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Policy Brief
Sustainable Development Goal 6: Setting the Course Right

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Pakistan Council of Research in Water Resources (PCRWR)
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Policy Brief
Sustainable Development Goal 6:
Setting the Course Right

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List of Abbreviations

FAO	Food and Agriculture Organization
FFC	Federal Flood Commission
GoP	Government of Pakistan
IWRM	Integrated Water Resources Management
MoF	Ministry of Finance
MIMEC	Mining and quarrying, manufacturing, constructions and energy
MDGs	Millenium Development Goals
PCIW	Pakistan Commissioner for Indus Waters
PWP	Pakistan Water Partnership
SDGs	Sustainable Development Goals
OECD	Organization for Economic Cooperation and Development
UN	United Nations
UNEP	United Nations Environmental Program
UNECE	United Nations Economic Commission for Europe
UNICEF	United Nations International Children's Emergency Fund
UNESCO	United Nations Education, Science and Culture Organizations
UNU-INWEH	United Nations University, Institute of Nature, Water, Environment and Health
UNSD	United Nations Statistics Division
UNDESA	United Nations Department of Economic and Social Affairs
WHO	World Health Organizations
WUE	Water Use Efficiency

Executive Summary

United Nations since 1945 has worked for the global development and peacekeeping. They declared water as a basic human right in 1977 at the historical United Nations Conference on water. Since then, a series of efforts have been made to improve the quality of drinking water as well as sanitation in order to upgrade the standards of living for global population. In 2015, UN came up with Sustainable Development Goals (SDGs) after the limited or no success of Millenium Development Goals (MDGs). MDGs mainly targeted developing/least developed or poor countries. – It was designed in the context of “rich donors aiding poor recipients.” – SDGs targets and applies uniformly to all the countries; rich, middle income and poor. – It urges all countries to take actions. SDGs comprise of 17 individual goals. The objective of these 17 SDGs was to enable national governments to self-report their progress on the basis of their existing data. The term sustainable development was coined because the global population was on the rise and climate change had started knocking on the doors. Water is one of those limited and renewable water resources that is reducing as the number of mouths to feed and drink water is increasing. Likewise, with the increase in population economic opportunities are also increasing. Most of such commercial activities have not only become exploiters of freshwater but also the spoiler of water quality and related ecosystems.

All SDGs in general and SDG 6.0 in particular are crucial for developing nations. After the limited success of MDGs, these goals have provided an opportunity for the nations to re-think and re-assess their capacities related to water resources management in comparison to the developed nations. This context also applies to Pakistan, because in MDGs access to improved drinking water was reported to 94% population in 2015. These figures may be too optimistic and raises the question of whether progress towards MDG 7 has been sustainable and equitable. At the dawn of SDGs in 2017, JMP reported 35% of total population having access to safely managed drinking water as baseline for target 6.1 indicator 6.1.1. Access to sanitation and basic hygiene services is still based on household and poverty evaluation surveys. Older figures and datasets are to be re-assessed according to the methodology of reporting set out by the United Nations and its line agencies. Likewise, reporting on indicators 6.3.1 to 6.6.1 offers an opportunity for

Pakistan to fill its critical data and capacity gaps. National reporting on SDGs during the first exercise conducted in 2017 clearly hints about these gaps. This report also analyses the reporting of some of these indicators using the UNU-INWEH developed Policy Support System (PSS) designed with the developed fit for policy decisions on the basis of data incorporated.

1 Introduction

1.1 Historical Perspective

Planet earth may be the only planet in this universe that celebrates life. The natural resources on earth have supported life in many ways serving mankind, beginning in stone age to the modern age of commerce and technology. The population has evolved from few hundreds to billions where the supply and distribution of resources is not equal. As a consequence, in some places, people enjoy opulence while a majority live in misery and starvation. This unequal distribution of resources has incubated many local, regional, transnational and international conflicts. Since these economic and social issues are matters of great concern for global peace and harmony, the United Nations has introduced a number of agendas for global development. The objective of these global programs and development plans has always been focused on resolving inequalities while improving the standard of living of the people.

Fresh water is one of the very limited natural resources on earth. Since it re-generates itself through a hydrological cycle, it is beyond the control of humans for its fair distribution across the world. However, mankind may work out national, regional and transboundary management plans enabling social equity of water with minimal damage to the ecosystem. Human management of water resources is also vulnerable to conflicts and discourse among communities and nations because it is a basic necessity of life. Historical events and timeline of UN's initiatives on water are shown in figure 1.

A known focus of the United Nations related to water dates back to the 1977 Mar Del Plata conference in Argentina which provided an Action Plan on "Community Water Supply". This plan declared that all people have the right of access to drinking water in quantity and quality equal to their basic needs (UN, 2023). The next important development was, the International Decade for drinking water supply and sanitation (DWSS) for the period of 1981-90. During this decade, member UN countries had to focus on improving drinking water and sanitation with an overall objective of economic development through health improvement (WHO, 1983).

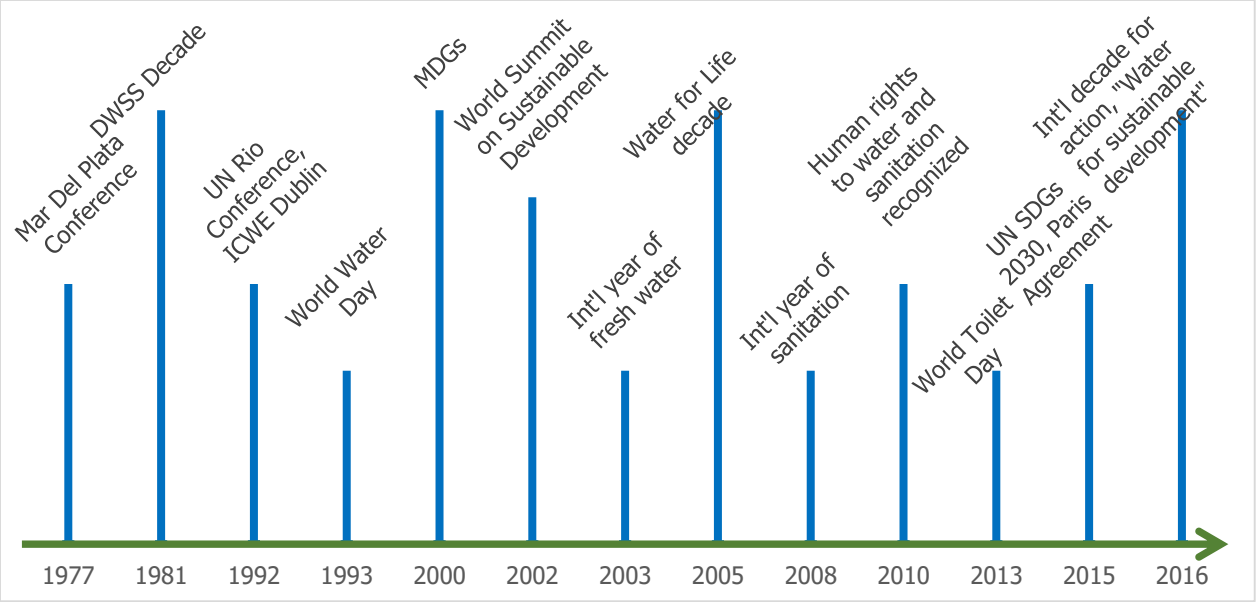

Figure 1: Timeline of UN led progress on global development policies for water

In 1992, United Nations conference on Environment and Development proposed Agenda 21. This agenda approached better water management in two ways; drinking water and sewerage management to improve the quality of life. Management of freshwater system, ocean water and their protection from toxic wastes were considered very important (Meakin, 1992). It was International Conference on Water and Environment, Dublin 1992 when the term "sustainable management of water resources" was coined for the first time (WMO, 1992). In 1993 United Nations General Assembly dedicated March 22 as International World Water Day.

Millennium Development Goals (MDGs) emerged in 2002 when 147 world leaders at the UN Millennium Summit adopted MDGs. Among other targets, the leaders agreed on halving the population without access to affordable and safe drinking water by 2015 (UN, 2003). In 2002, at the World Summit on Sustainable Development, member countries agreed to the parallel goal of halving the population without proper sanitation by 2015 (UN, 2003). In order to enhance coordination and generate public awareness regarding critical freshwater resources, the year 2003 was declared as International Year of Fresh Water (UN, 2002). On March 22 2005, a decade of action on "*Water for Life"* was officially started to help advance the achievement of MDGs for water and sanitation (UNDESA,

2023). This decade concluded with MDGs in 2015 with historical declarations during that period, including; Year 2008 declared as international year of sanitation, access to drinking water and sanitation was regarded as human rights in 2010 and November 19 as World Toilet Day in 2013 by United Nations General Assembly (UN, 2023).

In 2015, United Nations Agenda for Sustainable Development was announced with the idea to address gaps left by MDGs (UN, 2015). Among 17 goals, SDG 6.0 requires to; “Ensure the availability and sustainable management of water and sanitation for all”. This goal is composed of 11 targets that need to be measured on the basis of several indicators. Sustainable Development Goals are unique because countries will have to define their own national baseline, targets, and priorities (UNU-INWEH, 2019). The SDGs report on the progress of goals noted that 129 countries are still not on track to enable sustainable management of water resources (UN, 2021). Water in the essence of SDG 6.0 targets complements all other goals of SDGs. Limited progress in any of the targets of SDGs will negatively impact other SDGs too. Therefore, understanding SDGs is crucial among countries.

1.2 UN-led goals and Pakistan

Pakistan was among the first member states which agreed to MDG’s and SDG’s. Failures to achieve most of the MDG’s are attributed to a lack of enabling policies and limited financial opportunities to continue progress on MDG’s target. The 2013 progress report on MDGs, Pakistan showed high progress in the alleviation of poverty while failing in other subsequent goals. In many developing and under developed countries poor cross cutting relationship of reported figures with improvement in national income. As a consequence, many low-income countries were able to attract donor assistance under these goals. The middle-income countries who already had their national development goals similar or more ambitious than MDG’s were not able to draw these benefits; neither in terms of development nor in financial partnerships. In case of Pakistan, the over reporting of MDG’s exaggerated the national progress because there was no link between achieving MDGs to the improvement of institutional, governance and financial systems (Fatima et al, 2022). The MDG’s had the core focus on poverty alleviation whereas 2 water and sanitation targets were fixed under MDG 7; Ensure environmental sustainability. The core

aim of MDG's was poverty alleviation therefore, water and sanitation access were also made part of limited scale household survey (World Bank, 2005). As a consequence, despite reporting the target of poverty reduction 12.5 out of 13%, sub-targets remained unaddressed (Subohi, 2021). The official national report on MDGs showed that Pakistan achieved 89% access to safe drinking water compared to the target of 93% while missing the target of 90% of population with access to sanitation (GoP, 2015). In MDGs Pakistan kept very ambitious targets and reported the progress accordingly. The obvious gaps in over reporting were unleashed when Ministry of Climate Change drew a baseline for access to safe drinking water and basic sanitation.

Unlike MDG 7.0, the SDG 6.0 is a comprehensive goal with 11 targets starting from access to safely managed drinking water, basic sanitation, hygiene, chemical contamination of freshwater bodies by disposal of untreated waste, water use efficiency, trans-boundary water resources, Integrated Water Resources Management and state of water-related ecosystem. The efforts of UN are comprehensive sustainable management of water resources across the globe. Since endorsing SDGs Pakistan and its relevant authorities are picking up pace on SDG 6.0 gradually which is far better than many other countries. However, an attitude of setting aspirations at 100% and reporting without considering the framework of development still prevails. Moreover, no aspirations are logical without a well-defined baseline. The knowledge resources of the United Nations provide a complete set of guidelines for establishing a baseline and reporting within the development framework. The following sections will explain the baseline procedure and a way to report on the aspirations.

2 Reporting Line of SDG 6.0 in Pakistan

Goal 6.0 is an important goal of SDGs that requires a mix of survey and multi-institution data for reporting (SDG Supports Unit, 2018). In Pakistan, SDG 6.0 is distributed among different organizations for the compilation of national reports. The Government of Pakistan has nominated the Ministry of Water Resources to compile national progress on different indicators of SDG 6.0. An overview of the work of these focal institutions in setting the baseline on the basis of UN-defined methodology will be discussed in detail. Table 1 shows the responsibility for collecting reports against different indicators of Goal

6. Line ministries are responsible to collect data from relevant institutions in provincial governments to compile a national report. The national offices of focal UN organizations collect that data, have it endorsed with focal national organizations and report it to the United Nations Statistics Division (UNSD). It is the responsibility of focal UN organization to help the national organization in the compilation of national report in accordance with the methodology of each indicator, target and goal.

Table 1: Line ministries/organization for reporting SDG 6.0

SDG Target	National Reporting Organization	Focal UN Organizations
SDG 6.1.1	Ministry of Climate Change	WHO/UNICEF
SDG 6.2.1.	Ministry of Climate Change	WHO/UNICEF
SDG 6.3.1.	Ministry of Climate Change	WHO
SDG 6.3.2.	Pakistan Council of Research in Water Resources (PCRWR), Ministry of Water Resources	UNEP
SDG 6.4.1.	Department of Agriculture, Government of Sindh	FAO
SDG 6.4.2.	Water and Power Development Authority, Ministry of Water Resources	FAO
SDG 6.5.1.	Federal Flood Commission and Pakistan Water Partnership, Ministry of Water Resources	UNEP
SDG 6.5.2.	Pakistan Commissioner for Indus Waters, Ministry of Water Resources	UNESCO, UNECE
SDG 6.6.	Pakistan Council of Research in Water Resources (PCRWR), Ministry of Water Resources	UNEP

Additionally, Goal 6.0 has complementary role in all other goals as the statement of the goal seals its scope “sustainable management of water for all”. The reporting of SDG is made in three tiers; Goal, targets and Indicators. A goal is comprised of two or more targets against which nations have to set their aspiration. The progress on each aspiration is measured through one or more indicators. In order to report the indicators, there is a well-defined methodology by a number of organizations of the UN who are responsible for the reporting of SDGs. Progress against the indicators and targets is to be reported through national consensus.

3 WASH Indicators (Water Sanitation and Hygiene)

SDG 6.1 and 6.2 are targets that jointly represent WASH and three indicators of Goal 6.0. These two targets are closely related to human health, life security and the prevention from water borne diseases. These are the first steps of human security starting from the personal hygiene of a person and the community as a whole. The structure of WASH indicators is shown in Table 2.

Table 2: Structure of WASH Indicators

WASH Indicators		
Targets	6.1: **By 2030**, achieve universal and equitable access to safe and affordable drinking water for all	6.2. **By 2030**, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
Indicators	6.1.1. Percentage population using safely managed drinking water services	6.2.1. Percentage of population using safely managed sanitation and hygiene services
Focal Ministry: Ministry of Climate Change through Joint Monitoring Program (JMP) of WHO and UNICEF		

The indicator 6.1.1. is measured on the basis of proportion of population using improved water sources that are located on-premises and available when needed and free of faecal (and priority) contamination (UNU-INWEH, 2019). To calculate safely managed sanitation, a program is in place named as 'Joint Monitoring Programme' (JMP), jointly managed by WHO and UNICEF. For the Sustainable Development Goals, the JMP uses its 25 years of experience and focuses on drinking water, sanitation and hygiene (SDG targets 6.1 and 6.2). JMP updated the definition of "basic drinking water services" by defining the access of travel time of 30 minutes round trip including queuing. Bottled water is also included in the category of safely managed drinking water services (JMP, 2023).

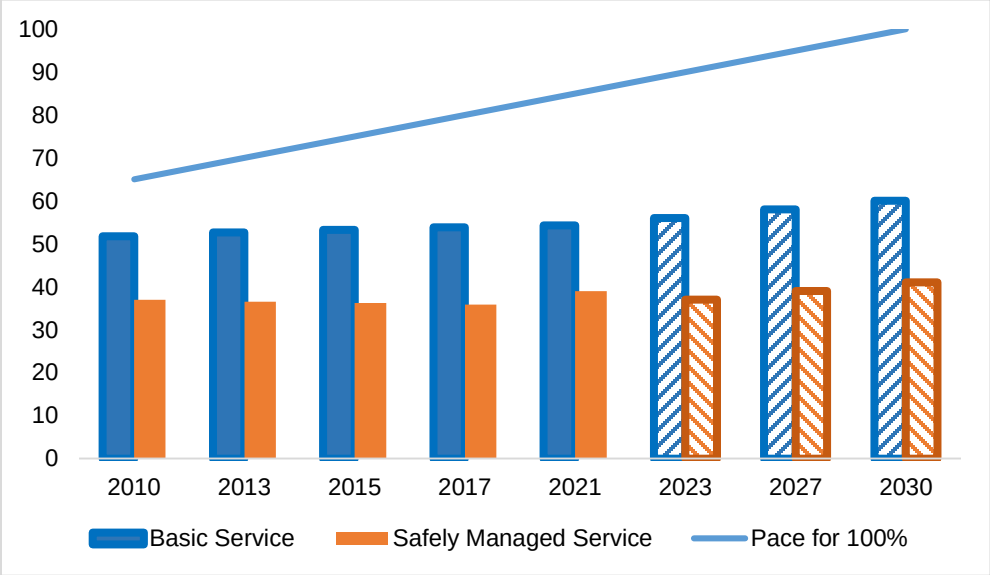

Figure 2: Baseline and progress on access to drinking water; predicted aspiration (Source: JMP (2023) & Rasheed et al., 2021)

In 2021, Pakistan's reported access to safely managed drinking water services was 39% (figure 2), a value that is much less than reported in the MDGs. However, the access to basic drinking water supply service has increased by four percent. With this pace, Pakistan would be able to achieve only 60% in case of basic drinking water access and 41% in case of safely drinking water supply services with the remaining less than 10 years. The *National Water Quality Monitoring Program* report of 2015 by PCRWR predicted that with safe water improvement of 31% in 2015, Pakistan would reach hardly up to 53% access to safe drinking water by 2030 (Imran et al., 2016). In figure 2, the combined results of JMP and PCRWR's reports regarding this indicator are quoted. Now

with the current safe water access of 39% in 2020, 50% of the population is projected to have safe water access by 2030. In order to achieve the predicted aspiration for basic and safely managed drinking, the Government of Pakistan needs to initiate development programs for improving the quality of drinking water supply services, capacity building of relevant institutions and improvement in governance structure. In order to enhance the efficiency and sustainability of these systems, a transparent revenue generation mechanism should be carved out. Most important of all, Pakistan is not in a position to achieve drinking water target of 100% by 2030. Therefore, it will need to revise its aspirational targets.

In 2015, the improved sanitation was defined as not shared with other households (sewer connections, septic tanks and other improved facilities such as improved pit latrines) from which excreta are safely disposed in situ or removed from the home through sewer lines and treated at a treatment plant, or emptied from non-sewer facilities, transported to a treatment plant and treated (UNU-INWEH, 2019). However, the revised definition excluded the term “shared facility without other households” (JMP, 2023). As shown in Figure 3, the access to at least basic sanitation facility in Pakistan is about 68% that includes; septic tank, sewer and improved latrine and other. Current statistics reveal that more than half of the national population has access to basic sanitation.

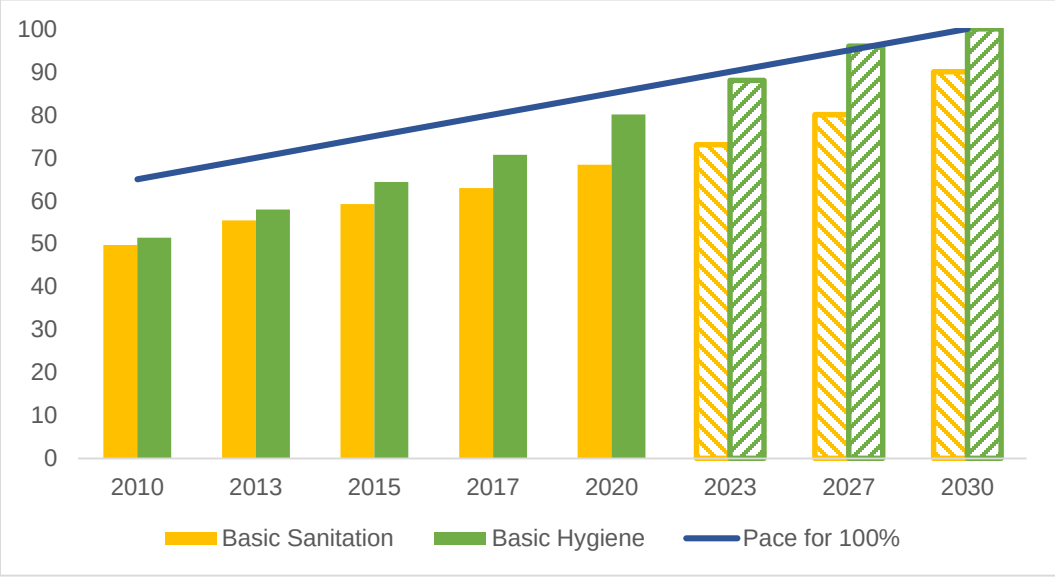

Figure 3: Current and predicted access to basic sanitation and hygiene

(Source: JMP, 2023)

The treatment of this sewerage waste is a distinguished debate which is covered in target 6.3. The indicator 6.2.1. is also associated with basic hygiene facility having water supply for hand washing along with soap. The 2021 data reported in JMP shows that at least 80% of population have basic sanitation facility. Pakistan is very likely to achieve the hygiene aspiration of 100% provided that more public awareness is generated in his regard. Private sector has played a key role in improving hygiene through commercial advertisements showing the benefits of handwashing.

In WASH indicators, Pakistan needs to give higher focus on safely managed drinking water supply services, starting with setting an achievable aspiration. Improved sanitation requires safe disposal of wastewater after necessary treatment that widens the scope of Goal 6.0 beyond drinking water supply services, sanitation and hygiene. In this context, reporting 100% progress on one target only, does not fulfil the aspiration of SDG 6.0. Therefore, it is essential to look each target in the context of other targets and goals as well as the framework for development to achieve this goal.

4 Target 6.3 - Improvement of Water Quality with Pollution Reduction

Statement of target 6.3 calls for improvement in water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally by 2030 (UN, 2023). The target 6.3 has two indicators, (6.3.1) the proportion of water safely treated and (6.3.2.) proportion of bodies of water with good ambient water quality (6.3.2). The first indicator (6.3.1) monitors both on-site and off-site treatment of wastewater generated from Industrial and domestic resources. The industrial wastewater is further categorized into hazardous and non-hazardous wastewater (UN-Habitat and WHO, 2021). At the UN level, the UN Habitat and World Health Organization (WHO) and the United Nations Statistics Division (UNSD) are jointly responsible for compiling data on this indicator. A report of relevant UN organizations on the basis of data collected and reported from Pakistan has revealed that in Pakistan, approximately 6 billion cubic meters of domestic wastewater is generated annually. Out of which 27% is safely treated in septic tanks through on-site faecal sludge management (UN-Habitat and WHO, 2021). The official reported data under SDG 6.3.1. is regarded as insufficient by

the reporting agencies, i.e. the UN-Habitat and WHO. Assuming that total wastewater volume has the composition of domestic and industrial wastewater (50:50%), the country report shows that presently only 13% of total wastewater generated is being treated. In 2015, the figure was less than 8% (Jones et al, 2021). In this scenario, it is predicted that Pakistan will not be in a position to achieve the target of 100% by 2030 (Figure 4). Therefore, there is a need to fix aspirations for this target through national consultation. Wastewater treatment and water recovery in large metropolitan cities needs to be supported through financial allocation and public-private partnerships.

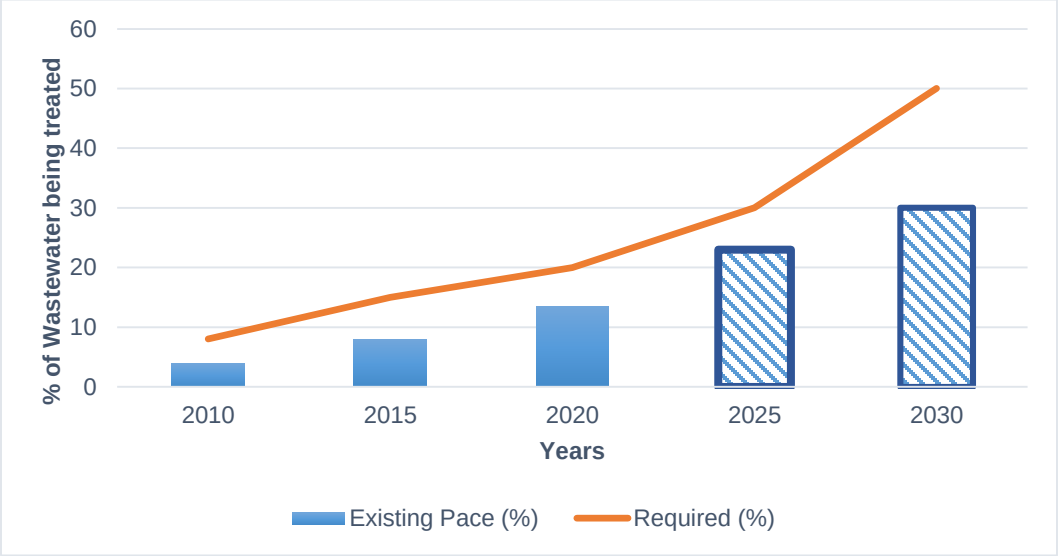

Figure 4: Aspirations for wastewater treatment in Pakistan, Reported Vs predicted (WHO & UN-Habitat, 2021; Jones et al., 2021).

Indicator 6.3.2. is inclusive of indicator 6.3.1. Figure 4 reveals that presently only 13.2% of wastewater is being treated out of total generated, remaining 87% of the wastewater is directly contaminating surface and groundwater bodies. This state of wastewater management cannot be observed individually rather in combination with the indicator 6.3.2. The rainfall runoff from urban and rural areas contributes directly into surface and groundwater bodies adding up into overall wastewater generated. This kind of contribution cannot be measured at the source. However, it can be measured by its effects on ambient water quality, i.e. indicator 6.3.2. (UNEP, 2021).

Second indicator (6.3.2) tracks the percentage of water bodies in a country with good ambient water quality. “Good” indicates an ambient water quality that does not damage

ecosystem function and human health according to core ambient water quality parameters and is set at the national level. This includes in situ monitoring of 5 core parameters: Dissolved Oxygen (surface water), Electrical Conductivity (surface water and groundwater), Nitrogen/Nitrate (surface water and groundwater), Phosphorus (surface water) pH (surface water and groundwater). As mentioned above, this indicator is a direct measure of ambient water quality and an indirect measure of natural water contribution into these surface water bodies.

At United Nations level, United Nations Environmental Program (UNEP) is responsible compiling the report under this indicator internationally. As per SDG 6.0 database of UN-Water, Pakistan has not yet reported a completed data against the indicator 6.3; limited data only for the indicator 6.3.1. and no data for the indicator 6.3.2. The methodology requires systematic monitoring of water quality data of water bodies (rivers, lakes and ground water) on a wide spatial scale (UNEP, 2021).

Pakistan Council of Research in Water Resources (PCRWR) being the federal research organization on water has undertaken monitoring for the indicator 6.3.2 according to the criteria set by UNEP. These samples are collected and analysed according to well defined and ISO 17025 recognized methods. These parameters include; Dissolved Oxygen (DO), Electrical Conductivity (EC), pH, total Nitrogen and ortho phosphate/total phosphate for lakes and rivers. In case of groundwater however, samples are monitored for EC, pH and Nitrate. These parameters are also regarded as basic or level 1 parameters.

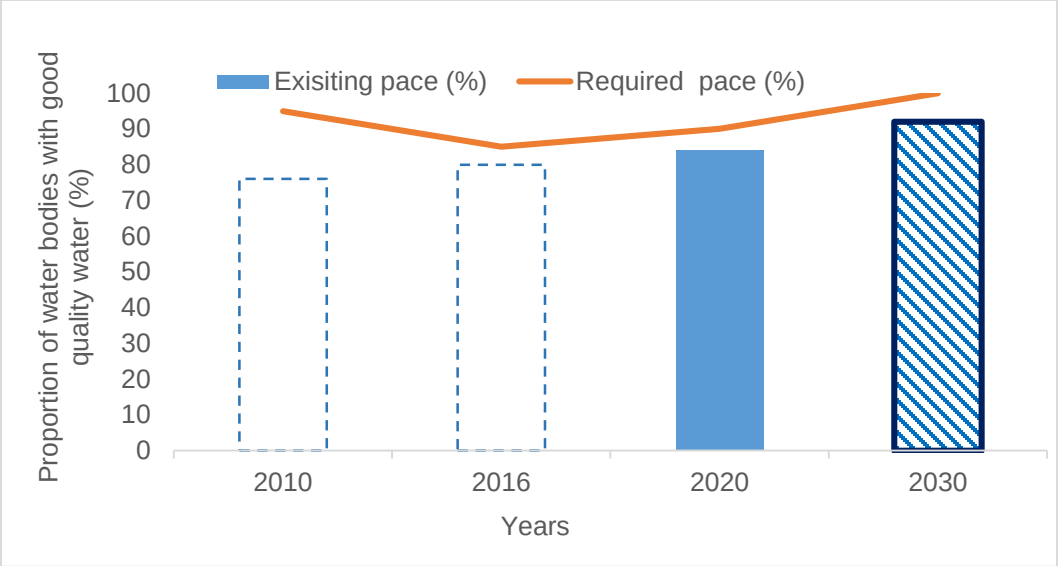

Figure 5: Proportion on water bodies having good ambient water quality

(Source: Imran et al., 2022)

The data collected was from 44 water bodies across the whole country including rivers, lakes, reservoirs and groundwater bodies. The results of this analysis revealed that in 2020, 84% of water bodies had good ambient water quality (Figure 5). Data for SDG 6.0's indicator 6.3.2. was collected for the first time according to the level 1 reporting methodology set out by UNEP. This represents a good ambient water quality, but these values also offer a point of concern regarding future water quality status.

Figure 5 shows status of ambient water quality trend since 2010 with aspirational progress to maintain the quality of surface water bodies by 2030. From 2010 to 2020, the graph indicates the absence of any measured data. The quality of water bodies is presumed as in good status during 2010 followed by a dip in 2016. Since ambient water quality is the indirect measure of environmental contribution into freshwater bodies therefore, assumptions are made. In 2010, Pakistan experienced historical floods across the Indus Basin during monsoon. These floods brought catastrophic damages to livelihood to a large majority of population. However, at the same time, they had long term positive impacts on river ecosystems. The natural course of rivers and lakes were rejuvenated, and groundwater salinity was diluted due to basin-wide recharge. On the contrary, in year 2016 river ecosystems, lakes and groundwater underwent a stress due to over exploitation, high evapotranspiration, less rainfall and snow cover.

Presently, 84% ambient water quality is sign of a healthy ecosystem which is continuously recharged by natures contribution of freshwater, given the fact that only less than 8% of Pakistan's wastewater is safely managed or treated before disposal into surface water bodies. Moreover, the vastness of aquifers is not yet showing the sign of nitrate stress despite continuous agriculture using flood irrigation. This scenario also raises an alarm due to the fact that there are rapid changes in land use and land cover in the proximity of rivers, lakes and above groundwater aquifers. Population increase and rapid urbanization will result in the generation of more wastewater, larger industrial activity and more hospital wastes. Another driving force is climate change. If Pakistan has to face rapid water scarcity in future years till 2030, ambient quality of rivers is more likely to decline. Stress from untreated wastewater disposal, reduction in river water supplies due to less natural contribution and over exploitation of groundwater resources is going to reduce current health (84%) of water bodies. The aforementioned facts inter-twine the indicator 6.3 and 6.4, i.e. target of water use and water scarcity. Wastewater is a resource if properly treated and a nuisance if not treated properly as it will reduce the quality of already scarce fresh water resources.

In the scenario of climate change, urban sprawl and insufficient data on wastewater treatment, it is important to consider level 2 reporting against this indicator. Level 2 reporting is based on; analysis of pathogens and bacteria that lives in water, quality of aquatic life in the surface water bodies, satellite observed data to determine the turbidity and contaminants in the surface water bodies, data collected by the private sector and modelling studies for filling the existing data gaps.

5 Target 6.4. Substantially Increase Water Use Efficiency and Water Scarcity

5.1 Indicator 6.4.1 "Change in water use efficiency over time"

In SDG 6.0, target 6.4 also has two indicators, the change in water use efficiency over time (6.4.1) and level of water stress "freshwater withdrawal as a proportion of water resources available" (6.4.2). The indicator 6.4.1 is the ratio of volume of water consumed

in a particular sector to the gross value added by this sector. In other words, this indicator shows the reliance of economic growth on exploitation of water. It helps sectors to improve their water efficient operations, for instance reducing the water footprint of their activities using less water to achieve certain growth targets or overall economic growth of a sector (FAO and UN-Water, 2021a). This concept may be clearly understood in industrial operations that how much dollar value they are generating while using a unit volume of water. In commercial businesses, water use efficiency may be estimated by the impact of WASH facilities in the office space over the productivity of the business. In domestic sector, reduced water and health bills are indicators of water use efficiency. The SDG 6.4.1 indicator determines the change in water use efficiency over time, globally reported at 17.3 US$/$m^3$ of water in 2015 to 18.9 US$/$m^3$ of water in 2018 (FAO, 2018). The rate of change in water use efficiency is easier to determine but the determination of WUE (Eq 1) is a complex process (FAO and UN-Water, 2021a).

$WUE = Awe \times PA + Mwe \times PM + Swe \times PS$……..(i)

Where:

WUE = Water-use efficiency [US$/$m^3$]

Awe = Irrigated agriculture water-use efficiency [USD/m^3]

Mwe = MIMEC water-use efficiency [US$/$m^3$]

Swe = Services water-use efficiency [US$/$m^3$]

PA = Proportion of water used by the agricultural sector over the total use

PM = Proportion of water used by the MIMEC sector over the total use

PS = Proportion of water used by the service sector over the total use.

An easier way to calculate and estimate change in water use efficiency over time is through SDG 6.0 Policy Support System (SDG Policy Support System (sdgpss.net))[1].

Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity			
Indicator 6.4.1 Change in water-use efficiency over time			
	Baseline	Current	Predicted (2030)
6.4.1.1 Gross value added by industry [including energy] (USD 000,000)	2780	6190	8000
6.4.1.2 Volume of water withdrawn by the industries [including energy] (000,000 m^3)	1920	2000	2000
6.4.1.3 Gross value added by agriculture [excluding river and marine fisheries and forestry] (USD 000,000)	7470	16140	20,000
6.4.1.4 Proportion of agricultural GVA produced by rainfed agriculture (%)	7.4	16.14	20
6.4.1.5 Volume of water withdrawn by the agricultural sector [including irrigation, livestock and aquaculture] (000,000 m^3)	94000	94000	105000
6.4.1.6 Gross value added by services [water collection, treatment and supply] (USD 000,000)	190	247	300
6.4.1.7 Volume of water withdrawn by the service sector (000,000 m^3)	5000	5000	7000

Figure 6. PSS webtool questionnaire for SDG 6.4.1[2]. (Source: SDG Policy Support System (sdgpss.net)).

The calculation sheet of tools shown in Figure 6 calculates the change in water use efficiency over time as per the methodology defined by FAO, an organization responsible for the reporting of SDG 6.4.1. Some of the values such as; value added by the water services sector cannot be separated from the services sector value addition into the GDP at present. The contribution of GDP into a number of factors is calculated from the historical data published by the Government of Pakistan. These values are then used in the PSS tool to estimate change in WUE during 2017 to 2020. The results generated using PSS are shown in figure 7, a change in WUE by 100% in just three years. These

[1] SDG 6.0 PSS is developed by UNU-INWEH under a project, Water in the World We Want. Complete guidelines on using PSS may be accessed from: User Guide for Policy Support System (PSS) (pcrwr.gov.pk)

[2] Values provided in this image are experimental as most values are not available or desegregated in Pakistan.

results are similar to the ones reported by FAO to the UN on behalf of Pakistan (See Appendix, A.1);

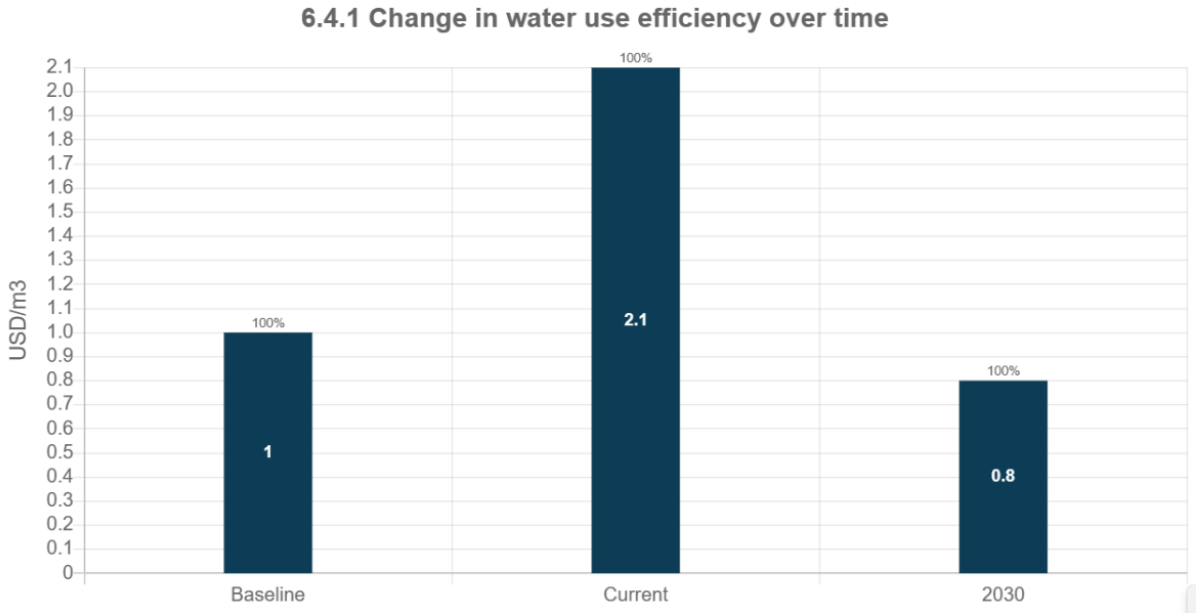

Figure 7: Change in water use efficiency over time as a result of data input in Figure 6[3].

Values thus generated in the system are synchronized with those reported by FAO as national status of WUE over unit of water used[4]. In 2016-17, the FAO reported WUE as 1 US$/m^3 and in 2020 it reported WUE as 2 US$/m^3 (UN, 2023), these values are similar to the ones generated by PSS. However, the tool has predicted further reduction in WUE by 2030 because the population is also expected to rise to 230 million. In this regard, current state of value addition of services and agriculture sector is going to reduce in the upcoming years. For two consecutive reporting periods, a status of WUE seems promising as compare to the global average of 192 countries. In order to show some improvements in this sector, there is a need to highlight some grey areas around WUE. For instance, those may be:

[3] Figures 7, 8 & 10 are system-generated graphs by the PSS tool. The value 100% on top of the graph shows all required data sets (100%) are filled to generate this information.

[4] One unit of water for WUE estimation = 1 cubic meter of water (m^3)

- Accountability of water consumption by the industries
- Accountability of gross value added by the rainfed agriculture
- Establishment of water supply services industry
- Transparency in irrigation water charges collection and their reporting.

Currently, the gross value added by rainfed agriculture is not accounted in contribution of agriculture sector into the national GDP which imbalances the agricultural accountability (MoF, 2023). Rainfed agriculture is practiced on 12 million hectares of cultivable land (40%) of total cultivable area (Ashraf and Hasan, 2018). A number of subsidized schemes are offered for the expansion of agriculture in the rainfed areas from the public exchequer therefore, its accountability in water use efficiency is important. Indicator 6.4.1 is unique compared to other indicators of SDG 6.0 because it does not have an issue of high national aspiration which are not achievable by 2030. It rather has problem in accounting of all factors necessary for the estimation of WUE.

5.2 Indicator 6.4.2. "Level of water stress"

The indicator 6.4.2 identifies the level of water stress in a country, sub-divided into three main categories; no water stress (25%), approaching scarcity (60%) and strong water scarcity (75%). In this indicator, level of water stress is determined as the ratio of total freshwater withdrawn by all major sectors and total renewable freshwater resources, after having taken into account environmental flow requirements. Freshwater withdrawal is measured from one of the major basins in the country and accounts for water acquisition from rivers, lakes, and aquifers. Non-conventional water resources such as; treated wastewater, desalinized water and direct use of agricultural drainage are not accounted for in total freshwater withdrawal. In the case of Pakistan where domestic drainage is directly being used in agriculture, it needs to be subtracted from total freshwater withdrawal. The level of water stress is determined according to the Equation 2:

$$Water\ Stress\ (\%) = \frac{TFWW}{TRWR-EFR} \times 100 \qquad (2)$$

Where;

TFWW = Total freshwater withdrawal (TFWW)

TRWR = Total renewable freshwater resources (TRWR)

EFR = Environmental flows requirements (EFR) (FAO and UN-Water, 2021b).

The calculations for this indicator are straight forward. If the values of TFWW, TRWR and EFR reported by FAO in 2020 is accounted for, PSS generates the following report (Figure 8):

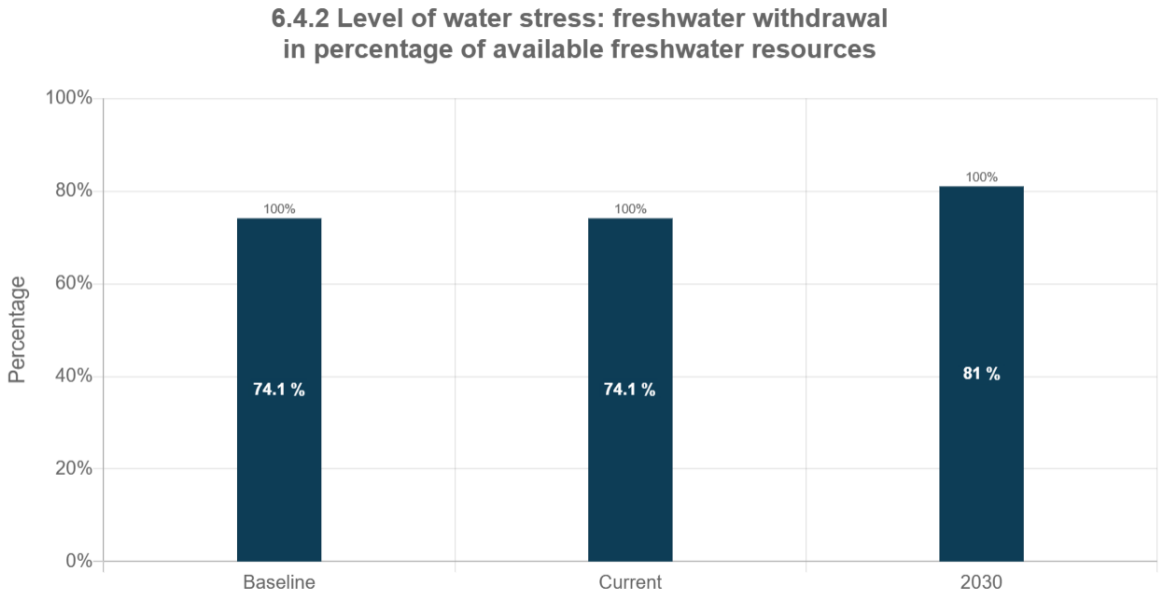

Figure 8: Level of water stress as reported by FAO in 2020 (See Appendix A.2)

As per these estimations, level of water stress in the country far exceeds the scarcity limit defined. These figures show exaggerated water account for level of water stress in Pakistan. Level of water stress is approaching 75%, establishing Pakistan as one of the highly stressed countries. Methodology for determining water stress is derived from Water Resources Vulnerability Index (WRVI), according to this index Ashraf (2016) estimated level of water stress as 77%. In this line, with increase in population per capita water availability is likely to reduce pushing Pakistan as highly water stressed country by the conclusion of agenda 2030.

6 Target 6.5: Implementing IWRM at all levels

6.1 Indicator 6.5.1. Degree of implementation of IWRM (0-100)

The target 6.5 also has two indicators, degree of Integrated Water Resources Implementation (6.5.1) and proportion of trans-boundary basin area with an operational arrangement for water cooperation (6.5.2). The indicator 6.5.1 represents a degree of implementation of IWRM on a scale of 0 to 100 (very low to very high). It tracks the degree of IWRM implementation, by assessing the four key components. These components are further explained in Table 3.

Table 3: Degree of Implementation of IWRM explained

1. Enabling environment
1.1. What is the status of policies, laws and plans to support Integrated Water Resources Management (IWRM) at the national level? a) National water resources policy, or similar. b) National water resources law(s). c) National integrated water resources management (IWRM) plans, or similar. **1.2 What is the status of policies, laws and plans to support IWRM at other levels?** a) Sub-national water resources policies or similar. b) Basin/aquifer management plans or similar, based on IWRM. c) Arrangements for transboundary water management. **d)** Sub-national water resources regulations (laws, decrees, ordinances or similar).
2. Institutions and participation
2.1 What is the status of institutions for IWRM implementation at the national level? a) National government authorities for leading IWRM implementation. b) Coordination between national government authorities representing different sectors on water resources, policy, planning and management. c) Public participation in water resources, policy, planning and management at national level. d) Private sector participation in water resources development, management and use.

e) Developing IWRM capacity.

2.2 What is the status of institutions for IWRM implementation at other levels?

a) Basin/aquifer level organizations for leading implementation of IWRM.
b) Public participation in water resources, policy, planning and management at the local level.
c) Participation of vulnerable groups in water resources planning and management.
d) Gender included into laws/plans or similar within water resources management.
e) Organizational framework for transboundary water management.
f) Sub-national authorities for leading IWRM implementation

3. Management Instrument

3.1 What is the status of management instruments to support IWRM implementation at the national level?

a) National monitoring of water availability (includes surface and groundwater, as relevant to the country).
b) Sustainable and efficient water use management from the national level, (includes surface and groundwater, as relevant to the country).
c) Pollution control from the national level.
d) Management of water-related ecosystems from the national level.
e) Management instruments to reduce impacts of water-related disasters from the national level.

3.2 What is the status of management instruments to support IWRM implementation at other levels?

a) Basin management instruments
b) Aquifer management instruments
c) Data and information sharing within countries at all levels.
d) Transboundary data and information sharing between countries.

4. Financing

4.1 What is the status of financing for water resources development and management at the national level?

a) National budget for water resources infrastructure (investment and recurrent costs).
b) National budget for IWRM elements (investments and recurrent costs).

4.2 What is the status of financing for water resources development and management at other levels?

a) Sub-national or basin budgets for water resources infrastructure (investment and recurrent costs).
b) Revenues raised for IWRM elements
c) Financing for transboundary cooperation
d) Sub-national or basin budgets for IWRM elements

(Source: UNEP, 2021c).

The IWRM is a complex concept and it needs to be understood as the bottom-up approach for the reporting and implementation of IWRM. At the UN level, the United Nations Environmental Program is responsible for its reporting and collecting the necessary information from countries. In Table 3, further elements of IWRM implementation are explained. In Pakistan, Federal Flood Commission/Ministry of Water Resources is responsible to collect this information at national level through a comprehensive consultation process. The information from the relevant institutions is gathered according to prescribed format of UNEP, compiled and reported (FFC, 2021). This comprehensive set of questions covers all water resources management elements such as; availability of policy at national and provincial level, river basin management instruments including data availability, sustainable and efficient use of water at all levels, presence of strong institutions to implement IWRM principles at national and provincial level, financial allocations for water resources management and revenue generation through IWRM implementation (Fatima et al, 2021). The score against all components is compiled and aggregated and this practice is repeated after every three years. In 2017, Pakistan had reported degree of implementation as 50/100 whereas, in 2020 it was reported as 56/100 (sdg6data.org). The timescale progress against this indicator is shown in Figure 9.

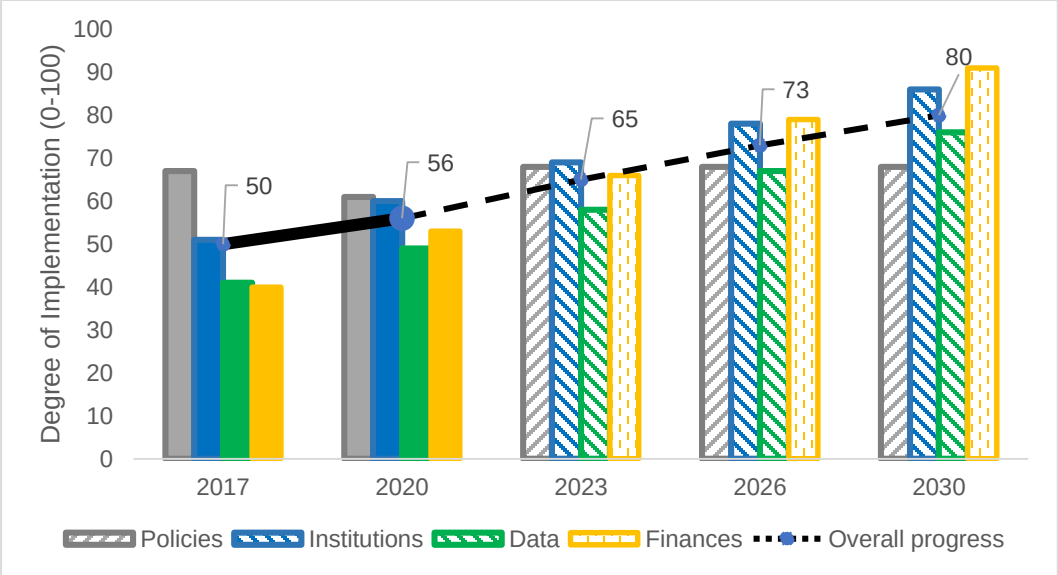

Figure 9: Degree of Implementation of IWRM as per 2020 national reporting

The reporting against indicator 6.5.1. needs to be observed in the line of reporting of SDG target 6.4 which shows clear lack of account of data in different sectors. In this regard, the scale of implementation of IWRM more than 50 percent is contestable. A national level consensus among water resources institutions is required to set their levels of institutions. Bangladesh, Türkiye and Ghana have made efforts on the implementation of IWRM since 2007 through recurring financing mechanism (Fatima et al, 2021). Despite years of efforts, 2020 reports of IWRM implementation indicated; Bangladesh 50, Ghana 50 and Türkiye 62. Japan has however, excelled in this degree by reporting of IWRM as 90. If Pakistan has to follow the existing reporting trend, then it is predicted that by 2030, the IWRM score will be around 80.

6.2 Indicator 6.5.2 Transboundary water cooperation

The indicator 6.5.2 measures operational arrangements for both river and lake basins and aquifers. The indicator is defined as “Proportion of transboundary basin area with an operational arrangement for water cooperation”. The relative importance of surface water and groundwater may differ per state. Therefore, the indicator allows for the possibility to disaggregate the data and highlights specific needs at national, regional and global levels related to both river and lake basins, and transboundary aquifers separately. Its calculations are based on two main elements:

i. The spatial coverage of transboundary basin areas located in a state;
ii. A determination of the extent to which these areas are covered by operational arrangements for water cooperation.

Transboundary aquifers may also be accounted for if the operation arrangement of cooperation between two countries is based on an aquifer-specific agreement. According to UNECE an “operational arrangement for cooperation” requires; a joint commission for cooperation, regular and formal communication between the riparian countries, joint and coordinated management plan and regular exchange of data (at least once per annum) (UNESCO & UNECE, 2021).

The Indus River Basin is Pakistan's largest river basin which is under the operational arrangement with India through the Indus Waters Treaty signed in 1960. Pakistan Commissioner for Indus Waters is responsible for implementing this operational arrangement with India. Pakistan’s operational arrangement for transboundary water resources management is a surface basin and rivers-specific rather than aquifer-specific therefore, the reporting under this indicator accounts for surface river basins only. The status of indicator 6.5.2. generated by PSS is shown in Figure 10.

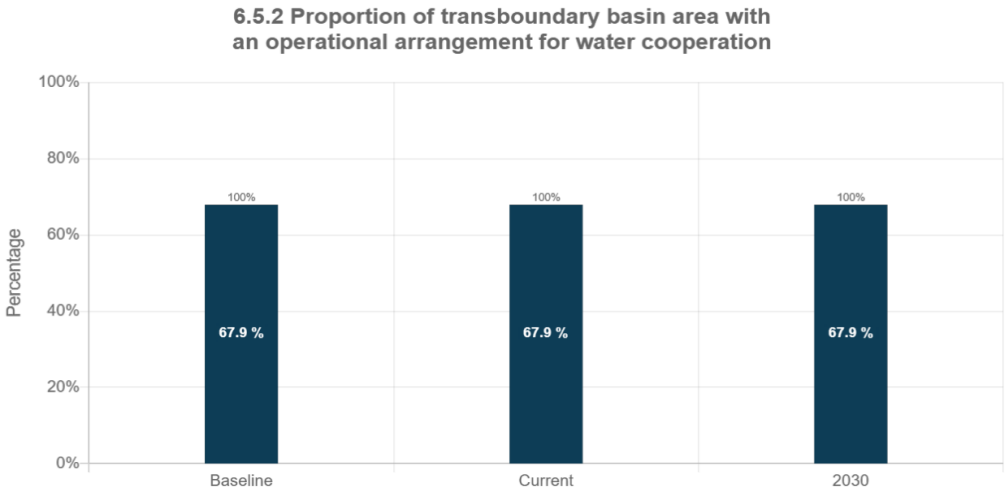

Figure 10: Baseline and status of transboundary water cooperation for surface water only

7 Target 6.6. Protection and restoration of water related ecosystem

This target is defined as “By 2020, protect and restore water related ecosystems, including mountains, wetlands, rivers and aquifers and lakes”. It has only one indicator (6.6.1) that aims at measuring the change in the extent of water related ecosystems over the time. The indicator tracks changes over time in the extent of water-related ecosystems according to categories shown in Figure 11.

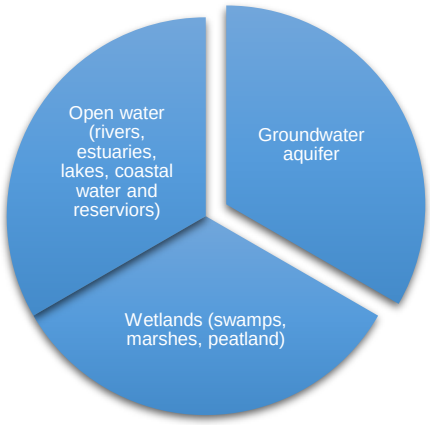

Figure 11: Water-related ecosystems defined by UNEP (UNEP, 2021b).

The UNEP requires to report on this indicator every three years according to the following reporting process:

i. Receive global Earth Observation data per ecosystem type.
ii. Convey national and basin statistics.
iii. Send statistics to the member states for approval.
iv. Approved SDG 6.6.1. statistics and status report to UNSD.

In order to acquire the remotely sensed ecosystem data, UNEP relies on NASA’s earth observation system for permanent and seasonal reservoirs, inland vegetative wetlands, water quality, and mangroves. This data further complies with an interactive tool[5] and

[5] FreshExplorer (sdg661.app)

through this dashboard country-specific data is also reviewed with respect to permanent and seasonal water dynamics in lakes, rivers, reservoirs, mangroves, and wetlands.

As mentioned in the aforementioned methodology, the UNEP shares the remotely sensed data with the national focal person on indicator SDG 6.6.1 and after approval shares it back with the UNSD. The approved data may be observed from the UN dashboard SDG 6.0[6]. This database contains nationally approved statistics that show a 33% increase in the freshwater ecosystem since the year 2000. This information provides a combined status of rivers, lakes, reservoirs, and wetlands. These statistics lack information on the extent of mangrove forests which has declined by 17% since the year 2000 as per UNEP's own dashboard. Figure 12 shows the change in extent of water bodies compared to baseline year (2005) to the most recent five-year analysis (2011-2015). It includes permanent and seasonal lakes and extent of man-made reservoirs. This extent is presumed to be increased to 50% in 2020 because of the availability of more man made and natural storages.

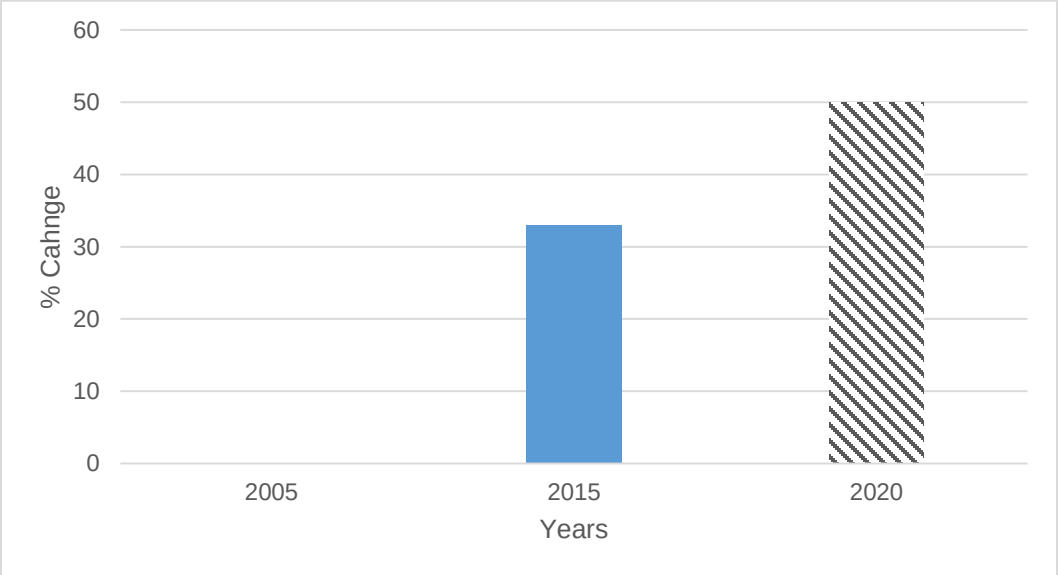

Figure 12: Change in the extent of surface water bodies

[6] Country (or area) | SDG 6 Data

This indicator is the most critical as it was due for reporting in 2020. The health of freshwater ecosystem speaks loudly about the degree of implementation of IWRM, level of water stress and ambient quality of surface water bodies. Once the quality and availability of renewable water is restored, adequate supply of safely managed drinking water and sanitation services will also be made possible.

8 Recommendations on Key Findings

All the indicators and targets of Goal 6.0 of SDGs are discussed in detail in line with national progress and methodology set by the line national agencies in Pakistan. The overall finding is that focal organizations in the country are making good efforts to collect required datasets to report on the progress. However, these efforts seem to go in the similar directions as that of MDGs where countries were able to report progress without any impacts on global development. These efforts of reporting are without setting aspirations. In order to set aspirations, a strong understanding of reporting methodology, ground realities and baseline information are required. Moreover, Goal 6.0 is merely understood as goal for water and sanitation whereas its entire focus rests on improving water use efficiency and IWRM.

In the light of limited datasets available at national scale, reporting methodology and what has been reported to UN-Water, baseline values are worked out for SDG 6. These analysed values against each target and indicator are given in Table 4.

Table 4: Baseline values assessed as per the methodologies defined by the UN

Sr#	Indicator	Baseline value with year	Comments
1	6.1.1	39% (2015)	Reported at JMP and data collected by the Water Quality Survey conducted by PCRWR in major cities only.
2	6.2.1	60% for Basic Sanitation 64% for Basic Hygiene	Collected by JMP, although limited dataset is available for hygiene and sanitation at public spaces.
3	6.3.1	8% (2015)	A research article (Jones et al., 2020) account for limited data available for septic tanks and pit latrines only
4	6.3.2	84% (2022)	On the basis of Level 1 reporting requirement for this indicator. Level 2 would require comprehensive quality monitoring and governance exercise.
5	6.4.1	1 US$/$m^3$ of water (2017)	Estimated without contribution from rainfed agriculture and water services.
6	6.4.2.	74% (2017)	The absence of water account for the country are showing this abnormal figure.
7	6.5.1	50% (2017)	Estimated on the basis of single consultation and questionnaire filling. Estimation requires in depth analysis of governance, capacity and transparency of institutions.
8	6.5.2	67.9% (2017)	On the basis of operational arrangements for surface water only.
9	6.6.1	33% (2011-15)	On the basis of satellite data of 2005. Although extent of water bodies was recorded to be increased in 2015 but the turbidity of the water bodies is also increased by 28%.

Table 4 shows the imitation of dataset behind the estimation of baseline values. The SDGs are going to be concluded in 2030 and given the hydrological scenario of Pakistan, hardly any actual improvement is expected against the targets of SDG 6.0. In this regard, the focal institutions should provide the realistic situation and try to underpin what has gone wrong for water stress level, IWRM, drinking water supply, wastewater treatment and water-related ecosystem health. There is no harm in reporting less values and setting up modest aspirations so that we may not have to start from level zero when the next development agenda of the UN is announced. In this regard, following few steps are suggested to be taken to set the SDG 6.0 journey right:

i. Set a modest aspiration of safely managed drinking water supply up to 50% by 2030 and allocate sufficient resources accordingly.
ii. Acquire public opinion survey over the quality of basic sanitation and hygiene and set a public owned aspiration of basic sanitation and hygiene at public spaces.
iii. Improve the analysis of household surveys to highlight the critical areas where basic hygiene and sanitation services are entirely absent.
iv. A desk analysis of wastewater being treated in Pakistan may be conducted to identify the percentage of safe disposal of wastewater. Moreover, statistics of sewerage waste directly consumed in agriculture may also be accounted for.
v. A national-level study for level 2 reporting against SDG 6.3.2 may be conducted.
vi. A comprehensive and multi-stakeholder study is required to estimate the existing WUE that may also propose a strategy to improve it.
vii. There is a need to develop capacity of the institutions on IWRM understanding and its implementation[7].
viii. The findings of indicators 6.3.2 and 6.6.1 are intimately linked. Therefore, a level 2 investigation around SDG 6.3.2. would provide evidence for SDG 6.6.1.

[7] PCRWR has developed a guiding document, IWRM implementation at river basin level in Pakistan. The readers of this report are encouraged to read this guiding document to acquire a basic understanding of IWRM IWRM Report (1-9-2021).cdr (pcrwr.gov.pk).

All the above recommendations are focused on generating evidence for developing water resources development and management plans in future. Acquisition of these datasets is also aligned with the smooth implementation of national and provincial water policies as well as provincial water acts. The SDG 6.0 may be taken as an opportunity to acquire support from the relevant UN organizations for developing human and institutional capacity to improve the water resources management and monitoring. Over reporting will only stop the transfer of knowledge and resources from the UN agencies and international development organizations to achieve SDG 6.0 targets and indicators. As a result, the communities will stay deprived of basic “water and sanitation” instead of “safely managed water and sanitation for all”.

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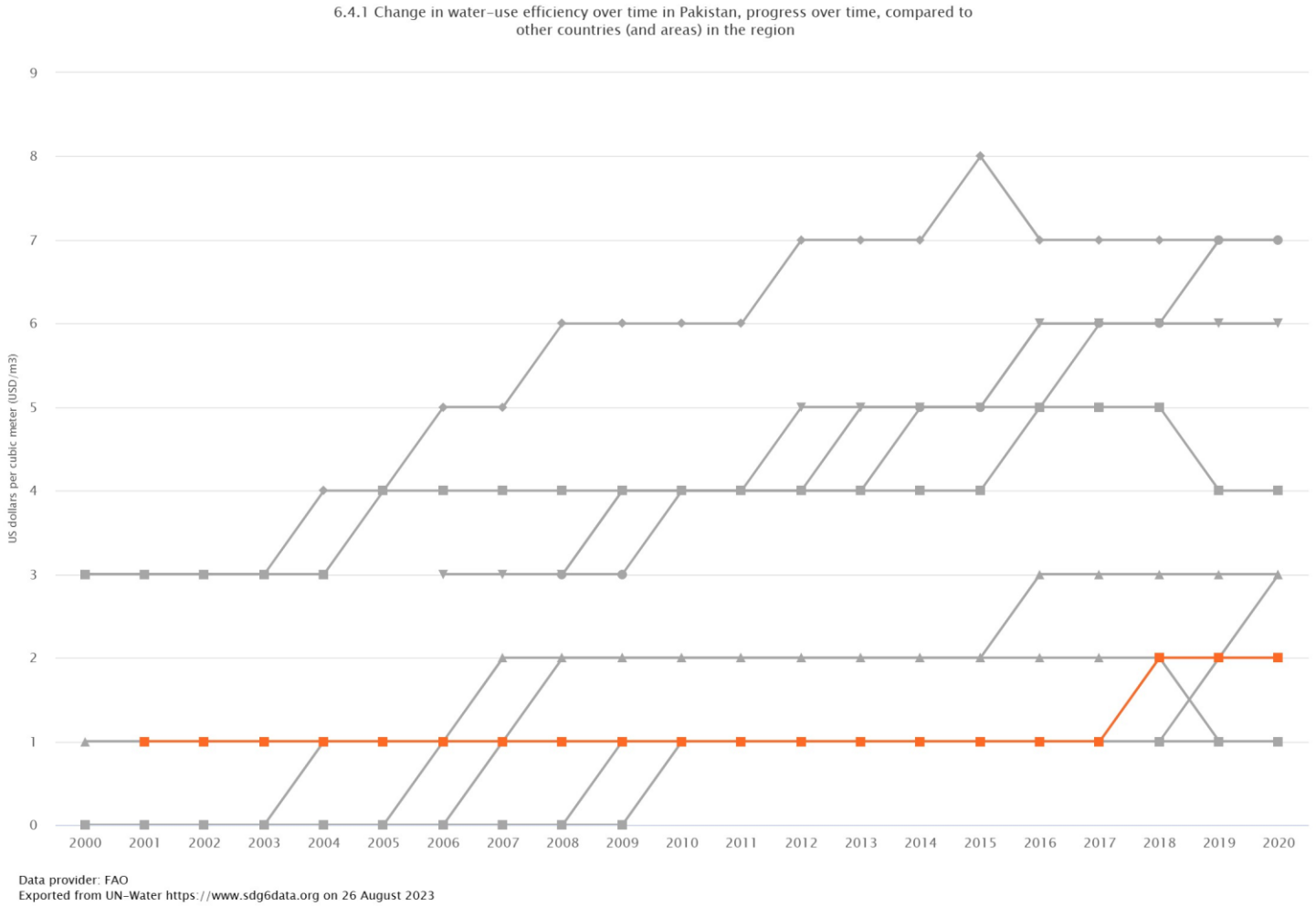
Appendix A

A.1. Change in WUE over time, reported by FAO to UN



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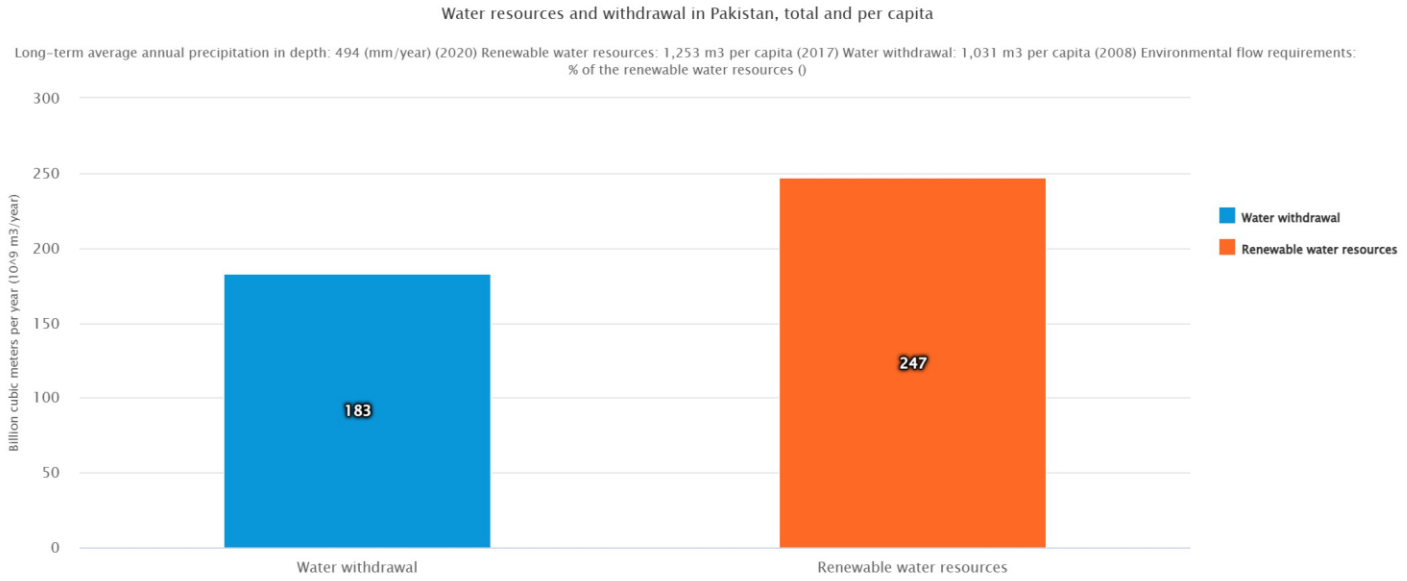
A.2. Level of water stress in Pakistan



The data of FAO Aquastat also offer following figures regarding the availability of natural flow into surface water bodies and per capita water availability compared to withdrawal;

- Long-term average annual precipitation in depth: 494 (mm/year) (2020)
- Renewable water resources: 1,253 m^3 per capita (2017)
- Water withdrawal: 1,031 m^3 per capita (2008)