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Optimal Water Allocation Methods and Policy under the Current Development and Climate Change Challenges: A Review on Gidabo Basin

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Abstract

Ethiopia, with over 1,700 m^3/s per capita water availability is not a water stressed country according to the water stress index (WSI), the spatial and temporal variability of water limits the country's development, management and equitable distribution. Rift Valley Lakes Basin is one of the twelve basins in Ethiopia which covers 53,000 km^2 and consists of 4 sub-basins and 14 watersheds and most of Rift valley lakes exist in this Basin and Gidabo is among these watersheds. There had no well-organized water allocation system in Gidabo Basin. A review was conducted to adopt an allocation plan from existing plan within the country from nearby basins and outside of the country. The water allocation study of the basin will target to provide water allocation for domestic, livestock, environmental flow, coffee wet mills, agro-processing and other industrial water demand in the sub basin and forecasted water demand with sustainable, equitable and rationally manner. As water scarcity has increased globally, water allocation plans and agreements have taken on increasing significance in resolving international, regional and local conflicts over access to water. This review also includes assessment of water conflict, water supply right and sanitation policy and identification of future scenarios for water allocation and adaptation strategies in the Gidabo basin. There were different papers reviewed on each sub topic to attain the aim of the review including domestic demand which is to be calculated with the ratio of population number, biodiversity water demand based on moody method, livestock water demand based on dry matter and their types, industrial water demand which is to be calculated as a function of industrial production data, industrial survey components, and economic development indicators. In addition, decisions related to water resources allocation need to incorporate local hydrologic conditions. This work investigates different water rights principles, and comparison of WEAP and water allocation models. The review suggests the possible application of policies, proclamations, regulations and traditional as well as UN water rights of the societies.

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Keywords: *Water allocation, Climate change; WEAP; Water demand, Conflict resolution; Legal and institutional framework, IBTs*

1 Introduction

The rapidly growing population has led to an increased claim on natural resources. The agricultural area has increased considerably, while changing agricultural practices have increased further the pressure on the natural resources. The associated increase in irrigation water extraction from surface water and groundwater resources puts an increasing claim on scarce water resources in Gidabo Basin (Ayenew, T., 2007). The process of water allocation is sharing of a limited natural resource between different regions and competing users (Speed et al., 2013). It is a process made necessary when the natural distribution and availability of water fails to meet the needs of all water users – in terms of quantity, quality, timing of availability, or reliability.

The objective of the review was to determine how much water is available for human use and how it should be shared between competing regions and users. This desk review attempts to analyse the water allocation modeling trends across countries as well as current efforts to address general approaches to develop water allocation principles and study, evaluate different water allocation models, adopt and recommend the optimum allocation for Gidabo basin.

1.1 Water Demands

Roberto A. and Matthew M. (2007) did a research in collaborate and computed domestic water demand as the product of the population and per capita use. The per capita domestic usage varies from 32 to 113 liters per capita per day (lpcd) with an average of 84 liter per capita per day. The livestock watering component accounted for 9 percent of the total rural demand. For the large growth (LG) and medium growth (MG) scenarios increases in the water demand were attributed to the population growth only, not to variation in the per capita use. For high growth (HG) scenario increases in the water demand were attributed to both population growth and an increase in the per capita demand due to anticipated socioeconomic development. Mark et al. (2002) provides the results from the modeling different types of water demands at the basin or country level in the global scope, during 1995 to 2025. Water demand is projected to grow rapidly for domestic and industrial uses, and relatively slowly for agriculture. The developing world is projected to have much higher growth in total water demand than the developed world, and about 93% of the additional demand will occur in developing countries.

Miranda et al. (2015) analysed livestock water demand by classifying them into different groups. Water demands of beef cattle are a function of the stage of production, lactation and environmental temperature. About 83 percent of water consumed by dairy cattle is consumed by drinking, with the remaining water coming from feedstuffs. Water requirements are influenced by the animal's diet and will increase with increases in dry matter, salt and protein. Sheep are able to obtain most of their water requirements from forage consumption. Horses that are hot from exercise should have limited access to water to prevent colic, laminitis and/or exertional rhabdomyolysis. According to study of Sultan et al. (2014), water requirement to produce 1kg dry matter of common green fodder, protein and energy feeds varied from 267 (sorghum) to 713.3 liter (lucerne), 1,000 (linseed) to 2,000 liter (soybean) and 690 (maize grain) to 850.0 liter (oat grain), respectively. For 250kg live weight, about 450m3 of water is required annually. Wildlife in the parks, pastoralist communities using the flood
recession farming and livestock farming are dependent on the river. The environmental flow that sustains these activities is inevitably necessary for the survival of the biodiversity (Tesfaye, T. W., et al., 2020). The water footprint of meat from beef cattle at 15,400 litre/kg on average globally is much larger than the footprints of meat from sheep (10,400 litre/kg), pigs (6,000 litre/kg), goats (5,500 litre/kg) or chickens (4,300 litre/kg) (Bhagat, S., et al., 2020). Donald J. and Eugene M. (2014) used the "Montana method", which is the most widely used of the reconnaissance-level methods, based on historical records of discharge to estimate biodiversity water demand. The study clinched that 10% of the average annual flow is the minimum instantaneous flow needed to sustain short-term survival. A flow of 30% of the average annual flow was required to maintain good habitat for aquatic life. Optimum habitat was provided by flows of 60-100% of the average annual flow and flushing flows were 200% of the average annual flow. According to Naveen et al. (2019), industrial water demand accounts for about 8–10 % of the total water demand in the country. Motasem N. (2020) showed that the monthly industrial water demand per worker is 0.634 m3 for domestic use, while that for process use is varied between 0.07 to 21.38 m3/tons product. The dominant industry in the basin (Wet coffee processing) consumes water in average up to 20 m^3 per ton of coffee beans processed without recycling (Nagesh, 2012).

1.2 Water Right

In Ethiopia the past access to improved water has increased but still very low compared to other countries. *Joint Monitoring Program* (*JMP*) reported that 52% of the population had access to improved water in 2012. Seyoum, S., & Graham, J. P., (2016), also reported 53.6% of households as using improved water in 2011. In SNNP and Oromia, less than half of their respective populations had access to improved water. The United Nations (UN) General Assembly formally recognized a human right to water and sanitation by adopting Resolution 64/292, stating that such a right "is essential for the full enjoyment of life and all human rights". The Resolution relied on the definition of a right to water and sanitation as provided in the United Nations General Comment 15 adopted by the Committee on Economic, Social and Cultural Rights (ESCR Committee) in 2002: "The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses." The right has since then been affirmed by the United Nations Human Rights Council in Resolution A/HRC/15/L.14. A great majority of Ethiopians use unsafe and polluted water, and are at risk for a great variety of water-borne diseases (Flintan and Imeru, 2002). As a result, both intra- and inter-ethnic conflicts over the use of natural resources are common place in the dry lands, central and southern Ethiopia. Dessalegn (1999) argues that in Ethiopia, development, not water scarcity, is a more important source of conflicts between the rural communities.

1.3 Types of water rights

Meinzen-Dick and Bruns (2000), Meinzen-Dick and Bruns (2003) and Paul (2003) classified types of water rights as follows; Public water rights are rights held by the state, and in which the government allocates rights to users. The government can assert its rights over water by controlling the water allocation directly through government agencies (Paul, 2003). Common water rights refer to communal water rights where water can be used by people in ways that are specified by some community. For true common property, some form of community or user group should have rights to allocate water at some level. In most African customary water law, water is considered as a community property and private ownership of water is not recognized (WFP, 2001). Private property rights are rights held by an individual or legal individual like corporations (Meinzen-Dick and Bruns, 2003). In water, it is generally only use rights that are recognized for individuals, particularly permits or licenses that give an individual a right to use water in certain ways (Paul, 2003).

1.4 Legal and institutional framework

River basin plan in general, Water Allocation in particular as multi-phase and multi-owner activity, its development process has to be in accordance with policies, proclamations, regulations and institutional arrangements developed in the country. With this frame, any water allocation plan development shall consult the FDRE Constitution (1995), the Water Resources Management Policy (WRMP), the Environmental Policy of Ethiopia (EPE), the Water Resources Management Proclamation (Proclamation No.197/2000), the Water Resources Management Regulations (Regulation No. 115/2005), the River Basin Councils and Authorities Proclamation (Proclamation No. 534/2007), and other related strategic documents to draw out the supportive articles of WAP. There are Legislative, Policy and Legal aspects pertinent to the development of WAP which includes The Constitution of FDRE (adopted on the 21st of August 1995) comprises the concept of environmental rights and sustainable development are entrenched in articles 43, 44 and 92 of the Federal Democratic Republic of Ethiopia (FDRE) Constitution. The articles present the rights of the citizens to improved living standard and sustainable development (Art.43.1), to be consulted with respect to policies and projects affecting their community (Art. 43.2), and to live in a clean and healthy environment (Art. 44.1).

The water resources management policy (2000) is ratified by the federal Ministry of water, irrigation and Electricity. The issue of water allocation planning and its sustainable use is directly addressed in the objective of WRMP of the country which states “to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available water resources of the country for significant socio-economic development on a sustainable basis”. The water resources management proclamation (Proclamation No.197/2000) is currently the basic legal instrument governing the management, planning, utilization and protection of water resources in Ethiopia. It has laid down the general conditions that need to be fulfilled for anyone wishing to use water resources for different purposes on the basis of water use permit. The water resources management regulations (Regulation No. 115/2005) were issued by the Council of Ministers; and its objective is to provide detailed provisions for the effective implementation of the Proclamation (Proclamation No.197/2000). It provides in detail the main requirements for the issuance of permits for different uses of water; construction works; waste water discharge, the conditions for the issuance, renewal, revocation etc.

Environmental Policy of Ethiopia (1997) The EPE incorporated sector specific environmental policy provisions for water resources and related sectors. Among others, the specific policy guideline aims to subject all major water conservation, development and management projects to the environmental impact assessment process, protection of the interface between water bodies and land, and integrate the rehabilitation and protection of wetlands and upstream forests into conservation, development and management of water resources. The aim of this River Basin Councils and Authorities Proclamation (Proclamation No. 534/2007) is to decentralize water resources planning and management functions to River Basin Organizations (RBOs) at the basin level so that most of the functions of the Federal government delegated to such a two-tier organizational set-up of RBO, Basin High Councils (BHC) and River (Lakes) Basin Authorities (R (L) BA). Following this proclamation, the Council of Ministers established by regulations the R/LBA for Abay, Awash Basin and RVLB authority and basin councils. MoWIE delegated a substantial portion of its administrative power to these river basin organizations.

The River Basin Authority was established as the technical arm and secretariat of the basin high council by proclamations No. 253/2011. It is responsible to promote and monitor the implementation of Integrated Water Resource Management (IWRM) principle in the basin. The Rift Valley Lakes Basin Integrated Development Master Plan Study (2010) concludes that this basin is characterized by under development, widespread poverty and severe land degradation. Water allocation plan (WAP) study project at the sub basin level is designed and started. Action plan of Ziway- Shalla sub basin water allocation plan is prepared. According the developed action plan, first phase activity is studying current sub basin water potential and demand as well as forecasting the future potential and demand is undergoing. World Waternet is part of a consortium aiming at improving water allocation in and around the freshwater lake Ziway Shalla, a sub-basin within Rift Valley Lakes Basin, including all relevant stakeholders. Traditional conflict resolution mechanisms in Africa are generally closely bound with socio-political and economic realities of the lifestyles of the communities. The customary courts rely on goodwill of the society to adhere to its ruling (Rabar and Karimi, 2004). Both inter- and intra-ethnic conflicts over the use of natural resources are common in the two major pastoral areas of Oromia, Awash River Basin and

Borana. Such conflicts are usually settled by the local elders using the principles of the Gadaa System. (Edossa, D. C., 2005).

1.5 Existing and future water availability under climate change

Findings of the IPCC 2001, strongly suggests that water resource respond to global warming in ways that negatively impacted the water availability and water supplies. The reduction in the runoff volume will lead to the decrease in the inflow to the reservoirs accordingly; longer period might be required to fill the reservoir (Habtom, 2009). Global water use will be negatively affected by the predicted changes in climate and the corresponding impacts on water supply IPCC (2008). As per the estimates of FAO, a 0.6 % annual expansion of irrigated area is expected in the developing countries until 2030. Currently about 40 % of global agricultural output is produced by irrigation (Fischer et al., 2006), which consumes more than 70 % of global water withdrawals.

The changes in climate affect both availability and demand for water. Water management decisions need to be made considering these climate and non-climate driven impacts. Agriculture sector, the largest of global consumptive water user, provides climate change affected supply and demand. Developing countries increasingly affected by climate change related water scarcity issues (Cosbey, 2009). The future water resources sustainability is affected by population, wealth and climate. The study in Asia found that water needs related to socioeconomic changes, which are currently small, are likely to increase considerably in the future. As a result, there is a high risk of severe water stress in densely populated watersheds by 2050. There is strong evidence to suggest that, in the absence of autonomous adaptation or societal response, leads water-stressed regions in the near future Charles F., et al., (2016). There is concern about the impact of climate change and socioeconomic growth on the future of our water resources (Jimenez C., et al., 2014).

Water scarcity occurs where there are insufficient water resources to satisfy long-term requirements. CC is likely to worsen the imbalances, through affecting both water resource availability and water demand. By the 2050s, the area of land subject to increasing water stress due to CC is projected to more than double the area with decreasing water stress (IPCC, 2008). Droughts can be considered as a temporary decrease of the water due to rainfall deficiency. Water-using sectors, such as public water supply, agriculture, industry and tourism compete for the finite freshwater amounts available in a given RB. In the future, the impact of CC on water availability is expected to lead to a stronger competition between sectors. (Mauser et al., 2012).

1.6 Adaptation strategies on Water allocation deficiency

Adaptation refers to the regulating strategies employed under actual or expected climatic stimulation (Pan and Zheng 2010); their objective being to mitigate climate change impacts and promote adaptive capacity. De Bruin et al. (2009) shows climate adaptation options to manage impact on water resource potential; prioritize and provided a ranking of the different alternatives. Their study evaluates the options based on stakeholder analysis and expert judgement. The criteria used for strategy analysis with experts, such as technical difficulty, potential costs of implementation and potential benefit. Jing T. et al. (2019) showed the pressure of water supply in water-deficient areas and balance the uneven distribution of water resources is solved using Inter-basin water transfer project. The indicators of water supply reliability, vulnerability and resilience are evaluated under different scenarios. Salomon S., Farinos D., (2019) evaluated the impact of future climate change and socio-economic scenarios by comparing various WEAP responses to different climate projection scenarios and baseline conditions in the Ourika watershed, and improve decision-making capacities in water resource management, the WEAP hydrological model was used and the sustainability of the proposed adaptation measures to climate change analyzed.

1.7 Comparative Evaluation of models

Water allocation modeling tool is used to develop plan for the future in the creation of equitable and reasonable water sharing agreements and operational rules for current conditions or future scenarios, and it is essential to cope with water scarcity(Gedefaw et al., 2019). Optimal water allocation model is also used to solve water security problems resulting from water scarcity, and increase the productivity or water use benefits of limited water resources through rational water use allocation within the affected region (Wang, X., et al., 2012).

Based the reviewed documentary sources, the key factors in selection of the water allocation modeling package are data requirements, model parameters and model structure in representing critical hydrological processes. Furthermore, the model(s) should also meet the main project objective of supporting upstream-downstream hydrological linkage. In water allocation modeling packages, the different ways in which water flows into and out of basins can be assessed and potential areas of water scarcity and those where further development of water resources may be needed can be identified. Many water allocation models applied by researchers were summarized below in table (Bakke, 2007).

Table 1: comparison of water allocation models

Model Name	Description	strengths	Weakness
WEAP	Simulate water demand, supply, flows, and storage, and discharge under varying hydrologic and policy scenarios.	WEAP has simpler algorithms to depict hydrologic processes but has the ability to model the economic implications of reallocation. free for non-profit organizations	Sub monthly level operating planning, Optimization of supply and demand and rule-based network operation
ModSim	It generalizes driver basin DSS and network flow model. ModSim can be run for daily, weekly, and monthly time steps.	Has capability of incorporating physical, hydrological, and institutional/administrative aspects of river basin management, including water rights. The model allows users to create a river basin modeling networks by clicking on icons and placing system objects in a desired configuration on the display. available free of charge	It is very data intensive for application in developing countries. The model requires extensive prior experience to implement
OASIS	It water simulation Model uses an object-oriented graphical user interface to set up a model,		Oasis does not have any link to GIS software or databases. it does not handle groundwater or water quality
RiverWare	It is a reservoir and river system operation and planning model	It is capable of modeling short-term (hourly to daily) operations and scheduling, mid-term (weekly) operations and planning, and long term (monthly) policy and planning. It has the capability of modeling multipurpose reservoir uses consumptive use for water users, and simple groundwater and surface water return flows.	RiverWare does not have a connection to any GIS software. RiverWare requires extensive prior experience with implementation and is proprietary software. It is assumed the costs are substantial high.
MIKE-BASIN	MIKE-BASIN couples ArcView GIS with hydrologic modeling to address water availability, water demands, multi-purpose reservoir operation, transfer/diversion schemes, and possible environmental constraints in a river basin.	well integrated surface-subsurface model,	It is too expensive to implement in the developing countries, It although lacks economic tradeoff analysis
AQUARIUS	It is a temporal and spatial allocation model for managing water among competing uses.	is freely available	The model does not include groundwater or water quality. The model implements only a monthly time step,

2 Materials and Methods

2.1 Description of the Study Area

The project area is located in the Abaya-Chamo sub-basin of the Rift Valley Lakes Basin situated in the southern part of Ethiopia, within the administrative Regions of SNNPRS, Sidama and Oromia Regions. It falls in Abaya district of Borena zone of Oromiya region and Dale district of Sidama zone of SNNPRS near Dilla town to East of Lake Abaya. The project area lies in the low lands, very close to the Dure and Gola marsh. It lies approximately between 6°20' and 6° 25' N Latitude and 38° 05' and 38°10' E Longitude and an average elevation of 1190 m a. s .l (see Figure 2.1). The study area falls within the traditional Kola agro-climatic zone, which can be classified as semi-arid climate. The climatic data are recorded from the four observation stations Amaro Kelo, Bilate, Dilla and Bule Hora, located nearby the project area. The average minimum temperature varies from 10.2^{o}C in Dec to 12.3^{o}C in July and the maximum temperature ranges from 25.9^{o}C to 30.5^{o}C in February. The average annual rainfall recorded so far in the project command is 1303 mm with minimum of 34.9 mm in January and maximum of 208.3 mm in April (WWDSE, 2009).

Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), the SNNPR has an estimated total population of 14,929,548 (SNNPR stst, 2007). The projected population for 2017 was 19,170,007. In the previous census, conducted in 1994, the region's population was reported to be 10,377,028. The SNNPR Water Resources Bureau announced that In August 2008, further increase the availability of drinkable water in the region from 58% in the previous year to 63.6%. The methodology of this desk review is based on a review of secondary data and related information collected through a systematic review of the available documents relevant to water allocation models and decision making, as well as publications related to water allocation trends in Ethiopia Basins and Gidabo catchment of the Rift Valley Lakes Basin of Ethiopia.

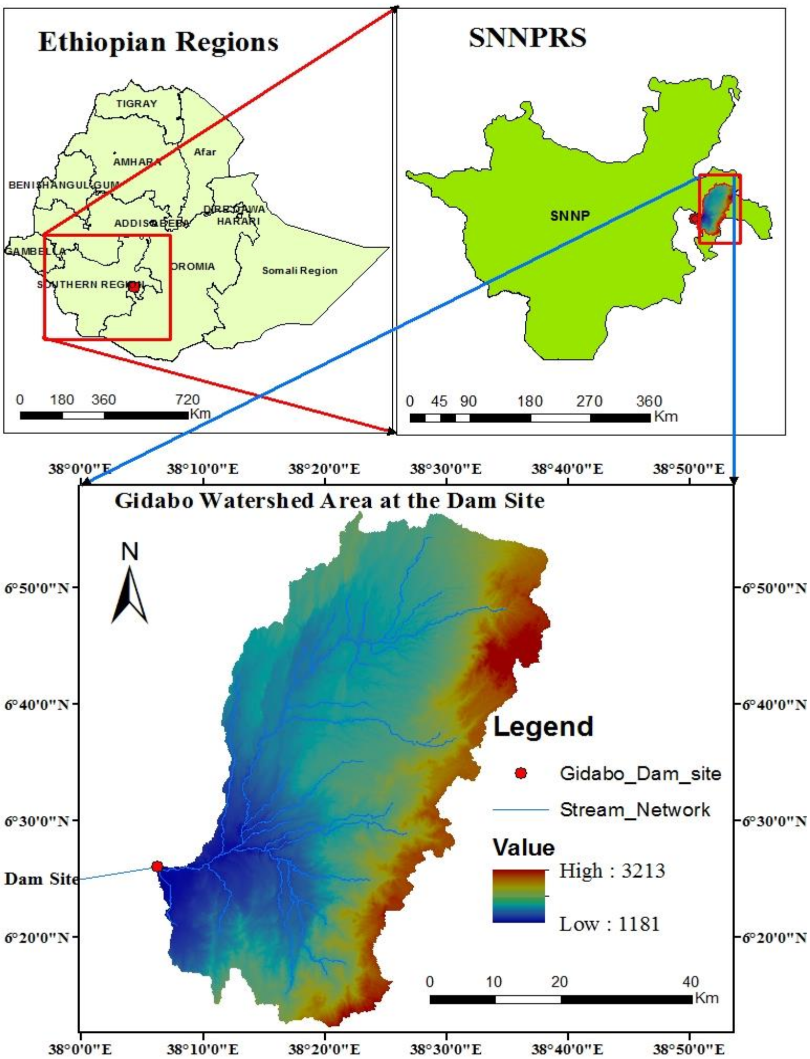

Figure 1: Location of the Gidabo earthen dam head work

2.2 Methods

The methodology of this desk review includes scanning the literature, a review of secondary data and related information collected through a systematic review of the available documents relevant to water allocation models and decision making. Furthermore, the publications related to water allocation trends in different Basins, Rift Valley Lakes Basin (RVLB) of Ethiopia and Gidabo catchment were intensively reviewed with the researchers.

2.2.1 Scan the Literature

The Scanned journal articles, reports and other gray literature were arranged with respect to water allocation mechanisms, water right, water demands Legal and institutional framework, and Existing and future water availability under climate change. Water allocation mechanisms includes Global Water Allocations (Lee et al., 2019, Wang J. F. et al., 2007, Wang Z.et al., 2015, Vaghefi et al., 2013, Ougouda et al., 2020), Water Allocation in Ethiopian Basin(Berhe et al., 2013, kerim et al., 2016), Water Allocation Rift Valley Lakes Basin (RVLB)(Shumet & Mengistu, 2016, Ersado et al., 2020).

Water right recognized a human right to water and sanitation in globally and country level (Seyoum, S., & Graham, J. P., 2016, Flintan and Imeru 2002, Dessalegn 1999). Types of water rights under Public water rights (Paul 2003), Common water rights (WFP, 2001), Private property rights (Meinzen-Dick and Bruns, 2003) were reviewed. Legal and institutional framework activities related with water allocations was referred accordance with policies, proclamations, regulations and institutional arrangements developed in the country (FDRE Constitution 1995 Art 43.1/2,44.1;.WRMP, 2000; WRMPr, 2000; WRMR, 2000;EPE, 1997;RVCAP, 2007;RVA, 2007;RVLBHCA, 2002). Furthermore, the climate change impacts on water resources have been reviewed under categories of reservoir (Habtom, 2009), Water Resources Management (IPCC 2008, Fischer et al. 2006), Water User Sectors (Cosbey, 2009), and Water scarcity and drought (IPCC, 2008). Developing the mitigation measures for climate change impacts and promote adaptive capacity is required to make resilient water resources planning. Hence, related literature with adaptation strategies were reviewed to Selecting adaptation choices and criteria for evaluation (De Bruin et al. 2009, Jing T. et al. 2019, Salomon S., Farinos D., 2019, Iglesiasa A. Garroteb L., 2015).

2.2.2 Analyze Secondary Data

Data collection approaches were based on an extensive review of the selected literature for the period 2000 to present, identified publically available data such geographically locations, demographic information's and other relevant data sets. In the next steps fieldworks were assessed by interviews with local stakeholders, basin managers and water resources managers in the field; structured and unstructured discussions with Thematic research Teams, site visits to address information gaps and gather insights and perceptions from multiple basin mangers on the role of the developing water allocation mechanisms and adaptation strategies. The aim of field work is identifying and collecting documents that may not be published or publicly available.

3 Results and Discussions

Different researchers have developed a multi-objective water resources allocation model. Lee et al., (2019) reviewed six water allocation tool including RiverWare, StateMod, Simplified Water Allocation Model (SWAM), OASIS, Aquarius and MODSIM-decision support system (MODSIM-DSS), and compared their capabilities for state-wide water allocation modeling in West Virginia. Wang J. F., et al., (2007) developed a dynamic model for equitable distribution of water in water-shortage areas, and aims to optimally satisfy the requirements of each locality, given limited supplies, and to maximize the total economic benefit of the entire areas. Vaghefi et al., (2013) introduced an integrated modeling approach by linking hydrologic models SWAT and water allocation models MODSIM to analyze the effects of climate and cropping pattern changes on agricultural and hydro energy production. Ougougda et al., (2020) introduced statistical downscaling model (SDSM) and the water assessment and planning tool (WEAP) model to analyze the impact of climate change and different socio-economic scenarios on water supply and demand, the sustainability of the proposed adaptation measures to climate change and to improve decision-making capacities in water resource management. Governments and water regulators address increased water scarcity in a regional setting by introducing policy interventions, including non-structural, such as pricing mechanisms and quotas to affect demand, and supply management means, such as water storage and extraction. One of the most extreme policy interventions is to build infrastructure to move water from locations where it is abundant to locations facing scarcity. Such interventions are known as intra- and inter-basin transfers (IBTs) of water and have been quite frequently practiced in many river basins around the world in recent years. In moving water from one place to another benefits and costs are realized, some of which are private and some are public in nature (Purvis, L., & Dinar, A., 2020).

Berhe et al., (2013) developed a river basin management decision support system (DSS) called MODSIM to be used for developing improved basin wide water planning analysis under different levels of irrigation development for Awash River Basin. The study includes the future reservoirs operation scenarios of Koka, Kesem and Tendaho dams. A water evaluation and planning (WEAP) model were developed to allocate the water supplies to demanding sectors based on an economic parameter to maximize the economic benefits. Kerim et al., (2016) studied the existing and future water availability under climate change in upper awash sub-basin which contributes significant flow to Koka dam and also on water allocation of the existing and planned water resource projects in the upper awash. WEAP model was applied to optimal water allocation for existing and proposed water resource projects using the monthly based data in both the demand side and supply sides and by priority setting situation for demand sites.

Shumet & Mengistu, (2016) applied the water allocation mechanisms applied in RVLB in Ziway Meki sub basin to assess the impact of existing and future water demand on economic and environmental aspects. The WEAP model was used to assess existing and future water demand. Ersado et al., (2020) introduced optimization of long-term water allocation. The WEAP model was generally used in the formulation and evaluation of alternative plans for responding to water-related problems and water resources development. The previous research related with water allocation and water management approaches were not done in detail including all competing demands and uncertain future conditions.

The needs of water allocation in Gidabo catchment study was identified through assessments conducted in 2000 to present. The review revealed number indicators of best water allocation needs. These includes rapid increases in population growth and economic development, the quantities of water continue to decrease or remain limited, global warming, urbanization, industrialization, uncertainties with respect to hydrologic and meteorological events as to demand patterns, pressure on irrigated agriculture to improve living standards and competition for water among various uses (water allocation problems). These indicators also verified that, efficient water management and developing water allocation mechanism is crucial to ensure the sustainable use of water resources with respect to environmental, social and economic dimensions. A synthesis of customary and statutory system of conflict resolution may facilitate a better understanding that will lead to improved management of resources, which are predominant variables for the socio-economic development of the country. Traditional water related conflict resolution mechanisms in Africa, such as the principles of the Gadaa System are not appreciated. In addition, the water allocation plan implementation should adopt points such as managing conflicts, Water resource development, Store at full capacity of the exiting reservoirs, Develop Surface water sources Development, Develop Ground Water Sources, improve water use efficiency, establish water use administration system, Capacity development, and Research and technology innovation. As a consequence, an increasing interest in water resource assessment and water management indicators can be observed. To develop the best-suited set a participatory, integrative and water allocation modelling needs, the common allocation models includes WEAP, ModSim, OASIS, RiverWare, MIKE-BASIN, and AQUARIUS were compared. Hence, The Water Evaluation and Planning System (WEAP) model for allocation purposes was selected because of it is a practical tool for incorporates both the water supply and the water demand issues in water resources planning, in addition to water quality and ecosystem preservation free for academic use, is also user friendly and easy-use software. In addition it also helps to Building and evaluates scenarios based on future trends on hydrology, management strategies, technological developments and/or other factors that affect demand, supply and hydrology and computes water mass balances.

4 Conclusions

Water allocation is the process of sharing a limited natural resource between different regions and competing user. Water Allocation has to be in accordance with policies, proclamations, regulations and institutional arrangements developed in the country and the modern basin allocation planning now focuses more on optimizing the use of existing supplies through significant economic, social and environmental analyses and the assessment of tradeoffs between competing users. Water resources management criteria for its efficient and effective utilization should be well conceived to avoid conflict, reduce negotiation and to increase cooperation. Water allocation modeling tool is used to develop plan for the future in the creation of equitable or impartial and reasonable water sharing agreements and operational rules for current conditions or future scenarios, and it is essential to cope with water scarcity. the objectives of water allocation tool is to find a balance among various competing sectors including domestic water demand, industrial water demand, agricultural water demand and ecological water demand. The overall the goal of this desk review is to better understand the Water allocation tool related needs as well as underlying causes of these needs, to form an evidence base to inform appropriate response planning and resource mobilization. In terms of needs for the study there are no previously studied research on Gidabo catchments, related with developing water allocation modelling and adaptation strategies to cope with climate changes. In addition, optimum water allocation is helps to managing conflicts, water resource development, maximizing the capacity of the exiting reservoirs, develop surface and ground water sources potentials, manage the wet coffee processing industry's needs, sustainable functioning of agro-processing, improve water use efficiency, establish water use administration system, capacity development, and input for further research and technology innovation. The reports also states the Water Evaluation and Planning System (WEAP) model is better model for allocation purposes due to it is a practical tool for incorporates both the water supply and the water demand issues in water resources planning's. Water resources management criteria for its efficient and effective utilization should be well conceived to avoid conflict, reduce negotiation and to increase cooperation.

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