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Araştırma Makalesi/Research Article

Assessing the Operational Performance and Stakeholders' Perceptions on the Management of Irrigation Projects in Kano, Nigeria

Nura J. Shanono[1*] Habibu Isma'il[2] Nuraddeen M. Nasidi[1] Mukhtar N. Yahya[1] Shehu I. Umar[3] Aminu Y. Nuradeen[1] Al-Ameen M. Musa[1] Zakariya Mustapha[1] Muazu D. Zakari[1]

[1]Department of Agricultural & Environmental Engineering, Bayero University Kano, Nigeria.
[2]Department of Agricultural & Bioresources Engineering, Ahmadu Bello University, Nigeria
[3]Department of Hospitality and Tourism Management, Federal University Wukari, Nigeria
*****Corresponding author**:** mdzakari.age@buk.edu.ng/njshanono.age@buk.edu.ng

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Abstract

A study was conducted to assess the level of operational performance and stakeholders' participation in, and perceptions on, the management of three major irrigation projects in Kano State, Nigeria (Kano River Irrigation Project KRIP, Watari Irrigation Project WIP and Tomas Irrigation Project TIP). The study uses questionnaire, site visit and focus group discussions during the 2019/2020 irrigation season to generate crucial information related to the hydraulic infrastructures and operational performances. The study identified some problems related to operational performance affecting the three irrigation projects including illegal water use, faulty water conveyance infrastructures and conflict among water users and between water users and managers. Moreover, the study observed that a continuous flow water allocation method is being used in all three irrigation projects, leading to poor water allocation performance. Based on this, the study recommends a rotation water allocation method. About 50% of the total water users from KRIP, WIP and TIP do not participate in the maintenance of the irrigation infrastructures. The study revealed that the majority of the farmers have no confidence in water managers' competence whereas water managers accused irrigators to lack enthusiasm and provided evidence of unlawful water usage as about 12, 8 and 39% of the irrigators from KRIP, WIP and TIP admitted to having been lifting water using pumps which have been considered as illegal since their farms were initially considered non-irrigable. Some of the underlying issues that led to these problems include lack of sensitization and awareness campaigns, seminars and workshops to facilitate farmers' involvement in the maintenance of irrigation infrastructures. This can be achieved through sensitization and awareness campaigns to enlighten farmers on resolving conflicts, efficient use of limited water, and facilitating water users' participation in irrigation management activities such as agency-farmer joint management. If such dialogue programs do not bring an end to these problems, other law enforcement measures such as legal actions need to be deployed. It is, therefore, recommended that the existing irrigation project management strategies need to be changed with new ones that encourage sensitization campaigns, law enforcement and participation. Also, in-depth coupled human-water interaction studies (socio-hydrology) need to be conducted to gain insights and propose solutions that could lead to sustainable irrigation system management and operation.

Keywords: Irrigation projects, Operational performance, Participation, Perceptions

Nijerya'nın Kano Eyaletinde Sulama Projelerinin Yönetimine İlişkin Operasyonel Performansın ve Paydaşların Algılarının Değerlendirilmesi

Öz

Nijerya'nın Kano bölgesindeki üç büyük sulama projesi (KRIP: Kano Nehri Sulama Projesi, WIP: Watari Sulama Projesi ve TIP: Tomas Sulama Projesi)'nin yönetimine ilişkin işletme performansı ve paydaşların katılım ve algılarını değerlendirmek amacı için bir çalışma yürütülmüştür. Çalışmada, hidrolik altyapılar ve işletme performansları ile ilgili bilgi elde etmek için 2019-2020 yıllarında sulama sezonu boyunca anket, saha çalışması ve grup tartışmaları gibi yöntemler kullanılmıştır. Çalışma sonucunda; yasadışı su kullanımı, hatalı su iletim altyapıları ve su kullanıcıları ile yöneticiler arasındaki çatışmalar dahil olmak üzere üç sulama projesini etkileyen işletme performansı ile ilgili birtakım sorunlar tespit edilmiştir. Ayrıca, çalışmada her üç sulama projesinde de devamlı akış yönteminin kullanıldığını ve bunun da zayıf su tahsis performansına yol açtığını gözlemlenmiştir. Buna dayanarak, bu çalışmanın sonuçları rotasyonlu bir su tahsis yöntemi önermektedir. KRIP, WIP ve TIP projelerindeki toplam su kullanıcılarının yaklaşık %50'si sulama altyapılarının bakımına katılmamaktadır. Bu çalışmada, çiftçilerin çoğunluğunun su yöneticilerinin yetkinliğine güvenmediğini, su yöneticilerinin ise sulama yapanları hevessiz olmakla suçladığını ortaya konulmuştur. Bunun yanı sıra; KRIP, WIP ve TIP projelerinden sulama yapanların sırasıyla yaklaşık %12, %8 ve %39'u, arazileri başlangıçta

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sulanamaz olarak kabul edildiğinden, yasadışı kabul edilen pompaları kullanarak sulama yaptıkları görülmüştür. Bu tip sorunlara yol açan temel problemlerden bazıları; çiftçilerin sulama altyapılarının bakımına katılımını kolaylaştırmak için farkındalık ve bilinçlendirme etkinlikleri, seminerler ve çalıştayların eksikliği olarak sayılabilir. Çiftçileri anlaşmazlıkları çözme, sınırlı suyun verimli kullanımı ve su kullanıcılarının sulama yönetimi faaliyetlerine katılımını kolaylaştırma konusunda aydınlatmak için farkındalık ve bilinçlendirme gibi etkinlikleri yoluyla bu sorunlar ortadan kaldırılabilir. Eğer bu tip diyalog programları bu sorunlara çözüm getirmezse, o zaman yasal işlemler gibi diğer kanuni önlemlerinin uygulanması gerektiği önerilmektedir. Dolayısıyla, mevcut sulama proje yönetim stratejilerinin, farkındalık etkinlikleri, kanun yaptırımı ve çiftçilerin katılımı teşvik eden yeni stratejilerle değiştirilmesi tavsiye edilmiştir. Bunun dışında, bu anlayışı kazanmak için derinlemesine birleştirilmiş insan-su (sosyo-hidroloji) etkileşimi çalışmalarının yapılması gerektiğini ve sürdürülebilir sulama sistemi yönetimi ile işletimine yol açabilecek çözümler önerilmelidir.
Anahtar Kelimeler: Sulama projeleri, İşletme performansı, Katılımcı, Algılar

Introduction

Irrigation scheme is a whole made up of water source, human activities, water allocation infrastructures and rules for water sharing among irrigators. Historically, irrigation schemes have no doubt contributed tremendously towards achieving food security in the face of climate change, rapid population growth and (Schierhorn & Elferink, 2016). Moreover, another reason for irrigation schemes development is not only to supplement water available for the crop but also to increase production and to grow crops that are not feasible during the rainy season (Shanono *et al.,* 2012). Hence, irrigation schemes are needed in areas where natural water source (rainfall) is either inadequate or too much for crop production (Nasidi *et al.*, 2015; Shanono *et al.,* 2019). Thus, irrigation schemes needed to be managed and operated efficiently as well as periodic appraisals in order to assess the level of its functionality (Burt *et al.,* 2004). One of the approaches for checking how successful an irrigation system is being operated is by routine assessment of various system components. The aim is to evaluate some performance metrics to ascertain the level of system functionality. For example, assessing the performance of water allocation is to evaluate water conveyance networks to determine the associated problems and suggest possible solutions in order to obtain reliable water supplies (Shanono *et al.*, 2014; Zakari *et al.*, 2015). After which some of these suggestions and recommendations can be adopted for subsequent actions by the management, users and other water-related organizations (Shanono and Ndiritu, 2020). Routine assessment is therefore a prerequisite to routine maintenance in other to achieve an effective and sustainable irrigation scheme management and operation (Shanono et al., 2019).

Since an irrigation scheme is a system made up of many other subsystems, a problem of a given subsystem could afterwards affect other subsystem or the overall system (Loucks *et al.,* 2005). Coupled with this, irrigation systems are managed by humans which could even make problems more problematic. Despite these, conventional irrigation system performance assessment mainly paid more attention to water allocation and infrastructures (Nasidi et al., 2015). Such a business-as-usual method could fail to assess the actual impacts of irrigation stakeholders' (managers, users and neighbouring community) unlawful activities. Contrary to such traditional methods of irrigation system performance assessment, this study intended to conduct an exploratory study to examine both hydraulic and operational performances and water users' and managers' participation in, and perceptions on the management operation and maintenance of the irrigation project. In order to have a wider coverage of information, the study was conducted at the three major irrigation projects in Kano State, Nigeria. The outcomes of this study could serve as baseline information for future human-water interaction study as explained in the concept of socio-hydrology (Sivapalan et al., 2012; Montanari *et al.*, 2013; McMillan *et al.*, 2016).

Materials and Methods

Locations of the study area

The research was conducted at 3 major irrigation projects in Kano State, Nigeria; Kano River Irrigation Project (KRIP), Watari Irrigation Project (WIP) and Tomas Irrigation Project (TIP), during the 2019/2020 irrigation season (Figure 1).

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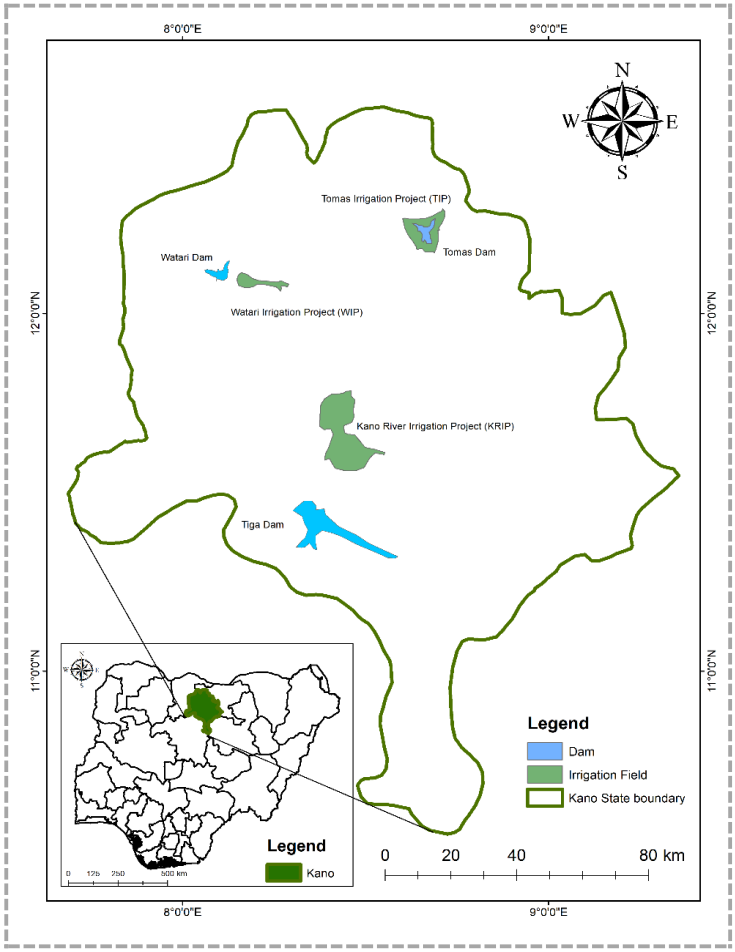

Figure 1: Study Location (Nigeria, Kano, KRIP, WIP and TIP)

Data collection

Information on the current state of the 3 irrigation projects (KRIP, WIP and TIP) were generated using three approaches;

a. ***Questionnaires:*** information on the projects were generated from both water users and managers using questionnaires. 50 questionnaires were administered each to the stakeholders situated upstream, midstream and downstream of KRIP, WIP and TIP (50 x 3 x 3 = 450 questionnaires).

b. ***Site visit:*** site visit was also conducted and some prevailing physical conditions of the irrigation projects were observed.

c. ***Focus group:*** Focus group discussions were separately conducted with water users and managers at KRIP, WIP and TIP (2 x 3 = 6 focus group meetings), and their overall views on the management of irrigation projects were generated.

Data analysis

The data generated were analyzed using simple descriptive statistics and the discussion and analysis of the results were presented in three (3) broad categories;

a. Problems affecting the operational performances of the irrigation projects

b. Water users' and managers' participation in the management of irrigation project.

Water users' and managers' perceptions on the management of irrigation project

Results and Discussions

Problems Affecting the Operational Performances of the Irrigation Projects

Illegal water abstraction

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The results presented herein are grounded from the information collected using the questionnaire, site visit and focus group discussions. There are quite a several problems currently affecting the operational performance of the three (3) irrigation projects (Kano River Irrigation Project, KRIP; Watari Irrigation Project, WIP and Tomas Irrigation Project, TIP). One of the numerous problems identified is that some farmers whose farm plots were initially considered as non-irrigable areas are now put into farming activities illegally. Out of the 450 respondents randomly selected from upstream, midstream and downstream of the 3 irrigation projects, about 88, 98 and 68% of water users' plots are abstracting water legally as their farm plots were initially considered as irrigable areas in KRIP, WIP and TIP respectively. This revealed that about 12, 2 and 32% of the irrigation fields are unlawfully abstracting water as their fame plots were initially classified as non-irrigable areas for KRIP, WIP and TIP respectively. The problem of illegal water abstraction is more pronounce in TIP (32%) compared to WIP with 12% and KRIP with only 2% as illustrated in figure 2. In all the 3 irrigation projects, the majority of the irrigators that break the water allocation rules and abstract water without authorization uses a pump to lift water from conveyance canals. It is, therefore, necessary for the concerned authorities to take appropriate action to bring the end of this problem, particularly at TIP. Farmers located in non-irrigable areas were considered to be abstracting water illegally.

Faulty water conveyance infrastructures

Although all the three irrigation projects (KRIP, WIP and TIP) have been designed to distribute and supply water to the farmers using a gravity system, only 80, 75 and 29% of the irrigators received water using the gravity at KRIP, WIP and TIP respectively. About 8, 17 and 32% of the irrigators in KRIP, WIP and TIP claimed to get water using both gravity and pumps depending on the availability of the water in the field channels. Whereas the remaining 12, 8 and 39% of the irrigators from KRIP, WIP and TIP confessed to having been lifting water using pumps only. Figure 3 shows the proportion of farmers lifting water using gravity, pumps or both at the three irrigation projects. Farmers claimed and insisted that they have no alternative than to be abstracting water using fossil fuel pumps due to several reasons including the larger proportion of the field channels are either silted or infested by the weeds which restrict or delayed water from reaching their farm plots. The majority of the irrigation farmers with their farm plots situated the downstream complaints the most on this problem. Although some of the farmers lifting water using pumps are the farmers with their plots initially considered non-irrigable areas and hence abstract water illegally which negatively affect the overall system performance.

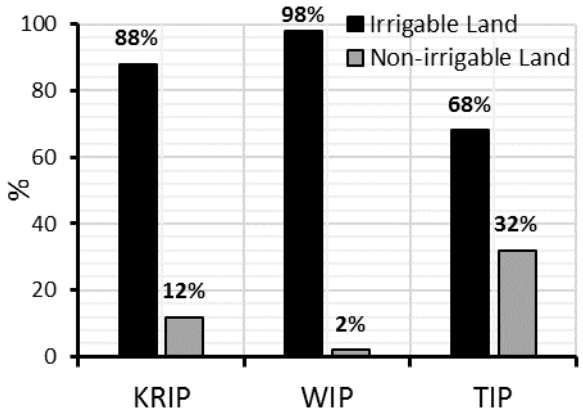

Figure 2: Irrigable and non-irrigable lands

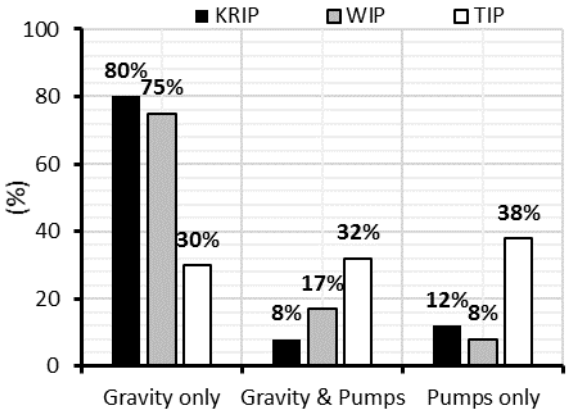

Figure 3: Lifting water (gravity, pumps or both)

In all three irrigation projects, irrigation stakeholders (water users and managers) unanimously believed that water conveyance systems were vigorously affected by three major problems (cracks, weeds and siltation). Generally, all the conveyance canals at the three irrigation projects are lined canals, but cracks, weeds infestation and siltation are the major problems affecting these canals. Other major human-induced activities that negatively affect conveyance canals include animal rearing/grazing and neighbouring communities that were found to be washing and bathing in the canal. All the distributary canals at these irrigation projects were found to be unlined although few were

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initially lined. There is an increased number of distributary canals that are silted up due to poor maintenance culture as lamented by the irrigators. Thus, the major problems affecting these canals are siltation and weed infestation. In addition to human-induced problems. The field channels are not lined and observed to be silted and infested by the weeds. In practice, field channels should be cleared at the beginning of every irrigation season before the gates are open, but this is not common in all three irrigation projects. When water users were asked to specify which among these problems can adversely affect the irrigation projects, 14% of the users believe that cracks are the main problems due to seepage, 44% believed that weeds are the main problems as weed restrict water flows, 12% believed that siltation are the main problems and 30% of the water users believed that all the 3 (cracks, weed and siltation) can adversely affect irrigation system performance while all the water managers (100%) believed that all the three can harmfully affect the performance of irrigation projects as shown in figure 4.

Faulty water allocation method

The study found that the so-called continuous flows allocation (CFA) method is currently used in all three irrigation projects. In the CFA method, irrigators have access to water throughout the season (no restriction mechanisms), and this commonly leads those upstream and midstream to over-irrigate their farm plots and hence low discharges at the downstream of the irrigation project. And these problems found to predominantly exist at WIP and TIP only. Although rotation water allocation (RA) and on-demand water allocation (OA) methods were found to be the most efficient water allocation methods, farmers in all three irrigation methods preferred the continuous flow allocation method as it is much easier to adopt with minimum conflicts. The majority of the water users (about 85%) particularly those located upstream and midstream are satisfied with the current water allocation method, as they perceive risk associated with rotation water allocation and on-demand water allocation methods. Only about 11 and 4% of the irrigators opted for rotation and on-demand water allocation methods. Unlike in KRIP where most of the farmers received a relatively adequate amount of water to irrigate their farm plots, in WIP and TIP, a significant proportion of farmers particularly those downstream had to abandon farming activities. Besides, there is approximately no shortage of water at the upstream and midstream but they were found to be either over-irrigating or abstracting the water unlawfully. Averagely, about 70% of the water managers from all three projects complaint about the current water allocation method (continuous flow allocation) and preferred rotation allocation method. Some of the reasons they provide include, continuous flow method cause much damage as a result of over-irrigation which commonly resulted in waterlogging and salinity problems. Only 30% opted for continuous flows while none of them chooses on-demand (0%) as this method perceived to be impracticable considering the prevailing behaviour of the irrigators. Such water managers views are in line with what Shanono *et al.* 2012), suggested about a decade ago. According to Shanono *et al.* (2012), the continuous flow water allocation method (CFA) is not reliable which need to be changed and strongly recommended rotation flow allocation method at WIP. Figure 5 shows the water users' and managers' views on the current water allocation methods.

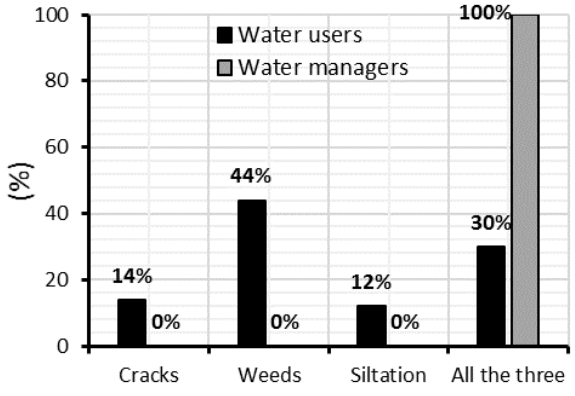

Figure 4: Problems affecting irrigation projects

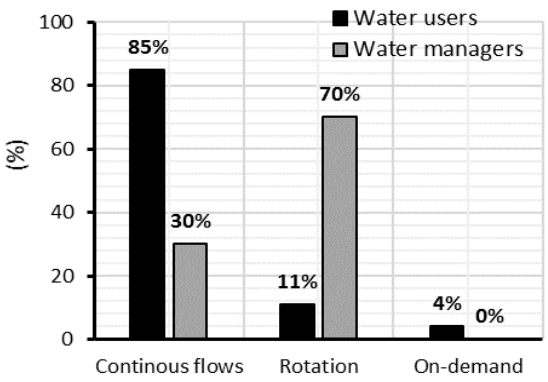

Figure 5: Stakeholders' views on water allocation methods

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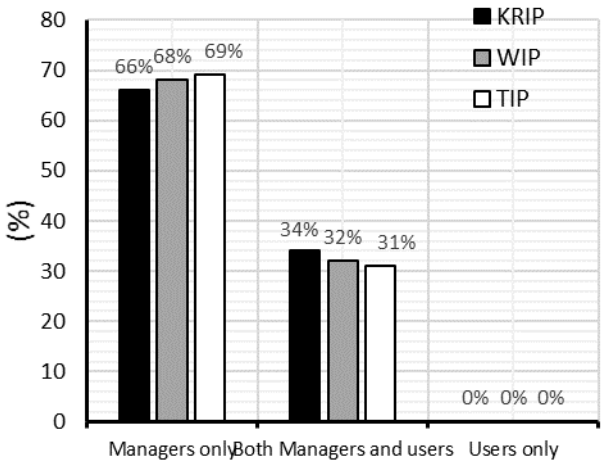
Stakeholders' Participation in the Management of the Irrigation Projects

Irrigators' levels of participation in the operation and maintenance of an irrigation project have been considered as one of the major indicators of the irrigation system performance (Chandran and Ambili, 2016). Based on this, a set of questions were asked both in the questionnaire and during the focus group discussions to assess irrigators' willingness to participate in the operation and maintenance of the irrigation projects. Fundamentally, the most common problem stressed by the farmers was that of water supply (on-farm delivery in terms of adequacy and reliability) and maintenance of irrigation infrastructures. In addition to that, very few water users' acknowledged that they have problems with deciding when to, and how much to irrigate which are known as the determinants of water application efficiency (Shanono et al., 2012). It was found that the majority of the water users do not participate in the maintenance of the conveyance and the distributary canals, they claim that they have no business with these two canals. However, water users believe that they should only participate in the maintenance of the field channels.

On average, about 50% of the total water users from KRIP, WIP and TIP do not participate in the maintenance of the infrastructures. This agrees with the assertion by Pete (2005), that most farmers in Nigeria have no culture of maintenance, particularly in public irrigation schemes. Farmers were asked if maintenance of irrigation facilities is also their responsibility. About 66, 68 and 69% of the water users from KRIP, WIT and TIP believed that the management and maintenance activities should be carried out by water managers only and this is similar to what has been reported by Haruna (2015) at Kano River Irrigation Project (KRIP). About 34, 32 and 31% believed that management and maintenance activities should be carried out by both water users and managers. Figure 6 shows the water users' views on who is responsible for the maintenance of irrigation projects. Water managers' views on who should participate in the management, operation and maintenance of the irrigation projects were also assessed. All the water managers (100%) from all the three irrigation projects (KRIP, WIP and TIP) believed that management and maintenance of any irrigation project should be performed jointly with water managers and users in addition to water users' association, traditional leaders and any other NGS's (national, international or multinational organizations). Figure 7 shows water managers' views on who is responsible for the management and maintenance of irrigation projects



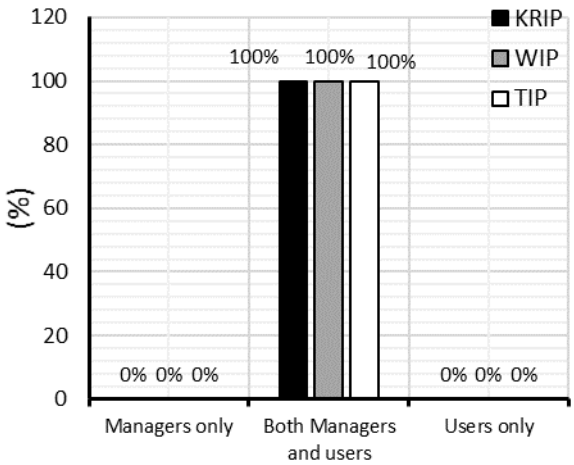


Figure 6: Water users' views on the management of irrigation projects
Figure 7: Water managers' views on the management of irrigation projects

Stakeholders' Perceptions on the Management of Irrigation Projects

During the focus group discussions, the majority of the irrigators from all the irrigation projects stressed their worries about farm output and income. Larger proportions of the farmers from all irrigation projects (KRIP, WIP and TIP) alleged that since they contribute to realizing food security for the country, their responsibility is to procure farm input before the commencement of farming

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activities. Whereas the government is responsible for the operation and maintenance of the irrigation project. Surprisingly, the majority of the water users perceived that government is always capable of funding and providing everything free of charge. Based on this, water users hold the belief that government should formulate policies that encourage and sponsor programs of activities, including management of irrigation projects and providing farm input at a low price. However, some farmers perceived that Water Users Associations (WUAs) are self-organized and cooperative associations of irrigators who willingly wish to jointly undertake some maintenance activities with water managers. From the focus group discussions, it was found that some group of farmers pay more attention to their farming activities and rarely participate in the management, operation and maintenance of the irrigation projects. These, among other reasons, further deteriorated both water management and physical conditions of KRIP, WIP and TIP. Site visit revealed that a larger proportion of farmers, particularly those downstream, had to abandon farming activities, which is similar to what has been discovered at WIP (Shanono et al., 2012).

A similar opinion was also observed from water users that irrigation agency personnel are vehemently shifting management and maintenance responsibilities to them although agency staff are being paid for the same work. This instigated the need to sensitize and educate water users to understand that irrigation system management is not one party concern but all the stakeholders involved. Such an awareness-raising campaign can inculcate the concept of participatory in the farmers' minds. This can guide water users to see themselves as the overseers thereby having a collective responsibility to manage the irrigation projects jointly with public agency staff, private organizations and civil societies, religious and traditional leaders among other stakeholders. The majority of the water users lost confidence in water managers' competency as 46%, 43%, 11% and 0% of the users scored managers as poor, fair, good and very good respectively. One of the questions asked whether the water managers work with farmers on the field to guide or advise them, to which more than 90% of the farmers from all the irrigation project responded **'No'** and added that they seldom see water managers and operators on the field unless when they are busy working on their farms. In addition, all the respondents stated that they do not receive any training or awareness on how and/or when to apply water to their crops.

It is therefore important to conduct an in-depth study on the co-evolutionary dynamics between water users and managers in an irrigation project to establish the actual problems due to complex interactions and feedbacks between the two parties (users and managers) and analyzed how the irrigation system is affected thereby proposing solutions for sustainable management of irrigation projects.

Shanono *et al.* (2019) recommended five (5) fundamental aspects that every water user need to understand and put into practice:

1. That irrigation agency staff and other non-governmental officials are there to educate, guide and support them to attain maximum farm production and hence, to improve their financial status and quality of life.
2. That the prescribed laws and regulations enacted to govern irrigation schemes are there to ensure the sustainable system operation and resolve disputes and conflicts among water users and between water users and agency staff and other neighbouring community.
3. That cooperative functions including participation in the management, operation and maintenance of the irrigation infrastructures is not an option but a necessity in order to achieve effective and efficient irrigation management.
4. That collection of irrigation water fees is not an act of extorting money from the farmers unnecessarily but to be used for the maintenance of the system.
5. That researchers, non-governmental organizations (such as UN and World Bank projects), civil society, religious and traditional rulers and extension support services are all there to foster profit-oriented agricultural production.

Conclusion

An assessment study was conducted to evaluate the operational performance and stakeholders' level of participation in, and perceptions on, the management of three irrigation projects (KRIP, WIP and TIP) in Kano State, Nigeria. The study uses questionnaire, site visit and focus group discussions to generate vital information related to the management and operational performance during the 2019/2020 irrigation season. The study identified some problems related to operational performance affecting all three irrigation projects including illegal water usage by irrigators, faulty water conveyance structures and conflict among water users and between water users and managers. In addition, the study observed that a continuous flow water allocation method is being used in all three irrigation projects which led to poor irrigation water allocation performance. Based on this, the study recommends a rotation water allocation system. Also, about 50% of the total water users from KRIP, WIP and TIP do not participate in the maintenance of the irrigation infrastructures. Some of the underlying issues that led to these problems include; lack of sensitization and awareness campaigns, seminars and workshops to facilitate farmers' involvement in the management and maintenance of irrigation projects. This can be achieved through sensitization and awareness campaigns to train farmers on how to resolve conflicts, efficient use of limited water resources and to facilitate water users' participation in irrigation management activities such as agency-farmer joint management. If such dialogue programs do not bring an end to these problems, other law enforcement measures need to be deployed. It is, therefore, recommended that the existing irrigation project management strategies need to be changed with new ones that encourage more stakeholders' participation.

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