21 % increase in the allocation in the second decade. This 21% increase appears to be small and incompatible with the scale of interventions required for upgrading existing and constructing new irrigation water infrastructure for meeting targets of the National Water Policy, 2018.

¹⁸ Data Source: 2001-20018 Ministry of Water Resources, from National Water Policy and 2018-19-2020-21 Federal PSDP Ministry of Planning Development and Special Initiatives

Over the analysis period of 20 years, the allocations exceeded 50 billion marks in 7 fiscal years with the highest allocation in FY (2019-2020) reaching PKR 85.73 billion and the lowest PKR 9.00 billion in FY (2001-2002). See Figure 3.1.

To observe, increasing and decreasing, trends in the Federal PSDP allocations, Table 3.1 provides a breakdown of the Federal PSDP Allocation over a 20-year period.

Table 3.1 Breakdown analysis of the Federal PSDP Allocation over 20 Years 2001 to 2020

Table 3.1 Analysis of Federal PSDP Allocation over 20 Years						
	Year	Allocation PKR Billion	Difference in Federal Water Allocation from the preceding Year (PKR Billion)		5 year Total Allocation PKR Billion	5 year Average PKR Billion
Funding Cycle 1	2001-2002	9.00		-10%	102.95	20.59
	2002-2003	11.38		26%		
	2003-2004	15.73		38%		
	2004-2005	25.42		62%		
	2005-2006	41.42		63%		
Funding Cycle 2	2006-2007	57.05		38%	241.88	48.38
	2007-2008	70.90		24%		
	2008-2009	41.71		-41%		
	2009-2010	37.57		-10%		
	2010-2011	34.65		-8%		
Funding Cycle 3	2011-2012	36.14		4%	221.24	44.25
	2012-2013	51.21		42%		
	2013-2014	57.84		13%		
	2014-2015	45.93		-21%		
	2015-2016	30.12		-34%		
Funding Cycle 1	2016-2017	42.79		42%	304.71	60.94
	2017-2018	36.05		-16%		
	2018-2019	61.00		69%		
	2019-2020	85.73		41%		
	2020-2021	79.14		-8%		

Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives¹⁹

Table 3.1 has presented a breakdown of the allocation made from the Federal PSDP over 20 years in a five-year funding cycle, the major findings are;

- i. When compared allocation of each data point from the preceding year, no consistent pattern of yearly allocation is observed over two decades in the Federal PSDP. While the allocation for each fiscal year within the 5-year funding cycles showed a mix of increasing and decreasing trends in allocation.

¹⁹ Data Source: 2001-20018 Ministry of Water Resources, from National Water Policy and 2018-19-2020-21 Federal PSDP Ministry of Planning Development and Special Initiatives

- ii. The first funding cycle shows an increasing trend in the allocation throughout the funding cycle, while rest of the three funding cycles 2, 3 and 4, indicate both an increasing and then a decreasing trend in the financial allocation from each preceding year.
- iii. The five-year average allocations for the funding cycles 1-4 centered around PKR 21 billion, PKR 48 billion, PKR 44 billion and PKR 61 billion per year in their respective funding cycles.
- iv. Considering the first funding cycle as the baseline, the next three funding cycle are compared to identify changes in allocation over a 5-, 10 and 15-year period from the baseline. In funding cycle 2 an increase of 139 billion (135%) is observed compared to the base funding cycle 1. PSDP allocation for funding cycle 3 went through a small change with an additional allocation of 118 billion PKR (115% increase) from the baseline funding cycle 1. However, allocation in funding cycle 3, declined by PKR 20 billion (10%) when compared to the previous funding cycle 2. Funding cycle 4 experienced a substantial increase with an additional allocation of PKR 202 billion, which is nearly a 196% increase from the baseline funding cycle 1.

In general, the breakdown analyses of Federal PSDP show that water management received higher attention by the federal government in terms of allocation in the first and last funding cycles in comparison to the two middle funding cycles 2 and 3. The observed increasing and decreasing trend in the federal PSDP allocations is inconsistent and based on short term planning, driven by urgent needs to revive projects of national importance such as raising and extension of major reservoirs (Mangla and Tarbella dams), construction of Diamer Bhasha, and Mohmand dams and construction, upgradation and remodeling of large canals.

Federal PSDP Allocation (Billion PKR) 2016 -17 to 2020-21

The description and analyses this point onwards focus only on allocations made in the last 5 years primarily to compare actual allocations with planned investments and stated targets of the National Water Policy 2018. The year wise allocation of the Federal PSDP of the last five years is shown in **Table 3.2**

Category	Federal PSDP Allocation Billion PKR					
	2016-17	2017-18	2018-19	2019-20	2020-21	Total 5 Year
Storage/dams	27.22	10.50	40.34	63.21	58.48	199.75
Canal Extension and Improvement	15.27	25.12	20.56	10.11	8.25	79.31
Agriculture/on Farm Water Management	0.30	0.43	0.10	12.41	12.41	25.65
Total	42.79	36.05	61.00	85.73	79.14	304.71

Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

A Total of PKR 304.71 billion was allocated from the Federal PSDP during the five-year period 2017-2021, including a foreign funding component of 1.37 billion PKR. The allocation included nearly PKR 200 billion on construction/raising of Dams (66%), followed by 79.31 billion on Canal extension and improvement (26%) and PKR 25.65 billion on Agriculture related on-Farm Water Management Initiatives (8%). In the last five years construction and raising of dams remained the priority investments of the Federal PSDP (except for FY 2017-18) where Canal extension and Improvement received the highest allocation.

Recipient Institutions of Federal PSDP, Water Resources Division

In the last five-year Water and Power Development Authority (WAPDA) had been the major recipient of the Federal PSDP, implementing large-scale irrigation water works that included storage (large dams), canal construction and remodeling and large surface irrigation and drainage works nationwide. Whereas provincial irrigation and agriculture departments implemented small to medium scale irrigation and agriculture water work from the federal PSDP.

During the analyses period, WAPDA remained a major recipient of the federal PSDP funds. The institution received (PKR 169 billion) which is 58% of the total federal PSDP Water Resources Division's total allocation of PKR 292 billion, excluding on-farm water management, while the combined share of the provinces from the federal PSDP remained nearly 42% (PKR 123 billion) for the same period.

In the sub-sectors²⁰ allocation of the federal PSDP during the last five-year, construction of small, medium and large dams received the highest share of the federal PSDP, nearly PKR 200 billion from the total PKR 305 billion, which entails 66% of the overall PSDP allocations in the last five years. This is followed by allocation to canal extension and improvement PKR 79 billion that is 26% of the PSDP allocation and lastly, Agriculture on-farm water management received an allocation of PKR 26 billion (8% of the total PSDP allocation) for the mentioned period.

Provincial Allocation Agriculture Water Management (2016-17 To 2020-21)

This subsection provides an overview of the provincial allocations under the Annual Development Programmes for Agriculture Water Management during 2016-17 to 2020-21.

Over the analysis period, Balochistan's Total Allocation to Agriculture Water Management totaled PKR 88 billion of which 24% was allocated to the construction of storage dams, followed by 19 % to spending on canal extension and improvement and 57% to Agriculture on-farm water management.

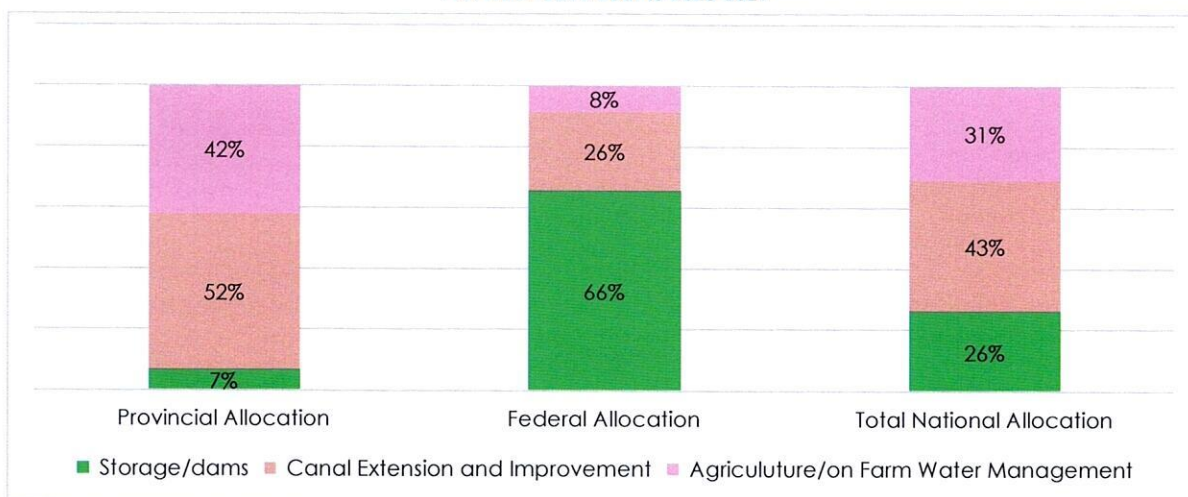
While the government of Punjab made a total allocation of PKR 220 billion of which 5% was allocated to the construction of storage dams, followed by 57 % to canal extension and improvement and 38% to Agriculture on-farm water management.

The government of Sindh made a total allocation of PKR 226 billion of which 2% was allocated to the construction of storage dams, followed by 60 % to canal extension and improvement and 38% to Agriculture on-farm water management.

Khyber-Pakhtunkhwa Province made a total allocation of PKR 81 billion to Agriculture Water Management during the 5-year period. The respective shares of allocation to the construction of storage dams were 6% only, while a major share of allocation 49 % went to canal extension and improvement and the rest 45% to the agriculture on-farm water management. In addition to that Khyber-Pakhtunkhwa Province, also received separate financing of PKR 9.6 billion in FY in 2020-21 for newly merged areas (former FATA, Federally Administered Tribal Areas) for the water and irrigation sector under Accelerated Implementation Programme for merged areas.

The four ADPs combined allocated 7% to dams 51% to canal extension and improvement and 42% to Agriculture on-farm water management initiatives. This is just an opposite to the federal allocations where an allocation of 66% to dams 26% to canal extension and improvement and 8% of the total allocations were made to the agriculture on-farm water management. Figure 3.3 highlights the relative priorities of the federal and provincial Governments in comparison to the combined national allocations.

Figure 3.3 Relative Allocation Priorities of National, Federal and Provincial Allocation 2016-17 To 2020-21
PKR billion 2000-2001 to 2020-2021



Data Source: Provincial ADPs, provincial Irrigation, Agriculture and Planning, and Development Departments

²⁰ National Water policy thematic areas

1. Storage/dams
2. Canal Extension and Improvement
3. Agriculture/on Farm Water Management)

Conclusion

Provincial allocations are targeted towards medium to small-scale projects. While federal allocations targeted financing for large infrastructure projects and National level programmes.

The above notion of financing large-scale projects by the Federal government over the years has evolved as a conventional practice. This convention is well understood by the planners both in the Federal and provincial governments, thereby provinces plan and allocate fundings to only build small to medium scale irrigation and agriculture water management projects and for the cost incurred on operation and maintenance of built canals and irrigation water infrastructure.

Total National Allocation Agriculture Water Management (2016-2021)

This section provides an analysis of the total national allocations for agriculture water management and their distribution across three major categories (components) under consideration. To reiterate, the total national allocations are presented as the combined allocations for agriculture water management from the federal PSDP and four provincial Annual Development Programmes combined. The purpose of this analysis is to highlight and understand the national investment priorities in each of the three categories (sub-sectors) over the analysis period of five years that is 2016-17 to 2020-21. The combined allocations for irrigating and agriculture water for the mentioned period are presented in Table 3.3.

Category	Federal		Provincial		Total National Allocation	
	Amount PKR Billion	% of Total Water Budget	Amount PKR Billion	% of Total Water Budget	Amount PKR Billion	% of Total Water Budget
Storage/dams	200	83%	41	17%	241	26%
Canal Extension and Improvement	79	20%	316	80%	396	43%
Agriculture/on Farm Water Management	26	9%	257	91%	282	31%
Total	305	33%	614	67%	919	100%

Data Source: Compiled from Federal PSDP and Provincial ADPs. Ministry of Water Resources, Ministry of Planning Development and Special Initiatives, PSDP Ministry of Agriculture and Food Security, provincial Irrigation, Agriculture and Planning and Development Departments

This National Water Allocation of PKR 919 billion constitutes 67% share from the provinces (combined) Annual Development Programmes and 33% from the Federal PSDP. Concerning the distribution of national allocations for each of the three categories, figures tabulated in Table 3.3 indicates that, of the total PKR 919 billion (100%), Spending on Dams included a share of PKR 200 billion (83%) from the Federal PSDP and PKR 41 billion (17%) from the Provincial ADPs. Similarly to the total PKR 396 billion (100%), the allocation for canal extension and improvement constitutes a share of PKR 79 billion (20%) from the Federal PSDP and PKR 316 billion (80%) from the combined Provincial ADPs. Likewise of the total PKR 282 billion (100%) allocation to Agriculture on-farm water management, a share of PKR 26 billion (9%) came from the Federal PSDP and PKR 257 billion (91%) from the combined provincial ADPs. The year-wise National Allocation for Agriculture Water Management from 2016-17 To 2020-21 is compiled and presented in **Figure 3.4**.

²¹ For details of provincial and federal allocations, See Annex 1

Figure 3.4 National Allocation for Agriculture Water Management per Category, 2016-17 To 2020-21

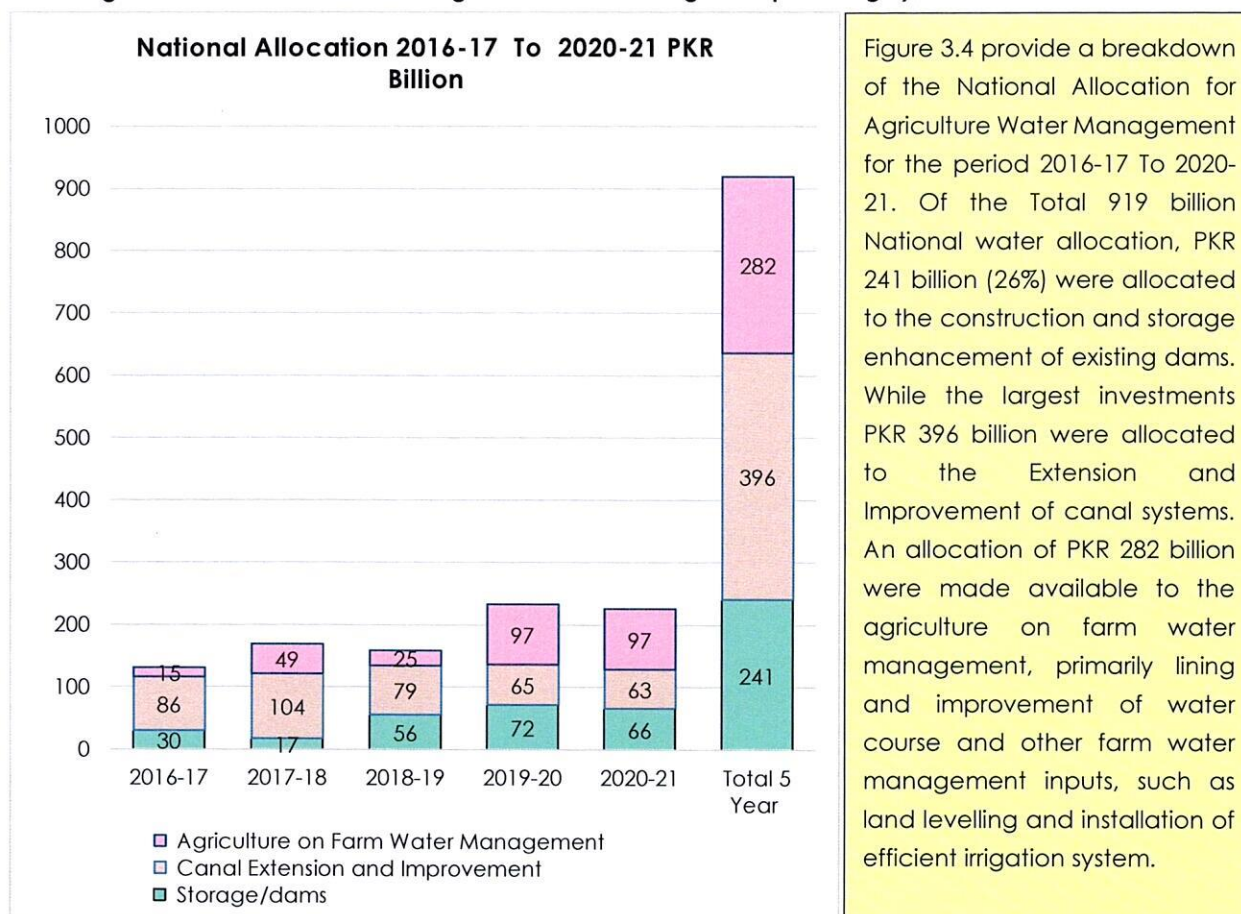


Figure 3.4 provide a breakdown of the National Allocation for Agriculture Water Management for the period 2016-17 To 2020-21. Of the Total 919 billion National water allocation, PKR 241 billion (26%) were allocated to the construction and storage enhancement of existing dams. While the largest investments PKR 396 billion were allocated to the Extension and Improvement of canal systems. An allocation of PKR 282 billion were made available to the agriculture on farm water management, primarily lining and improvement of water course and other farm water management inputs, such as land levelling and installation of efficient irrigation system.

Data Source: Compiled from Federal PSDP and Provincial ADPs. Ministry of Water Resources, Ministry of Planning Development and Special Initiatives, PSDP Ministry of Agriculture and Food Security, provincial Irrigation, Agriculture and Planning and Development Departments

Conclusion 1

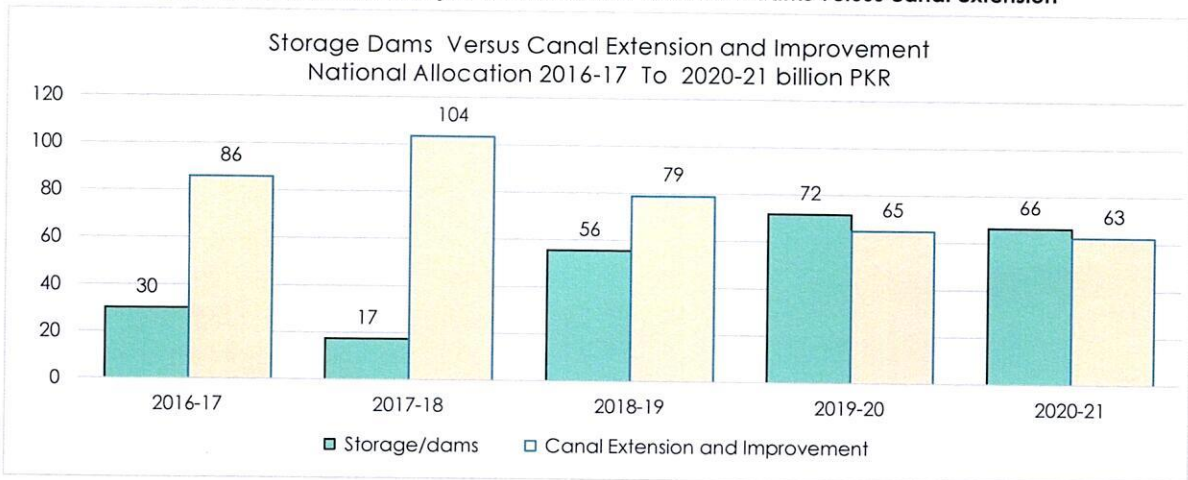
The category wise analysis reveals that, overall, at the national level, Canal extension and improvement is the highest national water spending priority (43% of national agriculture water allocation), followed by on-Farm Water Management (31% of national water allocation) and lastly construction of dams (26% of national water allocation).

Conclusion 2

National water spending priority is in contrast to the Federal Level Spending priority where construction of dams received the highest allocation with (83 % share of the federal PSDP), followed by canal improvement and extension (20% share of the federal PSDP) and lastly agriculture on farm water management (9% share of the federal PSDP) during the analyses period.

Analyses of subsectors' allocation are carried out to compare the allocation of each category with the other. A graphical presentation of the comparative analysis among three categories is presented in Figure 3.5 dams versus canal extension and improvement, Figure 3.6 dams versus agriculture on farm management, and Figure 3.7 canal extension and improvement versus agriculture on farm management.

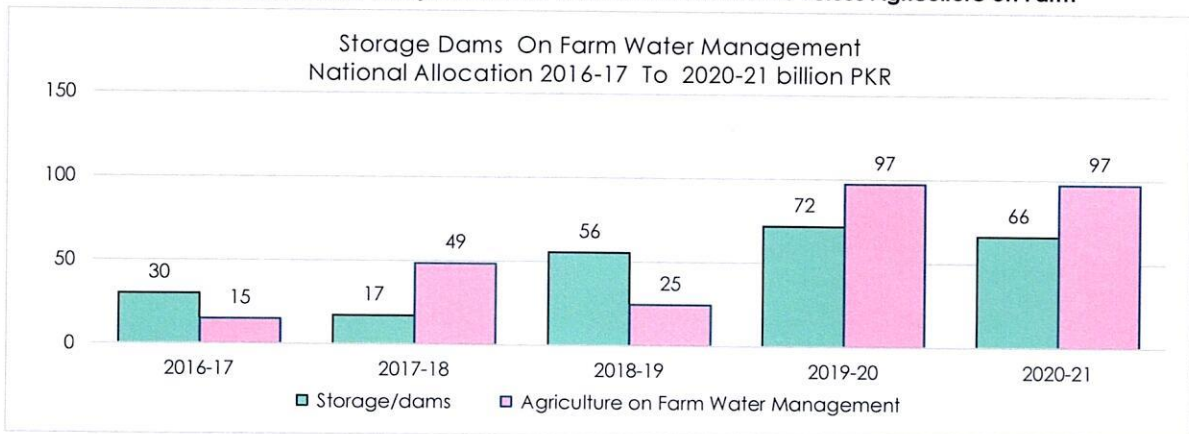
Figure 3.5 comparative analysis National Water Allocation dams versus canal extension



Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

Conclusion 1: Overall dams received PKR 155 billion (-17%) less than canal extension and improvement during the analysis period.

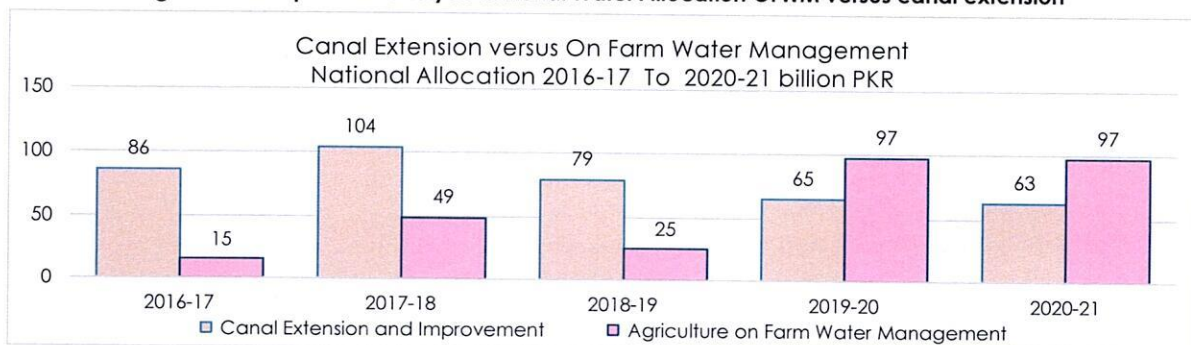
Figure 3.6 comparative analysis National Water Allocation dams versus Agriculture on Farm



Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

Conclusion 2: Overall dams received PKR 42 billion (-5%) less than the agriculture on farm water management over the same period.

Figure 3.7 comparative analysis National Water Allocation OFWM versus canal extension



Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

Conclusion 3: Overall Canal Extension and improvement received PKR 113 billion (+12%) more than Agriculture on Farm Water Management during the same 5-year period.

In summary, a comparative analysis of the distribution of the National Water budget among three categories during the five-year period of 2016-17 to 2020-21 reveals that dams received PKR 155 billion (-17%) less than canal extension and improvement during the analysis period. On similar lines, dams received PKR 42 billion (-5%) less than the agriculture on farm water management over the same period. However, Canal extension and improvement received PKR 113 billion (+12%) more than agriculture on farm water management during the same 5-year period.

Section 4: National Water Policy Targets Vs Actual Allocation 2017-2021

Section 28 of the National water policy sets major targets and funding requirements for storage, conservation, and improved management of water resources in Pakistan. NWP, 2018 outlines six major thrust areas (categories) with recommended funding requirements to achieve set targets of NWP till 2030. In this section, a comparison is made on recommended allocations viz a viz actual (national) allocation of funds for agriculture water management. The recommended investments for each category are presented in Table 4.1

Sub Sector	Investment PKR Billion	Investment (Percent of Total)
Storage	1,600	52%
Water conservation and efficient use	800	26%
Drainage	150	5%
Flood control	186	6%
Rehabilitation of irrigation system	300	10%
Research	30	1%
Total	3,066	100%

For the six thematic areas, a total allocation of PKR 3,066 billion is recommended for a 12-year period from 2018 to 2030. A greater emphasis is made on increasing allocation for water storage that include construction of small, medium, and large dams (52%) followed by water conservation and efficient use (26%), drainage , flood control and rehabilitation of irrigation system (surface irrigation combined) 21% and 1% for research and feasibility studies.

For the propose of comparative analysis, the six thematic areas are combined into three major categories that are;

1. *Storage/dams*
2. *Canal extension and improvement including drainage, flood control, rehabilitation of the existing system (surface irrigation combined)*
3. *Agriculture/on Farm Water Management*

Thematic areas from 3-6 are combined into a single category that is Canal extension and improvement including drainage, flood control, rehabilitation of existing system, because they all include surface irrigation, in addition to that the thematic area on research studies is also included in surface irrigation for simplification in the analysis.

Table 4.2 is presented to highlight the difference in the recommended investment by the National Water Policy²² vis- a-vis actual National allocation made from 2016-17 to 2020-21, collectively from the Federal PSDP and all Provincial ADPs combined for the period 2016-17 to -2020-21.

²² Calculated on prorata basis till June 2021 that is average of recommended allocation for 12 years times 5 years (Recommended/ Planned Investment/12) X 5

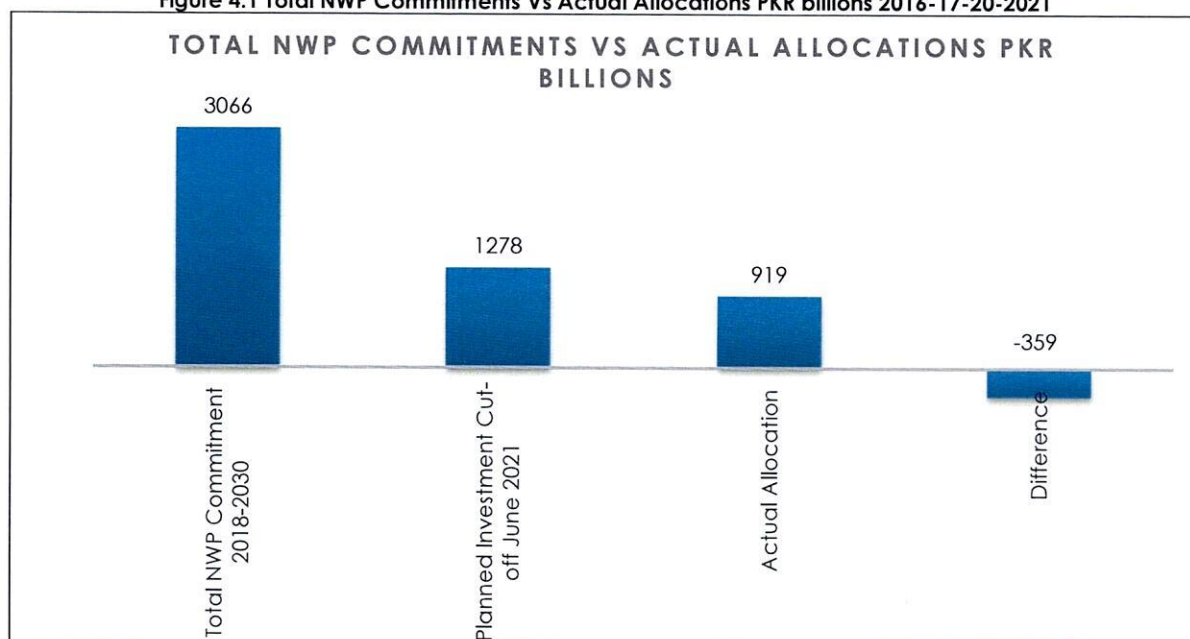
Table 4.2 Total Allocation National Water Policy Commitments Vs Allocations PKR billions 2016-17-2020-21

Category	Total Commitment (2018-2030, 12 Years) PKR Billion	*Recommended/ Planned Investment ²³ (2017-2021, 5 years), see foot note PKR Billion	**Actual Allocation ²⁴ PKR Billion	Difference (recommended-Actual) PKR Billion	Difference as of Planned (%)
Storage/dams	1600	667	241	-426	-64%
Canal Extension and Improvement including drainage, flood control, rehabilitation of existing system	666	278	396	118	43%
Agriculture/on Farm Water Management	800	333	282	-51	-15%
Total	3066	1278	919	-359	-28.8%

Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

Table 4.2 compares and calculates the difference in actual allocation for each of the three categories with the recommended fund requirement stated in the National Water Policy for the period 2017²⁵-2021. Figure 4.1 compares the Total recommended Irrigation and agriculture water allocation under National Water Policy Commitments versus Actual allocations for the period 2016-17 To 2020-21.

Figure 4.1 Total NWP Commitments Vs Actual Allocations PKR billions 2016-17-20-2021



Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

An overall deficit of PKR 359 billion is observed in the overall allocations, recommended by NWP viz a viz actual allocation during 2016-17 to 2020-21 at the national level. This is nearly 28% below the

²³ *Recommended Total Commitment is calculated prorate till 2018-2030 (12 Years)

²⁴ **Actual Allocation are for 5 years FY 2016-17 to 2020-21 (5/12)

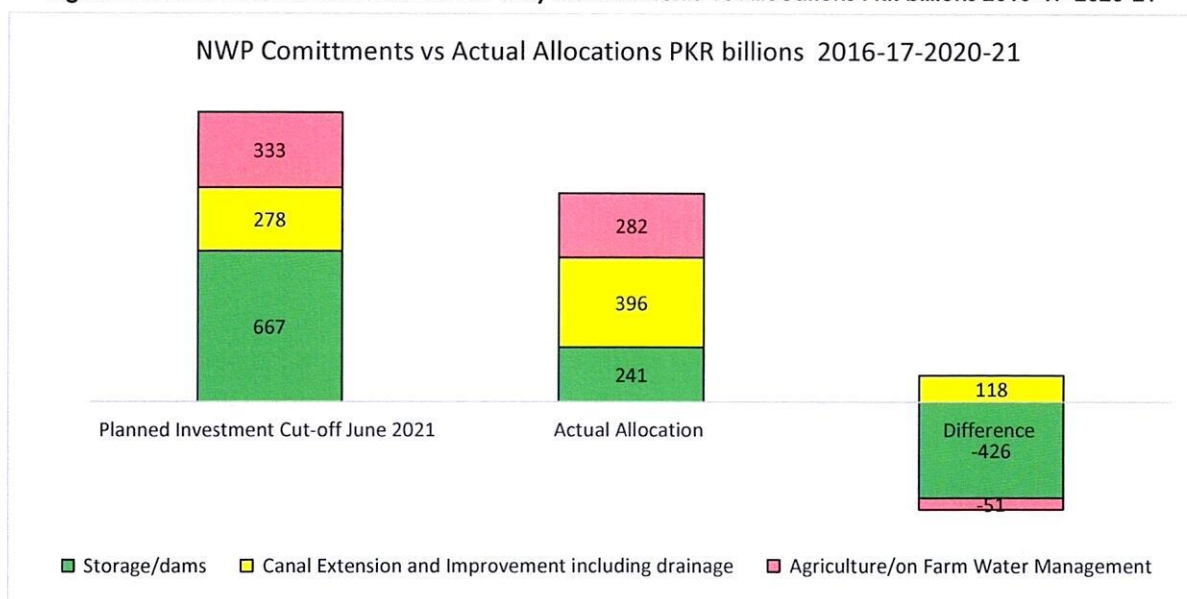
²⁵ To clarify, though NWP was approved in the FY 2017-18, however, the drive for the approval of NWP had been in process during FY 2016-17, thus allocations of the FY 2016-17 is included in the analysis.

recommended level of investment in the overall irrigation and agriculture water sector for the analysis period.

Thematic Analysis: Planned versus Actual allocation

Thematic, per category, analysis of Planned commitments versus Actual allocation is carried out (2016-17-2020-21) to precisely estimate under and over allocations in each of the three Agriculture Water Management thematic areas. Thematic analysis will guide policy decision for additional financing and realigning allocations to meet NWP targets. The analyses will also provide a space for an active dialogue and discussions, revisiting targets to meet Agriculture Water Management needs and priorities in the forthcoming National Action Plan for Agriculture Water management.

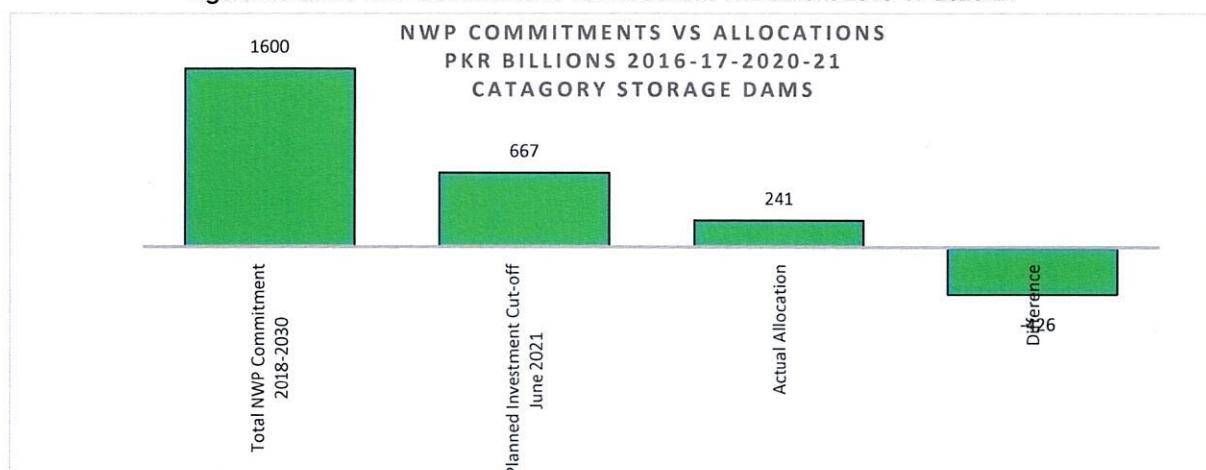
Figure 4.2 Total Allocation National Water Policy Commitments Vs Allocations PKR billions 2016-17-2020-21



Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

National Water policy Targets for construction of small, medium and large dams recommended a total allocation of PKR 667 billion, while allocation of only PKR 241 billion were actually made during the 5-year analysis period. Investment on dams' construction is PKR 426 billion (64%, under financing) under allocated against the planned investment stated in for the NWP targets, for the analysis period see Figure 4.3

Figure 4.3 Dams NWP Commitments Vs Allocations PKR billions 2016-17-2020-21

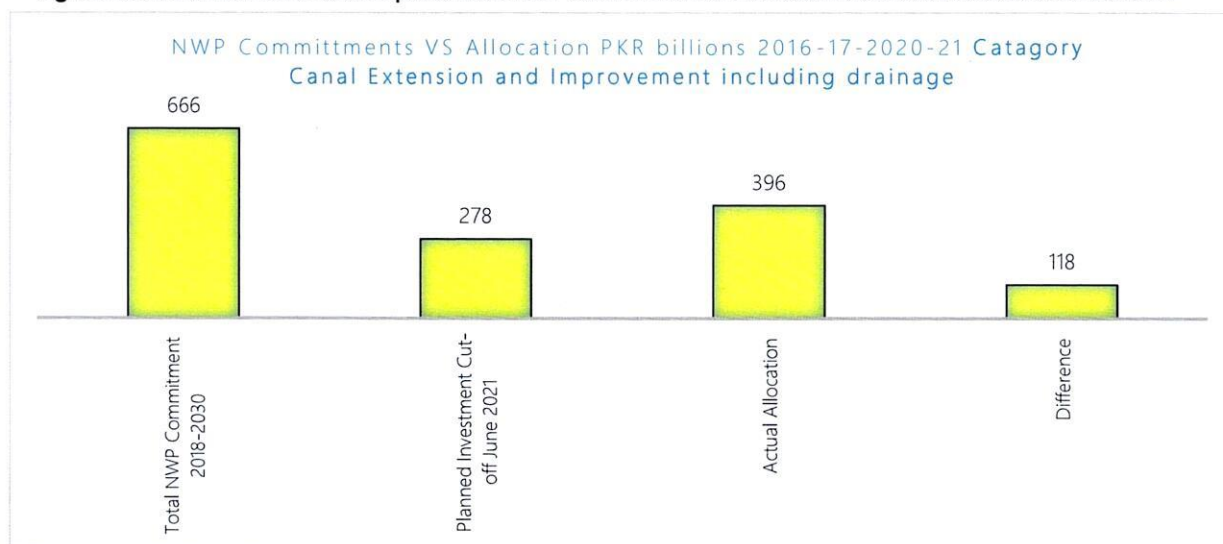


Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

In contrast to the under investment on dams, Canal extension and improvement, received the highest allocation among all three under consideration thematic areas and appears to be the highest national priority.

Against the recommended level of investment of PKR 278 billion, canal extension and improvement received an allocation of PKR 396 billion, overfinanced by PKR 208 billion (118% over financed). This allocation constitutes a 20% share from the federal PSDP, PKR 79 billion, and 80% from the provincial (combined) ADPs mainly from Punjab PKR 125.48 billion and Sindh PKR 134.62 billion. The over (actual) allocation on canal extension and improvement primarily accounts for expenditures incurred on developing new canals such as the Kachhi canal in Balochistan and ongoing operation and maintenance of large network of existing irrigation canals and barrages in the Indus Basin Irrigation System. Figure 4.4 compares recommended allocations in the NWP and Actual allocation made on canal extension and improvement for the period 2016-17-2020-21.

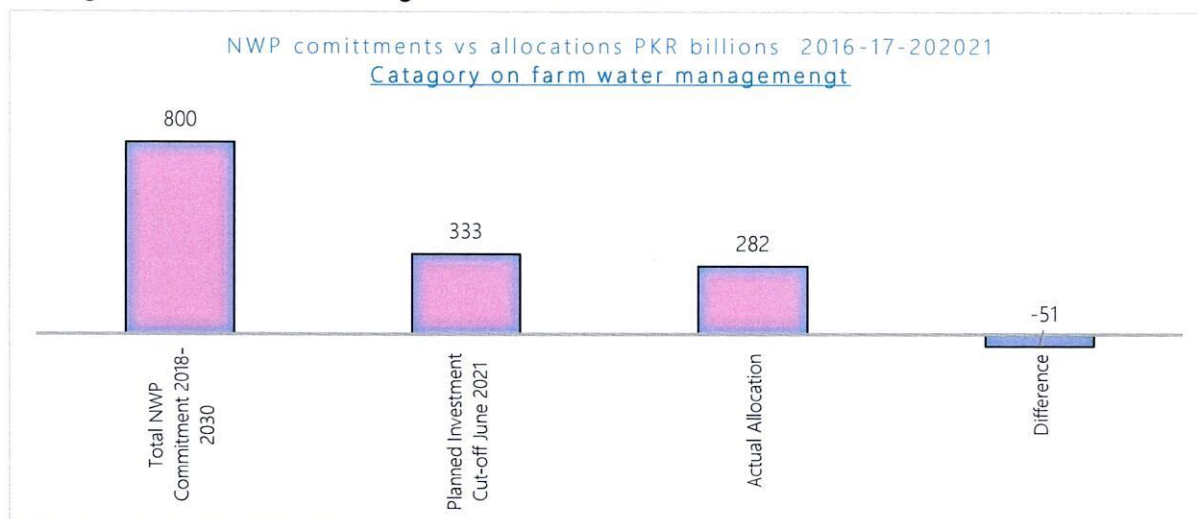
Figure 4.4 Canal Extension and Improvement NWP Commitments Vs Allocations PKR billions 2016-17-2020-21



Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

Next, National Water policy targets for on farm water management recommended a total allocation of PKR 333 billion, while allocation of only PKR 282 billion was made as actual allocation for the analysis period 2016-17 To 2020-21. This (actual) allocation for Agriculture on farm water management is under financed by PKR 51 billion (15%) below the recommended allocation as stated in NWP subsector allocation (water conservation) for the period 2016-17-2020-21 Figure 4.5

Figure 4.5 On Farm Water Management NWP Commitments Vs Allocations PKR billions 2016-17-2020-21



Data Source: Ministry of Water Resources, and Ministry of Planning Development and Special Initiatives

National Water policy identifies Water conservation and Efficiency as the top strategic priority for saving water within the existing system. The strategic target of 33 percent reduction in the 46 MAF of surface irrigation water losses is being addressed through accelerated programme of water course lining in saline and semi saline ground water areas See NWP, main targets pp 33.

NWP guides and advocate for 30 percent increase in the efficiency of water use by producing "more crop per drop". The water efficiency shall be increased through use of new technologies such as high efficiency micro irrigation systems. However, water efficiency targets of the NWP appear to be ambitious and difficult to achieve in the absence of a realistic water pricing.

With this note federal and provincial governments have made substantial increase in the allocation for on-farm water management during 2016-17 to 2020-21 see section 3.

THE OFWM programme though, is highly inclined towards lining of water courses is debatable whether the investment on lining of water courses can substantially result in water savings. Seepage losses are controlled but studies show that that in Pakistan almost 43.5% of the water losses occur in lined watercourses and 66% in unlined water course²⁶.

This anecdotal evidence indicates that not necessarily water course lining entail, the desired level of water savings. Thus, need of a nationwide research study is emphasized to identify and inform set of farm level interventions to provide best social, economic and environmental returns against the investment made.

²⁶ Sultan et al. 2014

Section 5: Conclusions and The Way Forward

This Stocktaking report has conducted a landscape analysis of the public investment in Agriculture Water Management in Pakistan. The report is expected to be used as primary input to the development of a road map and a National Action Plan for Agriculture Water Management.

The description of data and analysis in this Stock Take report presents an overall funding landscape of the three thematic areas of agriculture water in relation to the National Water Policy targets. The report provided a comprehensive overview of the federal and provincial investment in the mentioned sub-categories since year 2000 with greater focus and narrowing down analyses to the last five years. The analyses have assessed and examined allocations for national water policy milestones for the first five years, since its approval in April 2018. The report provided a comparative analysis of planned investments and actual allocations on water management priorities for the three thematic areas supported by secondary data from the public sector investments.

The summary of results and main conclusion drawn from the reports are listed below;

- I. The implementation of the National Water policy is pivotal for water resource management and reforms at the national scale. However, the implementation of the NWP is hindered by several challenges. This is speculated that among others weak institutional set up for implementation of national water policy and insufficient financing of the major infrastructure projects are two major barriers to implement targets of the national water policy. This is evident by the fact that within the last three years only a single meeting of the National Water council is held. Furthermore, the nomination of five private (technical) members of the council are still pending;
- II. After approval of the National Water policy in 2018, the funds allocation for large, medium and small dams have been increased substantially from 10.5 billion in 2017-18 to 84.14 billion in 2019-20. The statement is true that National Water Policy has been instrumental to a great extent towards increased allocation for new storages.
- III. Overall, at the national level, Canal extension and improvement is the highest National water priority and received PKR 396 billion 43% of national agriculture water allocation, from the combined federal and provincial allocations, [See Section 3 for details](#).
- IV. An allocation of PKR 282 billion to the agriculture on farm water management, is a giant step to improve water efficiency at the National Scale. However, there is little evidence that benefits of the investment on lining of water courses outweigh the cost.
- V. The On Farm Water Management Programme is highly inclined towards lining of water courses. This is debatable whether the investment on lining of water courses can substantially result in water savings. Seepage losses are controlled but studies show that that in Pakistan almost 43.5% of the water losses still occur in lined watercourses and 66% in unlined water course²⁷. In addition to that research studies on economic productivity of water in various agroecological zones are needed, to harness full benefits of agriculture water.
- VI. Comparison of the federal PSDP allocations over two decades, indicate that a 21 % increase in the second decade that appears to be small and incompatible with the scale of interventions required for upgrading existing and constructing new irrigation water infrastructure for meeting targets of the National Water Policy, 2018.
- VII. National Water allocations (provincial plus federal allocation combined) priority is in contrast to the federal level allocation priority where construction of dams received the highest allocation with (83 % share of the federal PSDP), followed by canal improvement and extension (20% share of the federal PSDP) and lastly agriculture on Farm Water Management (9% share of the federal PSDP) during the analyses period 2016-17 to 2020-21.
- VIII. In summary, a comparative analysis of the distribution of National Water allocation among three categories during the five-year period of 2016-17 to 2020-21 reveals that, dams received PKR 155 billion (-17%) less than canal extension and improvement. On similar lines dams received PKR 42 billion (-5%) less than the agriculture on Farm Water Management over the same period. However, Canal extension and improvement received PKR 113 billion (+12%) more than On Farm Water Management during the same 5-year period.
- IX. An overall deficit of PKR 359 billion is observed in the overall allocations, recommended by NWP viz a viz actual allocation during 2016-17 to 2020-21 at the national level. This is nearly 28% below

²⁷ Sultan et al. 2014

the recommended level of investment in the overall irrigation and agriculture water sector for the analysis period.

One limitation of the report was that it could not take into full account of the investment data from the foreign funded components of the irrigation water management projects, mainly grants and direct loans to provinces by various banks and foreign funded institutions out of the PSDP and provincial ADPS, as such precise data is not available. Furthermore, data segregation of the multipurpose hydropower and irrigation projects was not possible due to complexity. However, the data and facts presented in the Stock Take report provide a broad picture of the investment landscape at the national level for agriculture water management.

Nonetheless the Stock Take report provides a level of confidence based on which water sector investment priorities can be readjusted with consideration to emerging challenges of climate change, population growth and transboundary water issues which involve more complexities than appeared to be at the time when the National Water policy was drafted and finally approved in 2018.

The National Water policy suggests several reforms and outlines investments to enhance national water security and its productivity. The policy also suggests the need for dialogues among stakeholders and water institutions at the national and province level for the implementation of priority actions identified. Thus, the need for the development of an overarching implementation plan of the National Water policy 2018, is seen as very important. While at the same time developing sub-sector plans, including Agriculture Water Management, is seen as highly important for achieving national water policy targets by the year 2030. This Stocktaking report has conducted a landscape analysis of the public investment in Agriculture Water Management in Pakistan. The report is expected to be used as the primary input to the development of a National Action Plan for Agriculture Water Management.

The description of data and analysis in this Stock Take report presents an overall funding landscape of the three thematic areas of Agriculture Water Management concerning the National Water Policy. The report provided a comprehensive overview of the Federal and provincial investment in the mentioned sub-categories since the year 2000 with greater focus and narrowing down analyses to the last five years. The analyses have assessed and examined allocations for national water policy milestones for the first five years, since its approval in April 2018. The report provided a comparative analysis of planned investments and actual allocations on water management priorities for the three thematic areas supported by secondary data from the public sector investments. This stock Take report is a step toward the development of an implementation plan for agriculture water management. The report compiled investment data and will invite relevant institutions to review this Stock Take report and jointly plan the road map and develop an implementation at the national level for management of agriculture Water.

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Annexes

Annex 1: Federal and Provincial Allocation 2016-17 To 2020-21

Category	Federal PSDP Allocation Billion PKR					
	2016-17	2017-18	2018-19	2019-20	2020-21	Total 5 Year
Storage/dams	27.22	10.50	40.34	63.21	58.48	199.75
Canal Extension and Improvement	15.27	25.12	20.56	10.11	8.25	79.31
Agriculture/on Farm Water Management	0.30	0.43	0.10	12.41	12.41	25.65
Total	42.79	36.05	61.00	85.73	79.14	304.71
Category	Balochistan ADP Allocation Billion PKR					
	2016-17	2017-18	2018-19	2019-20	2020-21	Total 5 Year
Storage/dams	2.23	2.77	8.811	3.713	3.53	21.054
Canal Extension and Improvement	1.738	4.57	0	5.384	4.846	16.538
Agriculture/on Farm Water Management	3.628	4.909	3.847	19	19	50.384
Total	7.60	12.25	12.66	28.10	27.38	87.98
Category	Punjab ADP Allocation Billion PKR					
	2016-17	2017-18	2018-19	2019-20	2020-21	Total 5 Year
Storage/dams	0.00	2.30	3.73	3.61	1.48	11.12
Canal Extension and Improvement	41.00	33.46	15.61	19.67	15.74	125.48
Agriculture/on Farm Water Management	0.00	26.25	7.13	24.95	24.95	83.27
Total	41.00	62.00	26.47	48.23	42.17	219.87
Category	Sindh ADP Allocation Billion PKR					
	2016-17	2017-18	2018-19	2019-20	2020-21	Total 5 Year
Storage/dams	0.59	0.84	1.53	0.74	0.51	4.22
Canal Extension and Improvement	20.62	33.01	34.96	28.63	17.40	134.62
Agriculture/on Farm Water Management	11.01	12.55	10.95	26.15	26.15	86.81
Total	32.23	46.39	47.44	55.53	44.06	225.65
Category	KP ADP Allocation Billion PKR					
	2016-17	2017-18	2018-19	2019-20	2020-21	Total 5 Year
Storage/dams	0.00	0.97	1.09	0.34	2.26	4.67
Canal Extension and Improvement	7.15	7.38	7.74	0.96	16.40	39.62
Agriculture/on Farm Water Management	0.00	4.47	2.61	14.57	14.57	36.22
Total	7.15	12.83	11.43	15.87	33.23	80.51