Financial Risks and Economic Viability of Water and Sanitation Businesses in Rural Cambodia: A Rapid Review

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This paper discusses the findings from a literature review, followed by a survey and focus group discussions with 26 private sector suppliers. The top risks encountered by water services providers were water pricing, lack of management skills, and high investment costs. The most impactful risk factors for their economic viability were water losses, construction delays, and high energy costs. Sanitation services suppliers faced risks of low demand, lack of capital, and household affordability. Limited loan access and household subsidies were risk factors affecting both groups. The paper highlights that financial risks are primarily borne by suppliers serving impoverished households in rural Cambodia, despite the involvement of various stakeholders in the supply chains including donors, government, households, financial institutions, and NGOs. Assessing the financial health and viability of these businesses require consideration of multiple risk factors. The paper offers strategies to address challenges at both the supplier and government levels to ensure financial sustainability of water and sanitation businesses in order to achieve universal water and sanitation access in Cambodia.

Keywords: financial risks, economic viability, water services providers, sanitation services suppliers, rural Cambodia, subsidies, water tariff, affordability, rural WASH

INTRODUCTION

Cambodia's 2003 National Policy on Water Supply and Sanitation, enacted by the Council of Ministers on 7 February 2003, aims to improve sanitation options, protect water resources, and enhance people's living conditions (Open Development Cambodia, n.d.). It seeks nationwide access to affordable, sustainable, and environmentally friendly water supply and sanitation services. This policy establishes principles, responsibilities, standards, and monitoring for urban-rural water supply and sanitation. It promotes private sector involvement, cost recovery, cross-subsidies, utility autonomy, and establishing a regulatory body. The implementation of the National Policy on Water Supply and Sanitation is a fragmented process that necessitates collaboration between multiple ministries and stakeholders. Provincial waterworks, the private sector, the Ministry of Industry and Handicraft, the Ministry of Public Works and Transport, and provincial wastewater units all have different roles to play. The Ministry of Rural Development is responsible for rural water supply and sanitation, in line with the objective of the Rural Water Supply, Sanitation and Hygiene Strategy (RWSSHS) to achieve universal access by 2025 (Asian Development Bank, 2019).

This paper explores the financial risks and economic viability of water and sanitation suppliers in rural Cambodia in relation to the implementation challenges of the National Policy on Water Supply and

Sanitation. The first section provides an overview of the study's methods of data collection and analysis. Subsequent sections delve into a literature review on financial risks and economic viability of WASH suppliers in Cambodia and present the findings derived from a survey and focus groups involving 28 rural water and sanitation suppliers. The paper concludes by offering recommendations at both the supplier and government levels to effectively accomplish the goals of the RWSSHS to achieve universal access to safe water supply and sanitation by 2025.

AIM

The rapid review was conducted alongside a 4.5-year WASH development project (the Project) in rural Cambodia funded by the Australian Government. The Project was implemented by a local NGO in Cambodia in partnership with the Ministry of Rural Development, private sector water and sanitation businesses, Cambodian Committee for Women's and Children, and Cambodia Water Association. The Project aimed to increase access to water and sanitation services for impoverished households in nine rural provinces through an output-based subsidy scheme.

The review was conducted with the guiding research question: What are the financial risks encountered by private sector rural water and sanitation businesses and how do they impact the economic viability of these businesses?

METHODS

The rapid review involved a literature review to identify typologies of risks and impacts within the supply chain of the water and sanitation markets, which were used to develop a survey and guided questions in focus group discussions with water and sanitation suppliers in rural Cambodia. The participants of the survey and focus groups were selected through both direct and indirect recruitment methods. Direct recruitment involved reaching out to representatives of businesses directly involved in the Project. Indirect recruitment was carried out by involving the District Government focal points of the same project. This approach aimed to expand the participant pool and ensure a diverse range of perspectives were included in the review.

The survey was designed to gather specific information from participants regarding their assessment of financial risks and risk factors, and impact on the financial viability of their businesses. The author designed the survey and translated into Khmer to ensure its accessibility and comprehensibility for the participants. The survey consisted of five main parts. The first part included nine questions aimed at collecting general information about the business, its operations, and its relationship with financial factors. The second part focused on the operational aspects of the businesses, specifically whether they were involved in water or sanitation services. This section aimed to understand the nature and dynamics of their services, the structure of their financing mechanisms, and the factors that influenced their operations. The third part aimed to gather information about the financial risks experienced by the businesses and how these risks were perceived to impact their financial viability. The fourth part sought suggestions from the participants regarding policies or government support that could help mitigate the impact of financial risks on their businesses. Additionally, it aimed to gather ideas on how to encourage the sustainable provision of WASH services to poor and vulnerable households in Cambodia.

The focus group discussion questions follow the same structure as the survey. The discussion aimed to supplement information gathered from the survey and triangulate the results between the two data sources.

The participants, who represented the businesses, were invited to attend workshops where they completed the survey and engaged in focus group discussions. A total of three workshops were conducted, each lasting four hours. The workshops took place in Phnom Penh, Pursat, and Prey Veng.

The workshops were conducted under the guidance of the author, who facilitated the sessions with the assistance of two Cambodian research assistants. A total of 26 participants actively participated in the workshops. Among them, nine were engaged in water services provision, and 17 were sanitation services suppliers.

The participants primarily comprised business owners or individuals occupying senior management positions within their respective businesses. It is important to highlight that nearly all of the participants, except for two individuals, had prior involvement in the Project across eight rural provinces in Cambodia.

Descriptive statistics were employed to examine the patterns and trends among the variables in the survey data. Given the small sample size and the data collection approach, descriptive statistics offered a suitable method as an exploratory analysis of the survey data.

The focus group discussions were transcribed and analyzed using thematic coding. This coding process involved identifying and categorizing themes based on the same variables used in the survey. The analysis aimed to establish connections between the survey data and the insights gained from the focus group discussions by employing consistent categorical variables.

To ensure consistency and reliability, the results obtained from both the survey data analysis and the thematic coding of focus group discussions were cross-checked. This cross-checking process aimed to validate the findings and ensure their coherence across both data sources.

LITERATURE REVIEW

Water Supply Businesses in Cambodia

In Cambodia, water supply businesses can be broadly divided into two categories: those that provide piped water services to households (piped water supply systems) and bottled water to households. Piped water supply systems are typically managed and operated by private entities, some of which may be licensed or unlicensed (SEVEA, 2017). Bottled water suppliers, including locally operated kiosks and informal water distribution merchants, have extended their presence in rural regions. Water kiosks typically pump, treat, and store water from a water source, distributing it in 20-liter plastic containers. Additionally, informal water distribution services such as tanker trucks, carts, and rented pumps are common to meet temporary water demands during the dry season (WaterAid, n.d.).

Over the past decade, there have been significant changes in water supply practices among Cambodia's rural population of 12 million (National Institute of Statistics (NIS) and Ministry of Planning (MOP), 2018). Approximately 27% of rural households now purchase water from service providers, primarily through piped water supply systems or bottled water distributors, compared to only 11% in 2009 (SEVEA, 2017). These changes can be attributed to the country's ongoing economic growth, increased household disposable income, and the emergence, consolidation, and expansion of water supply services (SEVEA, 2017).

Despite the recent growth and development of piped water services, most rural households (68%) still rely on traditional non-serviced methods to meet their daily water needs (NIS & MOP 2018). These methods include accessing groundwater aquifers through a tube or dug wells, collecting and storing rainwater from rooftops, and utilizing natural or constructed surface water bodies like ponds, rivers, or lakes. Tube wells can be classified as either serviced supplies, public wells managed by local committees, or private supplies owned by individuals (WaterAid, n.d.).

In rural Cambodia, household water treatment is commonly practiced, with boiling being the most widely used method. Water purification products, such as mineral pot filters, have been available in some marketplaces for over a decade (NIS & MOP, 2018). While some filtration products are imported from neighboring countries, others, like ceramic and bio-sand filters, are produced within Cambodia (Brown et al., 2012).

The Ministry of Rural Development (MRD) and the Ministry of Industry, Science, Technology & Innovation Industry and Handicrafts (MISTI) regulate public and private piped water supply operations. Licensing coverage for small scaled piped water enterprises in rural areas is increasing, with approximately 61% of these enterprises being licensed. Efforts to license all enterprises are ongoing, but entrepreneurs face challenges due to regulatory burdens, tariff caps, administrative requirements, and compensation for damages. Compliance with national laws requires monitoring, capacity assessment, development, and targeted investments. While MISTI has initiated a management information system for larger systems, its implementation for smaller systems is limited.

Commercial bottled water service providers are regulated by MISTI, with oversight at the local level by provincial departments. However, there is no regulation for bottled water services provided by family-owned businesses or community kiosks.

Piped Water Supply Businesses

Rural piped water supply is considered an improved water supply in Cambodia. Although overall coverage remains low (16%), it is increasing moderately year by year. Significant potential for growth remains, as indicated by low-moderate coverage rates within the licensed areas and a high proportion of the rural population estimated to be living in viable regions (60%) compared to the overall level of coverage (16%) (WaterAid, n.d.).

In addition to the 13 existing public urban water utilities, there are approximately 530 private water suppliers in urban and rural Cambodia that are known to the regulatory authority (MISTI) and the Cambodia Water Supply Association (Cambodia water Association, 2018). About 350 private operators are categorized as Small Water Enterprises (SWEs) (Frenoux et al., 2012; GRET & ISEA 2017), typically serving small towns and rural areas. However, there is no distinction in the licensing and regulation of SWEs versus larger public and private operators (Frenoux et al., 2012). Households can only secure private water services in locations where a connection to the distribution network is viable. In such areas, connectivity is influenced by the affordability of connection fees and tariffs and the willingness to change water habits (WaterAid, n.d).

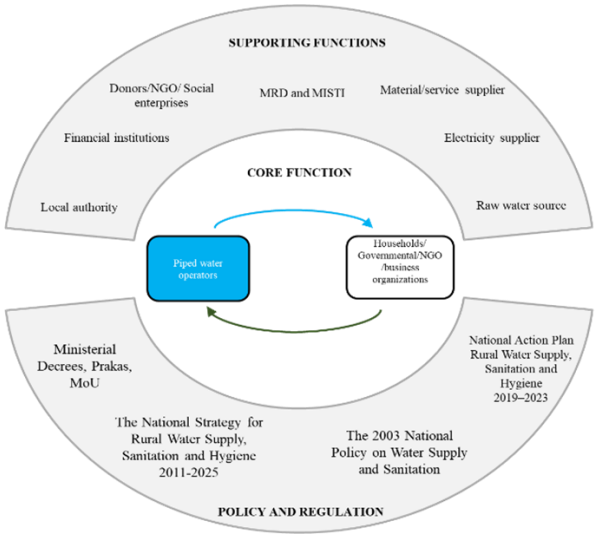
Many actors are involved in the setting up and operating rural water supply (Figure 1). MISTI and MRD are the governmental bodies regulating, monitoring, and licensing the pipe water supply operations (Frenoux et al., 2017). At the initial stage, local authorities, donors, and NGOs play significant roles in setting up the piped water supply in rural areas, which is not very attractive for private investors to invest in the startup of these businesses independently. Many NGOs and donors provide technical assistance and seed funds, grants, or subsidies, which partially cover the total capital required, to local people to start pipe water supply enterprises. So, these enterprises also need additional money derived or borrowed from personal savings, friends, families, and finance institutions.

After they have enough funds, investors need to identify the natural water sources that can provide constant raw water throughout the year. Then they need construction materials and services to design and build their water production system, including a water treatment plant, water storage tank, water tower, and pipe network. These can be sourced from local and national material, service suppliers, and supporting organizations. Operators need materials and services such as chemicals and electricity at the operational stage.

Many policies and regulations have been created to govern the water supply, namely Ministerial Decrees, Prakas, and Memorandum of Understanding. The key policy documents are the National Strategy for Rural Water Supply, Sanitation and Hygiene 2011-2025, the 2003 National Policy on Water Supply and Sanitation, National Action Plan Rural Water Supply, Sanitation and Hygiene (2019–2023) (Open Development Cambodia, n.d.).

Financial costs and economic viability. The economic viability of water supply providers is influenced by costs of investment and operations, and revenue from connection fee and water tariff. Historical data indicates that most operators (83%) in the water supply sector have been profitable and have successfully achieved operational and full cost recovery (Jemima et al., 2014). However, there is limited available data regarding the current sustainability conditions of these operators. MISTI has recently issued Prakas (regulations) on water tariffs to ensure full cost recovery, which is contingent upon the efficiency and performance of small water enterprises.

FIGURE 1
PIPED WATER SERVICES SUPPLY CHAIN



Risks of economic viability for private water suppliers include significant investment costs for the water production system, which involves constructing the treatment plant, storage tank, and water tower. Operators often forgo building a water tower if they already have a storage tank and a pumper for water distribution. The investment costs for pipe networks, including pipe purchase, installation, and trench digging, are also substantial, averaging around 720,000 USD. Operators typically finance the construction of their pipe networks using personal financial resources. However, those who borrow from commercial banks face challenges such as high-interest rates and collateral requirements in the form of land or buildings, ranging from 100% to 300% of the loan amount (Jemima et al., 2014).

Operational costs pose another viability risk for water supply providers, encompassing chemicals, energy, maintenance, salaries, and general administrative expenses. In Cambodia, where diesel is commonly used to power pumps and generators in most networks, energy constitutes 65% of the average costs. For pipe networks relying entirely on diesel, energy expenses make up 74% of the average costs. Labor accounts for 17% of the total cost, maintenance costs represent 13%, and rent comprises 5% of the overall expenses (Jemima et al., 2014).

The cost and quality of the water production system significantly influence service quality and financial viability. While the market for materials and equipment is well-developed in Cambodia, there is a lack of local companies providing professional consulting services for design, construction supervision, and monitoring systems. As a result, local enterprises often handle the design and construction themselves or rely on local tradespeople and laborers (Jemima et al., 2014).

Energy costs, especially for diesel operations powering generators and pumps, contribute significantly to operating expenses. In Cambodia, where diesel is commonly used, energy expenses account for 65% of average costs. Energy costs reach 74% of the total expenses for networks that depend entirely on diesel. The unreliability of the power supply further affects the ability to deliver consistent service (Jemima et al., 2014).

Various forms of support have been implemented to address the barriers to entry and enhance viability in the water supply sector. International development agencies like UNICEF assist by subsidizing connection fees for impoverished households, which helps create demand for water services. Some operators have reduced connection fees to half the price set by MISTI and introduced affordable monthly payment options, such as a fixed rate of 5 USD without additional costs. Financial support from donors in the form of soft loans can also aid in planning expansions to additional communes. Water suppliers operating in areas with easily accessible water sources, such as the Tonle Sap, have experienced high

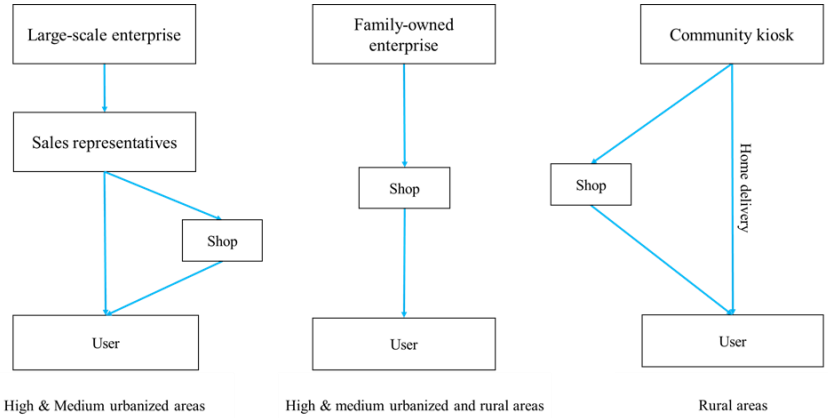
demand (SEVEA, 2017). However, risks of low water usage, particularly during the rainy season, persist, as most households continue to rely on rainwater even when they have piped water connections (Jemima et al., 2014). Additionally, the cash flow of water supply businesses may be at risk when poor and vulnerable households struggle to pay on time (Grant et al., 2018).

Bottled Water Services System

Figure 2 illustrates three models of Cambodia's 20-liter bottled water businesses: large-scale private enterprises, family-owned businesses, and community kiosks. While bottled water is considered an improved water supply by international standards, it is classified as unimproved in Cambodia (NIS & MOP 2018). Family-owned businesses and kiosks lack regulation, with facility operators and NGO platforms responsible for monitoring water quality. Independent evaluations have revealed significant microbiological contamination in some samples from treatment systems and the 20-liter jugs (WaterAid, n.d.).

Large-scale private enterprises. Large-scale private enterprises play a significant role in the 20-liter bottle market, particularly in high-demand areas. They sell approximately 100,000 bottles per month in Phnom Penh and distribute them through local retailers who can order between 30 to 150 bottles each. Like other private enterprises, these companies have various startup costs and daily operation expenses. Startup costs include equipment, incorporation fees, office space, inventory, marketing, website development, office furniture and supplies, utilities, payroll, and other expenses. Operating costs encompass direct costs of goods sold, selling, general and administrative expenses, rent, payroll, overhead costs, and raw materials and maintenance expenses (Investopedia, n.d.). Construction of the water production system, including treatment plants, bottling equipment, and distribution vehicles, is a significant cost for these enterprises. Profit distributions vary, with small operators averaging around 2,000 USD per month and large ones reaching 11,500 USD, with a portion reinvested in the business (SEVEA, 2017).

FIGURE 2
BOTTLED WATER SERVICES SUPPLY CHAIN



Large-scale enterprises face financial risks and constraints. Selling smaller bottles is more lucrative due to higher prices, easier transport, and the absence of constraints like bottle deposits and washing. Large-scale companies struggle to compete with family businesses in rural areas. Strict deposit rules, such as high prices (around 4 USD), pose affordability challenges for poorer populations. At the same time, family businesses can offer lower deposit rates due to proximity to customers and more flexible rules. The cost and quality of the water production system, similar to piped water supply, affect service quality and financial viability. The market for materials and equipment is well-developed in Cambodia, but local companies providing professional consulting services for design and construction are scarce. Energy costs, especially for diesel operations, represent a significant portion of operating expenses, with energy accounting for 65%

on average and reaching 74% for diesel-dependent networks. Power supply unreliability further hampers consistent service delivery (Jemima et al., 2014).

Family-owned businesses. Family-owned businesses in the bottled water market operate on a micro-small scale, selling 20-litre bottles to local grocery shops and delivering them. These businesses are privately owned and managed, with local production and distribution to other local businesses. They have flourished due to lower initial investment costs (typically 5,000 USD to 8,000 USD for a lower-end water treatment station) and inexpensive labor, often involving family members. Family enterprises are more common in impoverished areas and can offer lower bottle deposit rates (less than 2 USD) due to proximity to customers and less strict regulations.

Financial risks for family-owned businesses include the lack of delivery systems, limiting their reach to customers within 40 km of their production location. Intense competition with other family enterprises, low-income potential clients who cannot afford bottled water in certain rural areas, and limited production capacity per treatment unit (between 1,500 and 3,000 bottles per month) hinder their expansion opportunities. Additionally, the lack of regulation for family businesses and potential cost-cutting on water treatment may impact water quality, despite initially safe water distribution.

The cost and quality of the water production system pose challenges for family businesses, similar to piped water supply businesses. Cambodia's materials and equipment market is well-developed, with competitively priced and reliable imports from China and Thailand. However, local companies are scarce providing professional consulting services for design, construction supervision, and monitoring systems. International consultants cater mainly to larger firms operating urban water systems, making their services unaffordable for local enterprises. Energy costs, especially for diesel operations powering generators and pumps, represent a significant portion of operating expenses, with energy accounting for 65% on average and reaching 74% for diesel-dependent networks. Power supply unreliability further affects service consistency (Jemima et al., 2014).

Although the bottled water distributed is more likely to be safe initially, the critical lack of regulation for family enterprises and the necessary regular and not-so-obvious maintenance that needs to be regularly performed do not ensure the quality of the water. MISTI does not license most family enterprises, so they are not underwater quality regulations. As a result, some of them may reduce expenses on the treatment to have very competitive prices (around 0.45 USD in rural areas). Family enterprises represent significant potential in terms of access to 20-liter bottled water. Still, as long as no regulatory framework and no capacity building is implemented for these actors, such actors can hardly be considered suppliers of drinking water (SEVEA, 2017).

Community kiosks. Community kiosks operate under a decentralized model, purifying local water sources to strict World Health Organization standards and delivering the distilled water in reusable 20-liter bottles to consumers' homes (Shantz, 2013). The number of supported kiosks has significantly increased over the years, mostly through Teuk Saat 1001 (TS1001), a local NGO, in partnership with 1001fontaines (Muret, n.d.). TS1001 operates under a hybrid business model, with NGOs covering the capital expenditure (CAPEX) but aiming for financial independence for the stations who operate as franchisees afterward. While the kiosk model appears to be operational, it relies on international funds to cover initial capital costs, and one-third of the water kiosks supported by TS1001 require ongoing NGO funds for economic viability. Scaling up is possible only with external financial support, and the project faces constraints when transitioning from NGO oversight to independence (SEVEA, 2017).

Associated costs for setting up treatment stations average around 25,000 USD per station, with the majority of funding provided by supporting NGOs and a portion covered by the commune. TS1001's sites benefit from subsidies by international grants, relieving them of capital expenditure concerns. However, reaching breakeven can be challenging due to high fixed costs, particularly salaries and platform fees. The local entrepreneurs managing the kiosks earn an average monthly revenue of around 150 USD.

While sustainability has been achieved to date, longer-term risks remain. The financial self-sustainability of NGO-initiated kiosks varies, with 78% of kiosks founded in 2005 achieving operational cost recovery. TS1001 actively supports the remaining 22% to develop their businesses and attract new

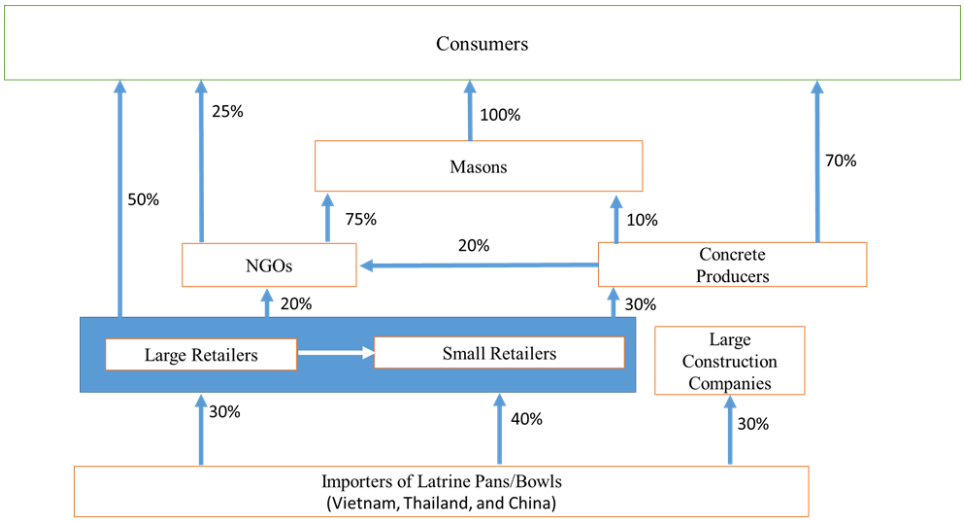
consumers. The TS1001 franchise is financial sustainability relies on the income generated by the 258 water kiosks in 2020, which covers the operating costs of regional and national support offices (SEVEA, 2017).

The community kiosk model implemented by TS1001 shows promise and replication capacity, but it depends on external funds and support. The model's scalability and long-term sustainability require careful consideration of financial independence, regulatory frameworks, and the gradual reduction of reliance on NGO assistance.

Sanitation Businesses in Cambodia

Figure 3 illustrates the sanitation services supply chain, which involves various actors in providing latrines to households. The process begins with importers who sell latrine materials to construction companies and retailers. These construction companies and retailers serve as intermediaries, as some of them then sell the materials to NGOs or concrete producers who engage masons to construct the latrines for households.

FIGURE 3
SANITATION SERVICES SUPPLY CHAIN



The construction of latrines involves using various components, including concrete, bricks, sand, gravel, PVC piping, zinc sheeting, ceramic pans, and tiles. While some materials like cement, bricks, sand, and gravel are produced locally, others are imported from Thailand, Vietnam, and China. Importers and wholesalers like Chip Mong Group, Peng Huot Co., Heng Asia, BPC Co., and K Cement are crucial in supplying these materials within the country. They serve retailers, and construction projects and sometimes even sell directly to clients (Roberts et al., 2007).

Retailers

Retailers are often family-owned shops in urban and rural markets that sell construction materials, including latrine components. They face competition in local markets, especially in provincial towns. Sales of latrine pans by rural retailers peak during the dry season when the local population has cash and labor availability after the harvest. Latrine pans account for a small portion of retailers' total sales, about 3-5%, but they also sell other materials needed for latrine construction. Retailers supply 50% of their sales to consumers, 20% to NGOs, and 30% to concrete producers (Roberts et al., 2007).

These retailers have startup costs and daily operating expenses similar to other private companies. They register with relevant government departments, maintain sales or accounting records, and have family members overseeing various operational functions. Their assets typically exceed 100,000 USD, including

trucks, cranes, and stock. Financial risks for retailers include late or non-repayment of credit, and lack of capital for daily operations and growth. Solutions involve credit management training and establishing linkages with existing credit sources such as financial institutions and suppliers (Roberts et al., 2007).

Concrete Producers

Prefabricated concrete producers specialize in manufacturing and selling concrete rings, slabs, and other components for wells, water tanks, and latrines. Some producers in urban areas also offer concrete slabs with embedded ceramic pans. Latrine-related sales account for most of their products, with 40% used in rural areas and 65% in urban areas.

Concrete producers. Concrete producers are small or micro-sized businesses, usually registered with the Department of Industry, Mine, and Energy. However, not all enterprises register their operations or file tax submissions. They are typically family-owned and may engage in multiple business activities alongside concrete production (EMC, 2009). Concrete producers supply 70% of their products directly to consumers, 20% to NGOs, and 10% to masons (Roberts et al., 2007).

The entry barrier for concrete production is relatively low, requiring a capital investment of about 300 USD and basic skills. Provincial towns may have 6-8 concrete producers, while rural districts have 2-3. Prices for concrete components vary regionally, influenced by input costs such as sand and gravel availability. Urban producers operate year-round, while rural sales are more seasonal, with the dry season accounting for 80% of annual sales. This seasonal turnover of labor and less experienced workforce can impact quality.

Startup capital for concrete production is estimated at a minimum of 8,000 USD, which includes a truck, moulds, and working capital. Although entry on a smaller scale is possible with around 1,000 USD for moulds, it is challenging due to the need to cover customer credit and slower payment terms. Larger producers typically have assets of around 30,000 USD, including trucks, mixers, moulds, stock, and equipment (EMC, 2009).

Financial risks for concrete producers include the lack of capital for daily operations and growth. Developing linkages with existing credit sources and providing credit management training are potential solutions (Roberts et al., 2007).

Masons

Masons are construction workers who build latrines as part of their general construction services. They can be skilled masons with advanced skills, simple masons with basic skills working under supervision, or unskilled laborers performing manual tasks. Skilled masons typically lead construction teams and earn 5 USD – 10 USD per day, while simple masons earn 3 USD to 4 USD daily, and laborers earn 1.50 USD to 2 USD daily.

Currently, masons lack formal training in latrine design, resulting in limited knowledge and ability to communicate design information to consumers. Consequently, the quality of construction is generally poor due to cost-cutting and limited technical ability (Salter, 2008).

Financial risks for masons include a lack of capital for daily operations and business growth, an inability to offer customer credit, and suppliers' unwillingness to provide loans due to trust issues. Solutions to these risks involve training in credit management, establishing linkages with existing credit sources such as microfinance institutions and suppliers, and fostering communication and coordination among supply chain actors through an "interest group" approach to build trust (Roberts et al., 2007).

FINDINGS FROM THE SURVEY AND FOCUS GROUP DISCUSSIONS

Water Services Providers

Background Information

In the survey and focus group discussions, nine water service providers were involved. Among them, five participants were female, while four participants were male. The participants' educational background varied, with three having completed lower secondary school education, three with primary school

education, and three each with upper secondary school, technical/professional college, and university education.

Regarding their work experience, five respondents had been in their current jobs for 4-6 years, three respondents had worked for 1-3 years, and one respondent had worked for 7-10 years. Regarding business operation duration, four respondents had operated their businesses for 4-6 years, three for 1-3 years, and two had businesses that had been running for more than 10 years.

Among the respondents, five of them exclusively provided piped water services. Two participants offered both piped water services and water filters. One respondent focused on selling bottled water, while another participant had a diverse range of products and services, including piped water services, water filters, bottled water, water truck services, pumping raw water, and other non-water products/services such as construction and trading.

The participants' businesses were in Kampong Chnang, Kampong Speu, Kratie, Takeo, Prey Veng, Prey Veng, Pursat, and Tbong Khmum provinces. Only five respondents provided information on business revenue, which ranged from 765 USD to 80,000 USD per month on average. The number of employees in these businesses varied between two and 26.

Financial Risks and Economic Viability

The respondents identified the top three risks: water pricing and tariff, lack of management skills and capacity, and high investment costs (Figure 4). The significance of water pricing and tariff as a major barrier may be attributed to many of these businesses operating in rural areas affected by drought, floods, or water scarcity. Moreover, their customer base consists predominantly of poor and vulnerable households. Structural reforms implemented in the mid-late 1990s, such as the separation of policy formulation, service provision, and regulation, as well as the establishment of regulatory bodies like PURC, have reduced political influence in tariff setting and adjustment for water services (Ameyaw & Chan, 2015b). However, in this survey, only one of the nine businesses reported setting tariffs independently, while the remaining eight followed government-set tariffs. This discrepancy may indicate that regulatory burdens, such as tariff caps and administrative requirements, pose challenges for these suppliers (Grant et al., 2018).

The finding that high investment costs rank among the top three risks aligns with the existing literature, highlighting that the initial investment is a significant barrier for water service suppliers. Starting a business in this sector requires substantial personal savings and investment, and an average capital expenditure of 720,000 USD limits the feasibility of implementing this model on a large scale.

FIGURE 4
FINANCIAL RISKS ENCOUNTERED BY WATER SERVICES SUPPLIERS (LAST 4 YEARS)

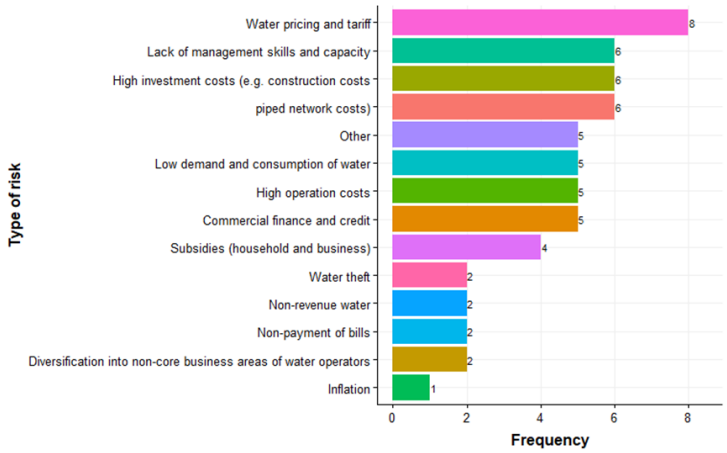
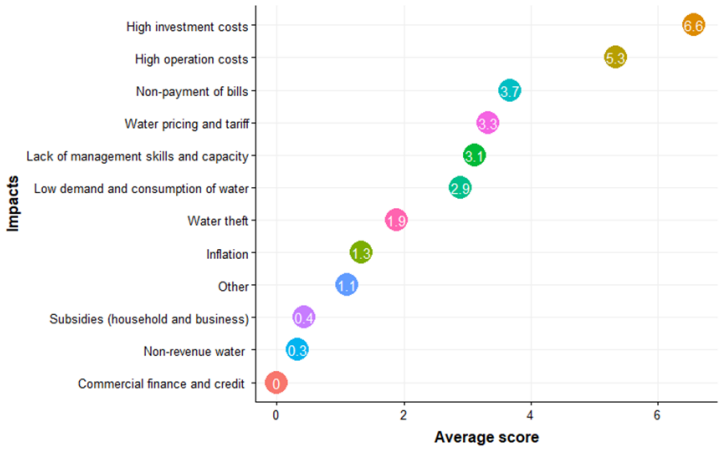


Figure 5 illustrates the degree of the negative impact that various financial risks have had on the businesses cash flow over the past four years, with a scale ranging from 1 (least negative impact) to 10 (most negative impact). The results indicate that high investment costs (6.6) and high operation costs (5.3) had the most significant negative impact on cash flow. These were followed by non-payment of bills (3.7), water pricing and tariff (3.3), and lack of management skills and capacity (3.1). These findings are consistent with the previous figure, which identified water pricing and tariff, lack of management skills and capacity, and high investment costs as the top reported risks.

FIGURE 5
IMPACT OF FINANCIAL RISKS ON CASH FLOW (LAST 4 YEARS)



According to Figure 6, the financial risks with the highest negative impact on profitability are high investment costs (6.7) and operation costs (5.3). Following closely are non-payment of bills (3.4), low demand and consumption of water (3.2), and water pricing and tariff (3.1). It is important to note that these five financial risks appear to be prevalent and significantly influence the businesses' profitability.

FIGURE 6
IMPACT OF FINANCIAL RISKS ON PROFITABILITY (LAST 4 YEARS)

It is interesting to observe that the lack of management skills and capacity, which has a relatively higher impact on cash flow (as indicated by a rating of 3.1 in Fig 5), appears to have a lesser impact on profitability (as indicated by a rating of 2.3 in Figure 6). The reason, as explained by the respondents in the focus group discussions, is that while lack of management skills and capacity affect the day-to-day financial operations and cash flow management of the businesses, they mitigate the impact on profitability through various strategies or compensatory factors. This includes cost-cutting measures, such as reduced data collection on water quality and reduced water treatment, which results in lower water quality and services.

In terms of the impact on full cost recovery, the following risk factors and impacts were reported by businesses. Low water tariffs had a medium impact on profitability. As explained by one supplier in the focus group discussion, they often cut water treatment costs because they could not increase the water tariff to keep the already low-profit margin. This is also because the treatment costs are already high for some areas or at some time, for example, during flood periods where the water is muddy.

> "*We just get the water and drain out the mud, but it does cost much. The cost covers pumping, electricity, laborer, and tank washing*." Prey Veng workshop.

Low water tariffs had a low impact on attracting private sector investment because most suppliers who entered the business did so out of their own savings or through family support. It also appears that most suppliers were more concerned about obtaining wide coverage of connections to ensure higher revenue to break even. As seen by SEVEA (2017), once the station is up and running, low fixed costs ensure quick economic viability for the operators. This seems to be what the respondents believe and that motivate them to enter this business.

> "*3ie told me once I have 1000 connections, I will break even. The ongoing costs are not a lot although the water tariff is not high.*" Prey Veng workshop

Subsidies were identified as a risk factor with a moderate impact on achieving full cost recovery. In this Project, the Project provided 30 USD for each household connection, and suppliers offered a 30 USD discount on the average connection cost of 70 USD, resulting in households only having to pay 10 USD for the connection fee. Despite the reduced fee, many impoverished and vulnerable households still found it challenging to afford or chose not to utilize the water service even after establishing connections. This was primarily due to their inability to meet the low water tariff. As Ameyaw and Chan (2015a) found, non-payment of bills significantly threatens the sustainability of water services delivery. Respondents also perceived subsidies for water tariffs that households were unaware of, further contributing to the gap between the acceptable tariffs and the actual operational costs of the water station.

Infrastructure-related factors such as high levels of water losses and unreliable power supply were reported to affect operational costs and the ability to deliver consistent service in both the survey and focus groups. The unreliable power supply is consistent with literature findings that utilities necessary for water supply may be unavailable or unreliable (Ameyaw & Chan, 2015a).

Risk factors with low impacts included the poor condition of pipe networks, low water pressure, deficient pipe network systems, lower operating capacity compared to installed capacity, and lack of reliable performance data for measuring and reporting efficiency in water operations. Low impact could be because they have found solutions, as in the comment below.

> "*Many problems such as water are costly, water loss through the pipe, pipe breaking, water stealing, and pipe losing water. The NGO we worked with has cooperated with the authority to request people to inform us in case they break our pipe. This solution is 80% effective. People can report to the authority, and they will report to us as soon as possible. Another way is social media. We have a Facebook page through which people can report us. They also can report us by phone, that they can find on the water invoice.*" Prey Veng workshop

Operational factors with a medium impact on full cost recovery included skills gaps in operation management leading to the inability to meet water quality standards, operational difficulties resulting in high costs such as water treatment costs or digging costs in hard ground areas, inflation raising production and operation costs, and high energy costs impacting the cost of water servicing.

In both surveys and focus groups, financial-related risk factors with medium impacts on achieving full cost recovery including difficulties in obtaining government guarantees for commercial finance, not meeting criteria for financial accountability required in loan contracts due to lack of reliable operational and financial data, and commercial lenders lacking confidence in income sources due to inability to enforce water tariff increases within a reasonable time frame. The term "financial" supports the definition of Xenidis and Angelides (2005). In Cambodia, where borrowing from formal financial institutions is widespread, enterprises expressed concern about collateral requirements and (to a lesser degree) interest rates. Commercial banks require that loans be collateralized with land or buildings, typically at a value of at least 130% (Jemima et al., 2014). It also shows that fixing water tariffs aligned with government pricing can lead to inability for businesses to manage their revenue and secure capital. Those with low impacts due to lack of access to commercial finance include businesses unable to maintain or replace existing infrastructure when required or undertake essential investment to start operations (e.g., R&D, acquisition, construction). This finding confirms Vives et al.'s (2006) study that these risk variables affect project sustainability's financial structures.

Risk factors at the household level impacting business viability included households' lack of willingness to pay, low consumption, and non-payment of bills which is consistent with (Haarmeyer & Coy, 2002). Grant et al. (2018) also stated that customers not paying on time are financial barriers for water supply entrepreneurs. Likewise, Pham (2021) stated that there are many challenges for private sector operators in rural areas, particularly in this Project.

> "*Another challenge is in some of our service areas, NGOs go there and drill wells for people. Digging costs could be 25 USD, and they have water, so people don't use our piped water. I spent around 10,000 USD per kilometer of pipe network, and there were only ten households that would use our water.*" Prey Veng workshop

It should be noted that some risk factors had low impacts on cost recovery, such as low consumption due to supplementary use of unimproved water sources, lack of guarantee of minimum revenue for water operators, and inability of other public/private agencies to pay bills affecting business cash flow.

Six of the nine respondents surveyed reported that they were financially viable. Among these, three suppliers projected financial viability for the next 1-5 years, while the remaining three anticipated viability for the next 6-10 years. However, three suppliers expressed uncertainty regarding their financial viability, but none reported being financially unviable. This finding resembles SEVEA's (2017) research, which revealed that piped water suppliers in Cambodia had an economic viability score of three out of four, indicating a level of economic sustainability, albeit not at the highest level. When asked about the needs for financing, most referred to additional funding to expand their network. Although they have customers, their current pipe network is limited, and they aim to extend their services to seven additional communes. Others who have successfully connected to 19 villages wanted to provide more villages loans to facilitate access to the service. Expanding connection coverage is their top financial risk mitigation priority.

Out of the nine water suppliers surveyed, only five stated their intention to continue providing services in the long term. Three suppliers intended to discontinue their services, while one remained unsure. It is worth noting that all five suppliers who expressed their commitment to continue working on the Project were actively involved in it. On the other hand, the supplier who indicated a negative response was not part of the Project. Two of the remaining three suppliers provided water filters, while the one who expressed uncertainty offered bottled water. This observation suggests that participating in the Project may have fostered a sense of empathy among the businesses towards impoverished and vulnerable households, particularly piped water suppliers, as long as their commercial viability is maintained.

Sanitation Services Providers

Background Information

The survey included 17 sanitation suppliers, seven from Pursat, five from Kratie, three from Prey Veng, one from Tbong Khmum, and one from Kampong Speu. Only one of the suppliers was female. Most respondents (13) had lower secondary and primary education, while two had upper secondary education and two had a university education. Seven respondents had been operating their businesses for 7-10 years, five for 4-6 years, and only one for 1-3 years.

Among the suppliers, 29% were materials and equipment supply shops, 24% were local producers of cement blocks, bricks, sand, and stones, and 23% were transport providers. There was also one construction company. Family-owned businesses constituted the majority, with 13 respondents falling into this category, while two were small and medium-sized enterprises. The average revenue of these suppliers was 1,400 USD, and one business reported 11,200 USD monthly revenue. The number of employees varied from two to 61, averaging 11.

According to the survey results (Figure 7), these sanitation businesses' top three reported risks were low demand for sanitation services, lack of capital for startup and business expansion, and household affordability (users). As this latrine business owner commented:

> "*To grow our business, we need more investment. If we can get a large amount of money, we can make the latrines in advance. For the shorter type of pit latrines, we have to make them beforehand and keep them ready for customers. However, we haven't been able to do it yet because we need more money, and the moulds for production are expensive.*" Kratie workshop

The finding that lack of capital for startup and business expansion is a recognized risk aligns with previous literature highlighting the financial risks sanitation businesses face, specifically the challenge of insufficient capital for daily operations and enterprise growth (Roberts et al., 2007). According to two medium-sized businesses, a lack of capital for a startup is not a risk if the owner is part of a network such as a franchise or a company:

> "*Unlike the water operator, we need a really small fund to start, in one branch, we need only 1,000 USD or even 500 USD. In one week, after constructing a toilet, we will get the payment back.*" Prey Veng workshop

FIGURE 7
FINANCIAL RISKS ENCOUNTERED BY SANITATION SERVICES SUPPLIERS (LAST 4 YEARS)

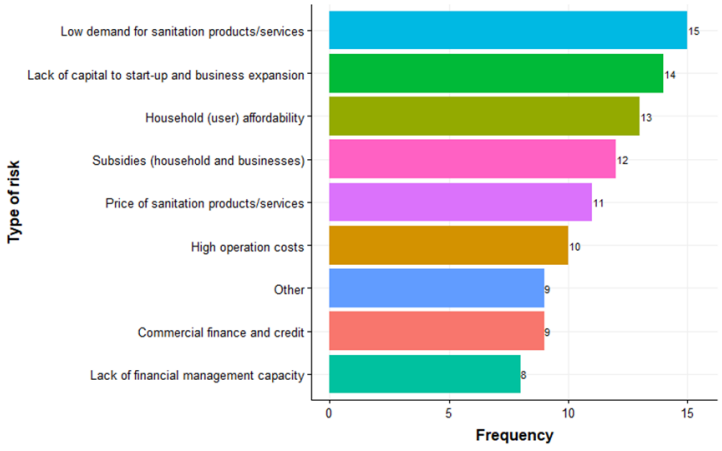
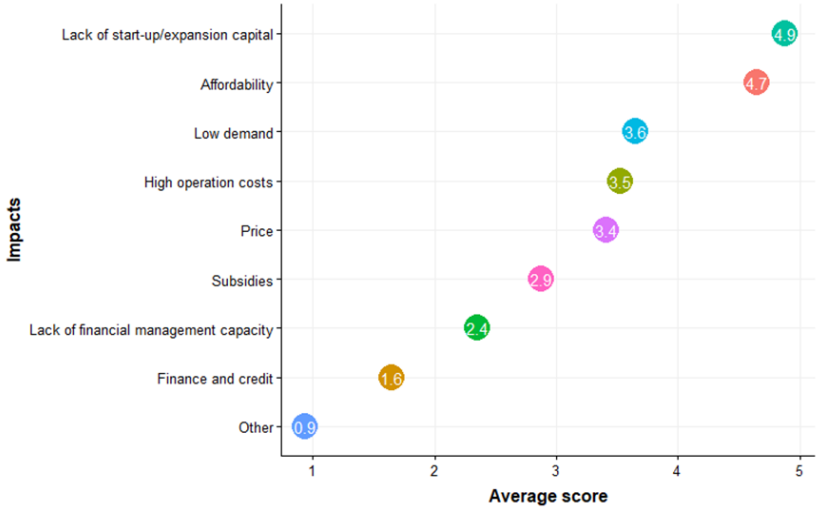


Figure 8 demonstrates the extent to which various financial risks have negatively impacted the cash flow of respondents' businesses over the past four years, using a scale of 1 to 10 (1 being the least negative impact and 10 being the most negative impact). The highest negative impact on cash flow was attributed to low demand for sanitation products/services, the lack of capital for startup and business expansion and household affordability. These findings align with the respondents' reports of the top three risks: low demand for sanitation products/services, lack of capital for startup and business expansion, and household affordability.

Similarly, in Figure 9, it is shown that low demand for sanitation products/services, lack of capital for startup and business expansion, and household affordability had the highest negative impact on profitability. These results further reinforce the consistency between the reported risks and their impact on the financial performance of the businesses.

FIGURE 8
IMPACT OF FINANCIAL RISKS ON BUSINESS CASH FLOW (LAST 4 YEARS)

FIGURE 9
IMPACT OF FINANCIAL RISKS ON PROFITABILITY (LAST 4 YEARS)



Financial Risks and Economic Viability

The risk factors with medium impacts on achieving full cost recovery in terms of pricing issues are as follows: firstly, the price variability of materials such as bricks, rings, and gravel affects the profit margin; secondly, the low sales price coupled with high transportation costs, especially in remote areas, leads to reduced profit margins; and finally, limited opportunities to reduce costs due to the already low-profit margins in the sanitation sector. According to the survey, although the current policy and regulatory frameworks do not attract investors or support businesses in reaching the scale required for full cost recovery, this only has a low impact. As with the water services providers, sanitation services suppliers seem to see increased household customers as a way to achieve economic viability rather than considering private investment. Additionally, there has been a prevalent price increase due to supply disruptions caused by containment measures and travel restrictions implemented during the Covid-19 pandemic. These findings are novel since previous studies have not specifically identified the impact of these risks.

The risk factor concerning low household demand and affordability that have a medium impact on achieving full cost recovery is the lack of households' (user) education and awareness raising to promote the benefits of latrines. Many commented in the focus group that people's awareness of the benefits of latrines is still limited in rural areas. Despite progresses in water, sanitation and hygiene (WASH) schemes and practices, Cambodia has the highest level of open defecation in the region, with eight out of ten of the poorest rural Cambodians defecating out in fields, in open bodies of water, or other open spaces, instead of using a latrine (Resource Development International Cambodia (RDIC), 2012).

The risk factors associated with access to finance, which have medium impacts on achieving full cost recovery, include two key aspects: Firstly, businesses face challenges in attracting commercial lenders due to their limited experience and understanding of the sanitation sector. Secondly, the high-interest rates associated with loans make it difficult to repay the borrowed amount effectively. These findings align with existing literature, which states that lenders such as banks or microfinance institutions are reluctant to provide loans to sanitation suppliers due to a lack of trust, as highlighted in Roberts et al. (2007). This holds particularly true for masons. All other risk factors mentioned in the study have low impacts, which were further affirmed during the focus group discussion.

According to the respondents, household subsidies greatly impact cost recovery because households wait for a subsidy-based intervention to buy latrines. This comment below explains the issue, which is associated with the Project. It is indeed an interesting perspective of the output-based method. From the perspective of household benefactors of the Project, the subsidized cost of latrines is still very high for many poor people (Pham, 2021). For elderly people and people with disabilities, saving even a small amount is very difficult because of ongoing basic needs.

> "*I want more people to build latrines, but with the NGO that works with the poor [like this Project], we couldn't make much profit. Most of my money was buried in the subsidy program, so I don't have enough cash flow. I wish to have more money to lend to the poor in the subsidy program, and many of them could have my toilets. I hope to build 100 latrines for the poor each year, so I need 30% more for financing support*." Prey Veng workshop

Out of the 17 sanitation suppliers surveyed, 14 reported being financially viable. Among them, 11 stated their financial viability for the next 1-5 years, while three projected viability for the next 6-10 years. Three suppliers were uncertain about their viability, and none reported being unviable.

Regarding continuing services for the poor and vulnerable households in the long term, 13 of the 17 suppliers expressed their commitment to providing ongoing services. Three suppliers stated that they would not continue, and one remained uncertain. The suppliers who expressed their intent to discontinue their services primarily focused on core businesses related to brick, sand, stone, and local production.

CONCLUSIONS AND IMPLICATIONS

Limitations

This rapid review of the financial risk and economic viability of water and sanitation suppliers in rural Cambodia has several limitations that must be considered. Firstly, the sample size was small, which may not represent all water and sanitation suppliers and could affect the validity and reliability of the statistical analysis. Additionally, most participants were involved in the Project, potentially influencing their responses based on their project involvement, as well as the design and implementation of the project itself.

Face-to-face interviews to assist respondents in completing the survey questionnaire may have further implications for validity and reliability, such as compromised independence of survey completion, and inconsistencies or biases in the responses. Furthermore, respondents may have felt inclined to please the researchers, potentially providing answers that align with the researchers' expectations.

Given these limitations, it is important not to generalize the findings from the review. However, the paper still offers a valuable review by drawing on the actual experiences of water and sanitation suppliers and the existing literature to highlight various risks and the prevalence of economic viability among these suppliers. Based on this information, several suggestions can be made to enhance the economic sustainability of these businesses.

Water Services Providers

To recap the findings, the top reported risks for water services providers were water pricing and tariff, lack of management skills and capacity, and high investment costs. The most impactful risk factors for economic viability were high levels of water losses, construction delays leading to cost overruns, and high energy costs. These risks were primarily borne by the suppliers but incurred at different levels, including sector, infrastructure, and community levels.

At the supplier level, high investment and operational costs were prevalent financial risks that significantly negatively impacted cash flow. Taking loans from banks is considered a reasonable solution, but it comes with risks if proper loan management is not ensured. Respondents also received financial literacy training and other capacity-building support from NGOs implementing WASH projects. Lowering interest rates is another viable solution to ease the debt burden. On-time water bill payments by users and raising the price of clean water are also suggested to alleviate high operational costs. However, adjusting the price of clean water may be challenging due to government regulations governing pricing. The Covid-19 pandemic disrupted supply chains, and respondents requested assistance in facilitating the import of raw materials.

At the government level, business suggestions include collaborating between levels of government especially Commune Councils and water services providers, to reduce pipe damage, leaks, and water losses during road construction. High investment costs are apparent, and government support in capital investment would encourage water suppliers to invest in rural areas and provide clean water to local communities. High-interest rates on loans are seen as burdensome, prompting the suggestion for the government to lower interest rates. Unreliable power supply and high energy costs are significant risk factors, leading to the need for the government to introduce intervention to reduce electricity costs and promote the use of solar panels. The skills gap in operation management contributes to high operation costs, leading to requests for technical assistance and support in production, trade, and marketing.

Rural populations have limited awareness about the importance of clean water for their health, despite the growth of water services. To address this, respondents propose that the government, in collaboration with NGOS, raise awareness among rural communities about the significance of clean water usage and health.

Sanitation Services Suppliers

The top reported risks for sanitation suppliers were low demand, lack of capital, and household affordability, impacting cash flow and profitability. These risks had a medium impact on viability. Market factors included price variability, low sales, and low-profit margins. Household-level factors included

affordability, limited access to loans, and the influence of subsidies. Bank-level risks included a limited understanding of the sector and high-interest rates.

The most common suggestion to improve economic viability at the supplier level is improved accessibility to obtaining loans or credit, which can help address the financial risks of insufficient capital for daily operations and business growth, contingent on the ability to manage their finances and repay the loan. Training in credit management, establishing linkages with existing credit sources (such as microfinance institutions and suppliers), and fostering communication, coordination, and trust among supply chain actors have been recommended in the literature. Suppliers could also actively seek clients and explore additional job opportunities to diversify their sources of income. Assistance from NGOs or other organizations in financial and business management capacity and water technical skills can be important in improving financial viability.

There are several suggestions at the government level to improve the sanitation sector. Firstly, there is a need to encourage people to use toilets and raise awareness through effective advertising campaigns. This suggestion aligns with the aim of increasing public understanding and adopting safe, hygienic practices, as outlined in the National Strategy for Rural WASH.

Secondly, it is recommended to allocate commune budgets specifically for sanitation work. This approach supports the action plan of advocating for increased government funding and reviewing community contributions. Funding sources include government funds, user contributions, loans, and grants from development partners.

Another suggestion is to provide technical assistance to enhance the capacity of sanitation service providers. This includes creating a competitive environment with transparent contractual relations among user groups, service providers, and local authorities. Access to capital investment and loans can be facilitated through partnerships with microfinance organizations. Developing business and technical skills through training programs and ongoing support for small businesses are also important aspects of this suggestion.

Furthermore, there is a need to collaborate with the private sector and engage with NGOs or organizations involved in WASH development projects. This collaboration can help leverage expertise, resources, and networks to address sanitation challenges effectively.

This paper emphasizes that the financial risks primarily fall on the suppliers involved in delivering water and sanitation services to impoverished and vulnerable households in rural Cambodia, despite the presence of various stakeholders in the water and sanitation value chains. It notes the importance of considering multiple factors and their interconnectedness when assessing the businesses' overall financial health and viability. The suggestions put forth aim to tackle challenges at both the business and government levels, aiming to encourage latrine usage, allocate appropriate funding, offer technical support, foster a competitive environment, and enhance awareness of WASH and health. They aim to improve the sustainability of WASH suppliers, thereby contributing to the overarching objective of attaining comprehensive WASH coverage as outlined in Cambodia's National Strategy for Rural WASH.

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