

Risk factors and mitigation measures in public-private water sector partnerships: lessons from the Asutifi North District, Ghana

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Abstract

Public-private partnerships (PPPs) are promoted as a practical option for developing countries to meet their water sector infrastructure gaps. Despite their appeal, PPP projects have been described as complex and challenging, and the water sector PPPs are particularly associated with high failure rates. Risk analysis and evaluations have been identified as critical to the success of PPPs. In this paper, we examine an on-going PPP arrangement for piped water supply in the Asutifi North District of Ghana under a Build, Operate, and Transfer arrangement. Safe Water Network will provide the supply systems and transfer ownership to the District Authority at the end of the contract. We reviewed key project documents to ascertain the measures that would minimize the likelihood of risk occurring during the project cycle. Of 11 risk factors, 7 were anticipated in the project documents. We recommend that project documents be reviewed and amended to address the unanticipated risks.

Key words: Ghana, mitigation, public-private partnership, risk, sustainable development goals, water supply

Highlights

- Public-private partnership (PPP) projects could enable developing countries to bridge water supply gaps.
- Risk analysis could enhance PPP projects for water supply.
- The PPP water supply project documents anticipated major risks and proposed mitigation strategies to minimize their occurrence.
- Most of the project risks could occur during the service delivery phase.
- Gaps in the proposed risk mitigation measures need to be addressed.

INTRODUCTION

According to the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), over 844 million people worldwide lack access to potable water (WHO/UNICEF 2017). Inadequate access to clean water has been linked to preventable health risks, morbidity, and mortality (Montgomery & Elimelech 2007). Every year, about 829,000 people die from diarrhea as a result of using unsafe drinking water and from poor sanitation and hygiene practices (WHO 2019).

The latest global strategy to rally support and coordinate efforts toward increasing access to potable water is the United Nations (UN) Sustainable Development Goal (SDG) 6. SDG 6 seeks to achieve

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universal access to safe water by 2030, and progress will be determined by the proportion of the global population using safely managed services that are located on premises, available when needed, and free from contamination (WHO/UNICEF 2017). In the absence of safely managed water, the use of basic service – an improved source with a total collection time of less than 30 min – is considered a crucial step toward achieving the SDG target of universal water access (Bain *et al.* 2018; WHO/UNICEF 2019).

Following the adoption of the SDGs in 2015, Ghana has stepped up efforts to achieve universal water coverage by the year 2030. Ghana's overall water access was 81% in 2017 (WHO/UNICEF 2019). With this level of water coverage, the country has been projected to achieve universal water access by 2030 (Monney & Antwi-Agyei 2018). Even before the SDGs, Ghana's 2012 Water Sector Strategic Development Plan articulated strategies for achieving universal water coverage by 2025 (Duti *et al.* 2014).

However, existing sector challenges could constrain the realization of Ghana's vision of universal water access. The rate at which potable water is being extended to both the unserved and underserved populations has been slow. It saw an average increase of just 1% per year between 2000 and 2017. Based on this rate of increase, universal access to even the lower tier basic services may not be achieved until 2036. This slow rate of increase in water coverage reflects the systemic underfunding of the sector. Between 2012 and 2017, the Ghanaian government's budget for water and related activities decreased from US\$ 278 million to US\$ 65 million (Appiah-Effah *et al.* 2019). Meanwhile, achieving universal basic water access by 2025 would require an annual funding of US\$ 325 million and achieving universal safely managed water services would require at least US\$ 946 per year (SWN 2017; UNDP 2017).

Given the current trajectory of sector investment, an annual funding gap of US\$ 833 million needs to be filled to meet the 2030 targets for safely managed full coverage in Ghana (SWN 2017). A related challenge is the expected decline in international aid inflows which have traditionally financed more than two-thirds of Ghana's water sector expenditure (Duti *et al.* 2014; UNDP 2017). Other confounding factors that will make universal access to either basic or safely managed water services a difficult task include rapid population growth, settlements expansion, and the inability of water service providers to meet the cost of financing recurring operational and capital maintenance expenditures, resulting in the provision of intermittent services to households (Duti *et al.* 2014; Peloso & Morinville 2014).

The current and projected funding gap and the host of related challenges have, therefore, made investments in Ghana's water sector from nontraditional sources such as public-private partnerships (PPPs) particularly attractive. Indeed, partnerships are being promoted by the UN as a practical option for countries in the Global South to meet their infrastructure needs and accelerate progress toward the attainment of the SDG targets (Gideon & Unterhalter 2017; Nizkorodov 2017; Eberhard 2019).

In spite of their appeal, PPP projects have been described as complex and challenging (World Bank 2020). Water sector partnerships are particularly notorious for their high failure rates (Harris *et al.* 2003; Ameyaw & Chan 2015; Sulser 2018), and research has shown that this failure occurs as a result of improper risk allocation among partners (Ameyaw & Chan 2015; Cui *et al.* 2018). The current literature on risk evaluation and allocation for partnerships, however, has focused largely on sectors other than water and in regions other than low- and middle-income countries. Other gaps in the research on water-related partnerships include a lack of attention to how risk factors change at different stages in the life cycle of infrastructure projects, a heavy focus on Management Contracts rather than the new and less constrained Greenfield Projects, and the nonprioritization of risk analyses and evaluation by project stakeholders.

In this paper, we examine an on-going PPP project for the provision of piped water systems in three communities in the Asutifi North District of Ghana under a Build, Operate, and Transfer (BOT) agreement. The partnership involved Safe Water Network (SWN), a private nonprofit organization, and the

Asutifi North District Assembly (DA), a local government authority. We provide an overview of PPP projects and the critical risk factors that affect their successful implementation. We adopt the 11 risk factors identified by *Xu et al. (2011)* as critical to the success of water-related PPP projects as our analytical framework because of their exclusive focus on BOT water projects. Using key project documents, we ascertain the presence or absence of measures that would either minimize the likelihood of these risk factors occurring or mitigate their impacts. We identify gaps in existing risk mitigation strategies and offer some recommendations for improvement.

RELEVANCE OF PPPS

PPPs have reemerged in the discourse on development financing in recent times (*Hodge et al. 2018; South et al. 2018*). This approach is being promoted by the UN as a practical option for countries in the Global South to meet the SDG targets (*Gideon & Unterhalter 2017; Nizkorodov 2017*). The UN envisaged partnerships to provide opportunities to access and redirect resources from the private sector to deliver on the sustainable development objectives (*Gideon & Unterhalter 2017*). Given the massive demand for infrastructure projects around the world, PPPs are regarded as a gap-bridging necessity for governments in developed and developing countries alike (*Xu et al. 2011; South et al. 2018*). PPPs, regardless of their structure and scope, involve some form of contract between government and private sector actors for the provision of specific goods and services (*Moore et al. 2017*), and they are forged to generate win-win outcomes for the partners (*Van Dijk 2008; Warsen et al. 2019*). Governments benefit from access to private finance and technical expertise (*Van Dijk 2008; Robert et al. 2014; Hodge et al. 2018*). Project beneficiaries receive the timely delivery of durable projects and possibly efficient services (*Hodge et al. 2018*). Private sector actors share investment risks with public sector institutions and generate shared benefits from those investments (*Robert et al. 2014; Hodge et al. 2018*).

Research has shown that PPP projects have increased in number since the late 20th century, and currently contribute about a quarter of infrastructure investments in over 130 countries worldwide (*Ameyaw & Chan 2016; Saha et al. 2019*). In 2018 alone, the World Bank's Private Participation in Infrastructure Database revealed that about US\$ 90 billion in private investments were made in 335 infrastructure projects in low- and middle-income countries (*Saha et al. 2019*). Even though the 2018 private investment was the second lowest since 2009, it did represent a sustained recovery from a 10-year low of US\$ 71 billion investment in 2016 (*Saha et al. 2019*). Consistent with the general trend, water sector PPPs have also increased. *Ameyaw & Chan (2016)* observed that between 1990 and 2005, more than US\$ 50 billion of private investment was committed to over 380 water supply projects in low- and middle-income countries, and by 2012, the level of investment was more than US\$ 69 billion in 814 projects in 63 countries. *Table 1* presents different types of PPPs.

Despite their growing popularity, the design and implementation of PPPs have been described as complex and challenging (*World Bank 2020*), with many reviews providing mixed results and even below-expectation outcomes (*Ameyaw & Chan 2016; Nizkorodov 2017; Warsen et al. 2019*). Unlike Management Contracts, BOTs are partnership arrangements in which a private sponsor builds a new facility and then owns and operates it throughout the contract period. The facility is transferred to the public partner at the end of the contract period (*Nizkorodov 2017*). Particularly for the water sector, PPPs have high failure rates and low levels of private investment compared with other sectors like transport and energy (*Ameyaw & Chan 2015; Nizkorodov 2017*). Together with the low rates of return on investment, high political interference, and diverse range of customers with different needs and interests, the water sector's unique set of challenges present high risks to PPPs (*Harris et al. 2003; Ameyaw & Chan 2015; Sulser 2018*).

Table 1 | Different types of infrastructure PPPs

Type of public-private investment	Definition
<i>Management and Lease</i>	Private operator manages state-owned enterprise for a fixed period of time. Ownership and investment decisions remain with a public partner.
Management Contract	The public partner pays a private operator to manage a facility.
Lease Contract	The public partner leases the assets to the private operator.
<i>Concessions</i>	Private partner manages state-owned enterprise for a fixed period of time and absorbs majority of investment risk.
Rehabilitate, Operate, Transfer	Private sponsor rehabilitates existing facility, and then operates until the end of the contract period.
Rehabilitate, Lease, Transfer	Private sponsor rehabilitates public facility, leases it from the public partner, and operates it until the end of the contract period.
Build, Rehabilitate, Operate, Transfer	Private developer expands an existing facility or rehabilitates existing assets and operates it until the end of the contract period.
<i>Greenfield Projects</i>	Private entity or a public-private venture builds and operates a new facility. At the end of the contract period, whether facility is transferred to the public sector depends on the contract type.
Build, Lease, Transfer	Private sponsor builds a new facility, transfers ownership to a public partner, and then leases the facility from the government.
Build, Operate, Transfer	Private sponsor builds a new facility, then owns and operates the facility throughout the contract period. The facility is transferred to the public partner at the end of the contract period.
Build, Own, Operate	Private sponsor builds a new facility, and then owns and operates the facility.
Merchant	Private sponsor builds a new facility. Government provides no revenue guarantees.
Rental	Government rents mobile power plants from private partners for a short period of time (1–15 years). Private sponsor places the facility at its own risk. Government compensates for risk by providing revenue guarantees.
<i>Divestitures</i>	Private partner buys stock in the state-owned enterprise through asset sale, public offering, or mass privatization program.
Full	Public partner transfers 100% of equity to the private partner.
Partial	Public partner transfers part of the equity to the private partner. Private stake in facility management is determined on a case-by-case basis.

Source: Nizkorodov (2017: 24).

By 2016, over 20% of the total investments in water sector PPPs since the 1990s were cancelled (Nizkorodov 2017). Jensen (2017) noted changing degrees of support toward these projects in several Asian countries. For example, the Indonesian government revoked the law that permitted these partnerships and annulled water concession contracts in 2015. The Vietnamese government temporarily banned PPPs in 2003, which negatively impacted new investments once the ban was lifted. Similar accounts of bumpy experience with PPP projects are documented in Bolivia, Chile, France, Ghana, India, and Ireland, largely in reaction to PPP projects not meeting people's expectations (Harris *et al.* 2003; Ameyaw & Chan 2015; Jensen 2017).

The trend of private investments in infrastructure also reveals huge regional disparities. Sub-Saharan Africa ranked 5 out of the 6 regional divisions of the World Bank in terms of the total number and the total volume of investments in infrastructure projects between 1990 and 2018 (World Bank 2020). Thus, the low investment in PPPs in Sub-Saharan Africa and the particularly high levels of risk in water compared with other sectors have made PPPs less attractive to investors in the region and made water both the sector with the biggest infrastructure gaps and the sector where such investments are most needed. These setbacks notwithstanding, proponents argued that under the right conditions and structure, PPPs could work in low- and middle-income countries (Jensen 2017; Sulser 2018). Consequently, many strands of research have emerged to address the problems affecting

PPP project implementation. Cui *et al.* (2018) summarized these areas of study under the following broad themes: (a) financial package and PPP applications; (b) economic viability and value-for-money; (c) risk management and success factors; (d) procurement and contract management; (e) performance management; and (f) governance and regulation. This paper focuses specifically on the risk management and success factors theme since it is understudied in the literature even though poor risk management contributes to PPP project failure.

CRITICAL RISK FACTORS FOR PPPS

Aven & Renn (2009: 1) defined risk as the ‘uncertainty about and severity of the consequences (or outcomes) of an activity with respect to something that humans value’. Aven *et al.* (2011) explained that the element of uncertainty in the definition of risk relates to the limitations of the human’s inability to tell whether an event will occur or not, the time at which it will occur, and what the consequences would be if the event occurs. Aven *et al.* (2011) also explained that severity relates to the subjective measures of magnitude and how they affect the things that are of value to humans – including lives, the environment, and money.

Given that risk conditions always imply that something of value to humans is at stake, Cui *et al.* (2018; see also Hodge *et al.* 2018) indicated that one of the main advantages of the PPP model is the benefit of risk sharing among multiple partners. PPPs are, however, subject to greater risks than traditional infrastructure investments, mainly because of the inherent uncertainties in the project environment, the wide range of stakeholders involved, and the diversity of project objectives and interests at play (Cui *et al.* 2018). Xenidis & Angelides (2005) argued that the awareness of critical risks will provide PPP project practitioners with a useful tool for analyzing the project’s potential impact and the strategies to lessen them in the course of project implementation. According to Delmon (2009), risk identification and allocation are among the most significant challenges in partnerships. Poor allocation of risks to the partner who is most capable of managing them is one of the main reasons for the sub-optimal performance of the private sector in water provision (Ameyaw & Chan 2015; Cui *et al.* 2018). Indeed, studies have shown that when PPPs for water projects have faced severe difficulties, it is usually the case that risks were improperly allocated to the government, the public sector client, or private sector partner (Ameyaw & Chan 2015). Likewise, there is almost a consensus in the PPP literature that the higher risks in these areas have resulted in the higher cost of capital and hence the low attraction of private investments (Ameyaw & Chan 2015; Sulser 2018). Xu *et al.* (2011) identified 11 critical risk factors affecting the performance of PPP water projects under BOT arrangements in China. These risks are summarized in Table 2.

METHODS

We used three PPP project documents to identify potential risk factors in the project environment and determine whether these risks factors were anticipated in the project design. We adapted the 11 risk factors identified by Xu *et al.* (2011) as being critical to the success of PPP water projects as a normative framework for the data analyses. We adopted a case study approach to examine the on-going partnership between SWN and the Asutifi North District Authority for the provision of water systems under a BOT arrangement. Through the PPP arrangement between SWN and the DA, three piped systems are to be provided in three different communities: Kenyasi, Wamahinso, and Gambia No. 1. The systems are comprised of mechanized boreholes, overhead storage tanks, distribution networks, public standpipes, and house connections (SWN/DA 2019a).

Table 2 | Critical risk factors and risk allocation between government and private partners

Critical risk factor	Description	Allocation of risk factor
Political risk	Interference with project designs, award of contracts, procurement of goods and services, biased selection of project sites, and arbitrary termination of PPP agreements	Government can control this risk through the proper definition of roles and responsibilities
Financing risk	Difficulty in raising funds for the project	This risk can be shared by the government and private sector through the pooling of resources
Government credit risk	Failure to honor credit guarantees	This should be borne wholly by the government to ensure that they uphold their pledge of providing credit guarantees
Inflation risk	Fall in the exchange value of the local currency, fall in effective demand for PPP services	The private sector needs to make accurate calculations about the inflation rate and take the risks arising from the inconsistency between the actual and the forecasted rates
Inaccurate market forecast risk	Substandard decision-making procedures, lack of PPP project operational experience and capacity, inadequate preparations, unequal information-sharing among project partners	The risk of decision-making error should be shared by both sides and adequate market investigation and analysis could control this risk
Product price risk	Undervalued prices which may decrease expected profits and reduce the competitiveness of PPP projects, or outrageous prices which could cause chaos and affect the use of the services provided through such projects	This risk should be shared and can be minimized through a detailed feasibility study by both parties
Technical risk	Failure or below-expectation performance of the technology adopted for the production, transmission, storage, and distribution of piped water	This risk should be borne by the private partner since they have more competence to control it than the government
Contract risk	Potential changes in the social, political, and economic environment may not be anticipated in contract documents. It also includes ambiguities, inconsistencies, and errors in contract documents	By the fault rule, this risk should be borne by the party who makes the mistake or fails to perform assigned obligation
Legal risk	Absence of a robust and dedicated legal system to handle PPP contracts and related cases	The government has the power to establish and modify laws and thus has a strong ability to control and sustain the legal risk
Market demand risk	The demand and use of the services provided through a PPP project	The government and the private sector share the market risk
Lack of supporting infrastructure risk	The conditions and facilities which are external to the PPP project but basic to their optimum performance	This risk should be borne by the government and the private sector that needs to transfer this risk to the government through a 'take-or-pay' agreement so as to ensure project returns

Source: Adapted from Xu et al. (2011).

This partnership between SWN and the DA is part of a larger initiative. In March 2018, the DA launched an ambitious and novel water, sanitation, and hygiene (WASH) initiative. It partnered with six Ghanaian and international organizations to meet the SDG of universal water and sanitation access by 2030 (Asutifi North District Assembly 2018). Under the umbrella of the bigger partnership, the DA had a bilateral agreement with SWN to provide three piped water supply systems. The DA and SWN agreed to share the cost of providing the piped water infrastructure. Thus, unlike the case in the other parts of Ghana where SWN is currently operating its small water enterprises (SWEs), their participation in the Asutifi North constitutes a unique form of partnership with both SWN and the DA contributing significantly to the project cost. The partnership between SWN and the DA is also different from other forms of PPP arrangements in Ghana which largely involve management contracts with the private partner not contributing to the original cost of providing the water supply

infrastructure (Ameyaw & Chan 2015, 2016). Aside from general taxes that are levied on goods and services in Ghana, no special tax obligations were required for water supply in the district, and therefore, no such tax exemption was granted to SWN. The DA, SWN, and indeed the other partners on the on-going WASH initiative hope to use this PPP as a successful and viable model that can be implemented in other communities.

Our analysis of the steps that the DA and SWN have taken to mitigate the occurrence of risks that could affect the success of the project focused on the following three documents.

- Safely Managed Water for All: Partnership Proposal (13 August 2018)

SWN developed this document which provided a description of the partnership, including the technology options that would be deployed, the estimated number of people who would benefit from the intervention, procurement processes, and cost sharing arrangements. Both SWN and the Asutifi North District Assembly signed this document.

- Financing Agreement (28 February 2019)

SWN developed this document and its purpose was to provide an understanding of the financing of three piped water systems in three different communities in the district. It specified conditions for the expiration of the financing agreement including the completion of the payment of contributions by each party, completion of the construction of the water infrastructure and ancillary facilities, and mutual agreement of parties to terminate the agreement.

- Financing agreement: Addendum (26 November 2019)

SWN prepared this addendum and it included modified terms of the original financing agreement. Two of the original project communities were replaced at the request of the DA, and the cost of the water systems was revised accordingly to reflect these changes. A new payment schedule was also proposed for the DA.

RESULTS AND DISCUSSION

Of the 11 risk factors listed in Table 2, 7 were anticipated in the PPP project. The following sections use the three project documents to provide evidence of the level of risk anticipation and the mitigation strategies deployed. The four risk factors not anticipated are also described. We analyzed the likelihood of their occurrence, whether the partnership could be adversely affected should they occur, and whether resources in the project environment could be leveraged to prevent their occurrence. The timing of when during the project timeline these risks may occur is also discussed.

Anticipated risks

Political risks

Undue political influence such as those involving people in authority interfering with project designs, award of contracts, procurement of goods and services, and a biased selection of project sites all constitute political risks (Xu *et al.* 2011). Similar to Ameyaw & Chan (2013), we expand this risk category to include the tendency for governments to arbitrarily terminate PPP agreements without the mutual consent of all parties. In the partnership proposal, measures were instituted to mitigate these political risks. For example, it was mentioned that Community Water and Sanitation Agency (CWSA), the lead sector agency for water provision in rural communities and small towns, would provide expertise in the selection and awarding of project contracts. Works, goods, and services were to be procured using country standards and best practices recommended by reputable organizations such as the World

Bank. The PPP water project in the district was expected to be implemented based on the technical drawings provided by SWN who have the required competence in this area of work.

In the partnership proposal (SWN/DA 2018), active collaboration was expected between the DA and SWN to avoid overlap of functions and to ensure the smooth implementation of planned construction and post-construction activities. To ensure that the functions of SWN and the DA do not overlap, roles and responsibilities were defined for both actors in the partnership proposal. The DA is expected to embark on periodic visits to the project sites and beneficiary communities before, during, and after project completion, while SWN is to be responsible for drafting key project agreements, the construction of the water systems, and the initial management of these systems. These provisions in the partnership proposal could be interpreted as strategies to mitigate political risks – real or perceived. By indicating the expectations for project design, contract award, and project management from the outset, the partnership proposal takes care of the possibility of undue interference by any one partner in the award, supervision, and management of the PPP contracts. On the contrary, none of the project documents anticipated the likelihood of an arbitrary termination of the partnership agreement by the DA (or even a withdrawal by SWN) and what should happen in that situation.

Financing risk

Xu *et al.* (2011) identified fundraising as the most common financing risk in PPP projects. In the PPP project between SWN and the DA, both the financing agreement and the partnership proposal contained the total contract sum and the contributions expected from the partners. The financing agreement and its addendum provided three quarterly payment schedules for the DA. There was a provision that failure on the part of the DA to make the expected financial contributions on time would constitute grounds for the ‘substitution and revision’ of the financing agreement (SWN/DA 2019a: 2). Thus, key project documents made explicit both the financial obligations of partners and the consequences for not upholding these terms. The financing agreements also sought to ensure that the DA commits to the payment of its share of the project cost.

Given that financing risks occur when partners find it difficult to raise capital to meet their contractual obligations, the aforementioned details in the project documents could be interpreted not only as being a standard procedure for doing business but also as measures to minimize the occurrence of potential financing risks. Indeed, the quarterly payment schedules proposed for the DA aligned with the cycle of the DA’s receipt of transfers from the central government and/or mineral royalties. This flexibility could enable the district to easily pay its part of the contribution to the partnership without sacrificing other equally critical expenditures. The sharing of the contract sum between SWN and DA could also be seen as a way of diversifying the financing portfolio for the project, which then addresses the concern that a single financing channel is a risk to PPP projects (Xu *et al.* 2011).

In the partnership proposal, it was stated that SWN would pay its share of the contract sum through a ‘blend of existing and new philanthropic sources’ (SWN/DA 2018: 3). Similarly, it was indicated in the financing agreement that ‘all parties agree to pay their respective financial contributions defined in the program term sheet’ (SWN/DA 2019a: 1). These premises suggest that the two actors would be contributing toward the project funds. However, with specific reference to the financing agreement (SWN/DA 2019a, 2019b), payment schedules were provided only for the DA and not for SWN. Three meanings could be inferred from this: either SWN was guarding against the likelihood of the DA not fulfilling its financial obligations, SWN had already secured its share of the funding, or SWN did not see itself reneging on fulfilling this promise. In any case, local government authorities in Ghana have been described as lacking ‘creditworthiness’ (Ameyaw & Chan 2013: 173) which may provide some justification for the extra details that went into the expectations from the DA regarding their financial obligations toward the project.

Inflation risks

Inflation risks could arise in two major forms. They could occur when there is a fall in the exchange value of a local currency against foreign trading currencies which will then affect the cost of goods and services. This type of inflation risk can result in discrepancies between the budgeted and actual cost and can especially affect projects during the construction phase when goods and services need to be procured. A second way they could occur is in the form of a fall in the purchasing power of citizens through a reduction in the real value of money, and this can affect effective demand for goods and services.

To mitigate inflation risks, the partnership envisaged a relatively short time span for construction. A total of 12 months was estimated for putting up the three limited mechanized boreholes with ancillary facilities. With an average duration of 4 months at each construction site, it is likely that inflation rates will not change drastically and that the projected cost of goods and services will remain fairly stable.

The expected cost of providing the needed hardware for the supply of water under the partnership was quoted in US dollars, which is a relatively stable currency. Partners were expected to contribute the Ghanaian cedi equivalent of this amount at the prevailing exchange rate. This measure provides another cushioning against inflation risks. Should the local currency depreciate considerably during the period that partners are still making their contributions, the exchange rate difference would make up for the difference in the contract sum. The risk of the currency value depreciating was, thus, shared equally between partners.

The risk of inaccurate market forecasts

According to *Xu et al. (2011)*, risks of inaccurate market forecasts are reflected in substandard decision-making procedures regarding the potential market for the services provided by a PPP investment. Poor project information sharing among partners, a lack of prior knowledge, or participation in a previous PPP project could all result in inaccurate prediction of the market (*Xu et al. 2011*). Measures were taken to mitigate and/or eliminate the occurrence of inaccurate market forecasting risk in these agreements. For example, prior to the development of the partnership proposal, SWN embarked on a market assessment survey in the district. The purpose of this survey was to determine existing water facilities, gauge people's willingness to pay for improved water services, and determine if SWN's SWEs model will be a good fit for the district. Essentially, SWN wanted to forecast the market for its business model in this new environment. SWN went into the partnership with over a decade of experience in the design, construction, and management of SWEs across many locations in Ghana and India, and this experience was used to design and cost the different types of limited mechanized schemes for consideration by the DA. The project proposal stated that SWN would manage the SWEs during the initial stages of construction while it recouped its share of the investment. Additionally, the proposal for the initial management of the water facilities by SWN is to ensure that the needed capacity at the community and district levels are developed and/or strengthened for the eventual local management of the water systems.

Measures were put in place to enhance information sharing among partners. For example, key project documents between the DA and SWN were first shared as drafts to enable both partners to review and make inputs before they were finalized. In the partnership, bi-annual project review meetings are to be convened by the DA for key actors and institutions. The DA also takes responsibility for organizing annual town hall meetings with community members and the general public. These meetings offer opportunities for stakeholders to review the progress of work and to enable information sharing regarding the partnership and the water supply projects. The meetings are also avenues for inputs to be received from a wider audience and incorporated into the project implementation process and for

the expectations of communities regarding the projects to be managed. The responsibilities for mitigating the risk of inaccurate market forecasts were, therefore, shared by the DA and SWN.

Product price risks

These price risks manifest in either undervalued prices which may decrease expected profits and reduce the competitiveness of PPP projects or in outrageously high prices which could cause chaos and affect the use of the services provided through such projects (Xu *et al.* 2011). The partnership proposal indicated that SWN ‘reserves the right to increase the price of water at regular intervals in line with inflation’ (SWN/DA 2018: 5). This suggests a future incremental review of prices when tariffs are deemed too low to meet operational costs and other related financial commitments. While this would cushion the project against product price risk, leaving this measure at the sole discretion of the private partner may create problems, including potential conflicts with the DA. Beneficiary communities may also become agitated if they feel they are being left out of decisions regarding tariff increases because of the impact of such actions on the ability and willingness to access water services.

Technical risks

Any failure or below-expectation performance of the technology adopted by SWN for the production, transmission, storage, and distribution of piped water services in the three project communities will constitute technical risks. This risk affects the quality of PPP projects and the overall services they deliver. This risk could be partially mitigated through the proposed Maintenance Reserve Account which SWN intends to manage exclusively for the ‘long-term sustainability’ (SWN/DA 2018: 6) of the piped water systems. It is not clear however where the initial prepaid sum would come from and whether there will be periodic payments into this account and by whom. SWN has tried and tested the technology currently being deployed in the Asutifi North District. With this experience, there is a minimal chance that SWN could make poor choices of materials or equipment or encounter problems with the construction and installation of the required components of the water facilities. The chances of technical risks affecting the success of the partnership are, therefore, minimal.

Contract risks

PPP projects usually last for several decades during which changes are bound to take place in the social, political, and economic environment of the project. A lack of the flexibility to anticipate and accommodate changes as they occur in contract documents could create problems for parties in the future (Xu *et al.* 2011). In the Asutifi North District, there was a specific clause in the partnership proposal to suggest that a review of the operations and financial performance of the SWEs by the DA is possible. This provision could be interpreted as giving some semblance of ‘flexibility’ (Demirel *et al.* 2017: 197) in the partnership arrangement. In addition, both parties incorporated a fair amount of transparency and consultations in the preparation of key project documents, and these actions may have helped in clarifying contract terms and creating common understanding around the project.

Despite their best efforts, some types of contract risks such as ambiguities in contract terms, inconsistencies in project information, and documentation errors (Xu *et al.* 2011) may not be obvious to partners at the initial stages of the project design. Some of these inconsistencies became apparent in the analysis of the project documents in the Asutifi North District. In the partnership proposal, it was stated that SWN ‘will sign 15-year BOT or Build, Own, Operate and Transfer (BOOT) with the Asutifi North District Assembly during which period Safe Water Network Ghana will be responsible for operation and management of the water stations’ (SWN/DA 2018: 5). The document stated further that ‘at the end of the agreement period, assets will be turned over to the Asutifi North District

Assembly' (SWN/DA 2018: 5). However, in another section of the same partnership proposal, it was indicated that SWN 'will transfer ownership to the Asutifi North District Assembly once its proportion of capital invested is recovered' (SWN/DA 2018: 3). The gray area is whether SWN will hand over the facilities to the DA if the organization is able to recover its portion of the capital invested in the project before the 15-year BOT or BOOT contract period expires. The other question is whether the BOT or BOOT contract will be extended beyond the initial 15-year engagement period if SWN is not able to recover its share of the capital invested. It is also unclear why the partnership proposal indicated that 'all contributions to the project will be considered as grants' (SWN/DA 2018: 3), but SWN would want to recoup its share of the capital invested.

Unanticipated risks

Government credit risks

The government's failure to honor credit guarantees extended to lenders for loans contracted by the private partner in PPP arrangements constitutes government credit risks. This risk also applies to the unreasonable assurances given by governments, sometimes about the prospects and profitability of proposed PPP projects, to enhance their attractiveness but with such promises not being guaranteed in the medium to long term (Xu *et al.* 2011; Cui *et al.* 2019).

There were no provisions in the project documents to address real or anticipated government credit risks. SWN neither requested nor required credit guarantee from the DA (or central government) to mobilize its share of the contribution to the contract sum. SWN's operations thus far have mainly been funded through a blend of different forms of grants and philanthropic donations. Again, SWN's decision to partner with the DA for the water supply project was informed by preliminary research on the viability of SWN's SWEs in the district. Thus, if the profitability or market conditions for the SWEs becomes an issue in the future, this would not be as a result of the DA originally giving unfounded and unsustainable assurances about the market and the demand for water to lure in SWN as a partner on the project.

Legal risks

Legal risks occur when there is an absence of a robust and dedicated legal system to handle PPP contracts and related cases (Xu *et al.* 2011; Cui *et al.* 2019). Currently, there are no court systems dedicated solely to handling PPP contracts in Ghana; however, the commercial courts that are equipped to handle business-related disputes could perform similar functions should contract or partnership-related disputes arise. The project documents do cover salient partnership issues such as the terms of financing and management responsibilities. They also outline project goals that could be used as evidence to adjudicate a case in court. However, one significant omission is the absence of an arbitration clause to define the options for partners should contract disputes arise.

Market demand change risks

This risk affects the demand and use of the services provided through a PPP project. A drop in the demand for services invariably affects revenue inflow with implications for the rate of recouping investments and the availability of funds for operations and maintenance of the projects. For water-related PPPs, changes in the demand of services could arise from the emergence of competing service providers, poor service quality from the PPP project, the inability of potential customers to afford the services being offered, seasonality, or boycotts as a way of protest over certain changes or concerns (Xu *et al.* 2011; Ameyaw & Chan 2013).

Market demand change risk was not anticipated and, therefore, no concrete steps were proposed to avert their occurrence or mitigate their impacts. There is, however, a likelihood of market demand change occurring in the project communities. For example, in some localities, private individuals have already developed mechanized boreholes from which they sell water to the public. In situations where both public and private actors share a common space to supply water, competition for customers becomes inevitable (Agbemor & Smiley 2021). Thus, it is likely other service providers, particularly private individuals, could emerge in the communities where the PPP water systems have been provided and this could affect the demand, use, and ultimately the revenue streams of the SWEs.

Lack of supporting infrastructure risks

Supporting infrastructure is the umbrella term for the conditions and facilities that are external to the PPP project but basic to their optimum performance (Xu *et al.* 2011). This category of risk did not receive explicit attention in the project documents and may have thus been taken for granted or addressed through the market assessment survey by SWN. The partnership between SWN and DA is part of a larger program to extend water access to all by 2030, and there are some benefits within this larger program environment that positively affects the PPP arrangement. These include the monthly community radio programs that are being used to engender community interest and support in the WASH program. Other favorable factors within the project environment include the availability of unemployed youths who could be hired as manual workers for digging trenches for pipelines or recruited and trained to manage the water systems. Also, the availability of electricity in the beneficiary communities provided the source of power for the submersible electric pumps.

Timing

One of the major reasons why PPP projects in the drinking water supply sector are often unsuccessful is the lack of investment of time and resources in effective risk analysis and management strategies (Xenidis & Angelides 2005; Xu *et al.* 2011; Cui *et al.* 2018). Our analysis revealed that the project documents put in place measures to mitigate a total of 7 out of the 11 risk factors. Even though some of the proposed mitigation strategies could be described as not being thorough enough, they could still be considered as largely impressive considering that the project was not necessarily designed with a goal to satisfy this template of risk factors. As Table 3 illustrates, the majority (seven) of the critical risk factors that affect PPP water projects are likely to occur at the service delivery phase, the longest phase of the PPP project cycle. The service delivery phase is critical to securing the long-term availability of the intended benefits from the partnership. It is at this phase that some critical decisions are taken, for example, tariff adjustment to keep up with the cost of operations and projected revenue inflows, management of customer demands and expectations, and transfer of assets from the private to the public partner. The potential risks that occur at the service delivery phase should, therefore, be taken seriously. For example, although periodic tariff review could minimize the occurrence of product price risks, such risk mitigation strategy could be described as inadequate in its current form and should, therefore, be reviewed to allow inputs from other key stakeholders in the project communities.

CONCLUSION

This paper provides a useful guide for how the emerging privately owned SWEs in Ghana could partner with local authorities to accelerate progress toward achieving the SDG of universal water access.

Table 3 | Summary of critical risk factors and mitigating strategies for the PPP water projects in the Asutifi North District

Risk category	Description	Mitigation strategies in project documents	Project phase likely to be affected
Political risk	Interference with project designs, award of contracts, procurement of goods and services, biased selection of project sites, and arbitrary termination of PPP agreements	Defined project goals, expectations, roles, and responsibilities; use of procurement standards, involvement of a neutral party (CWSA) in procurement processes	Pre-construction
Financing risk	Difficulty in raising funds for the project	Clarity on total project cost; diversified funding source between DA and SWN; flexible payment schedule for DA	Pre-construction
Government credit risk	Failure to honor credit guarantees	Not addressed	Pre-construction
Inflation risk	Fall in the exchange value of the local currency; fall in effective demand for PPP services	Short timeframe allocated for construction works; costing of the PPP project in US dollars; payment of contributions at the prevailing exchange rate	Pre-construction and construction
Inaccurate market forecast risk	Substandard decision-making procedures, lack of PPP project operational experience and capacity, inadequate preparations, unequal information-sharing among project partners	Market assessment survey by SWN to determine project viability; sharing of project documents in draft for partners' inputs before finalization; leverage SWN's long experience in SWEs; organize review and townhall meetings	Pre-construction and Service delivery
Product price risk	Undervalued prices which may decrease expected profits and reduce the competitiveness of PPP projects, or outrageous prices which could cause chaos and affect the use of the services provided through such projects	Opportunities for tariff reviews	Service delivery
Technical risk	Failure or below-expectation performance of the technology adopted for the production, transmission, storage, and distribution of piped water	Use of maintenance reserve account for servicing repairs and long-term sustainability of the water facilities	Service delivery
Contract risk	Potential changes in the social, political, and economic environment may not be anticipated in contract documents; ambiguities, inconsistencies, and errors in contract documents	Possibility of the review of key project documents including partnership proposal and financing agreement	Service delivery
Legal risk	Absence of a robust and dedicated legal system to handle PPP contracts and related cases	Not addressed	Service delivery
Market demand risk	Demand and use of the services provided through a PPP project	Not addressed	Service delivery
Lack of supporting infrastructure risk	Conditions and facilities which are external to the PPP project, and yet basic to their optimum performance	Not addressed	Service delivery

Source: Authors' construct 2020.

It also describes the risk factors that need to be addressed at different stages of a water project cycle. Although we agree that risk assessments are most effectively done during the pre-contract phase when most project decisions have not yet been made, we believe that risk factors during the service delivery phase of the project should be collectively reviewed and measures proposed to mitigate their potential impacts. For example, ambiguities in the contract documents regarding the timelines for the

transfer of the water supply assets to the DA need to be resolved. Procedures for tariff setting and reviews need to be clearly established and should involve other stakeholders in addition to SWN. The absence of guarantees for partners in the event of arbitrary termination of the current partnership without mutual understanding and consent are also serious risks that cannot be glossed over. We suggest that project documents be reviewed and amended to address these risks. Undertaking such reviews will be consistent with the observation of Demirel *et al.* (2017) that change is an intrinsic part of PPP projects given the long-term commitments required and the uncertainties in the project environment require project documents to be flexible to accommodate these changes.

We identified two limitations with our study. First, we relied solely on project documents as our primary data. Using other forms of data, such as interviews, may have generated different or complementary accounts about how project stakeholders perceived the various risks factors and the mitigation measures that we discussed. Second, we recognize our own positionality in our interpretation of what could constitute potential risks in the project environment and the project documents; however, risk exists regardless of a person's perception and knowledge about it (Aven *et al.* 2011). These limitations notwithstanding, we have used this paper to demonstrate that the partnership between the DA and SWN has so far been successful at the contractual and relational levels. While significant risks still exist in the water-related PPPs, they can be anticipated and mitigated during project design.

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DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

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