sevea

ACCESS TO DRINKING WATER IN RURAL CAMBODIA

CURRENT SITUATION AND DEVELOPMENT POTENTIAL ANALYSIS

MAY 2017

ABOUT SEVEA

Sevea is a consulting company offering strategic and operational support to Corporations, Organizations, Governments and Social Entrepreneurs that seek to develop their impact strategies in the Water & Energy sector in developing countries.

To achieve these goals, Sevea works on two main fronts. A first axis of intervention is a support to small entrepreneurs at all stages of their development, from incubation to scaling up and optimization. A second one is working hand in hand with corporates, NGOs or international donors from concept development to implementation, conducting among others feasibility or sectorial studies, PMO, monitoring and evaluations. Its objective is to advise and assist the people that bring tangible answers to environmental and social issues.

Sevea works closely with its clients to create, develop and ensure lasting social & environmental impact through market-based approaches. It combines its business acumen with a deep understanding of energy, water and Bottom of the Pyramid (BOP) issues to help the sectors – from grassroots to institutional levels- in Cambodia and developing countries around the globe through a Fact-Based, Result Oriented and Holistic approach.

Sevea's final goal is to put its technical and management expertise at the service of those who strive for good causes in order to rethink, improve the quality and maximise the impact of the answers (from an environmental, an economical and a social perspective) brought to Energy and Water issues in developing countries.

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ABBREVIATIONS

3i	Investing in Infrastructure
ADB	Asian Development Bank
AFD	Agence Française de Développement
ASEAN	Association of the South-East Asia Nations
B2B	Business to Business
BAU	Business As Usual
CAPEX	Capital Expenditures
CBO	Community Based Organization
CC	Commune Council
CSES	Cambodian Socio-Economic Survey
CWA	Cambodia Water Association
DPSP	Domestic Private Service Provider
DPWS	Department of Potable Water Supply
ESSAP	Empresa de Servicios Sanitarios de Paraguay
FTB	Foreign Trade Bank
DRWS	Department of Rural Water Supply
GDP	Gross Domestic Product
HH	Household
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
iSEA	Innovative Services Engineering & Advisory
JICA	Japanese International Cooperation Agency
JMP	World Health Organization and UNICEF Joint Monitoring Program for Water Supply and Sanitation
KAP	Knowledge Attitude and Practices
MDG	Millennium Development Goals
MIH	Ministry of Industry and Handicraft
MIME	Ministry of Industry, Mines and Energy
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MoE	Ministry of Environment
MoH	Ministry of Health
MoP	Ministry of Planning
MoU	Memorandum of Understanding
MOWRAM	Ministry of Water Resources and Meteorology

MPWT	Ministry of Public Works and Transport
MRD	Ministry of Rural Development
NAP	National Action Plan
NAPA	National Adaptation Program of Action
NGO	Non-Government Organization
NRDWQG	National Rural Drinking Water Quality Guidelines
NSDP	National Strategic Development Plan
OBA	Output-based Aid
OPEX	Operational Expenditures
PAP	Provincial Action Plan
PDIH	Provincial Department of Industry and Handicraft
PDRD	Provincial Department of Rural Development
PIN	People In Need
PPWSA	Phnom Penh Water Supply Authority
RGC	Royal Government of Cambodia
RWSS	Rural Water Supply and Sanitation
RWSSH	Rural Water Supply, Sanitation and Hygiene
SDG	Sustainable Development Goals
SENASA	Servicio Nacional de Saneamiento Ambiental
SNCCCC	Second National Communication on Climate Change in Cambodia
SRWSA	Siem Reap Water Supply Authority
UN	United Nations
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
TS1001	Teuk Saat 1001
TWG	Technical Working Group
WASH	Water, Sanitation And Hygiene
WB	World Bank
WHO	World Human Health
WMC	Water Management Committee
WSA	Water Supply Authority
WSP	Water Service Provider
WSUG	Water and Sanitation User Group

EXECUTIVE SUMMARY

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Introduction

Following the Millennium Development Goals (MDG) and Sustainable Development Goals (SDG), the Cambodian government has set for the country some ambitious access to water objectives:
"Universal access to Improved water by 2025" & "Universal access to Safe water by 2030".

Within the current Cambodian context, the objectives are, from the words of the Ministry of Rural Development (MRD), unlikely to be reached. Indeed, still recovering from the disastrous consequences of the Khmer Rouge regime, Cambodia is currently ranked at 165th place in terms of access to improved water in the world, despite a record growth rate in the field since the 90's. The current 54% of the population with access to improved water at national scale are what's more unequally distributed. The urban population, which represents only 20% of the total population, has an access rate of 83%, while the 80% that live in rural areas have an access of a mere 47%, and are still not a priority target for the government.

It is therefore essential to understand where current tendencies lead in terms of access to water, especially in rural areas, and if and how current actors and solutions are working together towards these objectives of universality.

Access to water is, among other things, a mean for a significant health impact. Thus, assessing in compliance with SDG objectives if the country can overtake universal access to improved water and aim at an access to safe water is also of critical importance. This huge step represents an even tougher challenge as the WHO/UNICEF Joint Monitoring Program evaluated that less than 10% of the Cambodian population has currently access to safe water.

Different innovative solutions, from small private operators who took the matter into their own hands to a widespread model of community water kiosks, are already impacting a growing number of lives. It is nevertheless a safe bet to think that, through a real optimization of their actions and targeted support programs, these impacts could be truly amplified providing real solutions to the drinking water challenge in rural Cambodia.

About this report

Within the framework of the government of Cambodia national strategy, this report, requested by 1001 Fontaines pour Demain and financed by the Stones Family Foundation, has for main objective to bring a new perspective to all the concerned actors on how to tackle the deficit of access to drinking water in rural areas when factoring the parameters of quality, speed of coverage and connection.
In that regard, this study aims to provide a fact-based analysis of the current status and perspectives of the various drinking water offers in rural Cambodia. To do so, it reviews the national water landscape of Cambodia, before assessing and comparing different actors, questioning their complementarity, relevancy, effectiveness, efficiency, sustainability and quality of water at the point of use. Finally, it projects the effect of different combinations of solutions' development and try to evaluate how to best optimize the water suppliers' development to best answer to the government's targets.

A few definitions

To talk about drinking water supply in Cambodia, several concepts have been defined and used in this study:

- **Types of areas:** Urban, Semi-rural, Rural[1]
- **Types of access:** Improved water, Safe Drinking water, Upgraded water access[2]
- **Types of people reached:** likely to be covered, covered, served[3]
- **Types of areas according to the ease of doing business in the water sector:** Viable, Challenging, Non-viable[4]

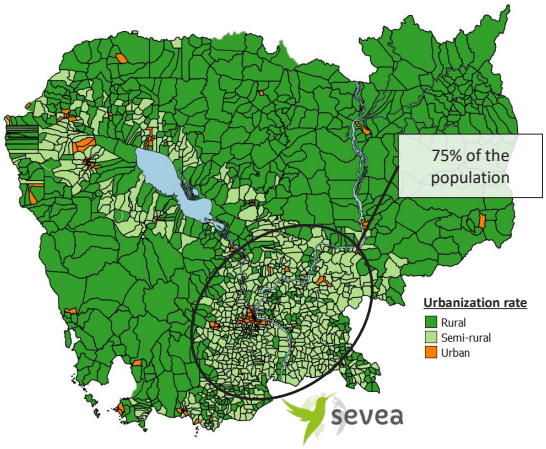

Figure 1: Urbanization in Cambodia

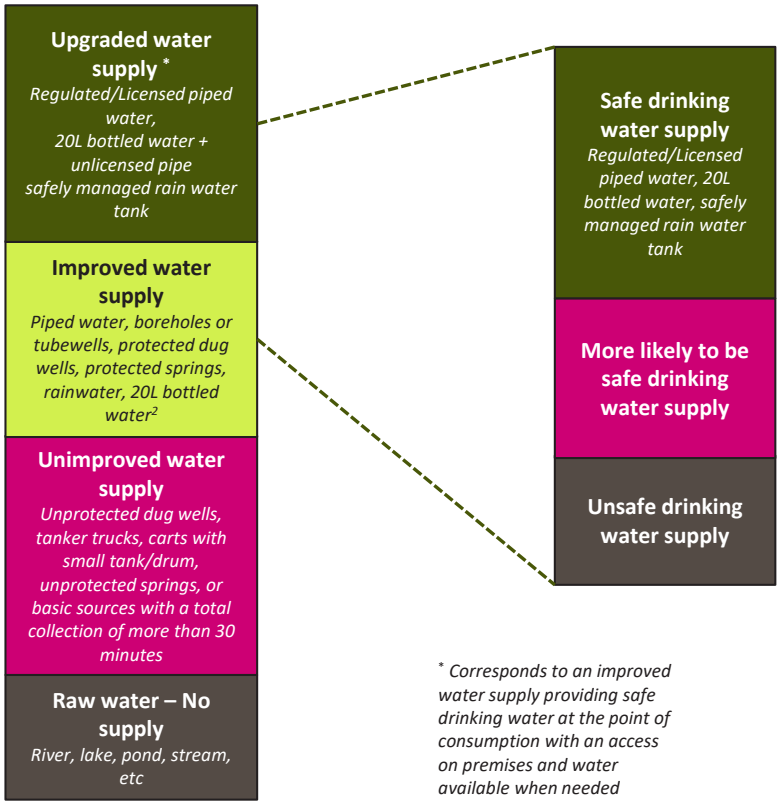

Figure 2: Water supply ladders [Mostly based on Sustainable Development Goals definitions]

1. "Semi-rural areas": rural areas with a high population density center. This type of areas presents characteristics that are closer to the ones of low urbanized areas and account for more than a half of the country's population.
2. Derived from the MDG and SDG, "Improved drinking water access" is considered a water supply solution that offers access to a water source which is "more likely to be safe", "Safe drinking water access" is when the water is safe for drinking at the point of consumption; "Upgraded drinking water access", is when the water is distributed both in quality at the point of consumption and in sufficient quantity to cover all domestic essential needs (44 liters per person per day)
3. "Likely to be covered" people are defined as people who live in an area where the water supply system is implemented but do not belong to its coverage area, 2) "Covered" people are defined as people living in the actual coverage of the existing water supply; and 3) "Served" people are the beneficiaries/customers of the water supply
4. "Viable areas" where it is possible for the private sector to invest and run a water supply business in a viable and sustainable way, covering also the initial investment cost, "Challenging areas" where operations are viable but the initial investment is too high to be recovered, "Non-viable areas" where operations are not economically viable

Access to Water in Cambodia

Defining various accesses to water brings widely different access rates. While rates are consistent for urban areas, where the 83% improved water rate translates into a 74% safe and upgraded access rate, they are much more deceitful for semi-rural and rural areas. In rural areas, the 15% access to improved water is three times the access rate to safe water (5%). Even more duplicitous is the one in semi-rural areas, where a 62% access rate to improved water hides a mere 8% access to safe water.

Logically, similar trends can be observed for upgraded water access with even less people served due to the higher constraint of providing water not only of quality but also in quantity.

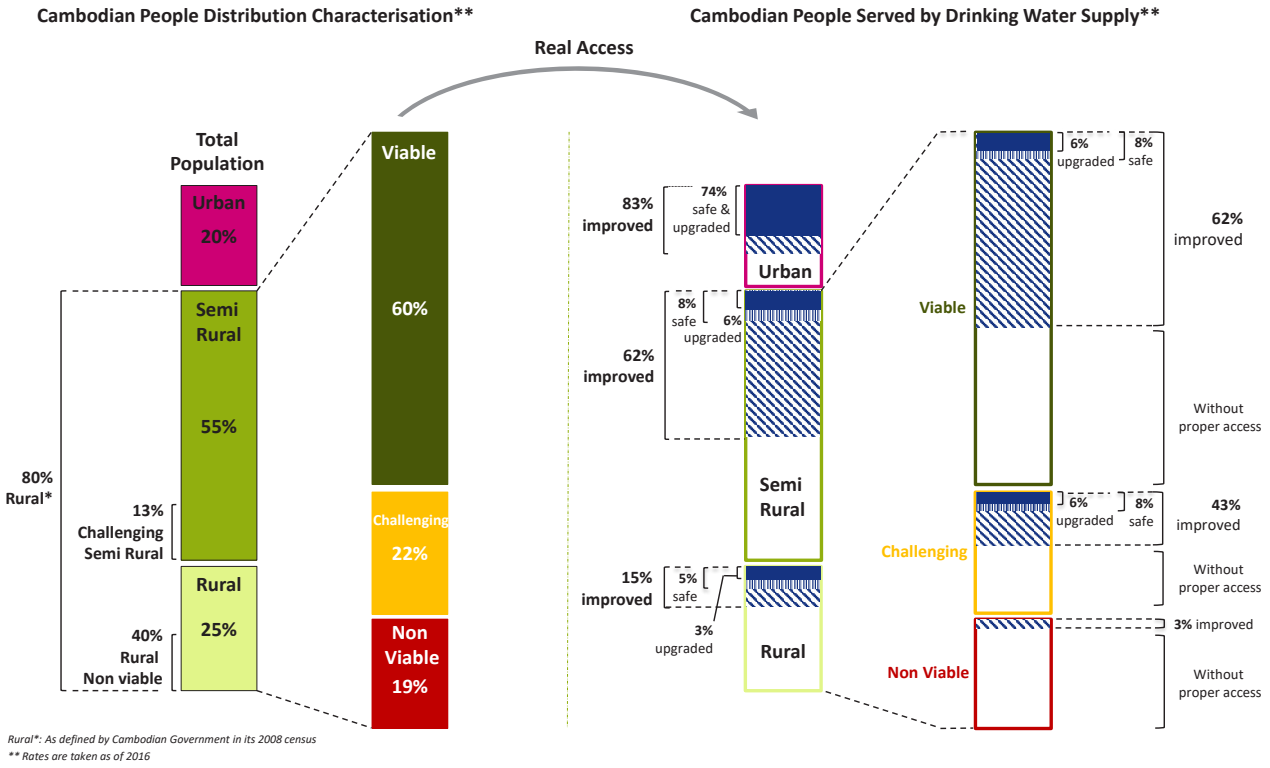

Figure 3: Estimated water access coverage rates per level of water access and type of areas

Translating these percentages into figures, the situation in rural areas is as follows:

Table 1: Safe drinking water access, current situation in Cambodia

Semi-rural areas – 8.1M people - 70% of total rural areas	
12% of semi-rural people are **covered** by safe drinking water supply solution 8% of people living in semi-rural communes are **really supplied** by a safe drinking water supply solution 24% of people in need living in semi-rural communes **can be covered by intra-communal expansion** of existing safe drinking water supply solution	Out of the estimated 8 million people living in semi-rural areas, • Less than 1 million of semi-rural people are really beneficiating from safe drinking water supply (i.e. people drinking 20L bottled water and/or connected to a pipe safely managed). ⇨ **7.5 million people without access to water (People In Need - PIN) are living in semi-rural areas and for a vast part, could be addressed with market-based solutions.** • Only 1 person out of 8 is currently living in the coverage area of a safe drinking water supply. The remaining people still don't have the possibility to use such services. • More than 1 semi-rural person out of 2 still lives in a commune where there is no solution of safe drinking water supply. ⇨ **On the opposite, almost 2 million people (25% of semi-rural PIN) can be reached through a "simple" expansion of the existing supply coverage area inside the commune.**
Rural areas – 3.7M people – 30% of total rural areas	
11% of rural people are **covered** by a safe drinking water supply solution 5% of people living in rural communes are **really supplied** by a safe drinking water solution	Out of the estimated 3.7 million people living in rural areas, • Only 5% are really beneficiating from safe drinking water supply (i.e. people drinking 20L bottled water and/or connected to a pipe safely managed). ⇨ **More than 3 million people in need are living in rural areas and will be hard to address through 100% commercial drinking water supply solutions.** • 75% of people are still living in a commune where there is no solution of safe drinking water supply. ⇨ **Only half a million people in rural areas can be reached through a "simple" expansion of the existing supply coverage area inside the commune.** ⇨ **For about 80% of people in need in rural areas it will require new implementation of safe drinking water supply or extra-communal expansion to be covered**

Overall, at least 11 million people still live today without access to a proper safe drinking water supply. 70% of them live in semi-rural areas.

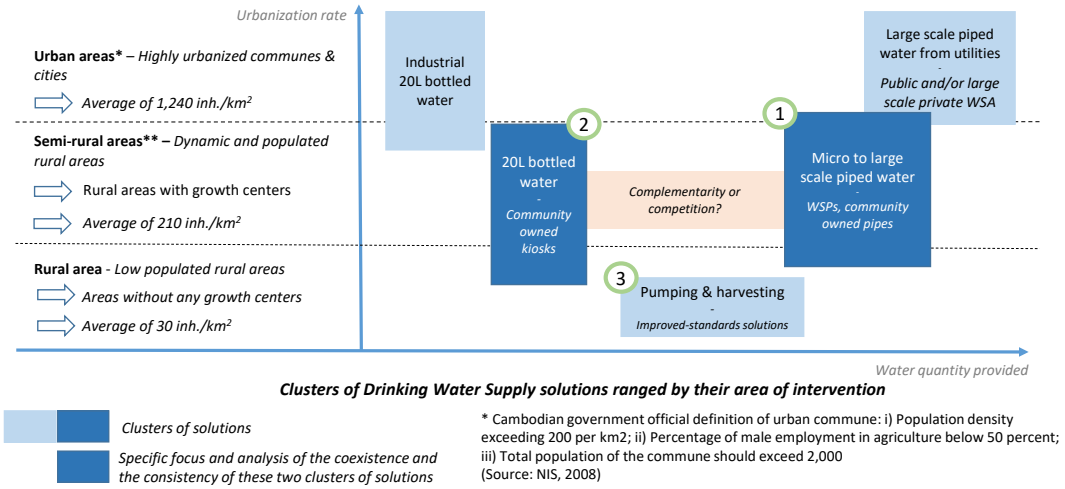

Figure 4: Clusters of water supply solutions in Cambodia - Scope of the study

Solutions & Actors: How are they answering to the water access needs of rural areas of Cambodia?

After having identified 3 clusters of solutions operating in rural areas, two turned out to be of enough potential to be considered key drivers of water access development while also in compliance with the ultimate objective of providing safe drinking water. These solutions are piped water supply operated by private Water Service Providers (WSP) and 20L bottled water distributed through community owned kiosks such as Teuk Saat 1001's (TS1001) model of intervention[1].

Overview of the 2 main solutions from Cluster 1 and Cluster 2

TeukSaat 1001, a community based model strengthened on multiple levels to deliver bottled water

TS1001 is a NGO that works to implement water kiosks around the country to sell 20L bottles of water. These local kiosks are managed by a local entrepreneur chosen and trained by TS1001. As of now, they have 154 active kiosks that deliver water to a total of 300,000 of beneficiaries. For their distribution, TS1001 delivers their own brand of water, called O-We and work through 3 distribution channels: They provide home delivery on a maximum two days basis, work with local resellers and sell bottles directly at the station. The price of their O-We bottles is fixed directly by the headquarters, at a price of KHR 1,500 per bottle when home delivered or KHR 1,200 when the bottle is bought directly at the station.

TS1001 made the choice to concentrate on drinking water bearing in mind the health impact of their presence. An access to 1.5 litres of daily quality water for drinking is indeed enough to have a direct consequence on the health of beneficiaries.

Water Service Providers, a panel of private actors under increasing government control working to provide piped water

WSP, or Water Service Provider, is the name given to different actors that manage a piped water network delivering water on premises at a communal scale. They are a true Cambodian specificity. These actors generally work on a same overall model: They are private entrepreneurs who manage their own business, meaning they oversee their production facility (for pumping and treating the water) and pipe network. There are around 400 of these operators, operating in approximatively 600 communes that represent almost 6 Million people. This coverage translates, in rural and semi-rural areas, into 2.2 Million of covered people and, with an average connection rate of 47%, 1 Million of direct beneficiaries. They usually sell their water at a price around 2,200 KHR/m^3. The term WSP encompasses a large panel of actors that can be divided according to the following relevant factors:

1. Model including home delivery

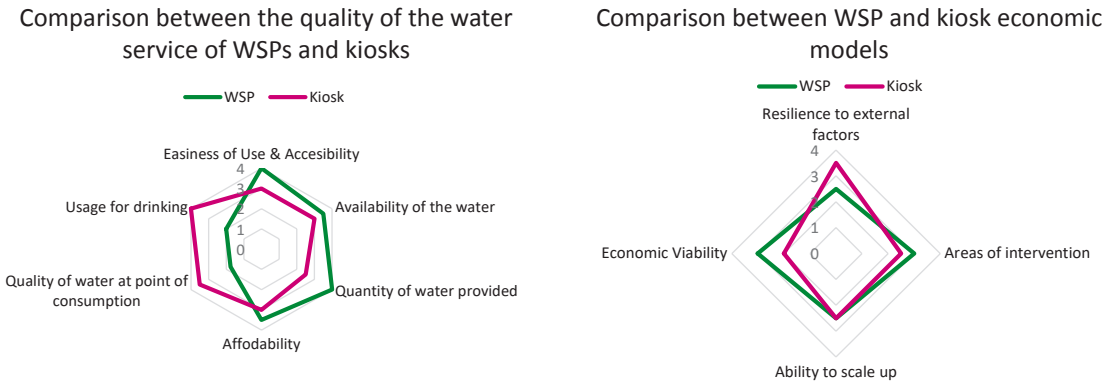

Figure 5: Comparison of strengths and weaknesses between WSPs and TS1001 model

- ***Licensed or unlicensed*** - Unlicensed operators, who often operate on small scales and without any regulation, can rarely be trusted as an actor of safe water access. On the contrary, licensed operators can increasingly be considered as a safe water source for consumption and household use.
- ***their size*** - Small WSPs, with less than 1,500 connections (70%), medium WSPs, with a number of connections ranging from 1,500 to 3,000, and large WSPs, with over 3,000 connections.

After the in-depth analysis of these two solutions, different strengths and weaknesses have been identified. The two diagrams above sum-up some of the assessment key factors results.

Quality versus Quantity: As a targeted drinking water model, kiosk water's main advantages are to be found in terms of quality. Its water is meant to be used for drinking, and as such the main point is to ensure perfect quality. On the contrary, WSPs, who are seen as a convenience, concentrate more on the quality of the service surrounding the delivery of water itself. It is cheap, available on premises all day and in unlimited quantity.

Affordability: For both solutions, the tariff is not considered an issue by the customers. For WSPs, once accepted the barrier of paying for one's water, the average monthly consumption fee of US$ 5.4 is seen as reasonable. On the contrary, the initial connection fee of US$ 70 can be more of a barrier. For TS1001, even if bottled water is far more expensive, its perception does not reflect that difference. People who consume O-We find its price reasonable, with an average monthly expense of US$ 5. As for those who do not drink it, the price is not a common source of dissuasion. The main barrier mentioned by households is the price of the first bottle (KHR 12,000), despite it not being a major economic constraint.

Areas of intervention: Both solutions target the same profile of communes, mainly semi-rural communes, with a high enough human density and an easily available water source.

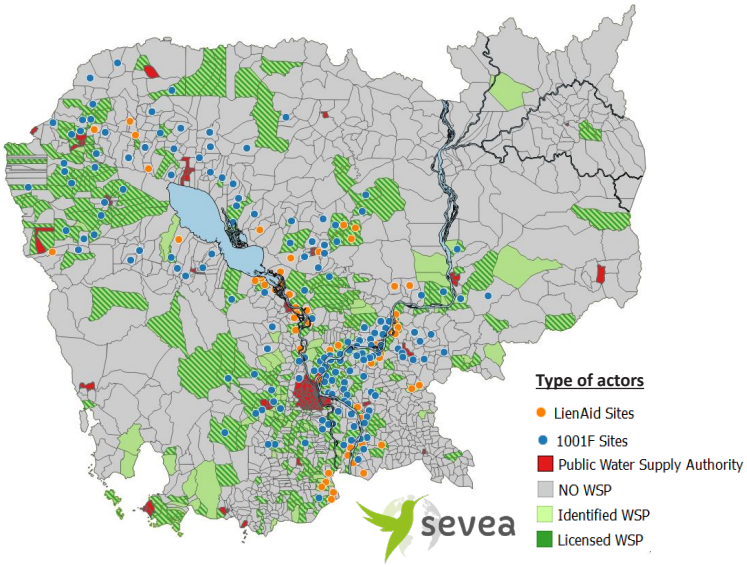

Figure 6: Mapping of drinking water actors in Cambodia

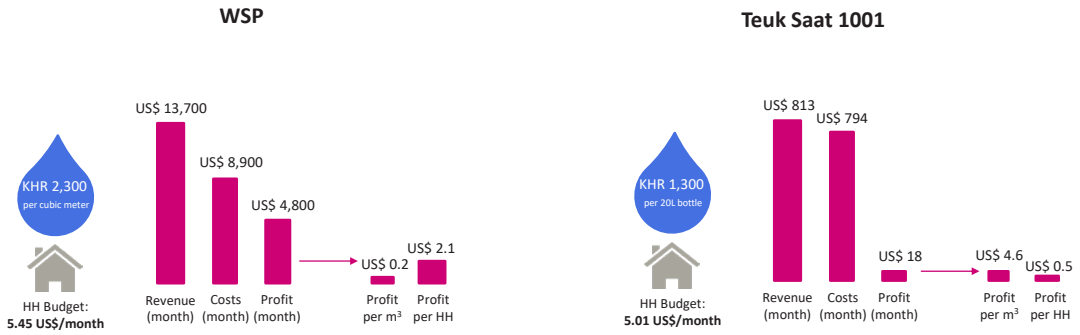

Figure 7: Economic aspects of water solutions

Economic viability: As of now, WSPs thrive on private investments with little outside help while TS1001 kiosks are still dependent on NGO funds. As such, the WSP model can be considered less dependent on outside support and thus more robust.

Ability to scale-up: WSPs, as independent actors, can scale up by extending their reach within their commune and to other communes. If kiosks independently have the potential for scaling up only within their catchment area, there is a perpetual scaling up at firm scale, with TS1001 (who, as of today, represents the majority of the kiosk sector) opening currently more than 30 stations each year. With different arguments, both actors finally reach similar abilities to scale up in terms of new beneficiaries (over the last 5 years, +220,000 beneficiaries for WSPs and + 250,000 for TS1001)

As actors of two different solutions, access to upgraded water and access to safe drinking water, both TS1001's water kiosks and WSPs have a role to play in the development of access to water in rural Cambodia. In the semi-rural communes of Cambodia, which represent more than 70% of the rural population and 55% of the total population of Cambodia, both are a possible answer to the issue of water access. Through parallel development inside covered communes and to uncovered one, they have a pool of several millions of potential clients inside favorable zones, those that are densely populated and show an easy water access.

However, both solutions present fundamental differences: Community kiosks are easier to invest into, boast as of today a better quality than piped water, and can reach through its model more isolated households. It is however limited in its penetration, which is in average not expected to grow over 40%. Piped water has the advantage of being cheaper for the end user, available when needed in unlimited quantity, and of having the capacity to reach close to full penetration rates. It does, on the other hand, still raises concerns about its quality, and especially necessitates much larger investment amounts. The fact that this amount needs to be covered mostly by the private sector makes it easier to reach, but is still a major brake to its expansion.

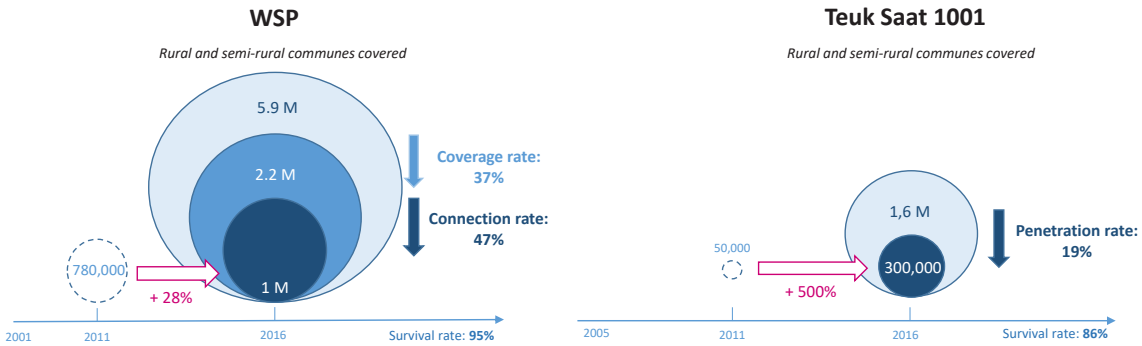

Figure 8: Evolution of the number of beneficiaries in rural and semi-rural areas

In the end, both solutions are more complementary than they are in competition. Especially because currently and for the coming years, WSPs will clearly not be able to follow the development trends needed and deliver a safe drinking water service, at the exception of large WSPs (and, to some extent, medium ones). The others will have to put a lot of efforts to reach this level of quality and reliability. This will take resources (mainly on capacity building, quality control, etc.) and time. In addition, even when acting in the same area, WSPs and kiosks each bring a different but crucial added value in terms of water health related impact. The limit of this complementarity is when kiosks are implemented in areas with large WSPs, already sufficing in terms of water access and quality. The relevance of this complementarity is particularly true in challenging zones. There, the WSP model is harder to transpose because of the higher investments it would need whereas the kiosk model is a low cost solution for the impacts it can bring.

What trend for tomorrow?

How realistic the government targets are?

When doing the exercise of projecting the evolution of access rates according to different target scenarios, the inflections required to reach both "universal access to improved water" and "universal access to safely managed water" are considerable. Indeed, according to the Ministry of Rural Development (MRD), in 2012, only 42% of Cambodian population had access to an improved drinking water source. In the National Development Plan, Cambodian government set ambitious targets to drinking water access. The plan aims to reach 60% of improved drinking water access rate in 2018 and a universal access in 2025. This would mean an improvement of 4% per year between 2013 and 2018 and of 6.5% per year after 2018. In other words, last years, 300,000 additional people gained annually access to an improved drinking water source. The target set for 2018 and 2025 would mean to reach yearly respectively 500 000 people and 1 million people per year.

So, even though Cambodia is a country with a unique and particularly dynamic situation in its access to water sector, reaching the government's targets by 2025 seems highly questionable.

The same results appear for the evolution of the access rate to safe drinking water. If the same speed of development as improved water is adopted, universal access to safe drinking water would be achieved only in 2100. This would be far away from the government's objective of 2030.

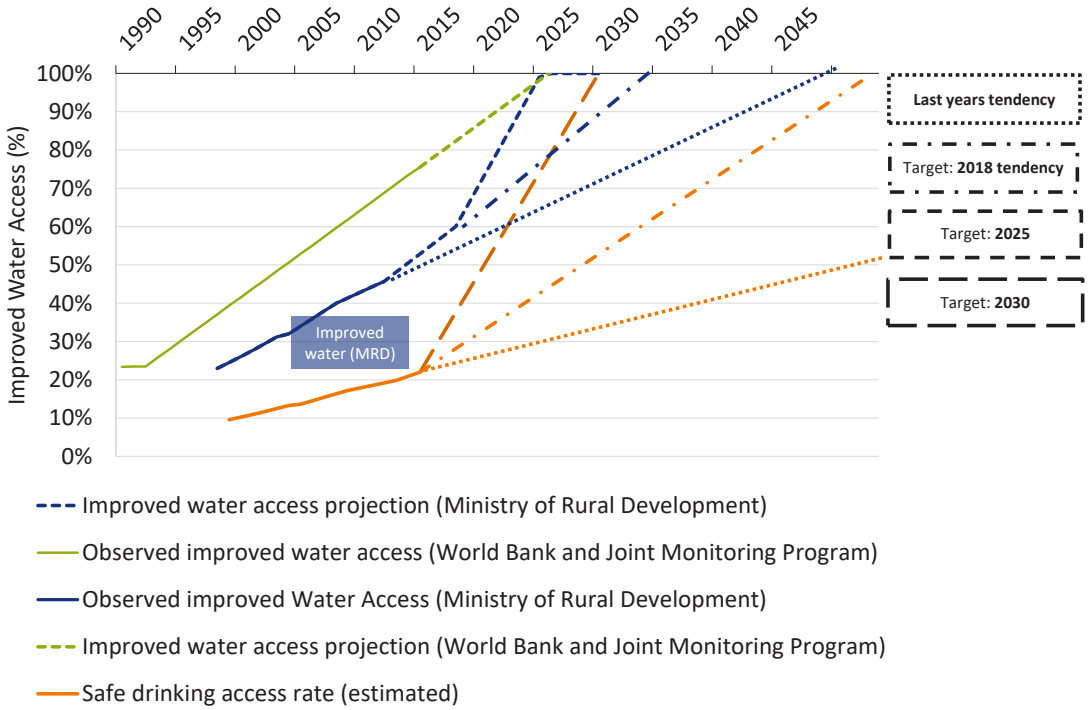

Figure 9: Evolution water access rates

Scenarios of main access to water solutions' development in rural areas and their respective budget estimations

It has been estimated that to follow the current trends of development (BAU scenario), a total budget US$ 123M over the next 15 years would be required, among which US$ 1.1M/year of public investment. With this, only 75% of people in rural areas could get covered by an improved water supply (51% by safe drinking and 30% by upgraded). The current trends are therefore far from being sufficient to reach universal access to improved water by both 2025 and 2030. In comparison, the World Bank estimated in 2015 that a yearly US$ 32 Million were needed to meet a 100% improved access coverage rate before 2025, which represents an investment of US$ 21 per new capita.

At the opposite, providing the largest access to safely managed pipe, would require an overall budget of US$ 604M, representing a yearly investment 10 times higher than in the BAU scenario (additional US$ 9/10M per year). With this 100% people in rural areas would have access to improved water, 83% to safe drinking and 83% to upgraded drinking water. This scenario is however highly unlikely.

In between, other scenarios have been modelled. The results are interesting as they show that an efficient and realistic way to leverage the sector's strength would be to operate a change of policy from improved water towards safe drinking water combined with targeted support programs.

With the addition of a well targeted US$ 1M budget per year, the level of rural people covered by an improved water supply could reach 90%, among which 70% could get access to safe drinking water.

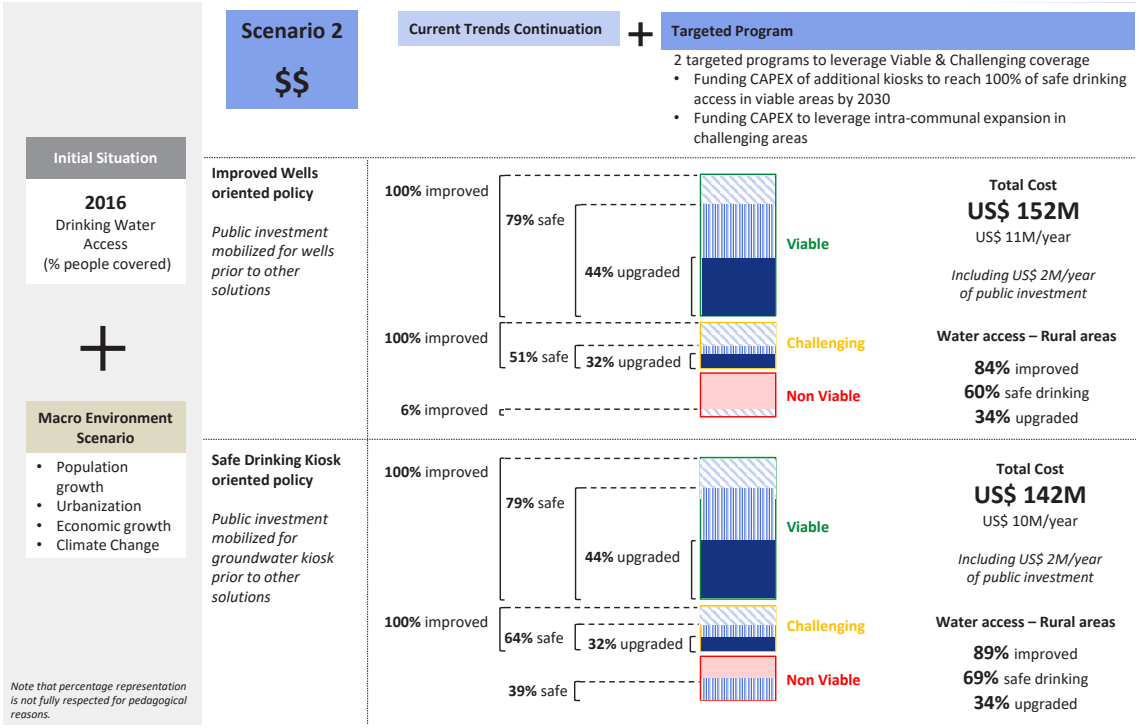

Figure 10: Drinking water access situation in rural areas by 2030 (% people covered) - Results of prospective scenario 2, current trends continuation and additional targeted programs

Conclusion

Recovering from the Khmer Rouge rule that put the country near to nil, the current 54% of access to improved water in the country is the result of 25 years of efforts that made Cambodia the fastest growing country in the world in terms of water access increase. This access rate is nevertheless unequally distributed: The urban population, which represents only 20% of the total population, has an access rate to improved water of 83%, while the 80% that live in rural areas have an access of a mere 47%. To reach the ambitious government access to water objectives: "Universal access to Improved water by 2025" & "Universal access to Safe water by 2030", the main challenge lies therefore in tackling the water issue in rural areas. So far, the 2 main ministries in charge, the Ministry of Industry and Handicraft (MIH) responsible for all commercial solutions of water access and the Ministry of Rural Development (MRD) responsible for all community based or other non-commercial solutions, have relied heavily on both private investment and private or non-governmental initiative to tackle the water issue in rural areas. Indeed, donor/government funded non-commercial pumping & harvesting solutions (protected wells, rain water harvesting...) have proved themselves far from sufficient to tackle alone the water issue in rural areas. With a limited governmental budget, Cambodia is fortunate to host two real and unique specificities among the global rural water sector: 1) its thriving network of small & independent private water service providers (WSP) that have naturally emerged and currently provide water through pipe networks to more than 1M end-users, and 2) its young but important network of 20L bottled water community owned kiosks that already provides water through a delivery service to more than 300,000 rural end-users. These two types of actors have been so far very effective in reaching new beneficiaries as they have enabled within the last 5 years the provision of improved water to 8% of the total unserved population. This established, with the universal objectives of the government in mind, several aspects remained to be clarified: 1) the capacity of these actors to cover all rural areas, 2) the quality of the water and service provided, 3) the level and nature of actors' interactions, 4) their capacity to scale-up and 5) the actions required to maximize access to water.

In terms of water quality and service, the range proposed is very broad: from small unlicensed WSPs that provide 65 L/day of untreated surface water per person to bigger licensed WSPs providing 77 L/day of healthy water to an average beneficiary in terms of piped water, but also bottle water kiosks that provide 1.5 L/day of healthy water. As a whole, only bottle water kiosks and large WSPs can be currently considered as safely managed drinking water solutions. In addition, even when fully drinkable, WSP's water is seen more as a commodity than a source of drinking water and as such, is barely used for drinking prior to other usage.

In terms of coverage, there is still room for further expansion. Currently both solutions mainly target more densely populated rural communes with sufficient access to raw surface water (viable semi-rural areas), which fortunately host the majority of the overall rural population. However, in these viable zones, only 8% of the people are currently being supplied by safe drinking water solutions. This also means that people living in viable rural areas but not supplied by a safe drinking water solution represent 60% of the total unserved rural population, highlighting the massive potential of market-based solutions to tackle water access issues.

In terms of potential to increase access levels, existing operators are a first and major lever that could allow to rapidly reach new populations. Indeed, as of now water operators have an average communal penetration rate of around 20% only. To extend their supply to this vast majority still unserved but easily accessible, they can work through two means of action. On one hand, they can work on their coverage rates, to ensure that everyone has the possibility to become a client. On the other, they can work on their connection rates, to ensure that people inside coverage zones do become real clients.

Concerning actors' interactions, two timeframes must be distinguished and considered. Until the 2020 horizon, kiosks are not in competition with most WSPs. They are rather providing complementary services to people. The study draws up many complementarities to reach both quality and

quantity water access when supplementing a small WSP (which still represent today 70% of all WSPs). For larger ones, the complementarity of their service with kiosks is much more questionable since they manage to reliably provide quality water. On a post-2020 vision, due to the encouraging current trends of regulation, business and quality improvements within the WSP's sector, it can be assumed that every licensed WSPs will safely manage their water supply. Thus, the optimum articulation between pipe and kiosks' solutions would be a post-2020 development of kiosks focusing only on unlicensed WSPs or non-covered communes.

Following the last 5 years' trends and including the current policies of the two ministries, the projected situation of rural water access situation by 2030 could be modelled as follows:

- 75% of improved access (people covered by wells, kiosks and or WSP)
- 50% of safe drinking access (people covered by kiosks and/or licensed WSP)
- 30% of upgraded access (people covered by a licensed WSP)

Thus, without any additional supporting program, reaching universal access to improved water source by 2025 seems unlikely. Furthermore, 50% of rural people could remain left apart from safe drinking water access. Therefore, although the natural capacity of development of both WSPs and kiosks is significant, it will not be sufficient to reach universal access in rural areas.

Based on the results from the modelling exercise, the following principles could be adopted to maximize the impacts of water access:

1. Going further than basic improved access especially when safe water access solutions can be implemented;
2. Favoring market-based solutions when they are fully or partially feasible.

Water supply through licensed WSPs should therefore be favored whenever feasible. When not feasible, the priority should then be given to bottled water solutions that for now only encompass the kiosk model but which distribution models could be diversified with the development of the sector. Thus, with a combination of targeted public and private investments and a change of policy favoring quality over quantity, significantly higher levels of access could be achieved.

For example, with US$ 1M of additional public investment per year and a more targeted strategy, that would devise preferences by area such as:

- In viable zones, the promotion and fostering of piped water and bottled water.
- In challenging areas, in already covered zones, the support of existing WSPs in their scaling up process. For uncovered zone, a support favoring piped or bottled water – whichever is more relevant- over wells.
- In non-viable zones, the promotion of market-based solutions when feasible (in this case kiosks), with wells for the remaining zones since it is the only suitable solution for most isolated areas.

The situation by 2030 in rural areas could be of 100% of improved access and 70% of safe drinking access, 34% of upgraded access.

To conclude, 3 priorities can be highlighted to reach sectorial objectives both in numbers and in quality within the desired time frame.

3. **Increasing the penetration rate of existing covered zones both for piped and bottled water solutions**. This would allow an increase of the number of actual beneficiaries and a strengthening of the viability of supplying solutions, especially as 5 Million people without safe water access live in communes with WSPs.
4. **Tackling pipe licensing issues & and further compliance with regulations when necessary**. For every WSP that faces critical barriers to apply & comply with the new MIH regulation conditions (especially the 90% of the commune covered within 3 years and water quality requirement) adapted supporting actions should be implemented.
5. **Matching each solution with its optimum impact and fostering the bottled water model when best adapted**. To enable this, an initial mapping of all national resources -both human and natural- to allow informed targeted action would be required. Furthermore, the development of bottled water solutions should be, whenever viable, favored to that of wells, as it ensures a safe access and sustainable access for a minimal cost.

Recommendations

Taking into account these priorities, a number of recommendations have been laid out to try to best meet all of the government objectives.

Table 2: Recommendations

Category	Description	Easiness	Cost	Impact	Priority
A. Increasing the penetration rate of existing solutions	A.1 OBA (Output-based Aid) programs to support connection fees (piped water) or first bottle purchase (bottled water) for poor households in order to increase penetration rates	Easy	Low	High	P1
B. Supporting WSP with potential but facing difficulties for scaling up	B.1 Technical and financial support for small WSP to allow a scaling-up of these operators in order to attain quality standards and reach more beneficiaries	Hard	High	High	P2
	B.2 Studying the feasibility and profitability of renewable energy installations for WSPs in order to decrease operating cost and reduce environmental impacts. Devising ensuing action plan	Easy	Low	Low	P1
	B.3 Encouraging a shift in investments in order to support either bottled water suppliers or licensed WSPs prior to wells in viable and challenging zones.	Easy	Medium	High	P2
C. Matching each solution with its optimum impact area and fostering the bottled water model when best adapted	C.1 Developing groundwater fed kiosks in Arsenic-free challenging zones to guarantee a safe water access	Hard	Medium	High	P2
	C.2 National study on water resource and availability to better map viable and challenging zones and have a more targeted action plan on supporting different solutions	Medium	Low	Medium	P1
	C.3 Reflection on the future of communes where present operators will not be able to meet official requirements and following action plan	Medium	Low	Medium	P3
	C.4 Studying how to scale-up the bottled water distribution in rural areas taking into account the existing actors (kiosks, family businesses and regional companies)	Medium	Low	Medium	P1
	C.5 Diverting wells implementation from viable zones to challenging ones as to stop competing with commercial solutions & focus on populations in non-viable zones	Easy	Medium	Medium	P1


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ABOUT THIS REPORT

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Objectives and scope

Within the framework of the government of Cambodia national strategy, this report, requested by 1001 Fontaines pour Demain and financed by the Stones Family Foundation, has for main objective to bring a new perspective to all the concerned actors on how to tackle the deficit of access to drinking water in rural areas when factoring the parameters of quality, speed of coverage and connection.
In that regard, this study aims to provide a fact-based analysis of the current status and perspectives of the various drinking water offers in rural Cambodia. To do so, it reviews the national water landscape of Cambodia, before assessing and comparing different actors, questioning their complementarity relevancy, effectiveness, efficiency, sustainability of the access and quality of water at the point of use. Finally, it projects the effect of different combinations of solutions' development and try to evaluate how to optimize the water suppliers' development in order to best answer the government's targets.

Armed with the result of this study, both private actors, governmental officials and international donors should be able to anticipate the market development of the drinking water access and find its best positioning/targeted support on this market in Cambodia.

A few preliminary considerations for the reader

In a pragmatic approach, the authors of this report have developed several new concepts. This seemed necessary to fit as closely as possible to the specific context and needs of the access to water sector in Cambodia and to be able to come-up with realistic and applicable recommendations.

These new concepts differentiate:
- Levels of access to water
- Types of areas in Cambodia
- Types of coverage levels
- Quality of drinkable water
- Types of areas with a specific level of difficulty of doing business in the water sector in Cambodia

The new concepts of levels of access to water used in this study are based on the United Nations definitions of an "**access to an improved water source**"[1] introduced in the Millennium Development Goal (MDG) 7 and of "**safely managed water services**"[2] introduced in the Sustainable Development Goal (SDG) 6. Throughout this study, access to water is therefore qualified:
- Either as "**Improved drinking water access**", defined by the capacity of a water supply solution to offer access to a water source which is "more likely to be safe". (Level 1)
- Or as "**Safe drinking water access**", defined by the capacity of water suppliers to distribute safe drinking water at the point of consumption. (Level 2)
- Or finally as "**Upgraded drinking water access**", defined by the capacity of water suppliers to distribute both safe drinking water at the point of consumption and water in sufficient quantity to cover all domestic essential needs (44 liters per person per day). (Level 3)

Because of the huge disparities of access levels between urban (83%) and rural areas (47%) and the fact that 80% of the population leaves in rural areas, the authors of this study have decided to focus their analysis and recommendations on where most of the challenges lie: in rural Cambodia.

Nevertheless, to translate the reality of Cambodian rural areas, the mere concept of "rural" was not sufficient. The authors have therefore taken the liberty to introduce another new concept: "**Semi-rural areas**". These semi-rural areas are considered by the government of Cambodia as rural areas but are areas hosting a center with a high population

1. An "improved drinking-water source" is one that by the nature of its construction adequately protects the source from outside contamination, in particular from fecal matter. Source, WHO/UNICEF JMP
2. Access to an improved drinking water source which is located on premises [Accessibility], available when needed [Availability] and free of fecal and priority chemical contamination [Quality]

density. This type of areas presents characteristics that are closer to the ones of low urbanized areas and account for about 55% of rural communes and more than a half of the country's population.

To assess the current level of coverage or potential of each solutions reviewed in this report, the authors have defined 3 levels of coverage:

- "**Likely to be covered**" people are defined as people who live in an area where the water supply system is implemented but do not belong to its coverage area.
- "**Covered**" people are defined as people living in the actual coverage of the existing water supply.
- "**Served**" people are the beneficiaries/customers of the water supply (i.e. people who use the access).

To be able to compare the different qualities of drinkable water produced in Cambodia, the authors have decided to separate "**potable water**" and "**healthy water**". Both belong to the group of drinkable waters as they are in compliance with the Cambodian National Drinking Water Quality Standards. The difference lies in that "potable water" in Cambodia is mostly distilled water thus de-mineralized water, whereas healthy water still has its natural minerals.

When evaluating the ease of doing business in the water sector in rural areas of Cambodia, the authors defined 3 different categories:

- "**Viable areas**": areas where it is possible for the private sector to invest and run a water supply business in a viable and sustainable way, covering also the initial investment costs
- "**Challenging areas**": areas where operations are viable but the initial investment is too high to be recovered
- "**Non-viable areas**": areas where operations are not economically viable

Finally, the focus of this study is on safe water solutions only. However, the authors understand that similar solutions need to be explored in the field of sanitation. This is particularly true for cases where safe water access translates into bringing large quantities of water into homes, which need to be evacuated and treated. Nevertheless, this essential aspect in terms of health and hygiene was left out of the scope of this study.

Methodology

Started in December 2016, this study has been conducted through four main phases:

Phase 1 – Desk review and background analysis
Collection of all the available documents and general data dealing with the water sector in Cambodia as well as worldwide insights of the sector including elements about typical countries to contextualize the Cambodian situation. It aimed at acquiring deep and critical understanding of the context and framework and situation of water access in Cambodia. It also aimed to identify the main stakeholders and actors of the sector for further interviews.

Phase 2 – Data collection based on sector practitioners' meetings
To deepen the desk review analysis, contextualize the description of the current situation of drinking water access in Cambodia with field based insights and discuss preliminary findings, a first series of meetings took place from January to March 2017. The goal was to identify the strategy of development partners as well as the capacity of development of operational actors, their difficulties and identify the best solutions to support and ensure the coherence of the sector in Cambodia. The detailed schedule of the meeting is available on the table 3.

Phase 3 – Field surveys
During this phase of the study, data collection of three different groups of actors of the sector were undertaken. It aimed to gather rigorous data and information about piped water operators, bottled water vendors and community water kiosks since they are of high interest to study the coherence of the sector.

Table 3: List of actors interviewed

Name of actor	Type of actor	Date
Cambodia Water Association	National Association of Water Service Providers (WSPs)	Jan-17
GRET	Operational actor acting on small scale water supply	Jan-17
iSEA	Operational actor acting on DPSP development	Jan-17
Lien Aid	Operational actor implementing bottled water kiosks	Jan-17
Plan International	Active development partner in water supply	Jan-17
Rain Water Cambodia	Operational actor implementing rain water harvesting tanks	Jan-17
Teuk Saat 1001	Operational actor implementing bottled water kiosks	Jan-17
UN-Habitat	Active development partner in water supply	Jan-17
World Bank	Active development partner in water supply	Jan-17
World Vision Cambodia	Operational actor acting on rural water supply	Jan-17
AFD	The French Development Agency	Feb-17
Ministry of Industry and Handicraft	Line ministry for urban water supply (His excellency EK Sonn Chan, Secretary of State)	Feb-17
Ministry of Rural Development	Line ministry for rural water supply (His excellency Try Meng, Secretary of State and Dr Mao Saray, Director of Rural Water Supply, Sanitation and Hygiene Department of MRD)	Feb-17
Palladium – 3i	Investing In Infrastructure is a program supporting DPSP development	Feb-17
UNICEF	Active development partner in drinking water supply such as kiosks	Feb-17
World Health Organization	Active development partner in water quality	Feb-17

Data Collection description

Bottled water suppliers: To get information, a telephone campaign with actors of the private water bottle sector was led. A questionnaire was built to get information on their product, sales numbers and areas of intervention. Both big and small suppliers (those that were registered at MIH) were contacted, the biggest suppliers through their salesmen. However, since most bottle vendors are run under a family business, (mostly only registered with Ministry of Commerce, and therefore difficult to get contact details), few answers were collected on the characteristics of those family businesses.

Piped water suppliers - WSPs: To better map and understand the situation of Water Service Providers around Cambodia, information on WSPs were obtained in 2 different ways: 1) through a phone campaign and 2) through field visits.

For both, in order to select a representative sample, four criteria were singled out:

1. The geographical zone where the WSP is located. Four were identified, the Coastal one, the Plain one, the Tonle Sap Lake one or the Plateau and Mountainous one. Most operators are however to be found in the Plain Zone or the Tonle Sap Lake Zone.
2. The rate of urbanization of the commune where it is, either rural, semi-rural or urban. The semi-rural communes are those who welcome the most WSPs.
3. The size of the operator, either small (less than 1,500 connections), medium (between 1,500 and 3,000 connections) or large (more than 3,000 connections). If small operators represent more than 60% of the sector, large ones are preferential actors of tomorrow.
4. And finally, whether or not the operator was licensed.

To have a relevant sample, it was chosen to conduct at least 22 interviews, distributed as follows:

Table 4: Planned Sample for phone interview

	Coastal Zone	Plain Zone	Tonle Sap Lake Zone	Mountains	Grand Total
Rural (Unlicensed)	1	1			2
Micro - Small	1	1			2
Semi-Rural (Licensed - Supported or not)	3	3	3	3	12
Large	1	1	1	1	4
Medium	1	1	1	1	4
Micro - Small	1	1	1	1	4
Semi-Rural (Unlicensed)	1	1	1	1	4
Micro - Small	1	1	1	1	4
Urban	1	1	1	1	4
Grand Total	**6**	**6**	**5**	**5**	**22**

Interviews were conducted through a list of contacts delivered by the Cambodia Water Association (CWA) and the MIH. However, the reality of the field study was different from the theoretical initial sample. Problems included the lack of phone answer from numerous operators, the progressive licensing of operators rendering the contact list obsolete, or leading to the difficulty to reach operators from some regions.

In the end, a total of 25 licensed operators were surveyed, with the following profiles (unlicensed WSPs did not want to answer questions):

Table 5: Characteristics of the WSPs' sample interviewed for the study

	Coastal Zone	Plain Zone	Tonle Sap Lake Zone	Grand Total
Rural		2		2
Small		1		1
Unknown		1		1
Semi-Rural	2	14	3	19
Large		4		4
Medium	1	1		2
Small	1	9	3	13
Urban		1	1	2
Large		1	1	2
Unknown		1	1	2
Large		1	1	2
Grand Total	**2**	**18**	**5**	**25**

To back up this sample, numbers and conclusions were crossed with data from other studies on WSPs. In addition, 5 case studies were undertaken directly on the field. During these field trips the focus was on the cohabitation and interaction between different actors. Communes where both piped water and TS1001's kiosks were located were chosen and five of them were examined to evaluate the level of complementarity between both solutions. For that, kiosk entrepreneurs, WSP operators and beneficiaries were surveyed on the water and the quality of the service of each actor, with details of business strategy for the suppliers.

Phase 4 – Analysis of results

All the data gathered was compiled and analyzed in different ways:

- Compilation of all data under a database to facilitate analysis and mapping
- Cartography of data
- Analysis of clusters of solutions particularly focused on the ability of solutions/actors to address drinking water challenges in the near future, their capacity of development and the articulation of such solutions in adequacy with Cambodian water access sector specificities and constraints. The analysis comprised therefore an assessment of 7 attributes proper to the type of access solution:
    - » Easiness of use/Accessibility of the water source
    - » Availability of the water
    - » Quantity of water provided
    - » Affordability
    - » Quality of the water at the point of consumption
    - » Sustainability of the access (environmental and economic)
    - » Ability to ensure the use for drinking

Besides, regarding the crucial need to achieve this objective on the shortest timeline and at the largest scale, 3 more attributes related to the implementation of the solution have been considered:

    - » Scope of implementation
    - » Economic viability of solutions
    - » Ability to scale-up of solutions
- Analysis of the degree of complementarities and competition between solutions of access to drinking water based on their advantages, weaknesses and constraints in the Cambodian context
- Scenario construction: The scenarios were constructed based on 6 main parameters: population growth, climate change, urbanization, economic growth, political engagement and vision and level of investments/financing. For each parameter, two boundary hypotheses have been determined based on the available documentation. In total 36 scenarios have been simulated. Based on the occurrence probability of each scenarios, only 2 main scenarios have been selected for the period 2015-2030. In addition, the study presents 3 potential tendencies for 2030-2050. The consequences for Cambodia society and the water sector have been described for each scenario and tendency.
- For each scenario:
    - » Development of a scenario of development for the main solutions
    - » Projections of potential levels of access to water and the corresponding number of people in need according to multiple scenario
    - » Evaluation of funding requirements
- Establishment of recommendations on the development of the water supply sector.

CAMBODIA & ACCESS TO WATER

INTRODUCTION

Following the Millennium Development Goals and Sustainable Development Goal, the Cambodian government has set for the country some ambitious access to water objectives:

"Universal access to Improved water by 2025" & "Universal access to Safe water by 2030".

Within the current Cambodian context, the objectives are, from the words of the Ministry of Rural Development (MRD), unlikely to be reached. Indeed, still recovering from the disastrous consequences of the Khmer Rouge regime, Cambodia is currently ranked at 165th place in terms of access to improved water in the world, despite a record growth rate in the field since the 90's. The current 54% of the population with access to improved water at national scale are what's more unequally distributed. The urban population, which represents only 20% of the total population, has an access rate of 83%, while the 80% that live in rural areas have an access of a mere 47%, and are still not a priority target for the government.

It is therefore essential to understand where current tendencies lead in terms of access to water, especially in rural areas, and if and how current actors and solutions are working together towards these objectives of universality.

Access to water is, among other things, a mean for a significant health impact. Thus, assessing in compliance with SDG objectives if the country can overtake universal access to improved water and aim at an access to safe water is also of critical importance. This huge step represents an even tougher challenge as the WHO/UNICEF Joint Monitoring Program evaluated that less than 10% of the Cambodian population has currently access to safe water.
Different innovative solutions, from small private operators who took the matter into their own hands to a widespread model of community water kiosks, are already impacting a growing number of lives. It is nevertheless a safe bet to think that, through a real optimization of their actions and targeted support programs, these impacts could be truly amplified providing real solutions to the drinking water challenge in rural Cambodia.

This report is written hoping that it will shed light on the stakes of actively supporting the existing actors of water access in rural zones on one hand, but also to see beyond access to improved water when considering the matter of water access. This is what it will take to have a real health impact at the scale of Cambodia.

CONTEXT OF CAMBODIA

General Context

Located in South East Asia, the Kingdom of Cambodia is home to 15 million people gathered mainly around the Mekong and the Tonle Sap rivers. Phnom Penh, with its 1.5 million inhabitants, is the capital city and the main cultural and economic center of the country. It is neighbor to Thailand in the West, Laos in the North and Vietnam in the East, with a southern access to the Gulf of Thailand. The country is culturally dominated by the Khmer, who represent more than 90% of the total population, and by Theravada Buddhism, the official religion practiced by around 95% of its population.

Figure 11: Geographical location of Cambodia

History

Historically, the Khmer Empire is considered the ancestor of the modern Kingdom of Cambodia. It reached its apex between the IXth and XVth centuries, when it dominated large scales of South-East-Asia, before declining in favor of its neighbors, modern day Thailand and Vietnam. More recently, Cambodia has been under French colonial rule from 1864 to 1953, before gaining its independence and soon plunging into civil war. Fed by regional and Cold war tensions linked to the Vietnam War, Cambodia in turn fell under communist rule with the Khmer Rouge regime. During this four years rule was perpetrated a terrible genocide which cost their life to millions of Cambodians, saw the country's whole intellectual elite exterminated and most of its infrastructures destroyed. Their rule was ended by the Vietnamese invasion in December 1978, opening a 10 years' occupation by their eastern neighbors and civil war until 1991. After various periods of confusion, it finally attained peace and stability at the end of the XXth century. It has since been governed as a constitutional monarchy by the Cambodian's People Party and its leader Hun Sen.

Economy

Cambodian economic growth is strong and driven by Services, Agriculture and Industry. The GDP per capita has greatly increased in the last years. The country still requires high levels of investments.

Cambodia's economy enjoyed a rapid growth of more than 10% since 2000. From 1998 to 2007, Cambodia's economic growth performance ranked 6th across all countries in the world. This period of growth has enabled considerable poverty reduction across the country. Due to the economic crisis, the GDP growth rate went down to 0.1% in 2009 but has stabilized between 6% to 7% since 2010 according to the Ministry of Economy and Finance. The Nominal GDP was around 18 billion dollars in 2015.

Cambodian economic growth has primarily been driven by a few key sectors – agriculture, garment manufacturing, tourism and construction. In terms of GDP composition, in 2015, Services occupied around 40% of the nominal GDP followed by Agriculture (29%) and by Industry (26%). It has to be noted that in the past years, the share of Agriculture has decreased while the share of Industry has increased. In 1995, agriculture counted for 44% of the national GDP. This trend is expected to continue with economic development. However, between 70% and 80% of the Cambodian population still relies on agriculture for their income. The GDP per capita has increased from US$ 87 to US$ 1,225 in the last ten years.

Cambodia's infrastructure coverage is amongst the lowest in the Association of South East Asia Nations (ASEAN) region. From date, according to the International Monetary Fund (IMF), Japan International Cooperation Agency (JICA), the need of investment is estimated to US$ 13 billion by 2020. This investment need represents almost 12% of the national GDP per year while the current Government investment forecast is capping at 7,5% of the national GDP.

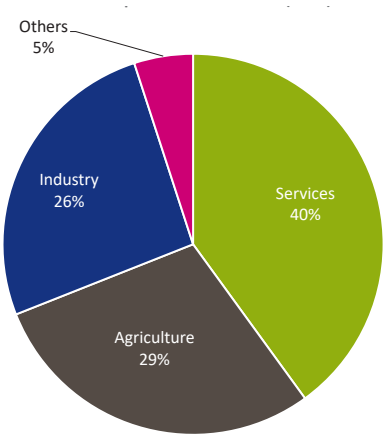


Figure 12: GDP composition in Cambodia in 2015 [Ministry of Economy and Finance]

Demography and Population distribution

Population distribution across the country is unequal and mostly distributed around the Tonle Sap and Mekong River.

The average density of the country remains low, about 75 inhabitants per km^2 according to the 2008 census. The population in Cambodia is not equally distributed, it is concentrated on the most arable lands. The rest of the country being mainly covered by forest. As shown on the maps below, nowadays the Cambodian population lives mostly along the Mekong and Tonle Sap Rivers. These areas also concentrate most of the infrastructures (electricity grid, roads…) and economic activity.

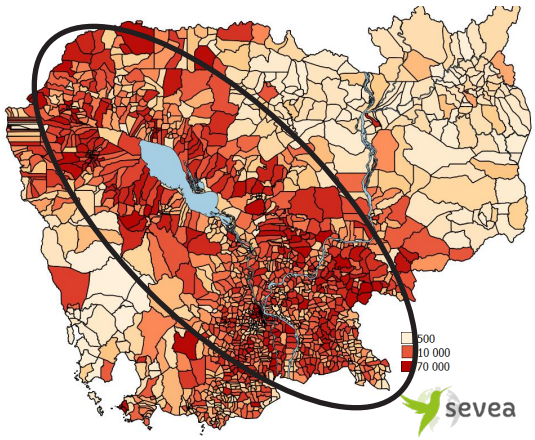


Figure 13: Population per commune [Data from Cambodia Inter-census 2013]

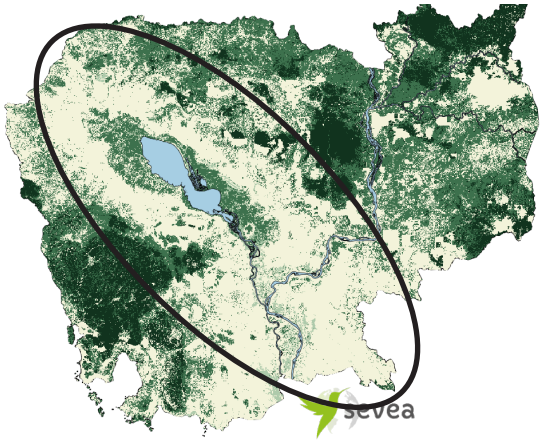


Figure 14: Forestry, rivers and lakes in Cambodia [Open Development Cambodia, 2011]

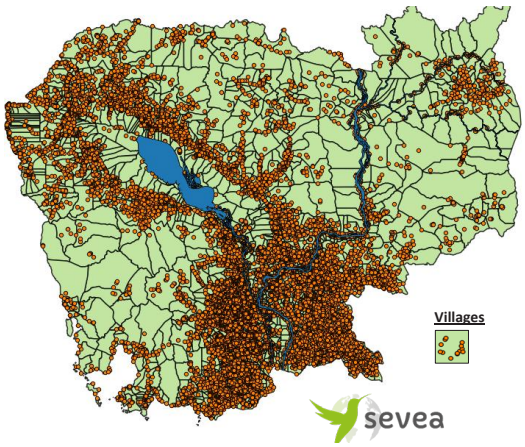


Figure 15: Distribution of the population in Cambodia [Data from Census of Agriculture of Cambodia 2013]

About 40% of Cambodian territory concentrates more than 90% of the population[1]. With a density of population ranging from 150 to 3,000 inhabitants per km^2, the South-Eastern region is the most densely populated. The official trends show a continuation of this concentration tendency. However, on the long term, climate change could reverse this dynamic because this area will also be the most impacted by sea level rise in the Mekong Delta (see figure 15 and 16).

A second concentration area is located along the Tonle Sap with a density ranging from 100 to 300 inhabitants per km^2. This area gathers a complex hydrological and ecological eco-system. This eco-system supports the economic and demographic development in the region but is also increasingly put under pressure by human activities.

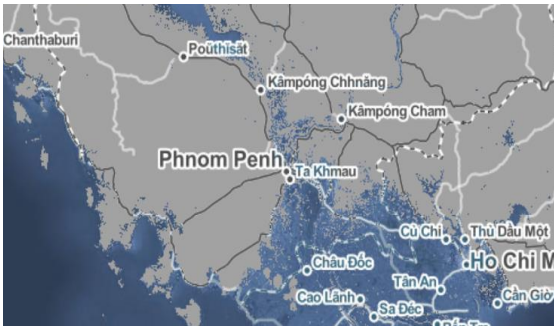


Figure 16: Land covered by water in a +4°C climate change scenario [Surging Seas, data from IPCC]

1. Source: GRET, Water Sanitation Program, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market - Cambodia", 2013

Administrative divisions in Cambodia & their classification

Administrative divisions in Cambodia

Cambodia is divided in 24 provinces and one municipality (Phnom Penh, the capital). Provinces are divided in districts and municipalities. Districts and provincial municipalities are divided in *Khom* / *Sangkats* which can be translated both by communes.

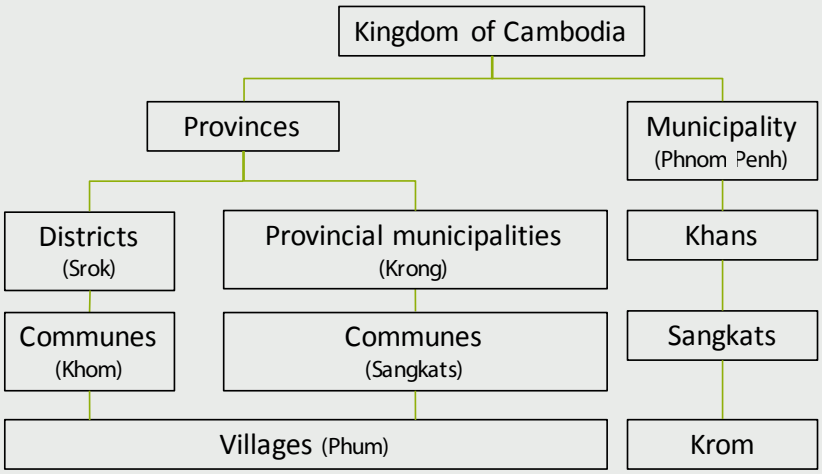


Figure 17: Administrative divisions of Cambodia

Table 6: Basic Characteristics of administrative units

Number of municipalities	1
Number of provinces	24
Number of provincial municipalities (*Krongs*)	26
Number of districts	168
Number of communes	1,633
Number of villages	Between 13,000 & 16,000

Classification of communes in Cambodia based on their level of urbanization:
According to the census 2008, the difference between urban and rural areas is made at communal level. In addition, to be able to stick closer to the reality, rural communes have been split in two according to their settlement patterns. Communes can thus be classified as follows:

- Urban communes: Communes with a population density over 200 people per square kilometer, with a total population over 2,000 and with less than 50% of its men workforce active in the agricultural sector.
- Rural communes: Communes without significant informal settlements, where population is scarce, with a density often under 50 inhabitants per km^2 and in average 5,000 inhabitants. This type of communes is hardly conducive to the development of infrastructure under a fully commercial approach.
- Semi-rural communes: Either communes with a growth center (a concentration of at least 1,000 households, i.e. 5,000 inhabitants[1]) or small communes with high population density. This type of commune presents characteristics that are closer to the ones of low urbanized areas. These semi-rural communes account for about 55% of rural communes and more than a half of the country's population.

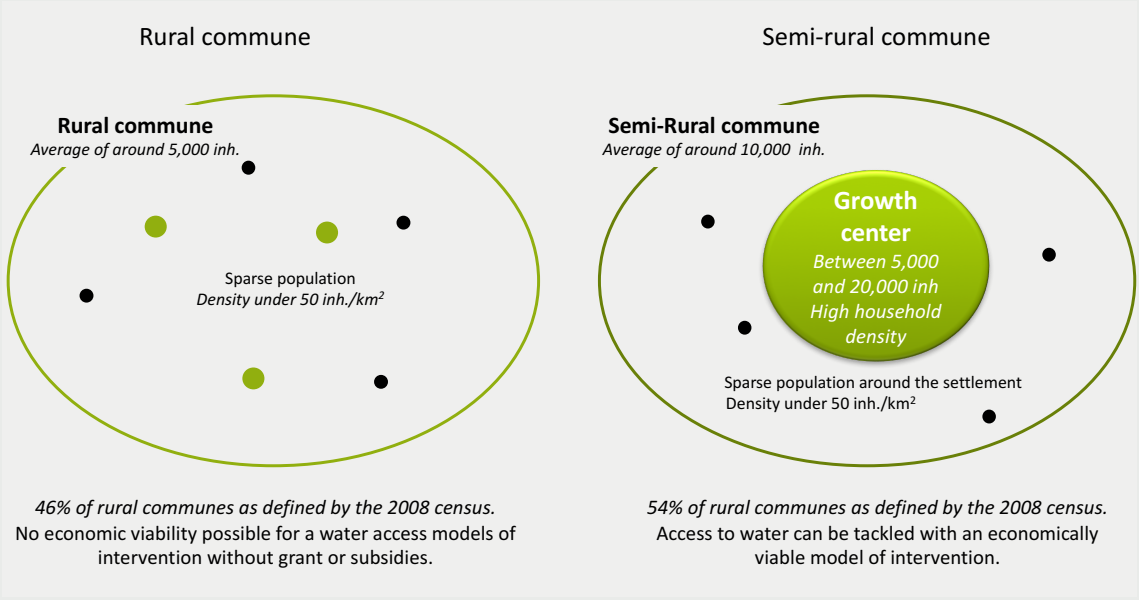


Figure 18: Distinction between rural and semi-rural communes

1. The value of 1,000 households is based on the observation that water distribution infrastructures come up at this level of concentration (e.g. small WSP have between 750 and 1500 connections). Outside this settlement, population distribution can be compared to that of rural communes, with a density around 40 inhabitants per km^2.

Table 7: General population of Cambodia Urban/Rural [Cambodia Inter-census 2013]

	2008				2013			
	Urban	Semi-Rural	Rural	Total	Urban	Semi-Rural	Rural	Total
Population	2,614,027	7,417,663	3,352,760	13,384,450	2,876,664	8,031,966	3,708,879	14,647,509
Total (%)	19.53	55.42	25.05	100	19.64	55.04	25.32	100
Density (inh/sq.km)	1125.96	194.26	24.60	75.72	1239.09	211.13	27.22	82.86
Nb people/HH (Census 2013)	4.9	4.6		4.7	4.8	4.6		4.6
Nb people/HH (Agriculture Census)					4.6	4.6		4.4

Urbanization

Cambodia experiences a strong urbanization process but most of the population still lives in rural or semi-rural areas.

According to the Inter-Censal 2013[1], Cambodia's population was 14.68 million in 2013, after growing an average 1.83% annually over the 5 past years, since the Census 2008. Over the same period, the annual growth rate of urban area was of 3.71%[2].

In 2013, Cambodia's population density was of 82 inhabitants per square kilometers, having increased by 7 points since 2008. Phnom Penh's density reaches 2,468 inh/km^2.

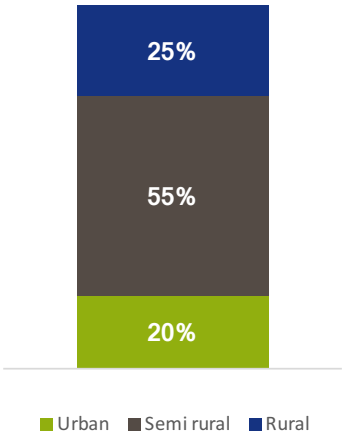


Figure 19: Population distribution in 2013 [data from Ministry of Planning]

In 2013, 20% of the population of Cambodia was living in urban areas, of which more than half (53.7%) lived in the capital city, Phnom Penh.
55% was living in semi-rural areas and 25% in rural areas.

Most of the existing infrastructures in Cambodia is concentrated in urban areas. This includes water and electricity coverage but also roads and supply facilities. These areas attract industries that cannot settle in rural areas. Consequently, Cambodian people are moving from rural areas to peri-urban or semi-rural areas seeking jobs and higher incomes than in the agrarian sector. Gradually, this could lead to labor shortages in rural areas.

The rapid and unplanned concentration of economic activities in urban areas lead to the creation of slums in the peri-urban centers where the infrastructures are completely saturated, resulting in greater insecurity, misery and a critical social situation. Conversely, urbanization may also lead to the impoverishment of the economic structure and the isolation of rural areas. Indeed, as urbanization is increasing the needs of investment in urban areas, it is also reducing the investment attractiveness in rural areas.

As shown on the figure 20, the urban and semi-rural communes are concentrated along the Mekong and Tonle Sap Rivers where most of the Cambodian population lives.

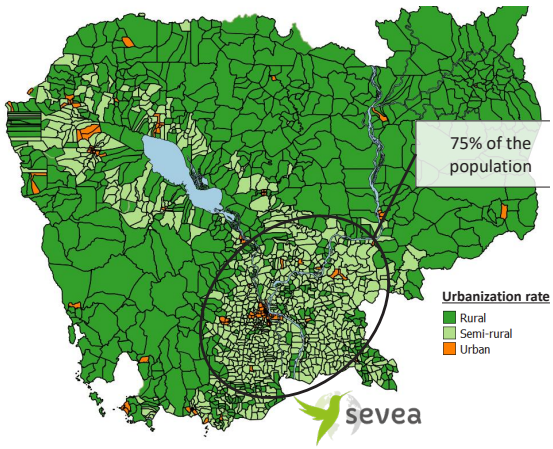


Figure 20: Population by communes and urbanization [data from Ministry of Planning]

1. National Institutes of Statistics, Ministry of Planning, "Cambodia Inter-Censal Population Survey 2013 Final Report," November 22, 2013, 1–155.
2. It was of 2.21% between 1998 and 2008

Table 8: Repartition of Cambodian population between rural, semi-rural and urban areas [data from Ministry of Planning]

	2008			2011		
Type of commune	**Urban**	**Semi-rural**	**Rural**	**Urban**	**Semi-rural**	**Rural**
Number of communes	162	790	666	162	790	666
Number of communes (% of total number of communes)	10%	49%	41%	10%	49%	41%
Population (thousands inh.)	2,614	7,417	3,352	2,876	8,061	3,708
Population (% of total population)	20%	55%	25%	20%	55%	25%

Poverty

A clear drop of extreme poverty, but a significant majority of the population remains vulnerable, just above the poverty line

In the aftermath of the Khmer Rouge genocide and years of civil war, Cambodia was left with a rate of poverty that reached peaks in the 90s. At that time, more than half of the population was living in poverty, which the United Nations defined as "a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. […]". But steady growth and stability have allowed for this number to fall drastically in the last years.

Thanks to great efforts put in poverty monitoring[1], a clear overview of the situation in Cambodia can be drawn up. According to government numbers, extreme poverty[2] has fallen from 47.8% in 2007 to 18.9% in 2012[3]. However, there is a backlash to these numbers. If 30% of the population has crossed the poverty line, most of them remain just above this line, with vulnerability to poverty rising alongside the decrease of poverty. For instance, 41% of the population is still living with less than US$ 2 per day and 72% with less than 3. Moreover, although poverty has gone down, the poorest quintile still lives with less than US$ 0.7 per day.

Development of proper infrastructure and rice market value, the two main decisive components of poverty in Cambodia

Poverty numbers go slightly higher in rural areas where, in 2012, 20% of the population lived under the line of poverty, with northern regions the most touched, some of them exposing poverty rates higher than 40%, mostly due to an underdevelopment characterized by a lack of infrastructure. Poverty rates have gone down in rural areas thanks to the steady rise in the market value of rice, but this also means that farmers are extremely dependent on the variations of the rice market and have precarious situations.

High poverty is not equally distributed

The figure 21 shows that poor households are mainly located in the North-Eastern and Western area of the country. The poverty rate is less important in the South-Eastern area.

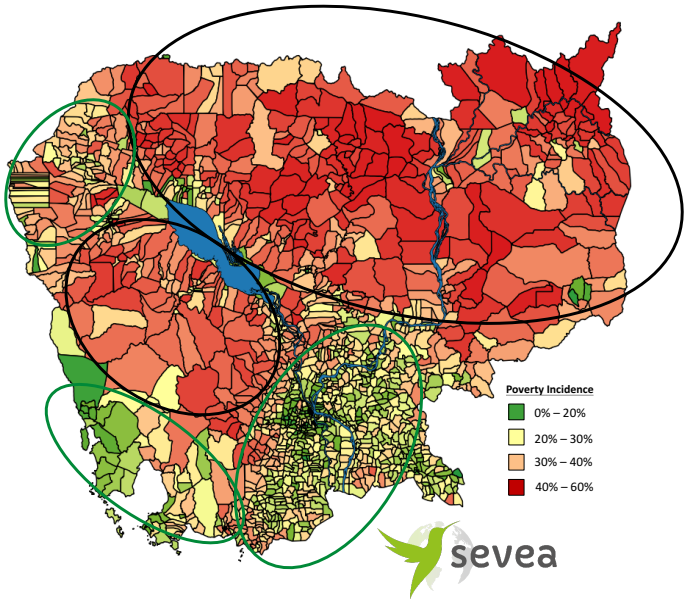


Figure 21: Distribution of the poverty rate in 2013 [data from Ministry of Planning]

1. The Cambodian government's "Identification of poor households programme" (IDPoor) has been initiated in 2006. All rural areas of the country have been covered by IDPoor, and updates of the data are carried out about every three years. For this program, three socio-economic group (housing, ownership, productivity) are distinguished and each one comprises different sub-groups for a total of 6: housing, assets, livestock, transportation, active members, income generation sources. Source: Ministry of Planning (2012) IDPoor Atlas, Identification of Poor Households, Cambodia.
2. These numbers correspond to those of the Cambodian Government, who set the line to poverty at a rate of US$ 0.93 per day and capita, slightly lower than the line set by The World Bank, at US$ 1.25 per day and capita.
3. Asian Development Bank, "Cambodia country poverty analysis", 2014

Vulnerability to climate related disaster

As a least developed agrarian country facing many social and economic development priorities, Cambodia is considered as one of the most vulnerable country to climate change and has lower adaptive capacity compared to other South-East Asian countries.

As an agrarian country, Cambodia is considered as one of the most vulnerable country to climate change.[1]. Cambodia is for example highly vulnerable to floods, droughts and saltwater intrusions. The country's entire agricultural production system (representing 35% of the national GDP) depends either on rainfall or on the annual flooding and recession of Tonle Sap Great Lake.

In the front line, the poorest communities highly depending on natural ecosystems or living the most urbanized areas are the most exposed to climate change variability.

A Vulnerability Index for Cambodia was developed in 2011 based on community data collected by United Nation Development Program (UNDP) in 2006 and 2008[2] . Today, the most vulnerable areas are located near the Tonle Sap, the Mekong and in urbanized cities. The number of communities rated as "Extremely high vulnerable" and "Extremely vulnerable" has decreased between 2006 and 2008. However, the extreme majority of Cambodian communities have been rated as "Vulnerable" or "Very Vulnerable".

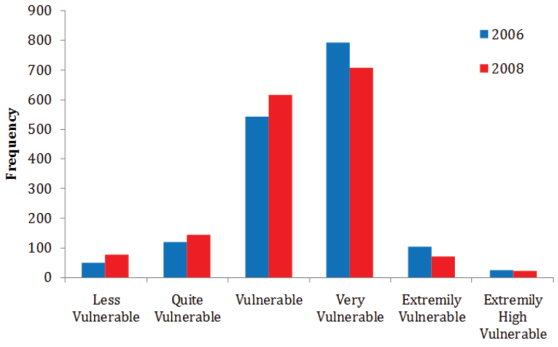


Figure 22: Vulnerability Index of Cambodia in number of communities [SNCCCC, 2015]

Vulnerable areas turn out to be the most populated ones of Cambodia. Furthermore, due to seasonality, areas which are vulnerable to floods are also highly exposed to droughts risks. Almost every province in Cambodia is subject to these droughts.

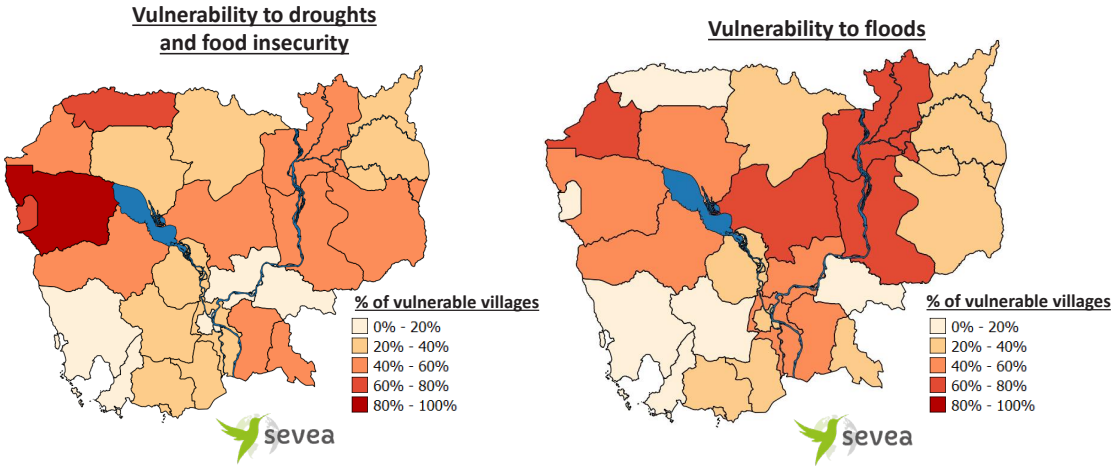


Figure 23: Level of vulnerability by provinces to floods (on the left) and droughts (on the right) - [data from Census of Agriculture of Cambodia, MOP, National Institute of Statistics, 2013]

1. See for example Global climate risk index 2015, Germanwatch and Climate Change Is A Global Mega-Trend For Sovereign Risk, S&P 2014.
2. Rizaldi Boer et al. 2011

Water context of Cambodia

Water availability

A large internal reserve of freshwater among which the Mekong River plays a predominant role

Cambodia has in its land large reserves of freshwater. The two main contributories to these accessible reserves are the Tonle Sap River and Lake and the Mekong River. With added seasonal rains during the six-months-long wet season, it adds up to a total of an estimated 34,000 m^3 of renewable surface water resources per inhabitants per year[1], of which 7,900 are considered internal. This places Cambodia well above the world's renewable internal freshwater resource per capita of 5,900 m^3[2].

Water sources

Three kinds of water sources available in Cambodia: surface waters, rain waters and ground waters.

Surface waters

Surface waters, led by the Tonle Sap and Mekong Rivers, but also numerous smaller rivers, lakes or ponds, make the largest source of available freshwater in Cambodia, and a substantial potential source of consumption. It is estimated that the general annual flow of surface water in Cambodia is of 500 km^3, of which 410 km^3 is an upstream inflow while 90 km^3 is internally generated[3]. They are accessible for populations through motorized pumps and are the preferential source for commercial use.

Rain waters

Harvested through tanks, they represent the favorite consumption water in rural areas. However, the Cambodian climate, separated between a wet season that brings monsoon rains and a dry one, makes these rains very unequal. During the wet season, from April to November, tanks are filled with an average 256 mm of precipitation per month, whereas during the dry season, from December to March, these precipitations are only of an average 39.35 mm per month[4]. These inequities generate storage issues in quantity and quality, and makes them hardly sufficient for the whole year.

Ground waters

Although no precise mapping of the countries ground water resources has been made, it is considered that they are abundant in Cambodia. They are accessible through different technologies, but are especially used through personal or community dug wells present in numerous rural areas. These wells are rarely exploited for commercial scales.

Water quality

Surface water, a microbial nest

Although they are relatively spared by chemical pollution due to a low level of industrialization, surface waters are highly vulnerable to microbial contamination. Indeed, contamination with the E. Coli bacteria happens through direct contact with human and animal feces. This bacterium is the first responsible for diarrheal disease. A lack of waste management and dubious practices like open defecation only exacerbate this hazard.

Rain waters, a safe source of consumption often spoiled during storage

Rain waters when collected properly are perfectly safe for consumption. However, they can be exposed to contamination before being consumed. Be it from animal feces on gutters, or unprotected storage in jars, they are susceptible to microbial contamination, especially when stored for numerous months.

Ground water, safe from microbial contamination but chemically hazardous

If often not contaminated and mostly safe for consumption when extracted, ground waters have the particularity in Cambodia to be likely to present high concentrations of dangerous heavy metals or other natural elements such as Arsenic, Manganese, Fluoride, …

Cambodian behavior about drinking water

According to the Ministry of Rural Development of Cambodia[5], around 80% of Cambodian households treat their drinking water. Boiling is preferred because it is easier and protects water from micro-organisms contamination. Nevertheless, Cambodian do not always drink treated water when they are traveling long distance or when they do not have enough wood to boil water. Besides, they prefer to drink raw water when rain water is available. In general awareness about safe drinking water conditions is more important in households with good sanitation conditions (latrines). Around 90% of Cambodian people store water at home. The most used storage system is wide-mouthed containers (67%).

1. World Bank, "Cambodia - Water Supply and Sanitation Sector Review", 2012
2. Food and Agriculture Organization, AQUASTAT – World Bank, http://data.worldbank.org/indicator/ER.H2O.INTR.PC.
3. Ministry Of Water Resources And Meteorology - 2003
4. Hong Kong Observatory data
5. Ministry of Rural Development of Cambodia, "National Sanitation and Hygiene Knowledge, Attitudes, and Practices (KAP) Survey", November 2010

Water pollution in Cambodia – Causes & consequences on access to drinking water

In Cambodia, and especially in rural areas, consumption of polluted waters is a major health problem. Whatever the origin of the ingested water, there are many ways for it to get contaminated between the point of production and the point of consumption.

(1) HTWS: Home Water Treatment Solutions.

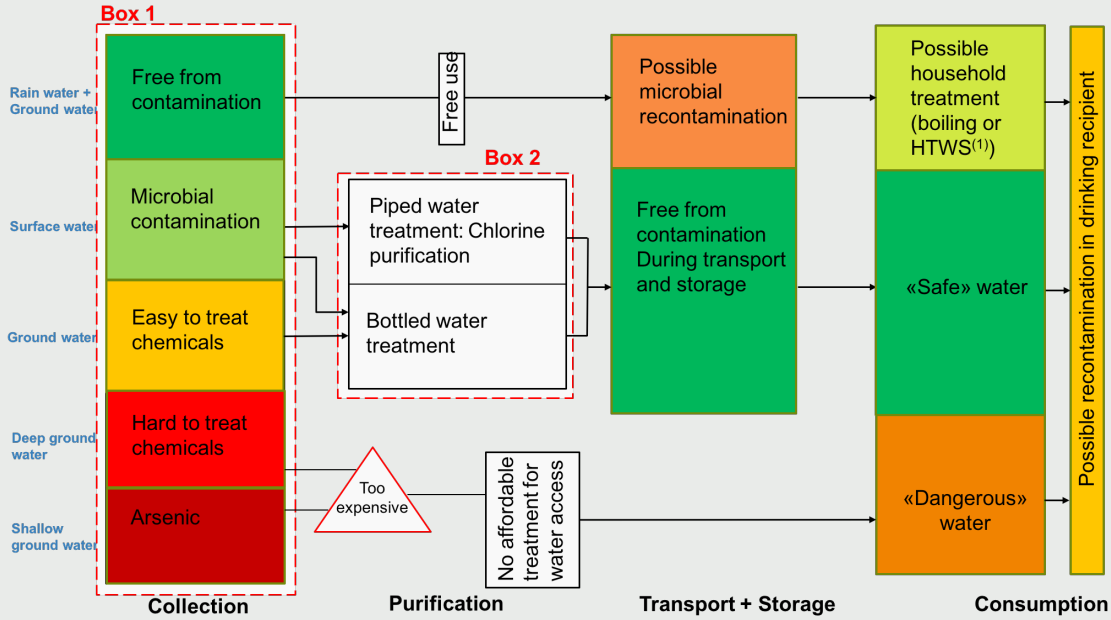


Figure 24: Possible sources of contamination during water supply chain

A pollution that occurs at different stages between the point of production and actual consumption

If chemical pollution occurs only at the source, microbial contamination can appear at different stages. Even some water safe for drinking at collection or that has been filtered through a household solution (boiling at least for 87% of the population[1]) can be re-contaminated during transport, storage or even in the drinking recipient. In addition, in a country where rain water harvesting and storing during rainy season is a main source of water consumption throughout the year, guaranteeing that households know how to properly proceed with the safe water storage is a really challenging task. It is important to note that piped water can also be compromised by these habits, as it was noticed that a large part of the population that had access to piped water stored it in jars instead of directly using it.

Surface water is the easiest water source to access and to treat

Surface water is the easiest source of water to access and to treat with easy and low-cost treatment. This type of water is indeed mostly polluted by microbial pollution and, as of now, rarely touched by chemical pollution in Cambodia, where the industry is still marginal. On the contrary, ground waters that present some form of chemical pollution are hardly treatable because of the costs incurred.

1. Sevea Consulting, «Behaviour change analysis in Cambodia», 2015

Table 9: Overview of main types of contaminations in Cambodia

	Microbial contamination	Chemical contamination	A specific case in Cambodia: Arsenic
Scale of pollution	Very high, particularly in rural areas	Present but not critical due to low industrialization of country	Naturally very present in areas around major freshwater sources (Mekong, Tonle Sap,…): around 150 000 people exposed as primary drinking water source.
Water sources affected	Surface waters and shallow aquifers accessible by dug wells	Mostly ground waters (minimal presence in surface waters and rain waters)	Ground waters
Main pollution factors	Human and animal presence, unmanaged waste disposal	Industrial waste management, agriculture and natural presence in rocks and sediments (Manganese or Fluoride for example)	Natural presence in the grounds
Available treatments	Boiling and filtration, chlorine disinfection, UV purification,…	Oxidation by ozone, coagulation, flocculation, sedimentation,…	Reverse osmosis
Easiness to treat	+ + (can be done at HH level)	-	- -
Cost of treatment	+ + (No or little initial investment and low cost during use)	-	- - (between 5000 and 10 000$ initial investment for one HH treatment unit)
Possible on-field solution to this pollution	Already used at commercial (Chlorine disinfection, UV purification) & HH (Boiling, filtration) levels.	Requires too big investments and technical skills for maintenance to be implemented successfully	Requires too big investments and technical skills for maintenance to be implemented successfully

Simple water treatments are in most cases largely sufficient in Cambodia

Except in arsenic contaminated areas, simple water treatment purification processes, such as Coagulation/ Flocculation, Sedimentation and Filtration with the help from chemical injection of Alum, Lime and disinfectant Chlorine or UV Purification, are largely sufficient to turn raw water into drinkable water. These water treatment processes have the advantages of being low-cost, low-tech and relatively simple to operate and maintain, thus adapted to the capacity of the usual operators.

Table 10: Efficiency of treatments according to the types of contamination

	Microbial pollution		* Chemical pollution	Arsenic
	Effectiveness	* Possible recontamination during storage or transport	Effectiveness	Effectiveness
Boiling	OK if well done (t > 1 min)	Possible recontamination	NO	NO
Filtering	OK	Possible recontamination	NO	NO
Chlorine disinfection	OK	No recontamination (but unpleasant taste)	NO	NO
UV water purification	OK	Possible recontamination	NO	NO
Reverse osmosis	OK	Possible recontamination	~ 90% of chemicals	OK
Oxydation (typically by ozone)	NO		~ 70% of chemicals	NO

* This can be a critical factor as water is subject to microbial recontamination during unprotected storage
* Numerous ground and surface waters can be subject to chemical pollution from human (Industry waste, agriculture pesticides…) or natural (rocks and sedimentation chemical pollution.

ACCESS TO WATER IN CAMBODIA

Governance

Institutional framework

The Ministry of Industry and Handicraft (MIH) and the Ministry of Rural Development (MRD) share the lead on the drinking water supply sector. The MIH is responsible for urban water supply and the MRD for rural water supply as long as the water supply system is owned by the commune[1]. Provincial departments of these ministries undertake related functions at sub-national level. MRD extends its presence to commune level through commune councils.

At a national level:

Table 11: Description of national institutions related to water supply in Cambodia

Lead Institutions	Roles
Ministry of Industry and Handicraft (MIH) – General Department of Potable Water Supply (DPWS)	Responsible for urban water supply including water quality control and the regulation of commercial piped water supply throughout the country (both private and public operators)
Ministry of Rural Development (MRD) – Department of Rural Water Supply (DRWS)	Through its DRWS, the MRD is responsible for providing water supply services in rural communities. It implies policy setting, planning, regulation, financing, and overall coordination of projects on the provision of water supply

At a provincial level:

Table 12: Description of provincial institutions related to drinking water supply in Cambodia

Key provincial actors	Roles
Provincial Department of Industry and Handicraft – Water Supply Office	The PDIH is responsible for: 1) preparing the annual investment plans; 2) supervising projects of public waterworks funded through the MIH; 3) liaising with interested private providers; and 4) overseeing operations of public waterworks, 5) Supervising the construction of water supply systems in small towns
Provincial Department of Rural Development – Rural Water Supply Office	The PDRD is responsible for planning and project implementation, and works with local authorities. In charge of 1) Provincial Action Plan implementation & management, 2) Coordination of implementing agencies and reporting at Provincial level, 2) Review and update Provincial Action Plan (PAP) annually

At a commune and village levels:

Table 13: Description of communal institutions related to drinking water supply in Cambodia

Key local actors	Roles
Commune Councils (CC)	Responsible for the planning, implementation, and financing of rural infrastructure. Owners of water facilities, CCs make agreements with implementing partners and private sector and legal aspects. It is the key actor for rural water supply implementation and operation management.

1. Other Ministries have also several responsibilities linked with drinking water.

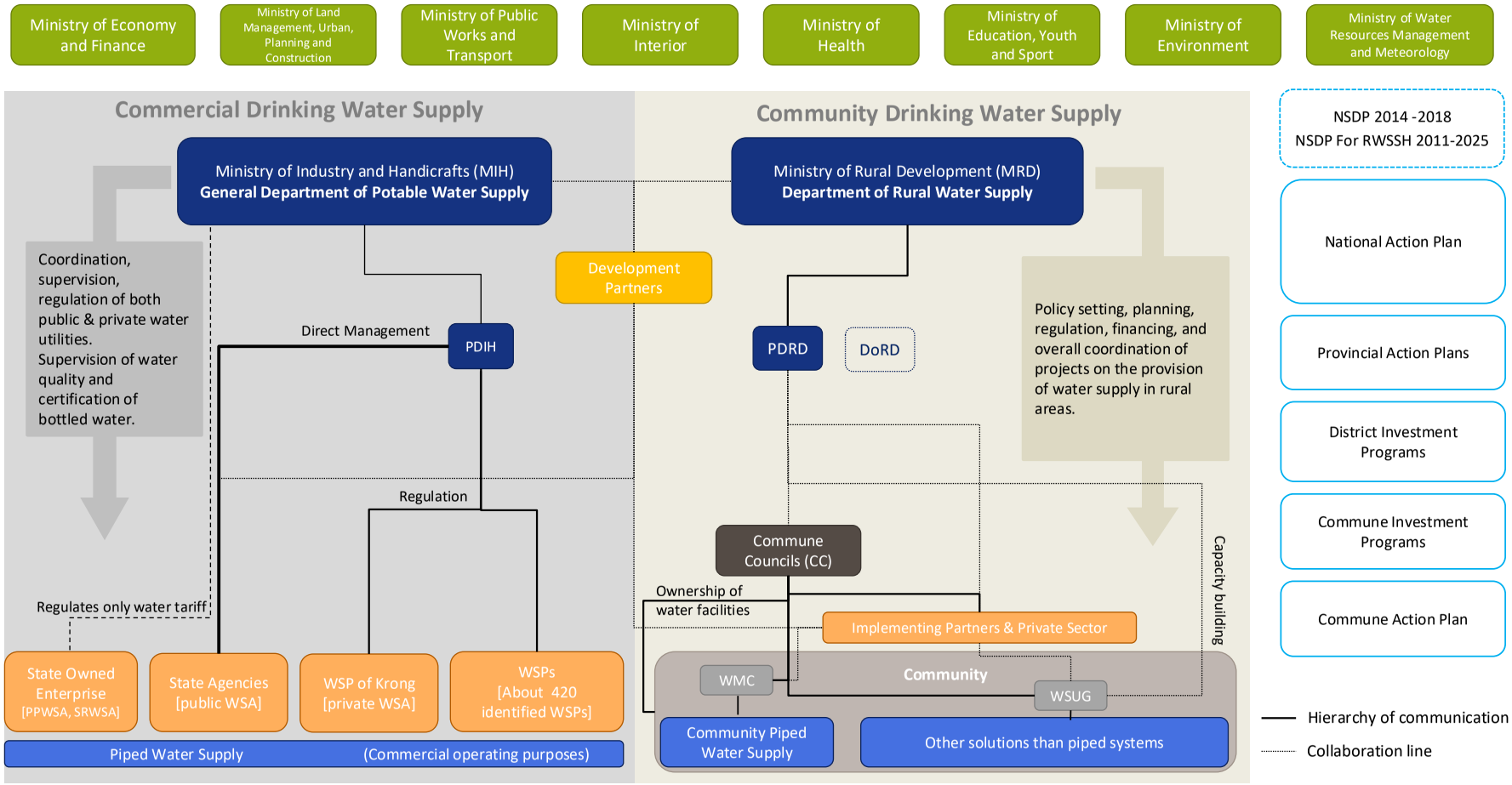


Figure 25: Drinking Water Supply governance 1

1. This schema is issued from the author's understanding of how the sector is really working and not how it should work. It is a simplified schema which does not detail the district level because of the low level of interactions at district level expressed by the operational actors met. For rural areas, implementation and operation are managed at the commune level. PDRD seems to be involved as a "secondary" actor. Rural water supply projects are carried out by two actors: implementing actors and commune council only.

Coordination of the sector

The coordination of the drinking water supply sector is well structured for rural activities and in complete restructuration for urban activities. A national technical working group has been set-up to facilitate discussion on WASH activities in rural areas between the MRD, development partners and operational-oriented actors. A sub-group more specific to rural water supply is also in place. On the urban water supply side, there used to be a specific technical working group chaired by MIH and co-chaired by JICA which is not active anymore. Thus, there is currently no coordination platform for the urban water supply sector which would gather the different active actors and development partners.

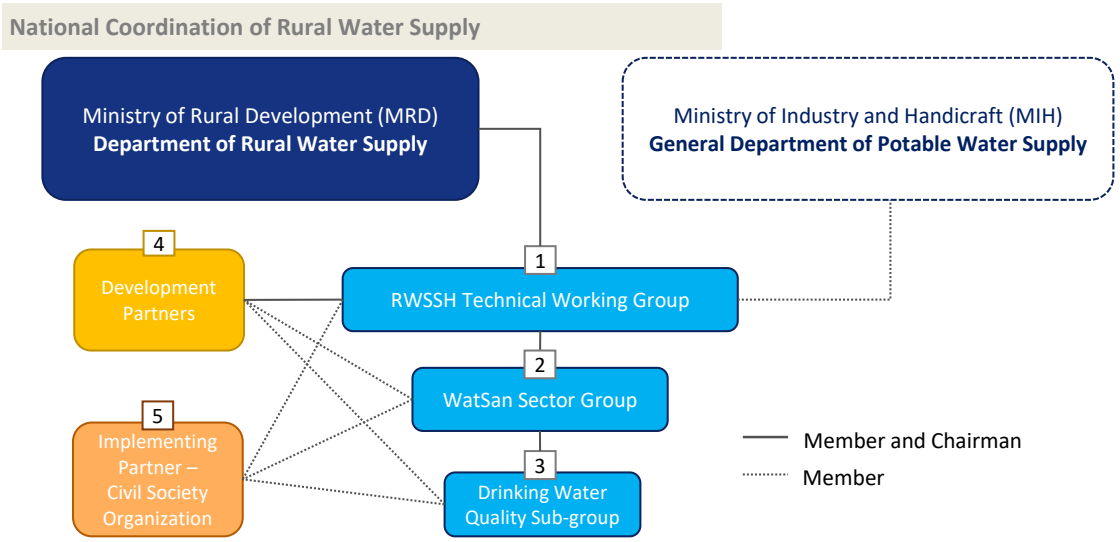


Figure 26: Description of national coordination of water supply sector in Cambodia

1	The Rural Water Supply, Sanitation and Hygiene Technical Working Group (RWSSH TWG) has been created in 2007. It gathers members from the 2 main ministries (MRD and MIH) as well as representatives from MOWRAM and MoH, development partners and a WatSan sector group representative. The group is chaired by the Minister of MRD with a development partner acting as co-chair on a rotating basis. Through quarterly meeting, the RWSSH TWG oversees coordination and provides guidance on policy, strategy and budget, capacity development, aid effectiveness, report and review. It includes the oversight management of National Action Plan (NAP) implementation.
2	Chaired by the Director of the Department of Rural Water Supply from the MRD, the role of the WatSan Sector group is to ensure knowledge and information sharing between MRD departments, NGOs and development partners through monthly coordination meeting.
3	The Drinking water quality sub-group is chaired by the Director of the Department of Rural Water Supply from the MRD. Regular meetings occur to exchange information and discuss about technical issues specific to rural water supply. It is attended by NGOs acting in rural water supply, development partners and MRD representatives.
4	Development partners are international agencies active in the WASH sector. They provide technical and financial support through service delivery, capacity building and other actions.
5	Implementing partners are local and international NGOs carrying out water supply projects in Cambodia. They participate in WatSan meetings and Drinking Water Quality meetings.

Sectoral approaches and strategy

Ministry of Rural Development & rural water supply

Vision and approach[1]

The MRD in its National Strategy for Rural Supply, Sanitation and Hygiene 2011 – 2025 envisioned that by 2025 every person in rural communities would have sustained access to improved water supply.

Following the MDGs & SDGs, Cambodia set-up its own intermediary targets, that were:

- Target of 50% of sustained access to improved water supply by 2015 in rural Cambodia
- Target of 60% of sustained access to improved water supply by 2018 in rural communities
- Universal access to safely managed water supply by 2030[2]

While the government is optimistic about the target of 60% of improved access rate by 2018, they expressed strong doubts about the universal access target by 2025 and even more for the target of safe water supply by 2030.

Strategy

The MRD laid down its strategy to achieve the previously mentioned targets on two phases: one short term and one long term

1st phase:

The initial objective is to provide water access through protected deep wells when ground water is available[3]. If not, priority will be given to rain water harvesting solutions.

In addition, surface water pumping solutions such as community ponds, pumping and filtering are also developed but in a more limited way. Finally, the MRD encourages the usage of household (HH) filters.

Note: Ground water based solutions are clearly privileged due to their resilience to droughts. MRD closely work with ADB on the construction of new wells since they funded a program of 1,500 wells until 2019.

2nd phase:

The objective of this phase is to test more upgraded solutions to understand and validate the role each solution could get.

As an example, the MRD has launched a pilot program consisting in building two community owned pipe systems[4] per province. In addition, the MRD plan to test a model of community owned bottled water kiosk, like TS1001 to see in which extent this solution could be scalable in the whole country.

To turn its vision into reality, the MRD is being supported by two main actors:

1. The World Health Organization (WHO) supporting MRD in taking actions for water quality improvement,
2. UNICEF contributing through a global support of MRD and with actions towards water resources availability[5].

« Cambodia has abundant resources of water, so why would Cambodia be an exception in terms of access to piped water supply? If developed countries managed to get universal access to pipe, Cambodia will do it as well»

Source: Interview of his Excellency EK Sonn Chan, Secretary of State of MIH.

Ministry of Industry and Handicraft & commercial piped water supply in rural areas[6]

Vision and approach of the MIH

MIH is clear about its vision for the water sector in Cambodia: Turning pipe into one of the main sources of access to water in the long term.

1. Based on the analysis of the National Strategy For Rural Water Supply, Sanitation and Hygiene 2011-2025, and the National Action Plan 2014-2018 designed to guide the further implementation of actions needed, as well as the interview of his Excellency Try Meng (State Secretary of MRD) and Dr.Mao Saray (Director of the Rural Water Supply, Sanitation and Hygiene Department).
2. Issued from SDG and validated as a target by the State Secretary of MRD
3. As a result, the MRD has planned to build more than 9,000 new wells between 2014 and 2018 (source: NAP RWSSH 2014-2018)
4. Size estimated between 300 and 1000 connections (source: interview of MRD official representatives)
5. Unicef is currently conducting a study about water availability's resiliency in Cambodia (source: MRD)
6. Based on MIH documents analysis and interview of his Excellency EK Sonn Chan (State Secretary of MIH)

Strategy

On the overall, MIH seems to have a two steps strategy:

1st step: Regulate the sector and ensure an access through pipe.

For now, the MIH is focused on licensing WSPs and striving at increasing the number of licensed communes. Indeed, with the new license (see ***Praka*** 2014) the sector is deeply structuring and professionalizing itself. As part of their strategy, MIH envisions a possibility of access for everyone, by forcing WSPs to extend their coverage to 90%, the minimum rate of coverage set after 3 years. At the same time, MIH works on access, by turning the service affordable (water tariff regulation), available (increase of hours of supply, proper pressure of supply) and sustainable (encourage full cost recovery tariff and business improvement[1]). Finally, the global strategy includes promotion actions for poorest households.

In parallel to this maximum reach strategy, the MIH also initiated quality oriented actions. Every WSPs will be forced to invest in a proper treatment process and quarterly water quality controls will soon be mandatory.

Note: The MIH works with the World Bank to build capacity to monitor and regulate the sector. It also works with the different programs consisting in supporting WSPs to help them getting a license and/or investing in their facility. Finally, they work with CWA to provide trainings to WSP.

2nd step: Ensure access for everyone and a safely managed supply to provide safe drinking water through pipe.

Only once the geographical development of WSPs is well on its way does the MIH truly want to enforce a strict regulation and check-up policy on water quality. Once people are connected, the goal will be to make sure WSPs manage properly the treatment process and implement frequent and strict quality controls.

Note: The first step will be more likely to take at least 3 years and thus last until 2020. The second step can be expected to be achieved post-2020 [2].

The MIH funds for pipe extension are for now mostly allocated to public utilities in urban areas so that the pipe service in semi-rural and rural areas relies almost solely on the private sector (WSP) which in turn is being supported by limited donor programs.

1. Business improvement includes energy costs management, proper technical design of the installation (sizing of pipes, pump design and installation, etc.), change from family business oriented operation to business minded management, etc.
2. Based on field observations

Main polices of the water sector

Below are listed the main policies that have had a concrete impact on the water sector in recent years.

Table 14: Water supply major policies[1]

Water Supply Major Policies	
Name	**Comments**
National Policy on Water Supply and Sanitation 2003	It is divided into three parts 1) urban water supply, 2) urban sanitation and 3) rural water supply and sanitation. This policy promotes six main sector visions for 2025: 1) Supply Driven and Demand Responsive Approaches; 2) Private Sector Participation; 3) Water tariff; 4) Protecting the Poor and Subsidies; 5) The autonomous Public utilities; 6) The Urban Water Supply Regulator.
MoU MIME-MRD 2005	Urban water supply and piped water supply for commercial use are under the supervision of the MIME when rural community piped water supply systems development are under the supervision of the MRD.
NSDP for Rural Water Supply, Sanitation and Hygiene 2011-2025	Establishing a clear set of objectives for Cambodia: 50% of rural population will have access to improved water supply by 2015, and 100% by 2025. • Increase in access to water supply services by 1) providing new water supply facility using fund from government, donors and community, 2) Rehabilitate existing infrastructure using funds from government, donors and community, 3) Identify more appropriate technology, 4) Encourage private sector • Application of water quality standards by 1) developing procedures for water supply scheme to conform to water quality standards, and 2) promoting water quality safeguard • Improvement in operation and maintenance
NSDP 2014-2018	Presenting the vision of development and objectives to reach in 2018 including for rural and urban water supply sector
Ministerial Decree from MIH issued regarding the licensing process: - ***Prakas*** on Procedures for Issuing, Revising, Suspending, and Revoking of Permits", accompanied with, - ***Prakas*** on "Standard Conditions of the Permit" 2014	• It covers all natural persons or legal entities that may be a public enterprise, public-private partnership and a purely private enterprise engaged in the provision of water service, but excludes 18 water service providers with special contracts (such as Design-Build-Lease and Design-Build-Operate schemes). • It sets the term of permits at 20 years for purely private enterprises and unlimited for public enterprises and public-private partnerships. • It contains procedures for the issuance and replacement of water permits and the issuance of the necessary operating certificates (5 years) allowing licensees to continue operations in case of compliance with the permit conditions. • In addition to a direct granting process, it contains provision for a competitive granting, where feasibility studies are made available to shortlisted bidders and permit is granted to bidder with lowest tariff. • It stipulates the necessity to submit a feasibility study with the application, including a systems-and build-out-plan indicating how the area will be served within a five year period. • It includes procedures for requesting expansion licenses covering adjacent communes/ service areas with basic services and maintain records and reports in format of MIH. • It provides for Tariff and Fees in the permit and stipulates that MIH shall study the tariff every 5 years for adjustment based on real circumstances. • It contains procedures for suspension, revocation of licenses in case of non-compliance with the obligations under the license

1. Asian Development Bank, "Cambodia: Water Supply and Sanitation Sector Assessment, Strategy, and Road Map", 2012 ; World Bank, "Strengthening Sustainable Water Supply Services Through Domes c Private Sector Providers in Cambodia," 2016

Current main donor funded water programs in Cambodia

AFD program – supporting WSP development in semi-rural areas

The French Development Agency has a program to provide loan money to institutions who in turn make low interest loans to WSPs so they invest in piped water systems while ensuring a proper implementation and sustainability of the water supply by conditioning the access to the loan with technical and business support services as well as water supply licensing process assistance. As such, they work directly with existing operators in the goal of scaling up in terms of quantity and quality.

Example of operational operators: GRET (iSEA) for WSP technical and business support, Foreign Trade Bank (FTB) for the provision of loan.

The program is sized at US$ 15 Million (1st phase).

3i (Investing in Infrastructure) – supporting high potential unlicensed WSP

Started in 2012 and funded by the Australian Government, and implemented by Palladium, the 3i project aims at developing key infrastructures through grant, direct loans to private sector investors, and co-investments with private equities. These are again loans to existing WSPs to promote their scaling up, or help during the process of licensing. It has a budget of around US$ 34 Million divided between investments in electricity and water infrastructures.

JICA - Capacity Building for Water Supply System in Cambodia

Only focused in urban areas, currently in phase 3 (2012/2017), it aims at providing universal urban access to piped water. In that optic, JICA works directly with Public Water Authority (they are for example working right with the Siem Reap WSA in order to build a 60,000 cubic meters to allow full coverage and distribution or urban areas.

World Bank – Supporting piped water access in urban and semi-rural areas

The World Bank worked on a double program with the MIME and Phnom Penh Water Supply Authority (PPWSA). The first part, implemented by the MIME for a total cost of US$ 16 Million, consisted in the financing of costs of civil works for improving water supply systems. The second part, implemented by the PPWSA for a total of US$ 7 Million, aimed at the expansion of water supply in the Municipality of Phnom Penh. This program provided approximatively 27,000 Households, or 133,350 people, with access to safe water supply.

USAID – Supporting existing WSP

Through the MSME (Micro, Small, Medium Enterprise) Project, USAID helped already existing WSPs to grow with small rebates that allowed extension for struggling operators. These rebates, ranging from US$ 10,000 to US$ 200,000 allowed water operators mostly to extend their distributing networks and connect households at a reasonable price, but also to expand water treatment capacities. It gave direct water access to more than 14,000 households, or an estimated 65,000 people, and contributed to the quality of the water and service linked to it for more than 70,000 people.

Understanding the different concepts & definition linked to water supply in Cambodia

To talk about drinking water supply in Cambodia, several aspects need to be distinguished:

Table 15: Concepts' definition to support the analysis

3	**Types of areas**: Urban, Semi-rural, Rural
	Types of access: Improved water, Safe Drinking water, Upgraded water access
	Types of people reached: likely to be covered, covered, served
	Types of areas according to the ease of doing business in the water sector: Viable, Challenging, Non-viable

Type of areas according to the ease of doing business in the water sector

When evaluating the ease of doing business in the water sector in rural areas of Cambodia, the authors separated these areas in 3 different categories according to 2 parameters, the population density and the level of access to a raw surface water source:

- "**viable areas**": areas where it is possible for the private sector to invest and run a water supply business in a viable and sustainable way, covering also the initial investment costs. Viable areas are areas located in semi-rural areas (higher density) with access to raw surface water.
- "**challenging areas**": areas where operations are viable but the initial investment is too high to be recovered. Challenging areas are semi-rural areas with low availability of surface water and rural areas with an easy access to surface water
- "**non-viable areas**": areas where operations are not economically viable. Rural areas with a difficult access to surface water are estimated to be non-viable areas.

Type of Access

Access to water in the new SDG:
The SDG 6's goal is to 'Ensure availability and sustainable management of water and sanitation for all' and more specifically on drinking water to **"By 2030, achieve universal and equitable access to safe and affordable drinking water for all".** This SDG comprises six technical targets relating to drinking water, sanitation and hygiene, wastewater management, water efficiency, integrated water resource management and protection of aquatic ecosystems.

Table 16: Normative interpretation of SDG [WHO, UNICEF, "WASH Post-2015," 2015]

By 2030, achieve	Normative Interpretation
Universal	Implies all exposures and settings including households, schools, health facilities, workplaces, etc.
and **Equitable**	Implies progressive reduction and elimination of inequalities between population sub-groups
Access	Implies sufficient water to meet domestic needs is reliably available close to home
to **Safe**	Safe drinking water is free from pathogens and elevated levels of toxic chemicals at all times
and **Affordable**	Payment for services does not present a barrier to access or prevent people meeting other basic human needs
Drinking Water	Water used for drinking, cooking, food preparation and personal hygiene
for **All**	Suitable for use by men, women, girls and boys of all ages including people living with disabilities

From "basic water services" to "safely managed water services"

Whereas MDG only focused on developing access to improved sources of drinking water [1], SDG 6 goes further by integrating the quality of services related to this access. Indeed, the indicator used to measure progress is the percentage of the population using safely managed drinking water services, meaning the percentage getting access to a drinking water source which is:

- located on premises [Accessibility]
- available when needed [Availability]
- free of fecal and priority chemical contamination [Quality]

Access to improved water supply according to the Cambodian government[2]:

Access to improved water supply is defined by the government as the ability for a household to have access to water from an improved water source located within 150 meters of a house and used for domestic consumption – drinking, washing, bathing and home-based economic activities. An "improved" water source is one that population using an improved drinking water source which is more likely to provide "safe" water, compliant with the National Guidelines on Rural Water Quality.

Objectives have been set by the government for access to improved water supply which corresponds to "basic" drinking services of SDG. The notion of safely managed services is not yet integrated by Cambodian government but tends to be considered at least in theory through these different parameters:

- Accessibility: the precision of 150 meters in the definition of access is close to be considered "on premises".
- Availability: not yet integrated in the definition
- Quality: the definition of safe water as "in compliance with National Guidelines on Rural Water Quality" implies to be "free from microbiological and priority chemical contamination"

Access to water in this study

- Improved water access is defined by the capacity of a water supply solution of offering access to a water source which is "more likely to be safe".
- Safe drinking water access is defined by the capacity of water suppliers to distribute safe drinking water at the point of consumption[3]. It is thus considered that only licensed piped water system[4] and community owned 20L bottled water kiosks[5]can provide safe drinking water on premises in rural areas. In other words, in rural Cambodia safe drinking water access corresponds to people covered either by a licensed WSPs and/or 20L bottled water kiosk.
- Upgraded water access is defined by the capacity of water suppliers to distribute both safe drinking water at the point of consumption and water in sufficient quantity to cover all domestic essential needs. Only on premises piped water access can comply with the objective of such access. In the case of unsafe piped water the supply needs to be combined with a safe drinking water supply such as 20L bottled water. In other words, in rural Cambodia, it corresponds to people covered either by a licensed WSP, or both unlicensed WSP and 20L bottled water kiosks.

1. An "improved drinking-water source" is one that by the nature of its construction adequately protects the source from outside contamination, in particular from fecal matter. Source, WHO/UNICEF JMP
2. MRD definitions issued from the NAP released in 2016
3. Safe water refers to water that is safely drinkable without requiring any household treatment such as boiling water or filtering.
4. In reality, some unlicensed operators (including waiting for license WSP) actually distribute safe drinking water while some licensed don't. Nevertheless, to simplify the assumption it is assumed that the first ones make up for the second.
5. These are solutions implemented by NGOs who pay careful attention to quality. As an example, TS1001 which is by far the leader of the sector complies with the Drinking Water Quality National Standards of MIH, requires regular testing from its kiosks and has its own lab to test the water produced by its 150 sites every month.

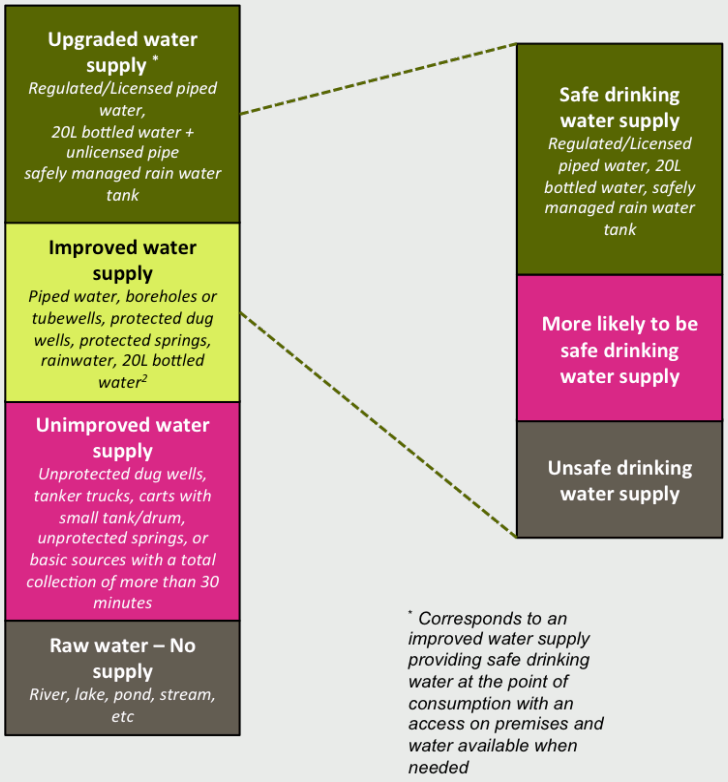


Figure 27: Different types of access

Types of coverage

- Likely to be covered people are defined as people who live in a commune where the water supply system is implemented[1] but do not belong to its coverage area. Contrary to other people in need, likely to be covered people can be covered though an expansion of the current covered area inside the commune.
- Covered people are defined as people living in the actual coverage of the existing water supply.
- Served people are the beneficiaries/customers of the water supply (i.e. people who use the access).

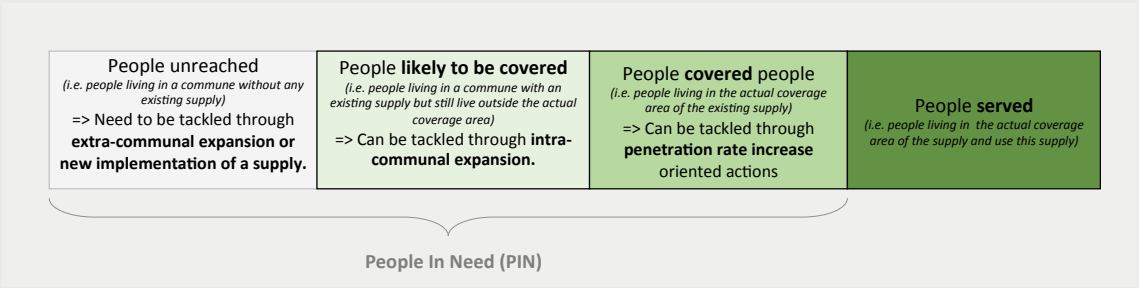


Figure 28: Different levels of coverage

1. Considering only water supply system has the potential to cover the whole commune

Overview of the current water access level in Cambodia

Level of access to improved water

Access to basic drinking water services (i.e. access to improved water source): coverage estimations

Table 17: Basic water coverage estimations[1]

Improved water supply - Cambodia	Basic water service coverage estimations (%)			
	Current status			
	2012 (NSDP2)	2012 (JMP3)	2013 (RWSH NAP4)	2013 (JMP5)
National	51%	71%	54%	76%
Rural	47%	66%	47%	69%
Urban	69%	94%	83%	100%

Note: Strong differences exist between the numbers released by the JMP and the ones from the Cambodian government. This could be explained by the fact that the JMP data are based on national surveys using mainly trend line analysis, while the government census is based on point data. Most of our analysis will be based on the Cambodian government figures[2].

Access to water per province: Even without integrating the exception of Phnom Penh, significant differences appear at the scale of provinces.

- Phnom Penh is clearly an exception in terms of access to improved water figures with more than 85% of access.
- 5 provinces are above 60% of access
- 8 provinces are below 43% of access with Kep at 32% of access.

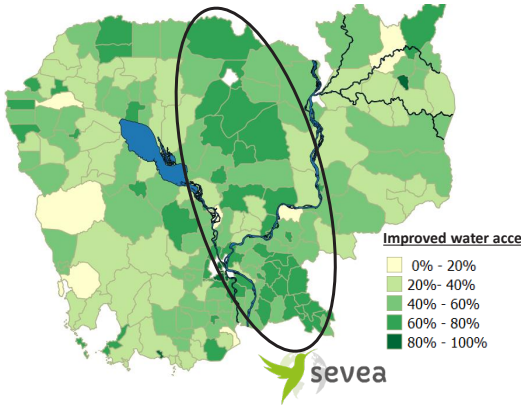


Figure 29: Improved water access by district in 2013 [Data from MRD, 2014]

Access to improved water by type of solutions – focus on wells

Two sources of data, Ministry of Planning and MRD have provided very different information regarding the number of wells. The difference could come from the concrete number of wells in activity. Nevertheless, the interesting aspects is that for both sources, wells are located in similar provinces: *Svay Rieng, Tboung Kmom, Prey Veng, Siem Reap, Kandal, Kampong Cham…*

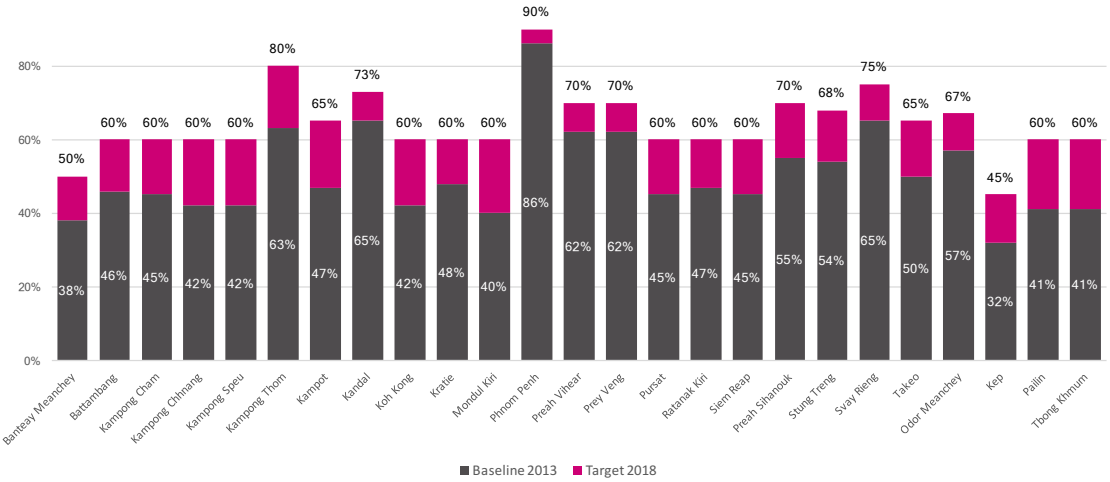


Figure 30: Improved water supply by province [MRD, 2016]

1. Data from JMP (WHO/UNICEF) and NSDP (Government of Cambodia)
2. World Bank, "Cambodia - Water Supply and Sanitation Sector Review", 2012, Page 26.

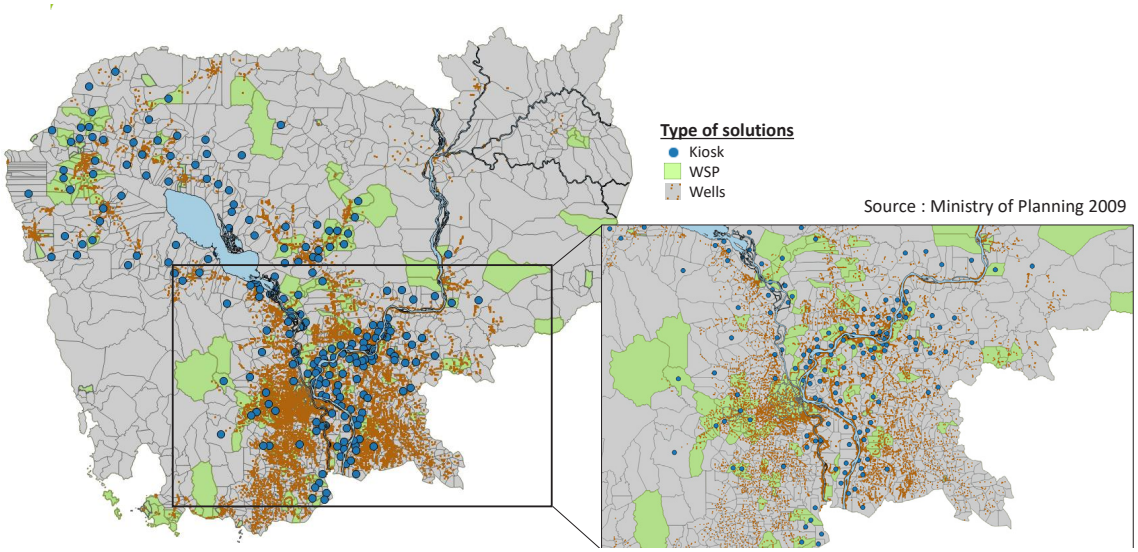


Figure 31: Location of well

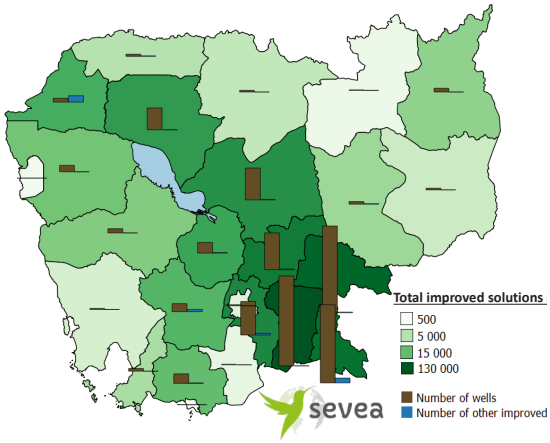


Figure 32: Total number of improved water solutions by provinces

Table 18: Access to Improved Water & Sanitation by location and by the Poor - [MRD 2012[1]]

Area	Overall Acess Improved Water	Water Access by the better-Off	Access to Water by the Poor*
National	45.7%	50.3%	38.9%
Urban	77.4%	85.6%	65.2%#
Rural	36.3%	35.9%	36.9%

* "Poor" here is being defined as the two lowest economic quintiles, as calculated in CSES
#Poor urban people are excluded from current urban water supply...

Access to improved water and poverty

In terms of overall access to basic services (access to improved water source), while there is no significant difference between poor and rich people in rural areas, poor urban people tend to be excluded from current urban water supply.

In urban areas, the access to improved water is done through piped water which is less inclusive (without any financial services and support) than wells, the most extended improved access in rural areas. Indeed, while there is a costly connection fee[2] for piped water access community wells are accessible to everyone in the village.

1. Ministry of Rural Development of Cambodia, "National Action Plan - Rural Water Supply, Sanitation and Hygiene 2014-2018", 2016.
2. Varies between US$ 30 to US$ 70

Piped water access

A huge contrast between urban and rural areas

With an access to piped water supply (including water supply networks delivering water that is not necessarily treated) estimated to be 21% by 2015 (based on 2013 data), Cambodia has one of the lowest access rate in the South-East Asia region. Access to piped services was only 7% for rural areas, where four-fifth of 15.6 million Cambodian inhabitants are living, and much higher for urban areas with 75% of access.

Table 19: Piped water supply coverage estimations [WHO/UNICEF JMP]

Piped water supply - Cambodia	Piped water supply coverage estimations			
	Current status			
	2000	2005	2010	2013
National	7%	11%	17%	21%
Rural	2%	3%	5%	7%
Urban	33%	48%	63%	75%

In terms of access to piped water (including basic piped and safely managed piped water services), the gap between the rich and the poor is more pronounced in rural areas than in urban areas.

In urban areas, between 2004 and 2012, while access for the rich increased by 8 percent, it increased by 20% for the poor. Yet, for rural areas the rich beneficiated from a 10 percent increase contrary to the rural poor who experienced a mere 3 percent increase.

On the overall, the gap in piped water service provision has therefor widened between 2004 and 2012. Rich households are ten times more likely to have access to piped water services than poor ones.

Against this backdrop, the Royal Government of Cambodia in its National Strategic Development Plan (NSDP) 2014- 2018 prioritized the acceleration of access to piped water services

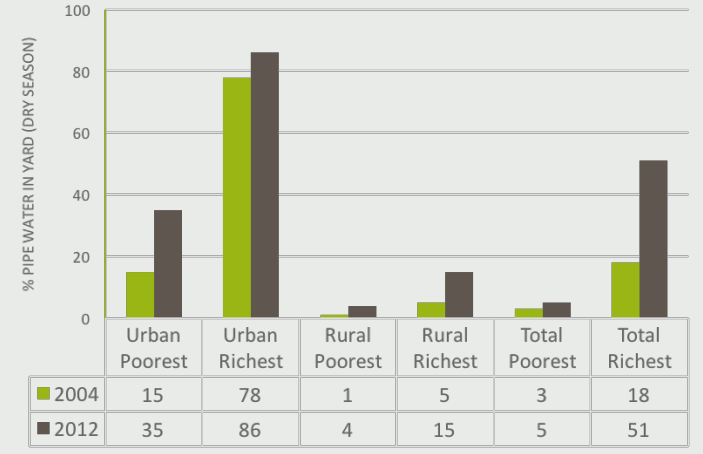


Figure 33: Equity aspects of piped water service provision in Cambodia - [World Bank, 2016][1]

This difference between urban and rural areas could be explained by the facts that:

- Piped water service is more able to reach poor people in urban areas than in rural areas because the architecture and population density of urban areas makes the areas easier to cover than in rural villages at a manageable connection fee
- Poor people tend to live in more scattered areas, therefor difficult to reach through pipe network

1. World Bank, "Strengthening Sustainable Water Supply Services Through Domestic Private Sector Providers in Cambodia," January 28, 2016.

Level of access to safely managed drinking service

The various accesses to water defined come with widely different access rates. While rates are consistent for urban areas, where the 83% improved water rate translates into a 74% safe and upgraded access rate, they are much more deceitful for semi-rural and rural areas. In rural areas, the 15% access to improved water is three times the access rate to safe water (5%). Even more duplicitous is the one in semi-rural areas, where a 62% access rate to improved water hides a mere 8% access to safe water.

Logically, similar trends can be observed for upgraded water access with even less people served due to the higher constraint of providing water not only of quality but also in quantity.

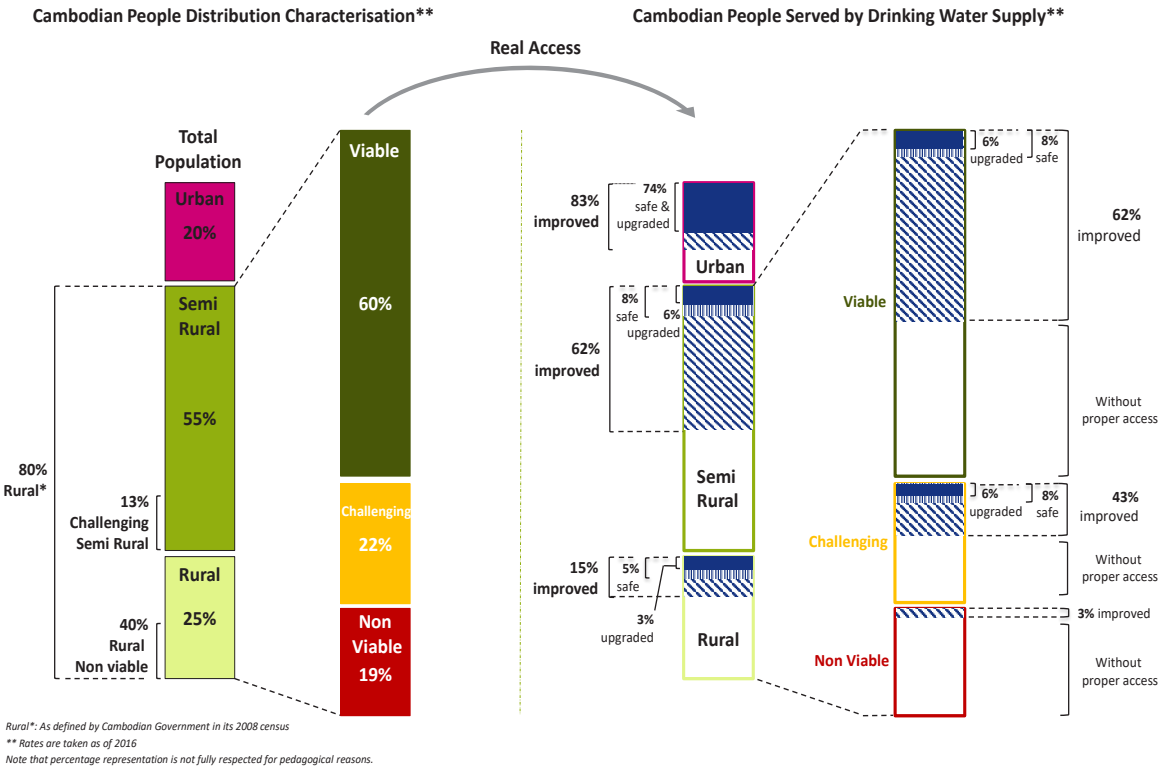


Figure 34: Estimated water access coverage rates per level of water access and per type of areas

Note: Even among urban areas, there are some high disparities in terms of access levels.

Table 20: Differences in WASH services between the capital and other urban areas [WaterAid, 2015]

Differences in WASH services between the capital and other urban areas		
Piped water to dwelling	**Phnom Penh**	**Other Urban**
CSES 2011	90%	33%
NSDP 2014-2018	85%	50%

Analysis of the number of "People In Need"

Note: Due to what is at stakes when talking about allowing people to drink safe water at home and the close figures between safe drinking water access and upgraded water access, the following part of the analysis will be based only on safe drinking water access.

Focusing on where the main challenges lie, meaning semi-rural and rural areas, the results of the analysis of the number of People In Need (PIN) are as followed:

Table 21: Current situation of safe drinking water access in semi-rural areas of Cambodia

Semi-rural areas – 8.1M people - 70% of total rural areas	
12% of semi-rural people are **covered** by safe drinking water supply solution	Out of the estimated 8 million people living in semi-rural areas, • Less than 1 million of semi-rural people are really beneficiating from safe drinking water supply (i.e. people drinking 20L bottled water and/or connected to a pipe safely managed). ⇨ **7.5 million people in need are living in semi-rural areas and for a vast part, could be addressed with market-based solutions.**
8% of people in semi-rural communes are **really supplied** by a safe drinking water supply solution	• Only 1 person out of 8 is currently living in the coverage area of a safe drinking water supply. The remaining people still don't have the possibility to use such services. • More than 1 semi-rural person out of 2 still lives in a commune where there is no solution of safe drinking water supply.
24% of people in need in semi-rural communes **can be covered by intra-communal expansion** of existing safe drinking water supply solution	⇨ **On the opposite, almost 2 million people (25% of semi-rural PIN) can be reached through a "simple" expansion of the existing supply coverage area inside the commune.**

Still a lot of work needed to give access to a safe drinking water supply to every people living in semi-rural areas. Intra-communal expansion of existing safe drinking water supply would allow to address 1 out of 4 of these semi-rural people in need.

Note: There are some semi-rural areas with hard conditions of access to water resources (i.e. drought exposed areas). It means higher constraints for market-based solutions (e.g. additional costly investments to get access to ground water) resulting into considerable difficulties to address drinking water access in these areas. It is estimated that 20% of semi-rural communes are "challenging areas" representing around 1M semi-rural people.

Table 22: Current situation of safe drinking water access in rural areas of Cambodia

Rural areas – 3.7M people – 30% of total rural areas	
11% of rural people are **covered** by a safe drinking water supply solution 5% of people in rural communes are **really supplied** by a safe drinking water solution	Out of the estimated 3.7 million people living in rural areas, • Only 5% are really beneficiating from safe drinking water supply (i.e. people drinking 20L bottled water and/or connected to a pipe safely managed). ⇨ **More than 3 million people in need are living in rural areas and will be hard to address through 100% commercial drinking water supply solutions.** • 75% of people are still living in a commune where there is no solution of safe drinking water supply. ⇨ **Only half a million people in rural areas can be reached through a "simple" expansion of the existing supply coverage area inside the commune.** ⇨ **For about 80% of people in need it will require new implementation of safe drinking water supply or extra-communal expansion to be covered**

Because rural areas are real challenging areas to address drinking water supply issues, the level of coverage is lower than in semi-rural areas. Nevertheless, because these areas are less populated, the share of people in need in terms of usage is the same as in semi-rural areas.

Overall, at least 11 million people still live today without access to a proper safe drinking water supply. 70% of them live in semi-rural areas.

To address these 11 million people, two development options can be encouraged:

1. the improvement and expansion of existing supply solutions (especially for semi-rural areas),

20% of rural and semi-rural PIN can be covered through existing supply solutions extension at commune level

2. the scale-up and/or replication of safe drinking water supply solutions to new communes.

A remaining 6 million people need to be covered through new pipe and/or kiosk facilities with 4 million living in semi-rural areas so potentially reachable through market-based solutions.

Along to this issue of coverage, actions[1] need to be implemented to increase the penetration rate. Covered people could therefore truly beneficiate from the safe drinking water service implemented.

1. Mainly marketing campaign to raise awareness about drinking water, inclusiveness oriented program so poor people are not left behind, etc.

10% of rural and semi-rural PIN can be reached through the increase of penetration rate so more people beneficiate from the service in the coverage area.

As a conclusion:

- A considerable amount of people of whom a large part is living in populated rural communes still need to be covered.
- Two ways to leverage the sector will need to be used with as much efficiency as possible due to how crucial it is to provide safe drinking water access on the largest scale and the shortest timeframe.
- The fact that 70% of PIN live in semi-rural areas lead to think market-based solutions of quality water access will be able to cover the major part of them. But it also means that it is crucial to support and foster the development of these solutions so the whole market can be addressed.
- Nowadays two solutions have been developed in Cambodia and proven their capacity to tackle safe drinking water issues in semi-rural areas: Piped water through WSPs and bottled water through community owned kiosks of 20L bottles.

Now the study will strive at comparing these two solutions and see how they are currently articulated in Cambodia and how they could be supported to increase their contribution to the sector of drinking water access

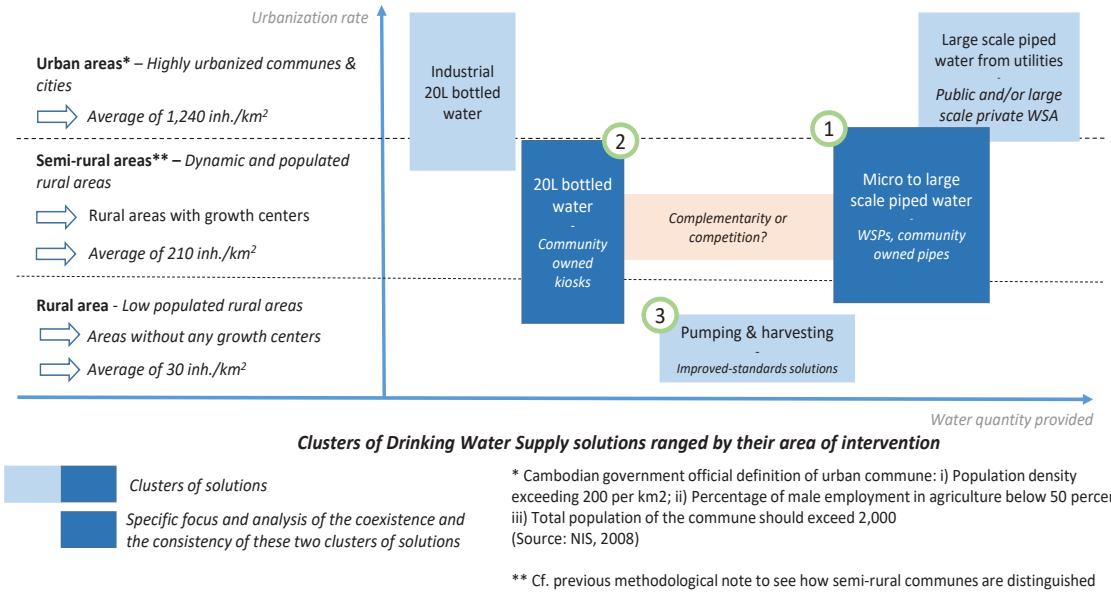
SOLUTIONS & ACTORS

HOW ARE THEY ANSWERING TO THE WATER ACCESS NEEDS IN RURAL CAMBODIA?

Clusters of drinking water access solutions in Cambodia

The 3 clusters of solutions that are considered solution of supply of drinking water[1] are:

1. Micro to large scale piped water service in rural and semi-rural areas[2]
2. 20L Bottled water sales
3. Pumping & harvesting solutions: wells, borehole, protected springs, rain water harvesting tanks[3]



Clusters of Drinking Water Supply solutions ranged by their area of intervention

Clusters of solutions

Specific focus and analysis of the coexistence and the consistency of these two clusters of solutions

* Cambodian government official definition of urban commune: i) Population density exceeding 200 per km2; ii) Percentage of male employment in agriculture below 50 percent; iii) Total population of the commune should exceed 2,000
(Source: NIS, 2008)

** Cf. previous methodological note to see how semi-rural communes are distinguished

Figure 35: Scope of the study - solutions

1. Solutions part of the 2014-2018 NAP of MRD and Solutions of sole water treatment such as filters are not studied as the study focus on supply solutions
2. Large scale piped water in urban areas such as public or private WSA are not included in the analysis.
3. Considering only pumping & harvesting solutions in compliance with the definition of improved water supply. As an example, for wells, only protected ones are considered as a solution. For rain water, only domestic tanks with a minimum of 3,000L capacity are counted.

Cluster 1: Piped water solutions for rural and semi-rural communes

Two types of model of intervention strive at developing piped water access in rural and semi-rural areas of Cambodia:

- Community owned piped water supply: the facility is funded by NGOs or MRD and operated by a local operator under a Water Committee Management remaining under the Commune Council. The current number of active community owned pipes is unknown. Doubtless, this number is marginal at a national scale and will remain very low based on the government target between 2014-2018 of 40 new systems implemented[1].

Note: See below in the next focus section an example of one of the most active actor of community pipe in Cambodia, World Vision.

- Commercial piped water supply: Private ownership and management by a Water Service Provider (WSP). Local production and local B2C distribution. Based on the Cambodia Water Association (CWA), there is currently about 420 WSPs. They represent more than 50% of piped water connections in Cambodia.

Cluster 2: 20L bottled sales

3 types of model for 20L bottled water distribution:

- Large scale bottled water companies selling 20L bottles to grocery shops: Private ownership and management. Centralized production and regional distribution on a B2B basis.
- Family business of bottled water (micro-small scale) selling 20L bottles to local grocery shops and deliverers: Ownership and management by a private entrepreneur (Bottled DPSP) local production and local B2B distribution
- Community owned kiosks operated by a local entrepreneur selling 20L bottles through local sales points or directly to customers through home delivery: local production and local B2B & B2C distribution. Two actors are active in Cambodia: Teuk Saat 1001 (TS1001) and Lien Aid.

Cluster 3: Pumping & Harvesting solutions

Implemented in semi-rural and rural areas, this cluster comprises all solutions based on pumping water from surface or ground water sources or harvesting rain water in a way that is "more likely"[2] to be safe. Thus, it includes the following solutions:

- Surface water pumping supply: protected springs
- Ground water pumping supply: protected dug wells, boreholes or tube wells
- Rain water harvesting supply: protected tanks of minimal 3,000L capacity

1. Ministry of Rural Development of Cambodia, "National Action Plan - Rural Water Supply, Sanitation and Hygiene 2014-2018", April 2016.
2. Term used in the official definition of improved water by the JMP Unicef/WHO

SOLUTIONS STUDIED WITHIN THE SCOPE OF THIS STUDY

Several criterions have been considered to define the framework of this study:

1. **Areas of intervention: focus on rural and semi-rural communes**

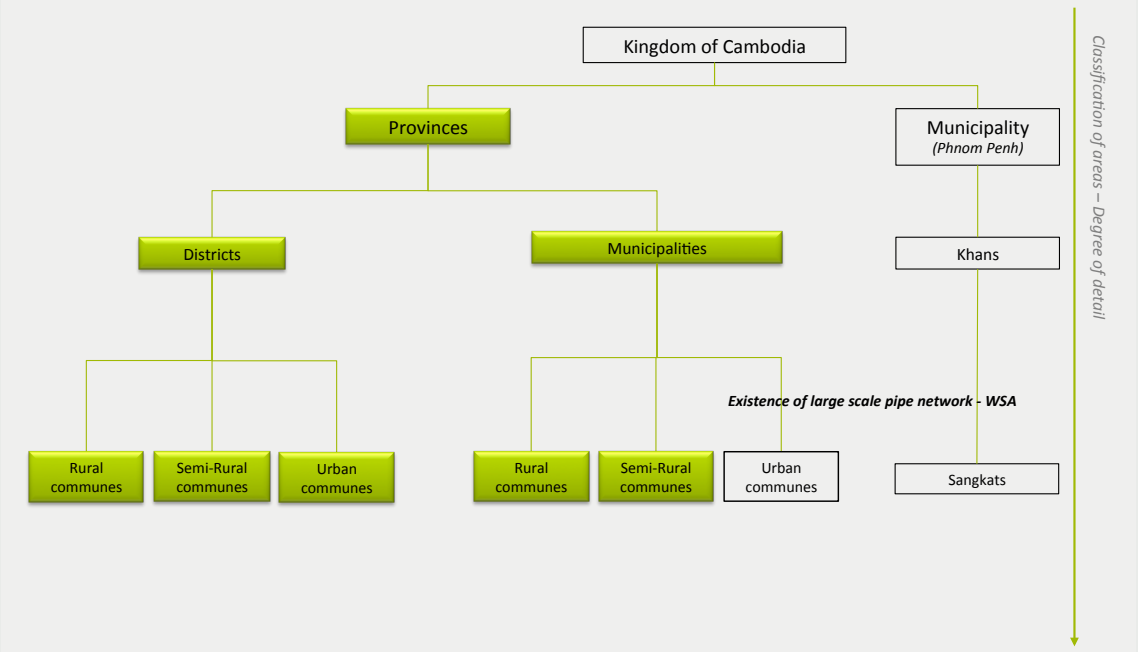


Figure 36: Scope of the study - areas of intervention

The study focuses its analysis on areas where the coherence and combination of drinking water services solutions still need to be defined and optimized. Therefore, large cities and municipalities and/or urban communes covered by a public or private WSA[1] are not analyzed. In such areas, we assume that the best way[2] to tackle drinking water issues, on both short and long term, is through the development/improvement of the existing WSA (large scale piped network).
Therefore, only drinking water supply solutions implemented in the "green-highlighted" communes above will be studied and analyzed based on their ability to tackle drinking water access challenges in such areas.

2. **Ability to address access to drinkable water issue today and tomorrow: Focus on solutions of water SUPPLY services & solutions which demonstrate both 1) a significant potential of lasting development in semi-rural areas for the coming years in Cambodia and 2) the capacity to provide safe drinking water at the point of consumption.**

1. It means that all urban communes belonging to a provincial municipality (Krong) are considered out of our scope of the study. It is assumed that the best way to tackle drinking water access in these areas is by improving the service coverage and delivery of existing piped water utilities.
2. Considered as the most relevant, efficient, effective and sustainable way to provide drinking water access in these areas. Thus, efforts should be focused on strengthening this model rather than trying to develop substitutive solutions.

- Cluster 1: Due to the insignificant contribution and role of community owned piped water supply, the study will analyze the piped water solutions focusing entirely on WSP model of intervention.
- Cluster 2: Due to 1) the preponderance of TS1001 bottles' sales in the sector[1], 2) the fact TS1001 has more than 3 times more of active 20L bottles kiosks in Cambodia than Lien Aid[2] , 3) the similarities of operation[3] between TS1001 and Lien Aid kiosks, 4) the fact that region scale companies won't contribute into the development of 20L bottles distribution in rural and semi-rural areas due to a lack of profitability and; 5) the fact that family businesses are currently under no regulation about quality water and thus cannot be considered today as a solution of drinking water, the study of this cluster will base its analysis of 20L bottles sales in rural and semi-rural areas mainly on TS1001 model of intervention and development.
- Cluster 3: Pumping and harvesting solutions mostly rely on international aid for their development[4] and are not planned to be economically viable. In this study, high potential solutions are considered to be solutions with economic viability's possibilities and/or room for large contributions of the private sector to finance its development at least in semi-rural areas. Pumping & Harvesting and Rain water harvesting are therefore not considered as high potential solutions for semi-rural areas and thus not analyzed in detail in this study.

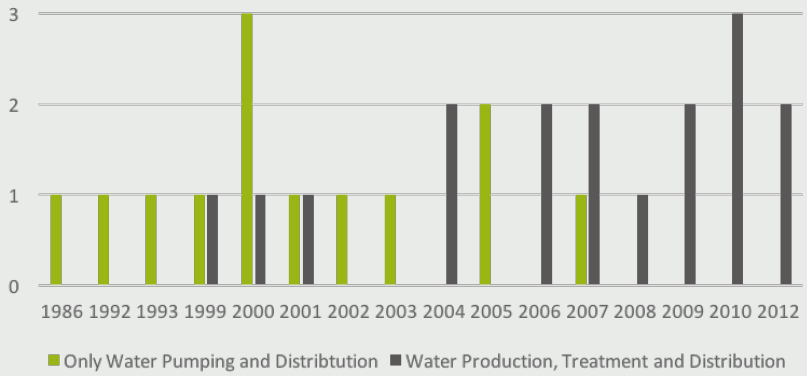


Figure 37: Change of investment nature over the past 20 years [GRET, Water Sanitation Program[5]]

Final scope of the detailed study

The study will finally focus only on WSPs and TS1001, excluding the solutions from the cluster 3 "Pumping & Harvesting", family businesses and big firms from the cluster 2 for lack of impact; and from the cluster 1, Community Pipe as they were deemed not developed enough to represent a significant potential for the sector. WSAs were already left out as this study focuses on rural access and they are only present in urban areas.

1. TS1001 sells about 352,000 bottles per month while the top 1 region scale company in the sales of 20L bottles manages to sell 90,000 20L bottles (including 70,000 20L bottles in Phnom Penh).
2. 154 active sites for TS1001 and 64 active sites for Lien Aid by the end of 2016
3. Same model of operation, management by a local operator, same water treatment technology, etc.
4. The private sector has not invested in only water pumping and distribution solution in Cambodia since almost a decade.
5. GRET, WSP, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market - Cambodia,", 2013

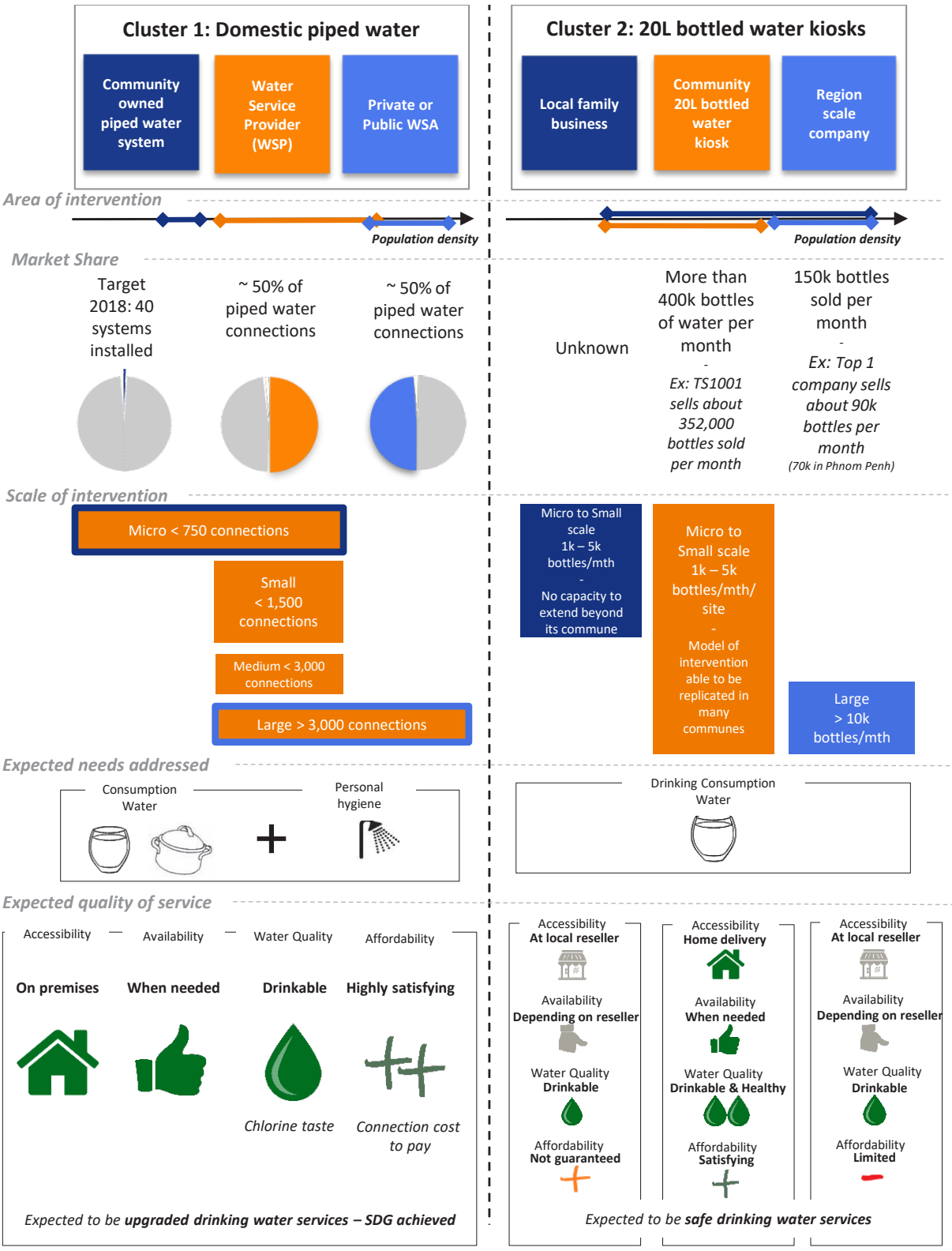


Figure 38: Cluster definition and main characteristic

EXAMPLES OF ACTORS FROM CLUSTER 1 & CLUSTER 2 NOT STUDIED IN DETAIL

Community-managed piped water systems, the example of World Vision

World Vision, one of the actors of community-managed piped water systems, builds around 5 systems per year. It funds and manages the construction of the system. Once set-up, World Vision pulls out of the project and hands over the management of the operation to the Water Management Committee (WMC), under the Commune Council who becomes owner of the system.

The piped water system is then operated by a local operator paid by the WMC. World Vision however remains present doing quality checks every month at the stations.

This kind of model has a scale of intervention that can reach 500 households, or 2,500 beneficiaries. It cost roughly US$ 50,000 to implement.

For beneficiaries, prices are competitive, with a connection fee of only US$ 30 and a water tariff at KHR 3,000 per cubic meter.

LienAid, a model of community-owned water kiosk

Following the example of TS1001, LienAid funds community owned bottled water kiosks which are operated by local micro entrepreneur. The management of the system is ensured by the Water Management Committee, established under the Commune Council to supervise the facility. There are few conditions that have to be met by the commune: They only need to bring US$ 500 of their own money and provide a public piece of land for the kiosk.

Aside from the set-up of the facility, LienAid also provides 2 years of technical and operational support to the Commune Council. The 20L water bottle are sold at KHR 1,000 at the production point and at KHR 1,500 at the local distribution point. Similarly to TS1001, they provide free bottles water to schools.

A focus on rural challenging areas

As of now, LienAid focus on rural floating communities and those on the floodplains of the Tonle Sap and Mekong River. The majority of their activity is located in the 9 or 10 provinces around the Tonle Sap. They also act in Arsenic infected areas.

A young but dynamic project

The NGO has, as of today, a total of 7 staffs based in Phnom Penh who supervise 64 kiosks implemented around the country. Each of these kiosks works at a commune level, with a number of beneficiaries that ranges from 2,500 to 10,000 per kiosk. They have three models of capacity for their water plants:

- Small: 3.5 m^3/day (8h of operation) => 2.5k – 4k beneficiaries;
- Medium: 6.5 m^3/day => 4-6k beneficiaries;
- Large: 12 m^3/day = > 6k beneficiaries
-

In 2016, 14 sites have been set up, of which 10 had a small capacity and 4 had a medium one. For 2017, 10 sites were already confirmed, with 5 more pending for approval.

The 20L Bottled water market

The 20L bottle market is today divided between three major types of actors: Big scale companies, family businesses and community kiosks.

Big scale companies represent a significant share of the 20L bottles' market with a focus on high demand areas.
As of today, they sell around 100,000 20L bottles in Phnom Penh and around 50,000 in provinces per month.[1] The bottles are distributed through local retailers able to order between 30 to 150 bottles per customer (i.e. retailers located in urban areas, mostly provincial towns). The delivery starts only at a total order value of minimum US$ 1,000 to 1,500.

However, the 20L bottles' market is seen as constraining and low-profits.
Indeed, selling small bottles is much more interesting because they are 8.5 times more expensive, easier to transport and free from constraint such as the deposits and washing of the 20L bottle. Moreover, there is always a risk that 20L bottles will not be given back and the centralization of treatment plants on Phnom Penh increases the cost of transport in outer regions. So, big scale companies can't compete with family businesses which sell in rural areas.

Family businesses are limited to a small scale because their lack of delivery system does not allow them to reach customers beyond 40 km from their production site. Thus, it is tough to estimate the number and the real contribution of family business to the 20L market.
They have no possibility for development as they are limited by: intense competition with other family businesses, low income potential customers that cannot afford bottled water in some rural areas, no long-term business or action plan, an incapacity to reach new customers as they have no delivery system, a limited capacity of production per treatment unit (between 1500 and 3,000 bottles per month).

Big companies have a strict policy on deposits, and its high price – US$ 4 – can be prohibitive for poor populations. Family businesses are more popular in poor areas as they are cheaper and can often cut prices on the bottle deposit to less than US$ 2 because of their geographical proximity with their customers and less strict regulations.
They have flourished due to the low price of the initial investment (US$ 5,000 to US$ 8,000 for a lower-end water treatment station allowing to process 1,000 liters per hour) and cheap task force as they often work in families.

Although the water distributed is more likely to be safe initially, the critical lack of regulation for family business as well as the necessary regular and not-so-obvious maintenance that needs to be regularly performed, do not ensure the quality of the water.
As most of family businesses are not licensed from MIH, they are not under any water quality regulations. As a result, some of them may cut expenses on the treatment to be able to have very competitive prices (around US$ 0.45 in rural areas).

As a whole, family businesses represent a great potential in terms of access to 20L bottled water but as long as no regulatory framework and no capacity building is implemented for these actors, such type of actors can hardly be considered as suppliers of drinking water.

1. Estimation issued from the interview of the 4 biggest companies of 20L bottles (Uy Mey, Hi Tech, Oral and EUROTECH).

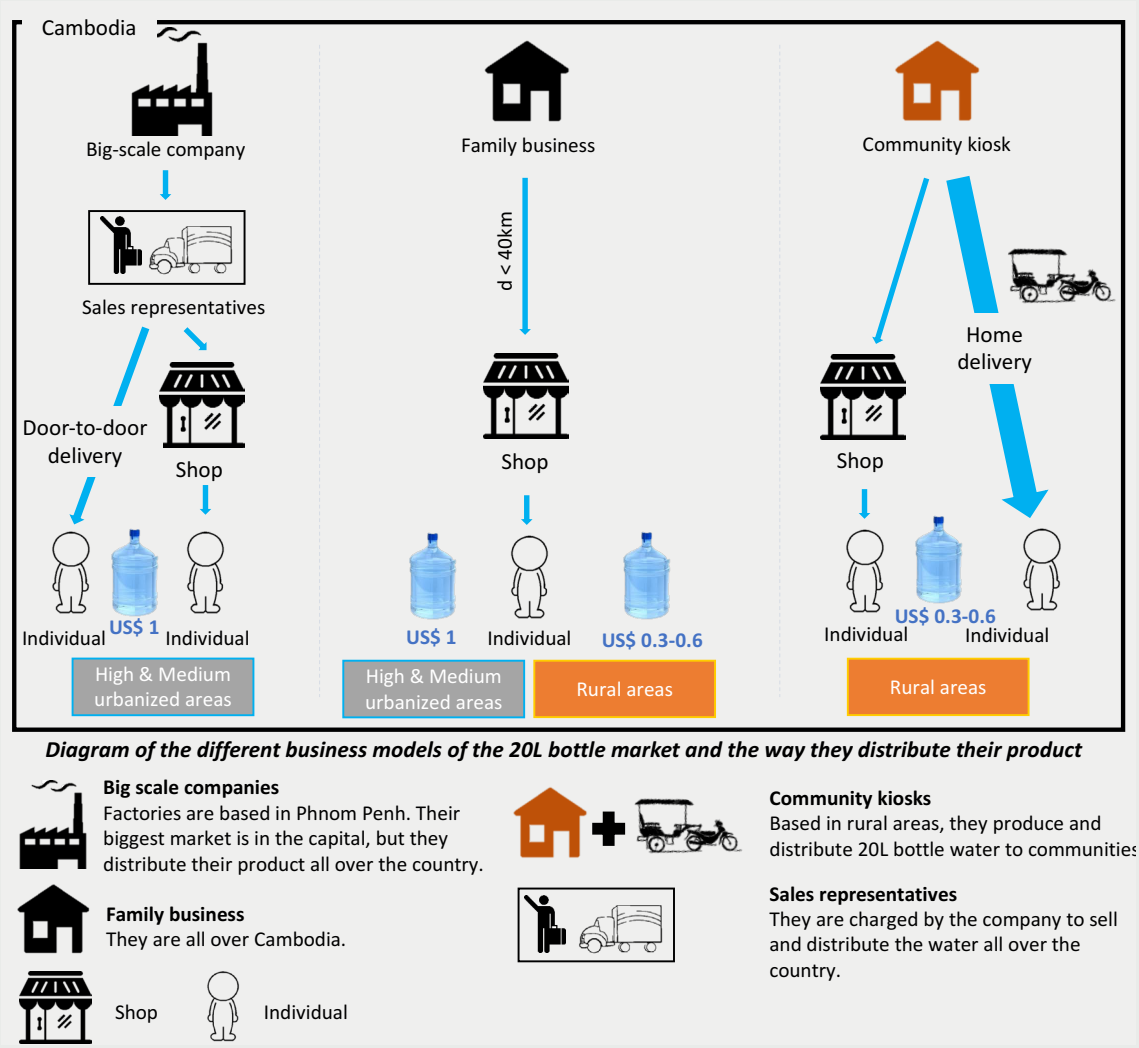


Diagram of the different business models of the 20L bottle market and the way they distribute their product

Figure 39: Existing models of 20L bottled water distribution in Cambodia

Detailed description & analysis of the 2 main water access solutions in Cambodia: WSP and kiosk models

General description of the solutions studied

Teuk Saat 1001, a community based model strengthened on multiple levels to deliver bottled water

Teuk Saat 1001 (TS1001) is a NGO that works to implement water kiosks around the country to sell 20L bottles of water. To that effect, they work on four different levels: At international level the French NGO "1001 Fontaines pour Demain" oversees all targeted countries, at national level, the Cambodian NGO TS1001 which headquarters in Phnom Penh, at regional level, TS1001's platforms that each oversee and help the water kiosks, who work at a communal level. These local kiosks are managed by a local entrepreneur chosen and trained by TS1001. As of now, they have 75 full-time employees, 3 active platforms (Battambang, Phnom Penh and Kampong Cham) and 154 active water kiosks that deliver water to a total of 300,000 of beneficiaries. For their distribution, TS1001 delivers their own brand of water, called O-We. TS1001 made the choice to concentrate on drinking water bearing in mind the health impact of their presence, with access to 1.5 liters of daily quality water for drinking being enough to have a direct consequence on the health of beneficiaries.

Since their beginning in Cambodia in 2005, Teuk Saat have had the occasion to test and upgrade permanently their setting up method to better ensure viability of their kiosks. The process starts hand in hand with the MRD, who hands them over a list of communes where they feel TS1001 can have a positive impact. The NGO then sorts the communes in question and selects them where a sufficient water source is available to be exploited for the kiosk. Site selection can also sometimes occur through partnership with other actors and sponsors like UNICEF. Among the selected communes, they then survey the village to find an adapted entrepreneur to run the business. This phase is strategic as the choice of entrepreneur is the first factor of success. Once he is chosen and approved by the community, he follows a training by the NGO, who also provides the full CAPEX to set up the treatment station (an average US$ 25,000 per station), who is then community owned. The entrepreneur then becomes independent, with a fixed salary and benefits from the firm that add up to an average revenue of around US$ 150 per month. Once up and running, water kiosks still work in close collaboration with regional platforms. Indeed, against fixed monthly fees, these platforms oversee all technical issues. This guarantees a risk-free model as there is no additional fee for kiosks in case of technical failure. The platforms also provide continuous support through advisors that are in close contact with the local entrepreneurs.

For distribution, TS1001 entrepreneurs work through three approaches: They provide home delivery on a maximum two days' basis, work with local resellers and sell bottles directly at the station. The versatility of the services offered allows them to estimate their coverage zone with a radius of 8 kilometers around the station, often equating to full coverage in the communes they work in, especially since they target mainly communes with a strong enough density, and to have an average rate of penetration in said communes of an average 19%. A rate that is constantly on the rise and that they expect to reach around 40% eventually.

The price of their O-We bottles is fixed directly by the headquarters, at a price of KHR 1,500 per bottle when home delivered or KHR 1,200 when the bottle is bought directly at the station. There are programs to target poorest households through discounts, but few people claim the right to those discount for question of pride. With an average consumption of 3.6 bottles per household per week, this represents a monthly budget of US$ 5 dedicated to this drinking water for beneficiary households.

In addition to their 300,000 beneficiaries, a number which is expected to rise with the opening of 90 additional stations before 2020, the NGO also reach 80,000 students through a school program. Indeed, inside their communes, every entrepreneur has to provide free water to schools, a fee which is covered by TS1001 afterwards and allows all the students to have a clean and safe drinking water for the whole day.

Water Service Providers, a panel of private actors under increasing government control working to provide piped water

WSP, or Water Service Provider, is the name given to different actors that share the management of a piped water network that delivers water on premises at a communal scale. The huge amount of these privately owned and managed piped networks is a specificity of Cambodia. These actors generally work on a same overall model: They are private entrepreneurs who manage their own business, meaning they oversee their production facility (for pumping and treating the water) and pipe network. As of today, estimates report around 423 active WSPs in the country, covering a total of around 600 communes in Cambodia and, with an average coverage rate of 37% and penetration rate of 47%, serve a total population of 1.3 million Cambodians, of which about 1 million live in rural zones. However, not all piped water operators are considered as WSPs as, in the largest cities of the countries, networks are managed by WSAs, or Water Supply Authorities, that are semi-public agencies that oversee the water production and distribution. When also taking them into account, the total number of 3.5 million beneficiaries of piped water is reached.

There is a large panel of actors that are described as WSPs, and that can be divided according to relevant factors:

- The first distinction is to be made at license level. Indeed, through monitoring by the MIH, WSPs have access to a license, distributed at commune level, for a period of 20 years. When WSPs started to appear, at the end of the 90's, there was no oversight of their work and no official frame in which to work. However, through successive licenses and reforms, and a continuous effort to regulate the market, a certain level of surety was attained among licensed operators. This new license, based on the 2014 ***Praka***, ensures a certain number of guarantees. These guarantees concern mainly the quality of the water and of the distribution service. Thus, a distinction between unlicensed and licensed WSPs must be done. This difference will be even more important in the next years after further implementation of compliance's actions. Unlicensed operators, who often operate on small scales and without any regulation, can rarely be trusted as an actor of safe water access. On the contrary, licensed operators can increasingly be considered as a safe water source for consumption and household use.
- A second distinction between actors can be made through their size. Multiple separations can be made on this point. For this study, it was chosen to characterize them in three categories:
    - » Small WSPs, with less than 1500 connections. They weigh for almost 70% of the total WSPs
    - » Medium WSPs, with a number of connections ranging from 1,500 to 3,000.
    - » Large WSPs, with over 3,000 connections.

According to their size, WSPs generally work on different models. The smallest WSPs, especially when unlicensed, tend to work as family businesses, operating their business with few staff, often familial, on their own land. These operators, while managing their business, have little insight on their operation, and often little business plan or strategy for the future. For other small WSPs, who already work on a more professional business model, their profile is closer to larger operators. The investment needed to start this kind of business is often for a large part private. This means that entrepreneurs who get into this line of work are often people that already have a certain level of wealth and invest knowingly in their business, maintaining a level of performance in their firm. Larger operators add to that a financial capacity to extend beyond the first perimeter of coverage and to other communes, often managing several businesses and production facilities in adjacent communes.

Three examples of WSP met and surveyed

Table 23: Case studies of different profiles of WSPs

Kandal Province	Kampong Speu Province	Kampong Speu Province
This WSP started his business in 2003. In 2005, the owner decided to change location. To do so, he got some support from USAID which provided 50% of the investment (US$ 200,000) to build a new water station. He now covers 6 communes with more than 6,000 connections, over a total of 15,000 households present in his communes. This market represents an average of 60,000 m^3/month. As of now, his total investment in the business has been of US$ 960,000. Following a deal with MIH, he recently decreased his water tariffs, down to KHR 2,000 per m^3. But thanks to a favorable demand and an easily accessible water source (the Tonle Sap), this tariff decrease is not impacting the further development of his business. This WSP invested in a control equipment to control standard water before and after treatment and monitors the quality of it water in real time. For his next expansion phase, he plans to get support from iSEA and AFD program for a soft loan, and plans to expand in the coming year to one more commune. This WSP is also supported by UNICEF that subsidizes 50% of fee connection for poor households. *Source: Sevea Consulting Field interview, 2017*	The owner of this WSP launched his first activities in 2014. He now covers one commune out of the 2 he is licensed for. He currently serves 750 households, for a total of 3,500 m^3/month. He faces many constraints such as a lack of access to a water source in his coverage area and a sparsely populated service area. Each village he serves has indeed only 25 to 100 households. Despite a lack of technical background, he understood that people from that area really needed water. Prior to his service, inhabitants used to buy water from water trucks at a cost of US$ 2.5 to US$ 5 per m^3. Seeing this, he decided to create this station, for which he drilled a well to extract the water from. This allowed him to offer water at a rate of KHR 2,800 per cubic meter, against an investment that cost him US$ 180,000 up to now. Despite the previously mentioned difficulties, he has managed to grow his number of connections, from 300 in 2015 to 750 in 2017. For that, he decreased the connection fee to half the price set by the MIH, and allowed people to pay at a rate of US$ 5 per month with no additional fee. *Source: Sevea Consulting Field interview, 2017*	This WSP started its operation in 2011. First, it just served untreated water from a small river. Initially, it started with 5 villages, but with a steady increase of coverage zones, in 2016, it has applied to get the new license from MIH. The business then turned from a supplier of untreated water to one with a water purification system. The WSP built the station under the supervision of a MIH's experts. As the water quality improved, so did the water tariff that increased from KHR 1,700/m^3 to KHR 2500/m^3. Today, it covers 12 villages with currently 750 connections, for a total of 10,000 m^3/month sold. The business is sustainable but the WSP won't be able to expend its coverage area because all neighbor communes with potential are licensed already, and the 2 remaining communes have too many constraints to present any economic interest. For the business the owner, this water business is just one of the multiple businesses he has. It's clearly not his main priority because of the lack of development potential. *Source: Sevea Consulting Field interview, 2017*

In-depth analysis of solutions studied

The objective of the following analysis matrices is to understand and evaluate, through a list of relevant factors, the capacity of each solution to answer to the problematic of water access in its different forms in Cambodia. The chosen criteria are as follow:

Table 24: Criteria for the water suppliers' detail model analysis

Criterion	Details of the evaluation
Easiness of Use & Accessibility	This criterion evaluates the physical constraints that households need overcome to access to the water source, especially in terms of time and distance to the water.
Availability of the water	This criterion evaluates the availability of the water produced on different scales. It is mainly focused on the solution's capacity to supply water all day long, all year long.
Quantity of water provided	This criterion evaluates the ability of a solution to provide a certain amount of water, theoretically and to answer the different needs it addresses.
Affordability	This criterion evaluates the impact of the price on the penetration rate. As such, it focuses on the following aspects: the reality of this price, the barriers it puts for poorest households and the perception of this price (or how people see the price and how it influences their consumption).
Quality of water at point of consumption	This criterion evaluates the quality of the water as it is drunk by the beneficiary, but through that evaluates also the treatment process, the testing frequency and reliability, and the vulnerability of the water during the supply chain.
Usage for drinking	This criterion evaluates the efforts needed to ensure the use of the solution as a drinking water source.
Resilience to external factors	This criterion evaluates the impact of three types of external factors on the solution. It evaluates its resilience to climate variation, and especially drought risks, its resilience to chemical pollution, and its resilience to human activity.
Areas of intervention	This criterion evaluates the capacity of a solution to serve a maximum number of beneficiaries. As such, it evaluates the capacity of a solution to set up in a commune according to the profile of the commune, to cover that commune, and to connect people inside its coverage zone.
Ability to scale up	This criterion evaluates the solution's capacity to widen its customer base and reach, its potential for expansion to, eventually, maximize its number of beneficiaries.
Economic Viability	The criterion evaluates the economic model of the solution and its capacity to reach economic sustainability.

The scale of grading goes from 1 to 4. A grade of 1 means that the criterion is not met, while a grade of 4 means that there is little room for improvement. Any grade above the median one (2.5) signifies that the actor is, with the necessary parsimony that comes with the grade, able to bring a form of solution to the factor.

Analysis of piped water services through WSP

Table 25: Matrix of analysis' results for WSPs' model of intervention

Indicator 1: Easiness of use & Accessibility	**Grade: 4**
• Accessibility is well tackled • Pipe connection on premises but mostly used with storage With a time and distance separating them from source access at zero, the accessibility of the water source is perfectly tackled.	
Indicator 2: Availability of the water	**Grade: 3.5**
• The availability of water varies with the operator but remains on the overall very high: available when needed during most of the day... • The quality of the availability can be affected by pressure problems... • The unavailability of water is often directly linked to shortages of raw water source • The use of jar storage partly makes up for the availability issue For most operators and their beneficiaries, there are no issue concerning the availability of water, which is usable all day long with unlimited capacity. However, some residuals problems like shortages during extended dry seasons costs the availability its perfect mark.	
Indicator 3: Quantity of water provided	**Grade: 4**
• A capacity logically linked to the size of the operation • A capacity that is limited mainly by treatment and pumping capacities • Operators that allow sufficient water availability for everyone (more than the 20L minimum per capita per day required to meet all domestic essential needs) There is not limit whatsoever in the consumption of WSP water. With unlimited water accessible in terms of volume, this factor also gets a perfect mark.	
Indicator 4: Affordability	**Grade: 3.5**
• Variable but always competitive tariffs among WSPs • Upfront connection fees as well as free water in rainy season are the main barrier to the adoption of WSP services, especially for poor people • Future tariff regulation will standardize the market and ensure the affordability of water Piped water is affordable for households and considered as such by beneficiaries. However, the price of the connection fee remains a blocking point that justifies this little gap with the perfect grade.	
Indicator 5: Quality of water at the point of consumption	**Grade Unlicensed WSP: 1** **Grade Licensed WSP: 2.5**
• A quality of water at the point of consumption which is not reliably safe enough to be currently considered as drinkable • A real gap in quality between different types of actors • This deficiency in quality is mainly due to financial constraints, poorly skilled water operators and a lack of interest in the process • Widespread home storage of piped water makes the lack of chlorine treatment or management even more charged in consequences	

For this criterion, it is necessary to distinguish two types of operators:

- For unlicensed WSPs, the question of quality is quickly settled, their water is almost universally unsafe for consumption, thus the minimal note.
- For licensed WSPs, recent regulation efforts have meant that all of them are now equipped with treatment stations. However, their operational use is not yet insured. With half the process already executed and first examples of responsible operators, the note given to licensed WSPs falls just over the mean one.

Indicator 6: Usage for drinking	**Grade: 2**

- Piped water access is highly desired by Cambodian people
- But its acceptance for drinking is slowed down due to the use of chlorine
- As a result, piped water is not necessarily the main source for drinking

Piped water is not considered as a source of drinking by the Cambodians. Traditions and taste problems make it undesirable for drinking. However, in case of need, it can still be used as drinking by households, although mostly after a boiling process, which explains why it does not receive the minimal note.

Indicator 7: Resilience to external factors	**Grade: 2.5**

- Droughts, a recent but serious and increasing problem resulting into water shortage situations
- Chemical pollution, a non-relevant issue for now that could become a major hazard
- Human activity, a critical factor endangering the sustainability of WSPs

Although rarely directly endangered by natural factors for now, WSPs will soon have to face consequences of human activity and global warming in Cambodia. Moreover, their lack of insurance when facing human destruction makes them susceptible to risks, which explains the mitigated grade earned.

Indicator 8: Areas of intervention	**Grade: 3**

- Two main areas of intervention, semi-rural and urban communes with easy access to water (i.e. presence of surface water sources)
- The coverage rate is satisfying at village level, less at a communal level, and very dependent on the size of WSP
- A zone of coverage that amounts to a fair share of connection and bound to rise
- A coverage situation which is expected to greatly evolve for licensed WSP in the next 5 years

Considering semi-rural and urban communes make up for 80% of the country's population, WSP's main zone of intervention allows access to piped water to the large numbers. Adding a mandatory rate of coverage of 90% for licensed ones and a potential for full connection rates, WSPs do not leave many behind, but enough to lose a point on their grade.

Indicator 9: Ability to scale-up	**Grade: 2.5**

- A great potential of expansion inside communes being already partly supplied by WSP
- However, an effective scaling up depends on many factors:
- But a limited capacity of expansion to other communes
- This will result into the concentration of actors and might see the rise of a new type of actor
- Changes brought by the regulations from the 2014 *Praka*
- Potentially isolating even more remote regions

With a great potential for scaling up within covered communes, but a limited one to touch neighbouring communes, the ability to scale up of WSPs gets a balanced grade.

Indicator 10: Economic Viability	Grade: 3

- WSPs, a general joint model of business, with differences brought in by the size factor
- Revenues mostly based on water sales
- Costs & expenses: a mostly variable cost linearly linked to production
- Capital Expenditure (CAPEX): US$ 720,000 in average

The economic viability of WSPs is pondered by two antagonizing elements. On one hand, the need for a large initial investment from the private sector limits the ability to put in place this model on a large scale. But on the other hand, once the station is up and running, low fixed costs ensure a quick economic viability for the operators. However, despite the need for large initial CAPEX, the number of functioning stations points to a certain viability of the model for all scale operators, justifying a grade above the median.

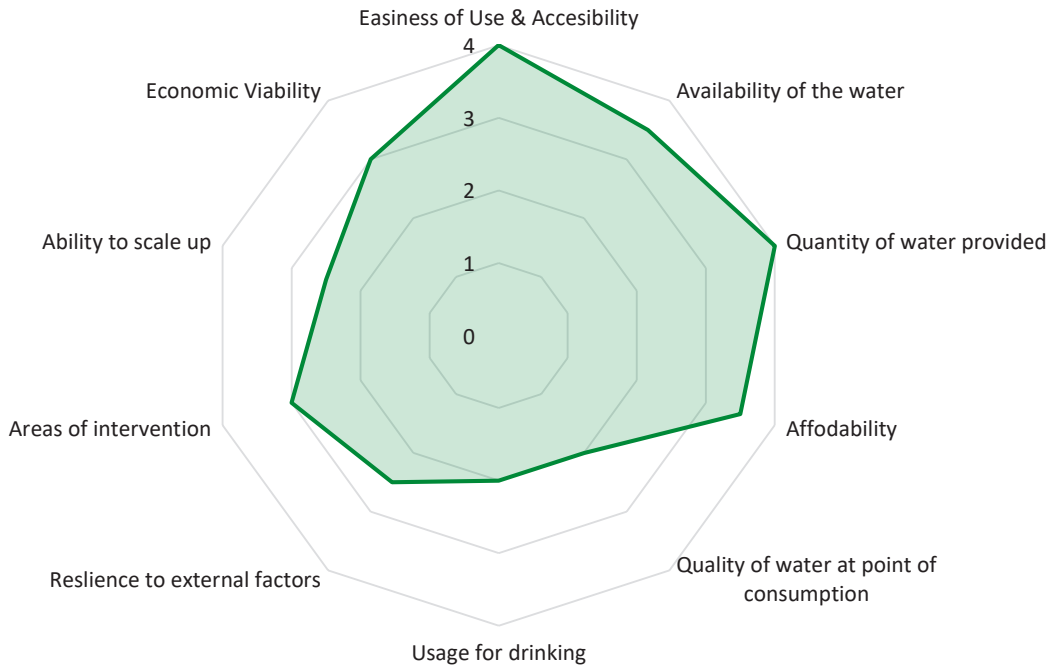


Figure 40: Summary of WSP's model analysis

While it is again hard to compare all WSPs considering the wideness of their model, there are still some common points to gather out of this study. The assets of WSPs do not lie in its potential as drinking water. On the contrary, as of today, its quality and use for drinking are its most substantial weaknesses. On the other hand, it shows great quality in terms of service, quantity and affordability, which explains why it is seen as so desirable by most Cambodian households. Another strength resides in the fact that its development and operation are for a large part only supported by the private sector.

Note: See the detailed matrix of analysis in appendices.

Analysis of bottled water services through kiosks based on TS1001's model

Table 26: Matrix of analysis' results for TS1001 model of intervention

Indicator 1: Easiness of use & Accessibility	**Grade: 3**
• Thanks to home delivery, the accessibility is closed to be considered on premises, as most beneficiaries do not need to move to access their water source. • The distance factor, still a main constraint and the first reason for stopping O-We (water brand of TS1001) for those who are not concerned by home delivery. While it hypothetically ensures an "on premises supply" through home delivery, this model cannot get a full grade as it leaves out certain households, mainly those far from the station.	
Indicator 2: Availability of the water	**Grade: 3**
• Available when needed on premises as long as household anticipate their needs **and delivery service is regular** often needing two bottles to mitigate this. • Specific criteria of area's selection have been set to ensure water availability all year long, a process doubled by a choice of areas with at least two water sources. • Due to a focus on supplying drinking water only, the management of raw water source is relatively easy, as it entails small quantities. On a yearly basis, water availability is not an issue, and gains a perfect mark. On a daily basis, water availability is mostly linked to households' capacity to anticipate their use. Although buying two bottles tackles that issue, this represents an additional expense that all households cannot afford. This and the fact that in the end, availability is based on customer action and not unlimited lowers this factor's grade to just over the median.	
Indicator 3: Quantity of water provided	**Grade: 2.5**
• A supply which is limited by the demand and not by the capacity of production, with stations sized as of now to absorb the demand. • As a sole actor of drinking water, they have a partial impact, not providing for all other water linked needs. As an actor of its own market, drinking water, TS1001 can easily cover full demand in terms of quantity, earning on this point a perfect mark. However, the very nature of its market positioning that includes only one water-linked need, and what's more the one who needs the least water in terms of quantity, makes it impossible for the model to exceed the median note.	
Indicator 4: Affordability	**Grade: 3**
• A more product 30 times the price of WSP water, but in a different market that demands a higher quality and addresses different needs. • A perception that the product is aligned with its price, as people link money and quality and O-We still remains below average prices for bottled water. • A reality that adds up to a reasonable budget, still unreachable for poorest households but under international recommendations for water budget. While TS1001's prices are perceived as reasonable and in fact do add up to a budget within acceptable limits for most households, it cannot gain the maximal note as it is still factually expensive and inaccessible for the poorest households.	

Indicator 5: Quality of water at the point of consumption	Grade: 3.5

- An irreproachable quality chain strengthened at multiple levels: communal through stations, regional through platforms and international through French headquarters.
- In consequence, a high-quality water, perfectly safe for consumption.
- But residual problems on which they have no control, including the entrepreneur's implication and customer habits.

Although their treatment process, supply chain and testing methods are almost risk proof and normally ensure a high standard for the quality of the water, the small but existing and uncontrollable risk brought in by the human factor explains why the quality is not at a perfect grade, but just under.

Indicator 6: Usage for drinking	Grade: 4

- A water sold and used solely for drinking, so a use ensured at the moment of sale.
- But a long process to change popular habits, who are marked by a history of harvesting free water.
- Targeted campaigns already at work to optimize user rates have shown in average very positive results, transposing strategies from performing stations to others.

As drinking water selling businesses, Teuk Saat kiosks ensure that their water is used as a main drinking source. Moreover, conditions for wider penetration rates are met, earning this factor the maximal grade.

Indicator 7: Resilience to external factors	Grade: 3.5

- A safe policy that allows a strengthened resilience to water shortages through doubling of water sources.
- Chemical pollution, a non-relevant issue for now that could become a major hazard if there was to be an unpredicted chemical accident

As of now, neither natural factors nor human activity endanger TS1001's supply process. As chances of chemical contamination are still weak, and sampling possible, it is also the most resilient source to any chemical leakage. As such, it almost garners the highest note, just losing half a point to the time it would need to detect that chemical pollution.

Indicator 8: Areas of intervention	Grade: 2.5

- A model that targets semi-rural communes, where population is dense enough for home delivery to be sustainable, and where water is easily accessible
- Regional platforms, locally enhancing penetration rates by accompanying the entrepreneur and improving the water service but limiting national expansion through the compulsory proximity with it
- A model that does not realistically aim at large penetration rates despite full coverage rates, showing goals of 40% penetration rate on the long term.

At every level, TS1001 brings antagonizing arguments. At communal level, it can cover virtually the whole commune but plans to deserve by 2020 in average 40% of its people. At national level it has, in its platforms, an advantage to train and transform ordinary citizens into full time entrepreneurs, but also a geographical barrier for expansion. With all aspects balancing each other out, the area of intervention of Teuk Saat kiosks is put at the median note.

Indicator 9: Ability to scale-up	Grade: 2.5

- A capacity for replication facilitated by a model that has been tested and improved multiple times by the NGO, improving the process over time.
- But in the actual model, replication is possible only on NGO funds, as they cover the full CAPEX or each new station opening.
- Finally, constraints that will appear with a progressive status change, when the French overview will disappear and the branch will lose its NGO advantages.

With a full ability to scale up on a national level, currently planning 30 new stations every year until 2020, Teuk Saat seems fully operational on this point. However, the model has its limits, with a high dependency on international funds and outside support that is meant to fade at one point, but also a failure to scale up on the smallest scale that prevents the project from reaching a full potential, thus justifying their average mark.

Indicator 10: Economic Viability	Grade: 2

- TS1001, a tested and continuously improved model at both kiosk and headquarters scale to better aim at financial sustainability.
- TS1001 has a hybrid business model, with NGO taking care of the CAPEX but financial independence for stations afterwards.
- Revenues based on the sale of water, with the sale of bottles just compensating the investment.
- Costs & Expenses: High fixed costs brought by salaries and platform fees that make the breakeven hard to reach for entrepreneurs.

While TS1001 kiosk model, which has been improved over the years, seems to be operational now (with only one site opened after 2012 to have closed), it still relies on international funds to cover all its initial CAPEX. Moreover, stations while most Tier 1 and Tier 2 stations make benefit, Tier 3 stations, who still represent a large third of the whole, are not viable for now, and survive on NGO funds while gaining their economic viability. This dependency on external funds, without which the system would not be sustainable as of now, justifies the average grade.

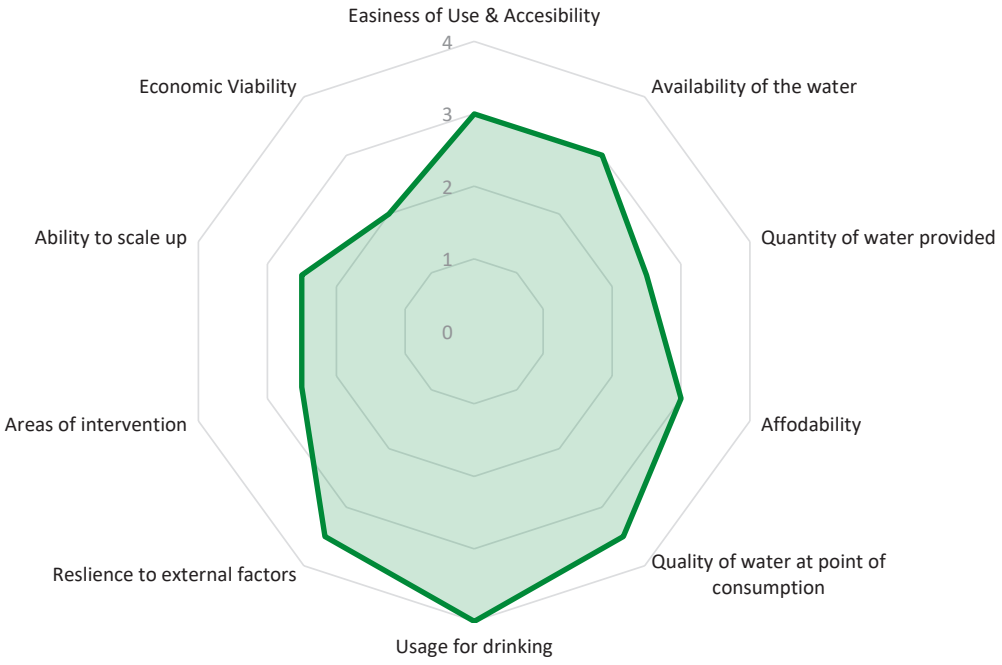


Figure 41: Summary of TS1001 model analysis

TS1001 model is above all consolidated by the fact that it shows no major flaws. Indeed, while it boasts strong points when it comes to the quality of its water for drinking, no real flaw balances that strength. The only real negative aspect would be the quantity it distributes, but it is not relevant to its model of drinking water only. Overall, all other criteria are addressed honorably, with no specific asset or weakness.

Note: See the detailed matrix of analysis in appendices.

Comparative analysis of WSP & kiosk models: In which extents do they tackle drinking water needs?

Geographical location

Main actors from the WSP and kiosk models are located as followed:

Profile of communes covered by WSP & kiosks

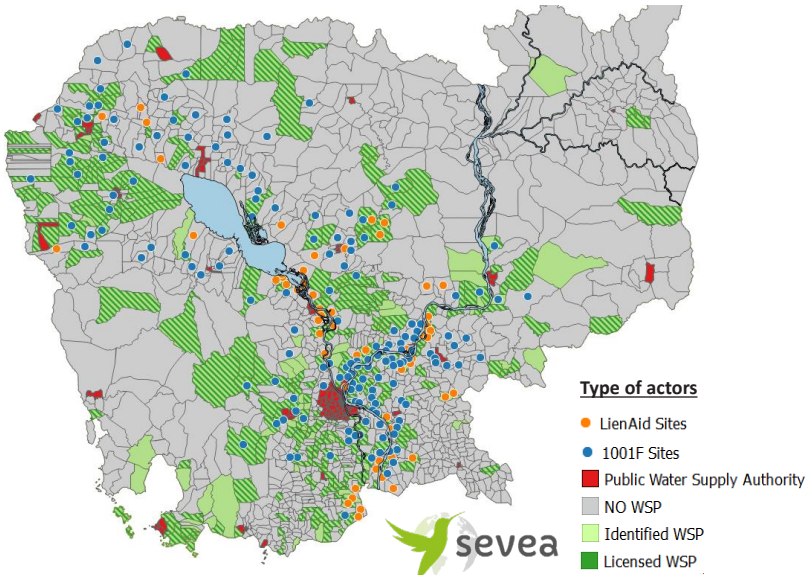


Figure 42: Geographical reparation of the actors of drinking water in Cambodia

Table 27: Average profile of rural and semi-rural communes in Cambodia[1]

Type of Commune	Number	Size (km²)	Population	Density (hab/km²)	Poverty Incidence (%)	Covered by water kiosks	Covered by WSP
Rural Commune	666	204	5,569	27	29	79	143
Semi-rural Commune	790	48	10,205	211	22	132	306

Logically, considering the way they were defined, semi-rural communes are mainly characterized by a high density, with an average of 211 inhabitants per square kilometer[2]. Rural communes are larger, less populated, and have a higher poverty incidence rate. Because of these conditions, semi-rural communes are host to almost twice as much private water service providers than rural communes and a larger number of additional water kiosks.

Table 28: Average profile of communes with presence of a WSP or a water kiosk in Cambodia[3]

Type of Commune	Number	Size (km²)	Population	Density (hab/km²)	Poverty Incidence (%)
Commune covered by WSP	477	88	9,929	113	23
Commune covered by TS1001 kiosk	154	88	10,314	117	24

1. Data from Cambodia Inter-census 2013
2. More than the official threshold of urban commune
3. Data from Cambodia Inter-census 2013

When looking closely at the communes targeted by both solutions, it becomes clear both aim for the same profile of commune: Their development is targeted towards communes that present a sufficient growth center to be viable. With an implementation mainly driven by demand, their targeted communes lean towards the model of semi-rural communes, with a high density and limited poverty rate, although they can still serve rural communes with some degree of viability. Thus, superposition of both solutions is common. 80 of the 154 Teuk Saat water kiosks (52% of the total) are implemented in a commune where a WSP is present. Moreover, out of these 80 cases of superposition, 40 are with licensed WSPs.

A geographical analysis to map the presence of water solutions in Cambodia

According to the Census of Agriculture of 2013, the country is divided into 4 geographical zones[1], with the following attributes:

Table 29: Demographic attributes of geographical zones[2]

Geographical Zone	Average population per commune	Size (km²)	Density (inh/km²)	Poverty (%)	Communes	Rural communes	Semi-rural communes	Semi-rural communes (%)
Coastal Zone	6,781	121	56	22%	149	80	54	36%
Plain Zone	10,225	40	253	20%	779	144	537	69%
Plateau and Mountainous Zone	4,800	314	15	34%	199	181	9	4%
Tonle Sap Lake Zone	9,605	132	73	28%	491	261	190	39%
Total	**9,052**	**109**	**83**	**24%**	**1,618**	**666**	**790**	**49%**

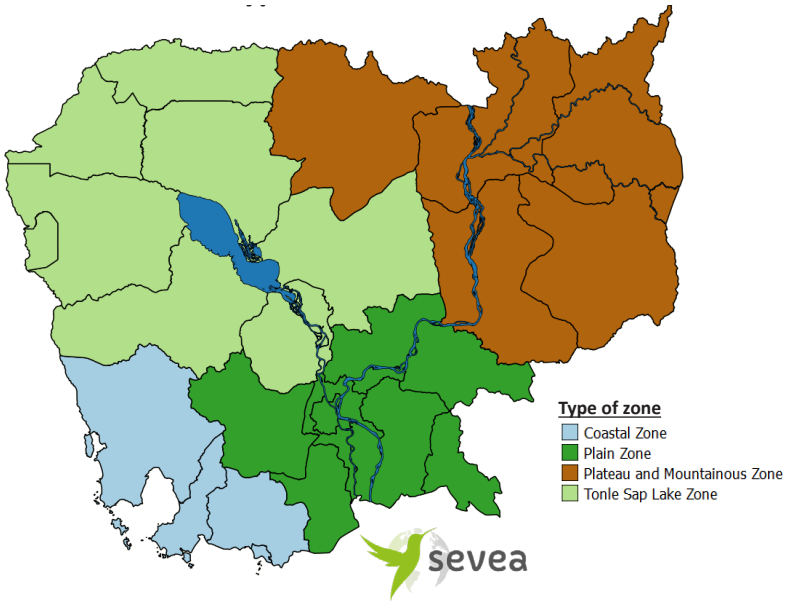


Figure 43: Geographic division of Cambodia in 4 major zones [Data from Census of Agriculture, 2013]

1. For this study, the province of Kampong Speu was considered as part of the Plain Zone and not the Plateau and Mountainous Zone to maintain geographical unity.
2. Data from Cambodia Inter-census 2013

The properties of each zone give an interesting insight on most easily coverable zones. The Plain Zone, with the highest density and the lowest poverty rate, would seem the ideal zone, opposite to the Plateau and Mountainous. However, factors that are harder to evaluate but just as important need to be considered. Among those factors, the major one is the accessibility of the water resource. Access to proper infrastructures plays also an important role.
These factors explain why the real distribution of water solutions is not a reflection of simple demographic numbers.

Table 30: Rate of presence of different solutions by geographical zone

Geographical Zone	TS1001 sites	% of communes covered by TS1001	Communes covered by a WSP	% of communes covered by a WSP	Communes covered by a large WSP	% of communes covered by a Large WSP
Coastal Zone	0	0%	32	21%	16	11%
Plain Zone	83	11%	244	31%	111	14%
Plateau and Mountainous Zone	6	3%	36	18%	18	9%
Tonle Sap Lake Zone	67	14%	165	34%	65	13%
Total	156	10%	477	29%	210	13%

.

Water accessibility, the primary reason for WSP presence
The gap between this distribution and demographic attributes of each zone is explained by water accessibility. Thus, a poor region like the Tonle Sap still has the highest access rates to drinking water solution thanks to high accessibility of fresh surface water. On the contrary, the Coastal Zone has a low presence of water providers, which corroborates the fact that fresh water is scarce and very susceptible to climate variations. On a second level, other factors still have their importance. In the Mountainous Zone, access to water solutions are not limited by the water resource, but rather by an extremely low density and the absence of proper infrastructures, with for example the lowest access rates to roads in Mondulkiri and Rattanakiri provinces.

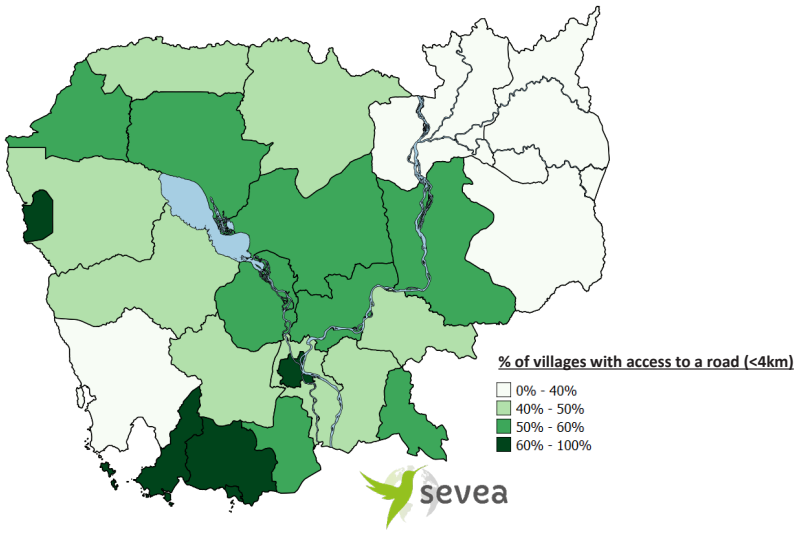


Figure 44: Access to roads by province in Cambodia [Data from Census of Agriculture, 2013]

Regional platforms, a limiting particularity of TS1001's kiosks

In the case of TS1001's kiosks, a last factor limits their geographical expansion: the proximity with a regional platform. As of now, there are three existing platforms: in Battambang (in Tonle Sap Lake Zone), in Kampong Cham and in Phnom Penh (both in Plain Zone)[1]. This distribution prevents a wider geographical distribution and is a limiting factor that WSPs do not have.

Location zones of safe drinking water providers can thus be divided into three categories:

- Economically viable zones, where there is no problem in foreseeing the installation of a WSP,
- Challenging zones, where there is potential for implementation but with harsher conditions,
- Economically non-viable zones, where it is hard to foresee any kind of commercially viable solutions in a near future. In these areas, solutions of access to improved water only seem more realistic.

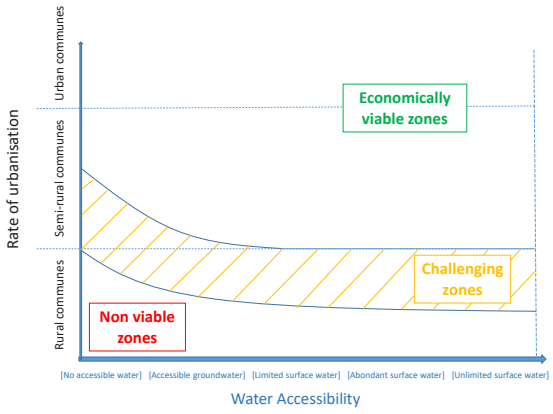


Figure 45: Economic viability of a commune for WSP presence

Dynamics of the sector: Penetration & growth rates

From the commune to the household, the real penetration rate of these solutions

As of today, for WSPs, the average rate of coverage inside a commune is of 37%. Inside those covered zones, the rate of connection is of 47%, meaning around 20% of the people inside covered communes (and 32% in covered villages) have direct access to piped water.

TS1001 has an average penetration rate of 19%. Seeing how they consider the whole commune as their coverage zone[2], this rate of 19% can be considered as a communal penetration rate.

Observed expansion of the solutions

Since 2011, the number of WSPs has probably risen from 376[3] to 423[4], a 12% increase. The number of licensed WSPs (and under-processing license) has gone up from 139 to 260, almost doubling in 5 years (+ 87%). This translates into a rate of communes covered by WSP that rose from 23% to 26%, with a rate of communes covered by licensed WSPs that grew from 8,5% to 16%.

For TS1001, the number of kiosks that appears every year is steadily rising. From 59 kiosks up and running at the end of 2011, TS1001 now operates 154 kiosks around the country, showing a gain of 161% kiosks in just 5 years. This represents today a rate of communes covered by this solution of almost 10% countrywide.[5]

For both solutions, there is no reason to see those numbers going down in a close future, as the WSP market is in high priority of the government and TS1001 has already a plan for 90 more kiosks before 2020.

As of now, a more dynamic bottled water market than for WSP

In the past 5 years, TS1001 has been able to reach 250,000 new people, and is expected to reach even more in coming years. This represents an evolution of 500% from their 2011 number. To this number can be added 10 LienAid sites opened every year. On the contrary, if WSPs have had almost as many new beneficiaries, around 220,000 in semi-rural and rural communes in the past 5 years, it represents just a 28% increase.

1. A 4th one will be opened in Siem Reap so still in the Tonle Sap zone
2. The covered zone depends on the topography of the area but mostly corresponds to an 8km circle around the station.
3. GRET, Water Sanitation Program, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market - Cambodia," January 2013.
4. CWA, "Situation of Private Water Supply and Way Forward", 2016
5. As of today, LienAid is showing the same dynamism, with 15 sites opened in 2016 and as many planned for 2017

Using those numbers, we reach, as of today:

Table 31: Coverage and real access to safe drinking solutions in rural and semi-rural areas

WSP		TS1001 kisk	
Inhabitants within a commune with a WSP	5.9 M	1.6M	Inhabitants within a commune with a TS1001 kiosk
Inhabitants within a zone covered by a WSP	2.2 M	1.6M	Inhabitants within a zone covered by a TS1001 kiosk
Direct beneficiaries of a WSP	**1M**	**300,000**	Direct beneficiaries of a TS1001 kiosk
% of people in rural zones client of a WSP	6.8%	2.5%	% of people in rural zones client of TS1001

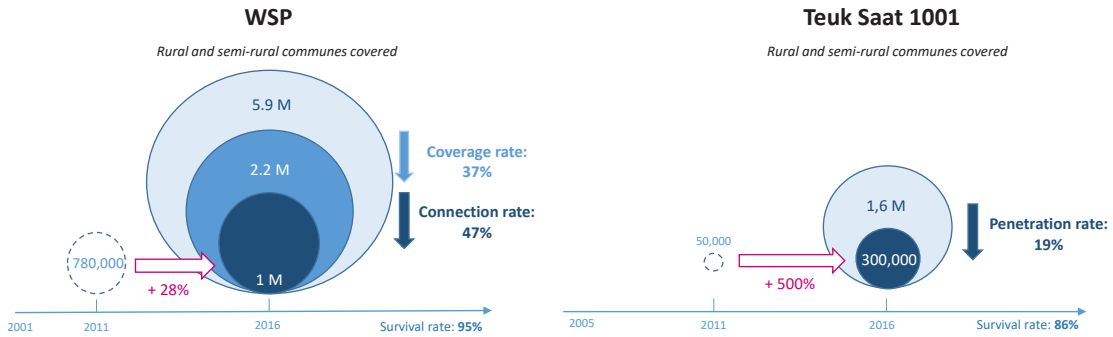


Figure 46: Evolution of the number of beneficiaries in rural and semi-rural areas

Different dynamics in the expansions

For WSP, most of the expansion is done when they extend to a new zone. This is when they reach most of their new beneficiaries. It is limited in time by the amount of the investment needed and the payback of current loans. For TS1001, most of the coverage is done during the implementation period, at the end of which the station is already fully operational. Additional investments in bottles and means of transport allow stations to reach the more isolated households once they have grown enough. This means that the global rate of penetration rises more steadily than for WSPs, with yearly growth always between 0 and 5%.

Different potential for full communal penetration rate

Whereas TS1001 has a coverage rate of almost all the commune and can reach more isolated zones than WSPs (through resellers mostly), they have an objective of 25% penetration rate within 5 years, and an average 40% on the long term. On the contrary, WSPs may not reach most outer households, but they can reach higher penetration rates within covered zones, where full connection is possible. Considering their connection rate will at least maintain itself and most probably rise while their coverage rate will go up, this means that they can reach an important communal penetration rate, far higher than that of 20% today.

Water quality and consumption

Real impact of the water can be evaluated through two main factors: quality and whether people drink it or not. If you consider water accessibility as a whole, affordability also becomes a critical factor.

Water quality: a difference between reality and perception, two equally important factors:
When considering quality, the perception of the quality is as important as reality because it is the factor that will decide whether or not people end up consuming this water.

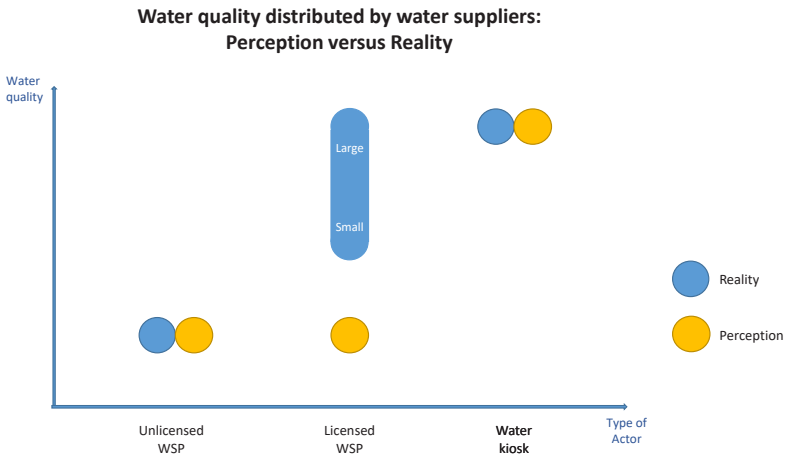


Figure 47: Water quality distributed by water suppliers: Perception versus Reality

Quality perception: An asset for water kiosk, and a residual image problem for WSPs

Water bottles from TS1001 have from a quality point of view a good image, which is also supported in people's mind by the 1001 fontaines French NGO's image. However, some factors can tarnish their image, like the arrival of rival water bottle businesses with more modern machinery. On the contrary, piped water is seen as not drinkable because historically pumped water has always been considered as untreated water. So, drinking piped water is often not the first choice (even interviewed entrepreneurs did not drink their own water) and if or when they do, they boil it beforehand, so there is finally no advantage in terms of quality compared to surface water.

Real quality: A high standard for bottled water, a variable one for piped water

The "good quality" of TS1001 can be evaluated through:

- The quality of its water that is ensured at different level and normally perfectly safe.
- The fact that its water has no particular taste.
- Its home delivery service. Having access to "drinkable-without-boiling" water is considered as a highly valuable service, especially for the youngest generations.

For WSPs, if the service around water is globally good (water distributed directly on premises, a generally all-day long availability and rare pressure problems), the quality of the water itself is variable:

- For most unlicensed (or under licensing process) operators, the water delivered can be considered unsafe.
- For licensed ones, as of today, even if there is an overall rise in quality, it still cannot be globally considered safe for consumption.

A few main factors explain these quality issues and plague the treatment process:

- If all licensed operators now own operating treatment capacities, they do not necessarily have the technical skills and knowledge to operate it and control their adjustments on the process.
- Moreover, awareness about the importance of delivering quality water is still low, even among station operators.
- Finally, there is a residual problem with the taste of Chlorine. It is mostly disliked by Cambodians. This results in an overall slowdown of the WSP expansion process when thinking in terms of consumption. It also incites many WSPs to lower their treatment doses to hide the taste.

Note: As for now, through its monitoring of operators, the MIH seems concentrated on making sure every station is equipped with a treatment plant before taking actions to ensure its correct use.

Affordability

Again, a difference between perception and reality, but not a major barrier for each solution

Table 32: Household budget dedicated to water consumption

	For TS1001	For WSPs
Price of water (US$/m³)	16.25	0.57
Average household consumption (m³/month)	0.31	9.5
Allocated household budget (US$/month)	5	5.4

O-We water is on average around 30 times more expensive than piped water. But since both do not address the same market, and are not distributed under the same quantity, this price difference is not necessarily seen as a problem.
In terms of monthly budget, each consumption represents roughly the same amount. Independently, they are under the WHO/UNICEF recommendation of 8% of a household budget, but when bought together (which is quite often the case for O-We users), they add up to a budget of US$ 11 a month, which represents a substantial expenditure for poorest households.

Even if bottled water is more expensive than piped water, the perception of each does not reflect that difference. People who consume O-We find its price reasonable and those who don't do not give the price as their first source of dissuasion. On the contrary, too cheap water can be considered as a sign of bad quality for some part of the population. What can become a constraint on expansion is the price of the first bottle. If it is, in reality, not a major economical constraint (KHR 12,000), it is given as the first reason for non-consumption by households who do not drink O-We[1].

The fact that O-We prices are considered reasonable can be seen in an analysis of its customers (not necessarily the richest village households). Thus, while there is still a barrier with the poorest share of the population, TS1001 can still be considered an inclusive solution.

For WSP, the water tariff itself is not considered a problem either. Once accepted the barrier of paying for one's water (which historically was rarely the case in Cambodia), the monthly consumption fee is seen as reasonable. On the contrary, the initial connection fee of US$ 70, a price set by the MIH which is high above the historical trend of this fee[2], can be more of a barrier, especially for the poorest households. Entrepreneurs have had therefore a tendency to promote their water by cutting connection prices to increase penetration rates.

Economics & Investments

Different constraints to reach profit, a high CAPEX on one side and a challenging breakeven on the other

Constraints to create the business and keep it running are different for both actors:

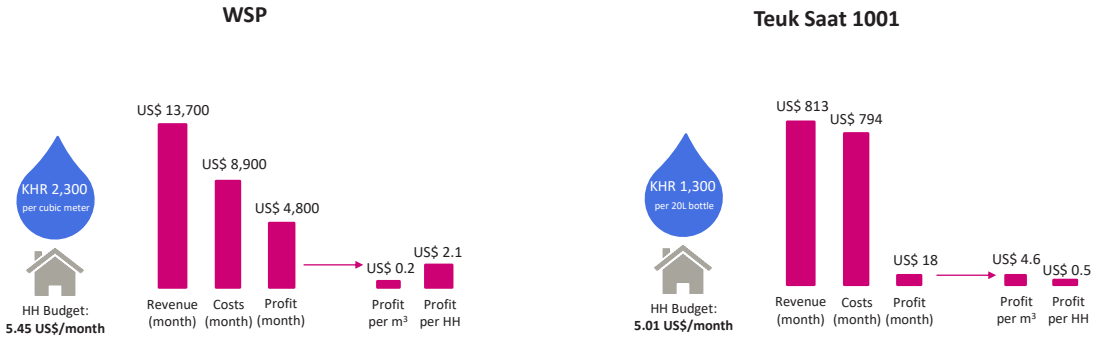


Figure 48: Evolution of the number of beneficiaries in rural and semi-rural areas

1. Sevea Consulting, "Behaviour Change Analysis", 2015
2. As of 2011, the average connection fee was of US$ 37 per connection [GRET, WSP, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market - Cambodia, 2013]

Figure 49: Investment profile of the water suppliers

- For WSPs, the main barrier is the initial investment. It requires a large amount of savings and personal investment to be able to start the business. However, once it is operational, the nature of the costs, for a large part variable (around 70%) and linked to the production of water, makes it easier for them to reach breakeven every month.
- On the other hand, while TS1001's sites do not need to worry about CAPEX, that comes through international grants, it is harder for them to reach their breakeven, considering that around 85% of their expenses are fixed costs (largely salary and platform fees).

This explains why TS1001 can reach more isolated zones, through external initial investment and the absorption of losses by the NGO while the business is still scaling up. With half of their stations generating loss, their system only becomes possible when they are monitored and helped by the platforms and headquarters in Phnom Penh. Without this opportunity, it is harder for WSPs to risk themselves to more challenging communes.

A difference in the personal and financial investment that entails a difference in the type of operators

Contrary to the TS1001's entrepreneurs, who are chosen by the NGO and do not have to cover the initial CAPEX, the WSP operators build their network through personal financial commitment. The needed sum to invest in such an operation, of hundreds of thousands of dollars, means that most of the time these operators were already wealthy enough. Indeed, with collaterals needed for a loan that range from a 100% to 300% of the amount, it is clear that the operator who invested in them already had his own investment capacity. As for TS1001's entrepreneurs, they do not have the same profile, and especially not the same bond to their business. Indeed, they did not personally invest in it, do not own it (as the kiosk is community owned) and often perceive themselves only as employees of their own business.

Operators are also separated by their revenue. While Teuk Saat entrepreneurs only make around an average US$ 150 per month, revenues for WSP, and especially large ones, are much higher. Considering they are sole owner of their businesses, an important part of the profits (an average US$ 2,000 per month for small operators to US$ 11,500 for large ones) comes back to them, even if some is dedicated to future investments in the business.

An average investment per beneficiary that is far heavier on the WSPs side to make an impact

While TS1001's average investment per beneficiary is only of US$ 13 and still falling, that cost is of more than US$ 300 per household[1], or US$ 66 per beneficiary for an average WSP. However, when taken to the quantity of water delivered to each beneficiary with this investment, the numbers are reversed, with an average US$ 6 to bring 1 liter of water a day for a beneficiary, against US$ 1 for an average WSP.

In an attempt to compare these numbers in a fair way, the investment needed to have one direct health impact could be evaluated. For this, the following hypothesis could be taken that impacts are reached for 1.5 liters of drinking water a day, or 40 liters of upgraded water for house needs. That way, the investment needed for a direct health impact is of:

- US$ 9 per beneficiary for TS1001.
- US$ 40 per beneficiary for WSPs.

However, like always, the average for WSPs must be nuanced by the diversity of profiles. For example, for large WSPs, the average investment per household goes down to US$ 238, and the average investment for direct health impact is US$ 30 (a 25% drop in costs, but still largely above water kiosks impact costs).

1. Sevea Consulting database issued from phone interviews and field visits

Interaction between the different actors

Even if theoretically, WSPs and TS1001's kiosks could be considered as competitors, on the market of drinking water, they are not considered nor behaving like it:

- As business entrepreneurs, WSPs do not perceive water kiosks as competitors, as their sales are limited in quantity and do not answer to the same household needs, which make up for most of WSP's sales. Moreover, water kiosks can even act as clients and provide themselves directly with the WSP.
- For the beneficiary, both services respond to different needs. Primarily drinking for TS1001's kiosks and house needs for WSPs.

Hence, from the health impact point of view, both again complete each other in giving access to improved services for both drinking and cooking/ washing, all of which have their direct health impact.

However, other actors are more directly in competition with these two solutions. In the market of the bottled water, family businesses often appear after the implementation of TS1001's sites as they see a business opportunity in the model it brings. These family businesses create a risk of competition, but also a hazard in the quality of the bottled water they sell. They have for now no guarantee of quality and no regulation whatsoever, meaning they can cut expenses on quality to be more competitive. WSPs do not face these competition issues between themselves and other actors, especially for the licensed ones who have the monopoly for piped exploitation on their commune.

As actors of two different solutions, access to upgraded water and access to safe drinking water, both TS1001's water kiosks and WSPs have a role to play in the development of general access to water in rural Cambodia and are not direct competitors. In the semi-rural communes of Cambodia, representing more than 70% of the rural population and 55% of the total population of Cambodia, they are a possible answer to the issue of water access. Through parallel development inside covered communes and uncovered one, they have of pool of several millions of potential clients inside favorable zones that are densely populated and show an easy water access.

However, both solutions still expose fundamental differences. Bottled water is easier to invest into, boasts as of today a better quality than piped water, and can reach through its model more isolated households. It is however limited in its penetration, which is in average not expected to grow over 40%. Piped water has the advantage of being cheaper, though that does not represent a blocking point for bottled water, available when needed in unlimited quantity, and of having the capacity to reach close to full penetration rates. It does, on the other hand, still raises concerns about its quality, and especially necessitates much larger investment amounts. The fact that this amount needs to be covered mostly by the private sector makes it easier to reach, but is still a major brake to its expansion.

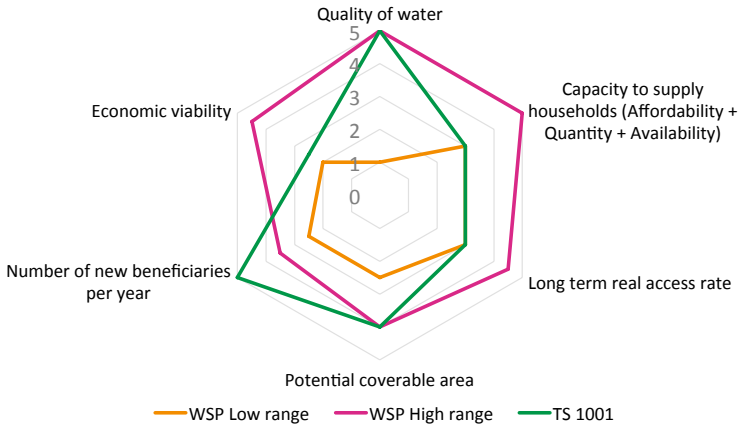


Figure 50: Comparison of strengths and weaknesses between TS1001 and WSPs

Conclusion: about access to water, actors and solutions in Cambodia

Solutions & Actors: How are they answering to the water access needs of rural areas of Cambodia?

This study focuses mainly on rural areas. These are the areas with the biggest amount of people in need. Furthermore, as of today, 50% of the Cambodian population still does not beneficiate from safe drinking water supply although they live in semi-rural areas, meaning in potential markets for economically viable solutions. Thus, addressing such areas in the most efficient and impacting ways could bring tremendous benefits. In that sense, it became crucial to analyze the panel of solutions able to tackle this issue, to understand how they are articulated today and how to optimize their interaction in the future to maximize impact while optimizing the level of investment required.

After having identified 3 clusters of solutions, two turned out to be of enough potential to be considered as key drivers of water access tomorrow while also in compliance with the ultimate objective of providing at least safe drinking water. These solutions are piped water supply operated by private water service providers and 20L bottled water distributed through community owned kiosks such as TS1001's model of intervention.

Note: these selected solutions are proper to the unique context of Cambodia especially due the large development over the years of informal actors supplying water to people in rural areas.

After the in-depth analysis of these two solutions, different strengths and weaknesses have been identified. The two diagrams below sum-up some of the assessment key factors results.

As a targeted drinking water model, kiosk water's main advantages are to be found in terms of quality. This water is meant to be used for drinking, and as such the main point is to ensure perfect quality, contrary to WSPs. On the other hand, WSPs, who are seen as a convenience, thus concentrate more on the quality of the service surrounding the delivery of water itself. It is cheap, available on premises all day and in unlimited quantity. In that field, kiosks will always remain a step behind despite their delivery service.

From the perspective of all the actors implied, it came up that, considering the difficulty of integrating the different conditions to be a proper solution of access showing both quantity, quality and sustainability abilities, WSP and bottled water kiosks turned out to be complementary. Strengths of kiosks (mainly quality of water) corresponds to the current weaknesses of WSPs and reciprocally (e.g. capacity of supply).

While their economic models are completely different, WSPs and kiosks show rather similar level of performance, with slight differences.

Through their model and choice of site implementation, TS1001 shows a level of precaution non-existent for WSPs and thus can boast a better resilience to external factors.

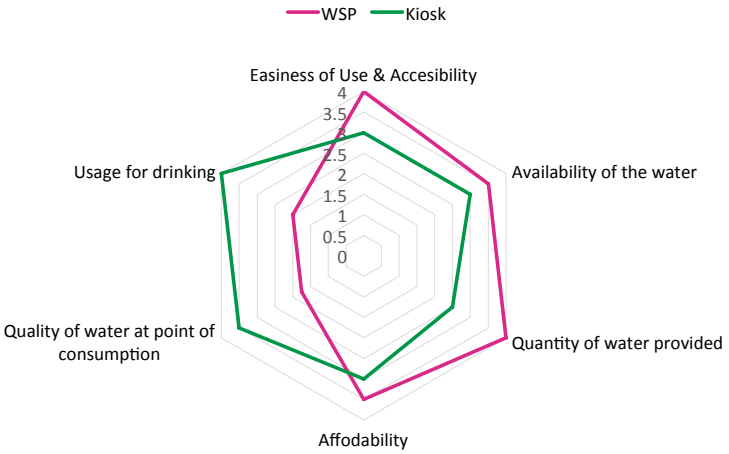


Figure 51: Comparison between the quality of the water service of WSPs and kiosks

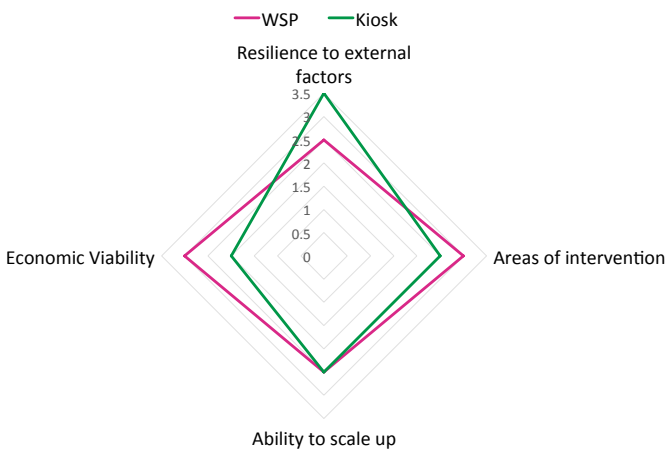


Figure 52: Comparison between WSP and kiosk's operation & scale-up models

Note: Due to the large number of WSP and their various characteristics, strengths and weaknesses of this type of actor considerably vary. Here is the average grade per factor. For instance, a large and licensed WSP would obtain much better grade for quality and economic viability.

However, with their platforms, on one side, they limit their area of intervention, a limit that WSPs do not have as they are independent entrepreneurs, and can implement wherever a market opportunity arises. On the other, the network of advisors inherent to their platform model enables TS1001 to set up in location where there wouldn't naturally be a "real entrepreneur". They can indeed afford to train operators to become entrepreneurs.

As for their ability to scale up, each has a field of potentialities. WSPs, as independent actors, can scale up by extending their reach within their commune and to other communes. If kiosks independently have the potential for scaling up only within their catchment area, there is a perpetual scaling up at organization's scale, with TS1001 (who, as of today, represents the majority of the kiosk sector) opening currently more than 30 stations each year. With different arguments, both actors finally reach similar abilities to scale up in terms of new beneficiaries (over the last 5 years, +220,000 beneficiaries for WSPs and + 250,000 for TS1001)
This brings the two models to a similar viability. Considering the two solutions target as of now the same profile of communes, it is logical to see them having similar level of constraint in order to survive. However, seeing that, for now, WSPs thrive on private investments with little external help while Teuk Saat kiosks are still dependent on NGO funds, the WSP model can be considered more easily viable.

In the end, both solutions are more complementary than they are in competition. Indeed, both solutions are designed to target the same type of areas: semi-rural communes. But due to the huge needs it is a good thing for Cambodia to have two ways to address these areas. Especially because currently and for the coming years, WSPs will clearly not be able to follow the development trends needed and deliver a safe drinking water service, at the exception of large WSP (and maybe medium). The others will have to put a lot of efforts to reach this level of quality and reliability. This will take resources (mainly on capacity building, quality control, etc.) and time. However, in the next part of the study, it is assumed that after 2020, even if a little optimistic, every licensed WSP will be able to provide safely managed drinking water. In the meantime, and to make up for all the non-licensed WSPs, kiosks can bring a quicker answer to the quality problem, with a facility to touch quickly new beneficiaries and reduce the number of people in need. So, up to this point, it turns out that as long as kiosks are not located and targeting the same clients as large WSPs, WSPs and kiosks bring both as different as crucial added value in terms of water health related impacts even if they are acting in the same area. This relevance is particularly true in challenging zones, where the WSP model is harder to transpose because of the higher investments it would need whereas the kiosk model still keeps a low cost in terms of direct impact.

WHAT TRENDS? WHAT COHERENCE?

HISTORICAL PERSPECTIVE: DEVELOPMENT OF THE ACCESS TO WATER IN EUROPE

Efforts to produce and transport drinking water date back to before human beings discovered how to make fire. These efforts have led to the development of several innovations.

The use of digging wells dates to 6000 B.C. in Mesopotamia. In antiquity, filtration systems through gravel and sand were already developed. In 400 B.C. Hippocrates emphasizes the link between water quality and health. Egyptian, Greeks and Romans had invented very elaborate water purifying and distributing systems. But the comfort of safe freshwater is reserved to the richest people and their palaces. Roman aqueducts were the first infrastructures invented to carry freshwater from the source to big cities. These aqueducts were open channels using gravity to move water.
One of the first reference of desalination date to the 17th century. In 1703, the French scientist La Hire proposed that every household in Paris should have rainwater cistern and a sand filter. Before the 18th century there was little progress in water work facilities and closed piping and pressurized water were extremely limited. In mid 1800s the understanding of how diseases (such as cholera) were transmitted by drinking water began to spread. Sand filtration and chlorine disinfection systems became commonly used in Western Europe.
After the industrial revolution, water became more and more polluted requiring more sophisticated treatment systems but the invention of steam engine enabled pressurized freshwater distribution in many households.

London was the first city in the world to generalize a universal access to pressurized drinking water during the 17th century. It began with numerous small private water companies that progressively replaced the infrastructures erected and maintained by local institutions such as: pumps, wells and the old low pressure gravity flow aqueducts that used to bring the water to cisterns and public fountains. This new business sector took advantage of the growing and wealthy population of the city that was, at this time, the first commercial hub in the world. London

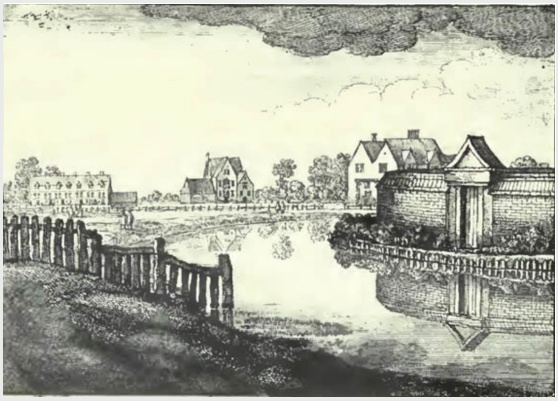


Figure 53: The New River of London: an open aqueduct that used to bring water from outside London

population went from 120 000 in 1550 to 500 000 in 1700. These new water companies such as the New River Company drew water from outside London and brought it through a giant open aqueduct to reservoirs and then directly distributed it to the households by wood pipes under the city streets. But by then, the water was low pressure and supply was intermittent. Some other companies were using pumping mechanisms, horse pumps, wind driven pumps or tidal waterwheels. By this time, the New River Company represented 75% of the market because its transportation system was more efficient and reliable than the mechanical systems of its competitors. This period also saw the historical invention of joint-stock financing mechanisms supporting the development of the water companies and their investments in new infrastructures. It became therefore a period of intense competition and healthy profits for the winners.

Years after London, between 1854 and 1860, Haussman and Belgrand developed a new public water distribution system in Paris. The network has been maintained and managed by a public company under the authority of the municipality of Paris until 1987 and was re-municipalized in 2008.
The rest of Western Europe inhabitants had to wait for the end of the 20th century to have access to pressurized drinking water.

ACCESS TO WATER AROUND THE WORLD

Putting Cambodia's access to water sector development under perspective

In the world, access to an improved water source seem highly correlated to the available GDP/capita. In the figures below, the size of each circle represents the total population of each country.

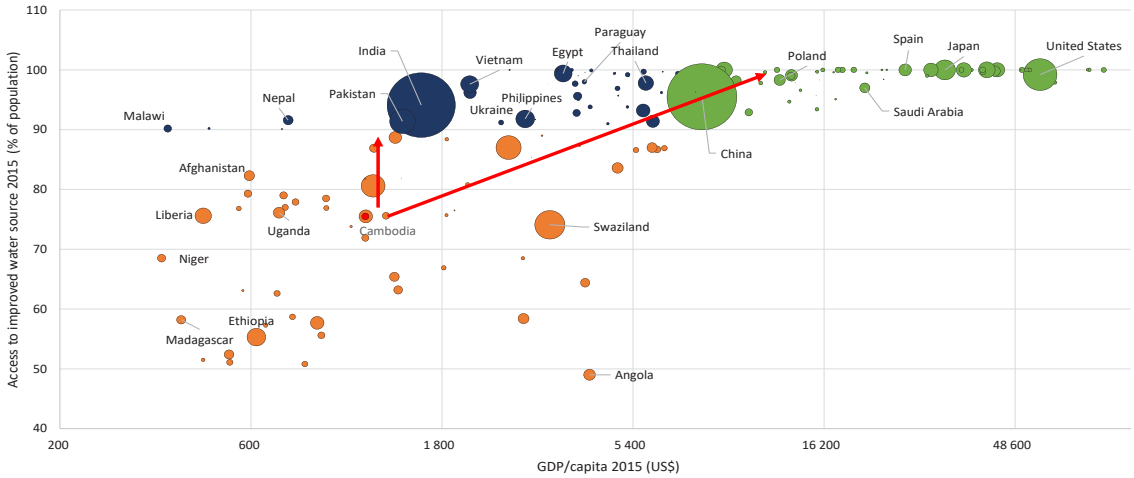


Figure 54: Access to improved water source in the world compared with GDP/capita

The available data from the World Bank shows 3 different group of countries:

- Above US$ 7,000 per capita, most countries have succeeded in providing safe drinking water to all their population with an improved water source access rate of more than 90%.
- There are also several countries beyond US$ 7,000 per capita who have succeeded in achieving a universal access to an improved water source.
- Beyond US$ 7,000 per capita, a significant number of countries are still in transition to achieve an improved water access rate of 90%

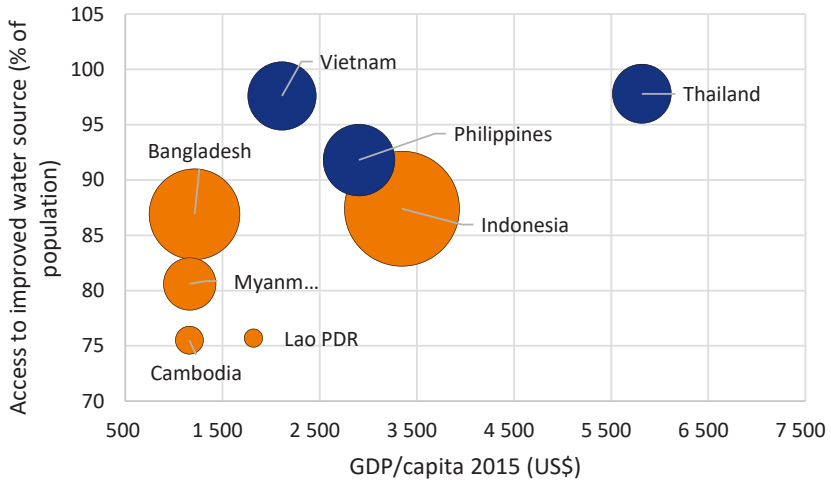


Figure 55: Access to improved water source based on GDP/capita in South-East Asian countries

Cambodia is part of the last group. Following the same logic, Cambodia could therefore achieve more than 90% of improved water access either through its own economic development or by an extrinsic development of the water distribution system.

Focus on South East Asia

With 75% of the population accessing improved water sources, Cambodia presents the lowest access rate of all South East Asian countries. 3 countries in the region have succeeded in reaching more than 90% of improved water access rate but drinking water distribution is still facing some critical issues.

In South East Asia, Indonesia, Bangladesh, Myanmar, Lao PDR or Cambodia are still in transition to achieve 90% of improved water access.

Only 3 countries have achieved more than 90% of improved water access: Vietnam, Thailand and Philippines. According to the UN's Joint Monitoring Program (JMP) for Water Supply and Sanitation, access to an improved water source increased from 58% in 1990 to 98% in 2015 in Vietnam, from 87% to 98% in Thailand and from 84% to 92% in Philippines.

This level of improved water access rate was enabled by the development of local water utilities using pipes to distribute water. But these countries are still facing some challenges and issues regarding drinking water distribution:

- Most people still boil drinking water because they do not trust the quality of the tap water, or use bottled water. In many cases, the water quality is under the standards set by the national government.
- They receive water from a tap in the yard or a public tap in the village from where they have to carry water to their home. For instance, only 23% of Vietnamese had a tap in their home in 2010.
- There is a wide inconsistency between the access to water of urban areas and rural areas. In the Philippines 61% of people living in urban areas had access to tap water while only 25% of rural inhabitants had.
- There is an important difference between the amount of water put into the distribution system and the amount of water billed to consumers. It is due to 3 main factors:
    - » *physical losses*, which consist of leakages from the system caused by poor operations and maintenance, the lack of active leakage control, and poor quality of underground assets;
    - » *commercial losses* caused by under-registration of water meters, errors in data handling, and theft;
    - » unbilled authorized consumption which includes water used by a specific utility for operational purpose.

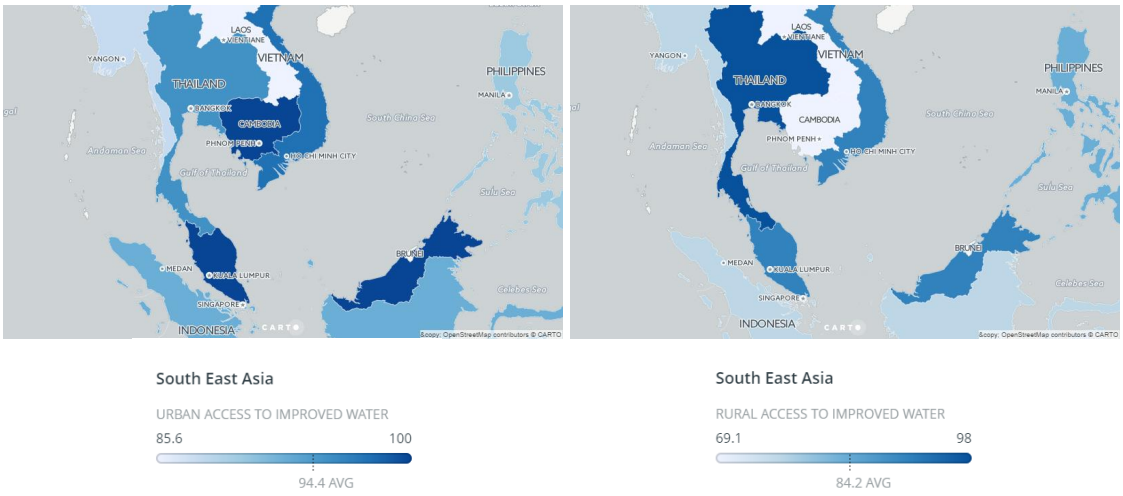


Figure 56: Improved access in South East Asia

On Cambodia's path to universal safe water access: a look back on History

If we look back on history, Cambodia is in 2015 on the same path as Vietnam or Paraguay 15 years ago. These countries have succeeded in achieving almost 100% of improved water access.

In 1990, according to the UN's Joint Monitoring Program for Water Supply and Sanitation, 30% of Cambodia's population had access to an improved water source. In 2015, more than 75%[1] of Cambodian people can rely on an improved water source. This make Cambodia the fastest country in terms of water access development in the last 25 years. But comparing to other countries Cambodia is still ranked 165th in terms of improved water access.

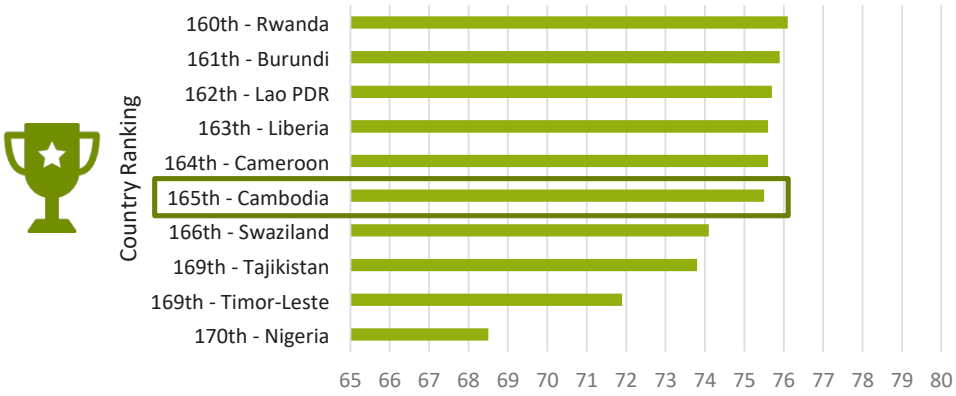


Figure 57: Country ranking - Improved water source access rate (% of the population)

Since the 90's, Cambodia has always been the first country in terms of development speed of improved water access.

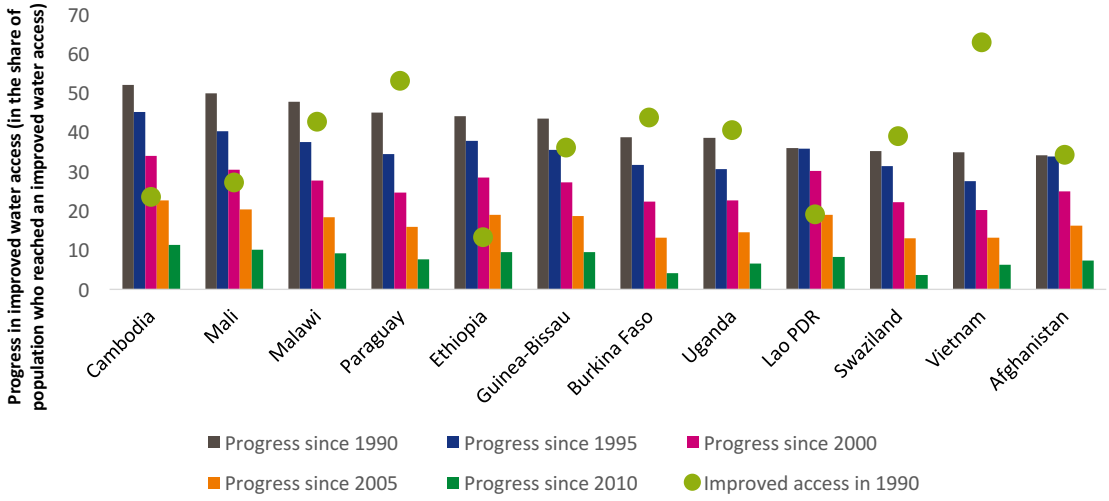


Figure 58: Fastest countries in improved water access development

The following figure shows that 15 years ago, 9 countries were on the same path as Cambodia right now in terms of GDP/Capita and improved water access. The countries showed below have succeed to provide universal access to improved water. They were between 70% and 80% of improved water access 15 years ago and they have succeeded to reach more than 90% of improved water access rate. Among them Paraguay and Vietnam have reached the biggest rate of improved water access (almost 100%). Sri Lanka, Bolivia and Paraguay in 2000 are the most similar countries to Cambodia in 2015.

1. In order to compare Cambodian situation with other countries on the same basis, the water access rate from JMP is chosen as a reference in this part.

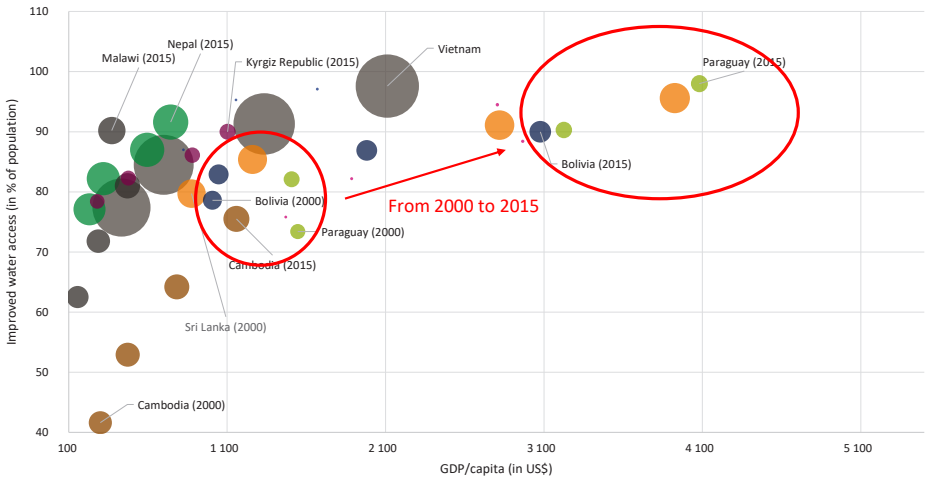


Figure 59: Top countries in the development of water access in the last 15 years

Some other countries have failed to provide universal access to improved water. 15 years ago, 12 countries in the world were at the same point as Cambodia right now (between 70 and 80% of improved water access) but failed in reaching 90% in 15 years (see figure 63). Ghana has almost reached 90%. Burundi, Benin, Zimbabwe, Senegal, Congo Republic and Salomon Islands failed to exceed 80%. In most cases these failures can be linked to:

- Political and institutional instability
- Corruption and mismanagement at the local and national levels of government
- Mismanagement in the water business utilities sector (maintenance, billing…)
- War and armed conflicts paralyzing economic development
- Lack of investment to erect and maintain the needed infrastructures
- Households revenues not high enough to cover the costs for operation and maintenance

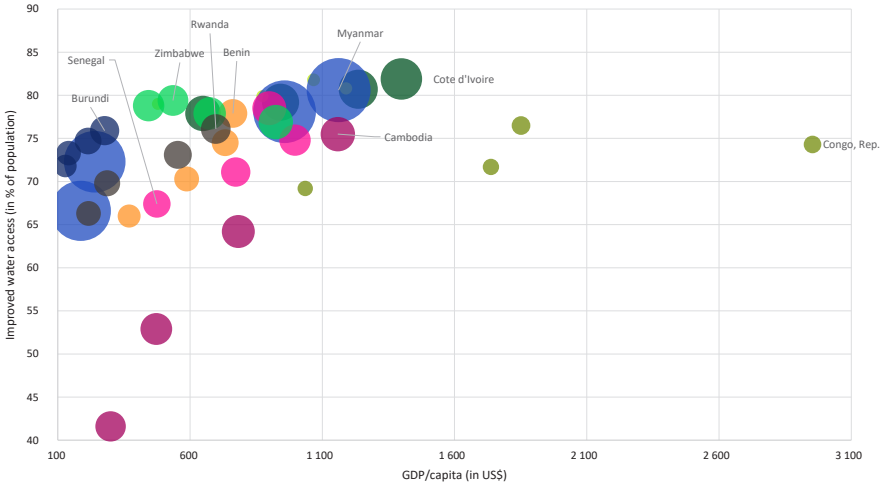


Figure 60: Worst countries in the development of water access in the last 15 years

In conclusion as shown by the different figures above, the situation of Cambodia right now is similar to the situation of other countries that already succeeded to provide universal access to improved water in 15 years. If Cambodia can follow this path it will surely achieve a universal access to safe water in the next 15 years. The recent great progress of Cambodia in drinking water development are promising. However, the recent path followed by less successful countries also shows that this objective is hard to achieve and its complexity should not be underestimated.

3 successful countries: Paraguay, Bolivia and Sri Lanka

These 3 countries managed to reach more than 90% of improved water access rate. However, these successes mask considerable disparities, different issues of low quality for safe drinking services as described above and a need for customized solutions in underserved geographic locations.

Paraguay:

In Paraguay, according to the UN's Joint Monitoring Program for Water Supply and Sanitation, access to an improved water source increased from 53% in 1990 to 98% in 2015.
In 2015, urban population represents 60% of the total population. In 2015, 100% of this urban population was connected to an improved water source. In urban areas water and sanitation services are under the authority of a national public enterprise: the ***Empresa de Servicios Sanitarios de Paraguay (ESSAP)***. It is responsible for serving urban centers of more than 10 000 inhabitants. But since the 1970s, small private and informal business utilities called "***Aguateros***" were created to operate small-scale systems with up to 3,000 connections. An estimated 500 private suppliers serve some total of about 500,000 people. Urban public utility tariffs are set below cost recovery levels leading to substantial operating losses to ESSAP. Tariffs of the ***Aguateros*** are not regulated but fully recover costs and compare favorably with tariffs charged by the public sector.

In 2015, rural population represents 40% of the total population. In 2006, 95% of this rural population was connected to an improved water source. In rural areas and urban centers of less than 10 000 inhabitants, more than 1620 community managed water associations (***Juntas de Saneamiento***) managed the distribution of water. Technical assistance and financing are provided by the National Environmental Sanitation Service (SENASA). The ***Juntas*** are grouped in 10 associations which supply water to more than half of country's population. ***Juntas*** were created with the help of a successful long-term partnership with the World Bank since 1977. Local ***Juntas*** are well organized and recover operating and maintenance costs. They are also able to expand their systems using their own resources and repay a portion of capital costs to the national treasury.

Bolivia:

In Bolivia, according to the UN's Joint Monitoring Program for Water Supply and Sanitation, access to an improved water source increased from 68% in 1990 to 90% in 2015.
In the last decades, frequent changes of government resulted in several restructurings of the institutional framework to face the problems of the sector. In the end of the 1990s the national government allowed 2 majors private concessions for water and sanitation: in La Paz and Cochabamba. But these concessions leaded to a decrease of investment and were terminated in 2000 and 2005 after popular uprisings against them.

Since 2006, the government of Evo Morales intends to strengthen citizen participation and public service within the sector and to boost sectoral investments. The former regulation authority was dissolved. He nominated two former leaders of popular uprisings against privatizations as minister of water and vice minister of basic services. Since then, the government has passed new water and sanitation services law called "Water for life" and published a National Basic Sanitation Plan that analyses the main problems in the sector, puts forward a vision, sets targets (90% access to water and 80% access to sanitation by 2015) and defines the investments needed to achieve the targets (US$ 283 million per year). These figures include investments for the reuse of wastewater and to adapt to climate change.
In 2015, urban population represented 69% of the total population. In 2015, 97% of the urban population was connected to an improved water source.
In 2015, rural population represented 31% of the total population. In 2015, 76% of the rural population was connected to an improved water source.

Sri Lanka:

population represented 18% of the total population and 99% of this urban population was connected to an improved water source.
In 2015, rural population represented 82% of the total population and, 95% of this rural population was connected to an improved water source.

These improvements have been enabled by a development strategy focused on Community Based Organizations (CBO). It has been co-financed by the government of Sri Lanka, the World Bank and the communities. This strategy is based on the following principles:

- Beneficiaries play the lead role in the entire process of implementation
- Beneficiaries share minimum 20% of the capital cost
- Communities plan, construct, own, operate and manage
- Economic, social and cultural activities are encouraged
- Collaboration with Health & Education Authorities

This model of development has been rated as the "Best Practice" and "Well Managed" Project by the World Bank among 200 similar projects around the World. Unfortunately, the prevalence of disasters such as floods and droughts has increased since 2010 and puts a lot of pressures on all the ecosystem responsible of these improvements in improved water access.[1]

1. http://siteresources.worldbank.org/EXTWAT/Resources/4602122-1213366294492/5106220-1234469721549/36.2_SRI_LANKA.pdf

PROSPECTIVE ANALYSIS

According to the scenarios established for this study (see in appendices), the following prospective analysis aims at projecting access to water figures and evaluating the evolution of the number of PIN to determine what could be the best articulation of water supply solutions to reach the government's access targets.

Part 1: Macro Analysis - Evolution of People In Need by 2030

Without going into the details of the different solutions' development, this part of the study consists in estimating the yearly amount of PIN to address[1]. The goal is, at a macro point of view, to assess how achievable the targets are.

Different data can be found about improved drinking water access in Cambodia. Previously in this report, data from the World Bank and the Joint Monitoring Program (World Health Organization) have been exploited to compare the situation in Cambodia with other countries around the world. According to the JMP, in 2015, 75% of Cambodian population had access to an improved drinking water source. Nevertheless, this data is only based on estimation. Cambodian Ministry of Rural Development (MRD) presents less optimistic figures based on sampled field survey. These figures will be used in the following part as they are considered as more accurate.

According to MRD, in 2012, only 42% of Cambodian population had access to an improved drinking water source but quick progress has been observed in the last years. In the National Development Plan, Cambodian government has set ambitious targets to drinking water access. The plan aims to reach 60% of improved drinking water access rate in 2018 and a universal access in 2025.

This would mean an improvement of 4% per year between 2013 and 2018 and of 6.5% per year after 2018 (figure below).

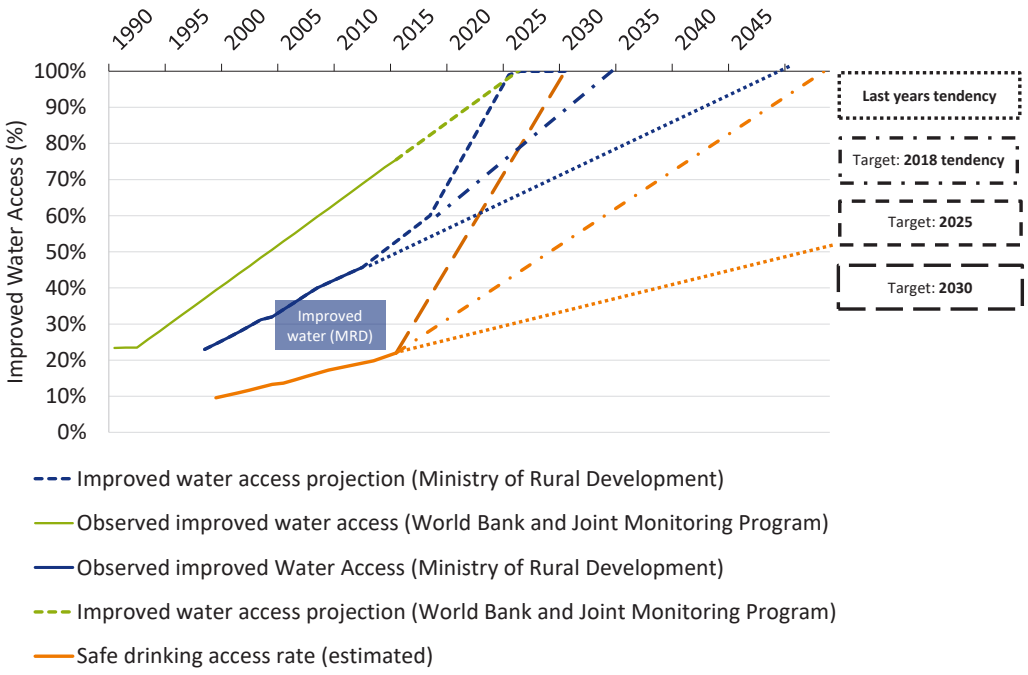


Figure 61: Water access rates projections

1. 100% of improved water access by 2025 and 100% of safe water access by 2030

Considering the evolution of the access rate to safe drinking water, if the same speed of development as improved water is adopted, universal access to safe drinking water would be achieved only in 2100. This would be far away from the government's objective of 2030.

Note: With the current trend, it is highly probable that the first objective for improved water set for 2018 will be reached.

In terms of people in need, the last years have shown a reduction of the population without access to an improved drinking water source of -1% per year (figure below). At this rate, the universal access to an improved drinking water source will be reached after 2080. The target set to 2018 would mean to accelerate to this rate -3% per year. At this speed, the universal access would be reached between 2040 and 2050. Finally, the target set to universal access in 2025 would necessitate to reduce the number of people in need of 36% per year in average. Such a rate has never been observed in history yet.

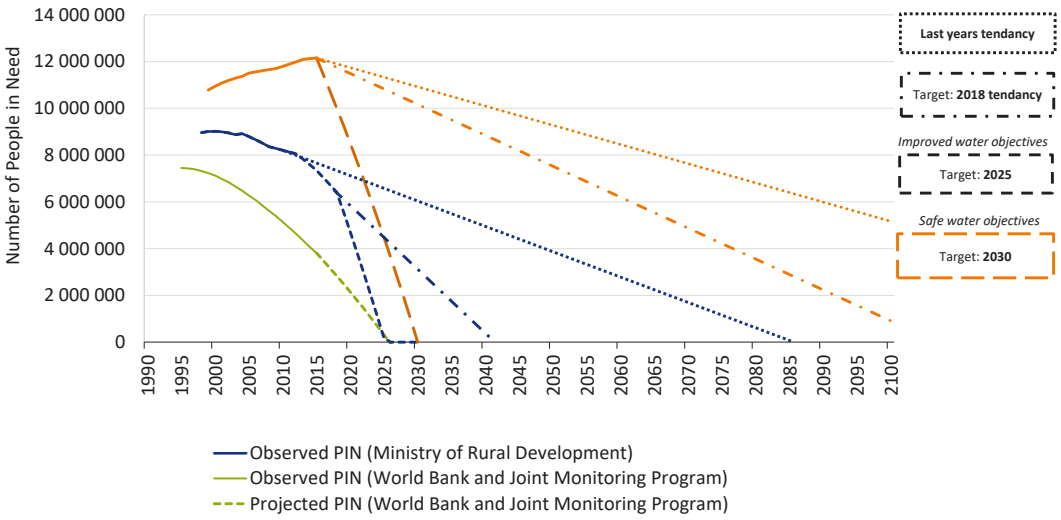


Figure 62: Evolution of PIN

In other words, last years, 300,000 additional people gained annually access to an improved drinking water source. The target set for 2018 and 2025 would mean to reach yearly respectively 500 000 people and 1 million.

Because most of the development of the water sector is carried out by the private sector, people in need in urban and in semi-rural areas should be the firsts to benefit from the development of improved water sources thanks to the possibility of developing their economical viable models. People in rural areas will be harder to reach because they are in more remote locations and less susceptible to benefit from a business solution as they have less revenues.

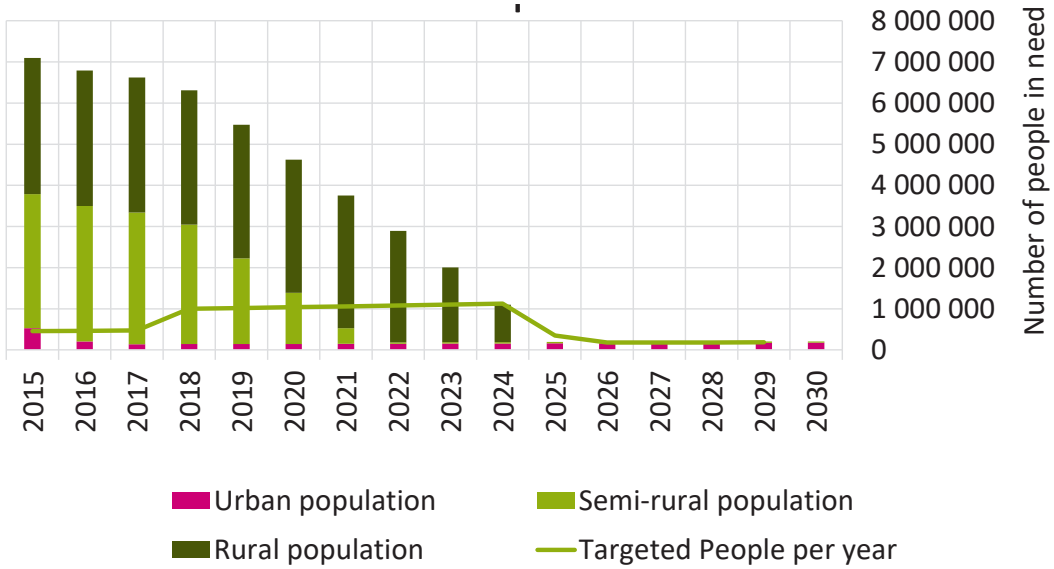


Figure 63: Evolution required of PIN per type of areas to reach 100% Improved Water by 2025

Without going into the details of the potential solutions development options, we see that the evolution required to reach the "universal access to improved water" is already considerable and that such an inflection and such a level of acceleration of the access rate has never been observed in any country of the world. So, even though Cambodia is a country with a unique and particularly dynamic situation in its access to water sector, reaching the government target by 2025 seems extremely unrealistic.
This statement gets even more accentuated when safe water access (SDG definition – equivalent to upgraded in our study) is in question. Reaching universal access by 2030 would mean servicing more that 15M people, among which more than 12M would be in rural areas.

The extent of the challenge is such that, at a macro point of view, all existing solutions that have already proved their potential should be cleverly mobilized.

Figure 64: Evolution required of PIN per type of areas to reach 100% of safe water access by 2030

Part 2: Solutions' oriented and investment needs' analysis

This part of the study consists in assessing what reaching universal improved access by 2025 and universal safe access by 2030 would mean in terms of solutions' development. In other words, the idea is to anticipate the most likely development trends of water access coverage in rural areas and identify what could be the most efficient articulation of solutions as well as the most impacting programs to implement during the next 15 years. See in appendices for more details about the methodology.

Reminder: To talk about drinking water coverage development, 3 types of zones need to be distinguished: economically viable zone, challenging zones and non-viable zones. In addition, based on the type of people to cover especially intra communal expansion and extra communal expansion, the most efficient solution varies.

Based on the analysis of 1) the current situation of drinking water coverage in Cambodia, 2) the establishment of past 5 years' trends of development of solutions, 3) the differentiated coverage cost of solutions per zones and type of people, 3 different 2030-horizon scenarios have been modelled and analyzed. Ranked by the level of budget necessary to mobilized here are the results.

Drinking water access situation in rural areas by **2030** (% people covered)

Initial Situation

2016
Drinking Water Access
(% people covered)

+

Macro Environment Scenario

- Population growth
- Urbanization
- Economic growth
- Climate Change

Note that percentage representation is not fully respected for pedagogical reasons.

Scenario 1

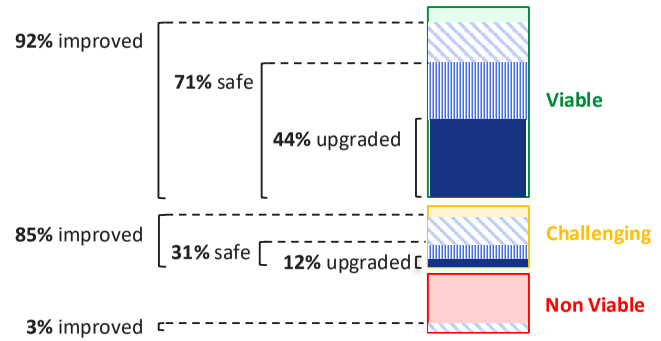
$

Current Trends Continuation

Same level of support of the sector than over the last 5 years
- Growth rate of coverage of WSP is maintained until 2030
- Same growth rate of kiosk implementation until 2020, then stagnation
- US$1M/year of public investment for rural areas

Improved Wells oriented policy

Public investment mobilized for wells prior to other solutions



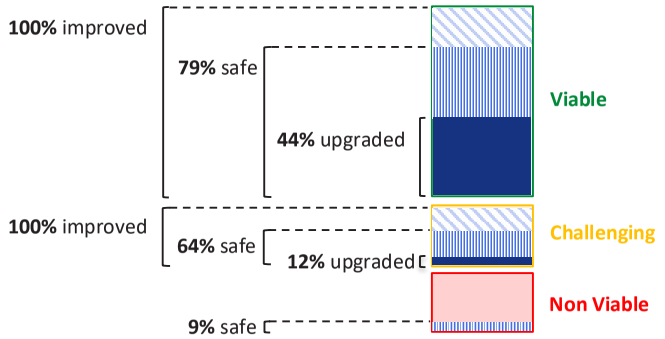
Total Cost
US$ 123M
US$ 9M/year

Including US$ 1.1M/year of public investment

Water access – Rural areas
75% improved
51% safe drinking
30% upgraded

Safe Drinking Kiosk oriented policy

Public investment mobilized for groundwater kiosk prior to other solutions



Total Cost
US$ 118M
US$ 8M/year

Including US$ 1M/year of public investment

Water access – Rural areas
84% improved
64% safe drinking
30% upgraded

Figure 65: Results of prospective Scenario 1, current trends continuation

Drinking water access situation in rural areas by **2030** (% people covered)

Initial Situation

2016
Drinking Water Access
(% people covered)

+

Macro Environment Scenario

- Population growth
- Urbanization
- Economic growth
- Climate Change

Note that percentage representation is not fully respected for pedagogical reasons.

Scenario 2

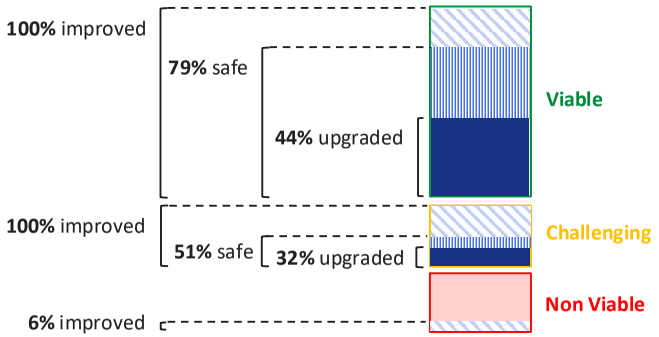
$$

Current Trends Continuation + **Targeted Program**

2 targeted programs to leverage Viable & Challenging coverage
- Funding CAPEX of additional kiosks to reach 100% of safe drinking access in viable areas by 2030
- Funding CAPEX to leverage intra-communal expansion in challenging areas

Improved Wells oriented policy

Public investment mobilized for wells prior to other solutions



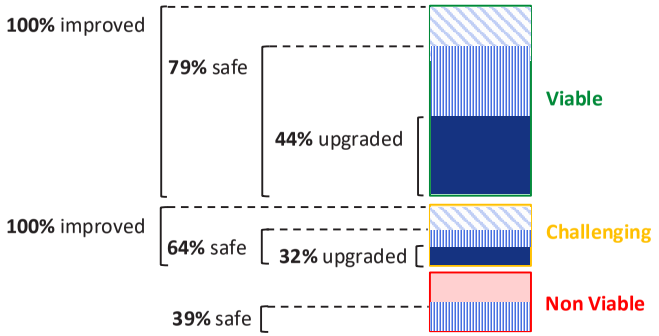
Total Cost
US$ 152M
US$ 11M/year

Including US$ 2M/year of public investment

Water access – Rural areas
84% improved
60% safe drinking
34% upgraded

Safe Drinking Kiosk oriented policy

Public investment mobilized for groundwater kiosk prior to other solutions



Total Cost
US$ 142M
US$ 10M/year

Including US$ 2M/year of public investment

Water access – Rural areas
89% improved
69% safe drinking
34% upgraded

Figure 66: Results of prospective scenario 2, current trends continuation and additional targeted programs

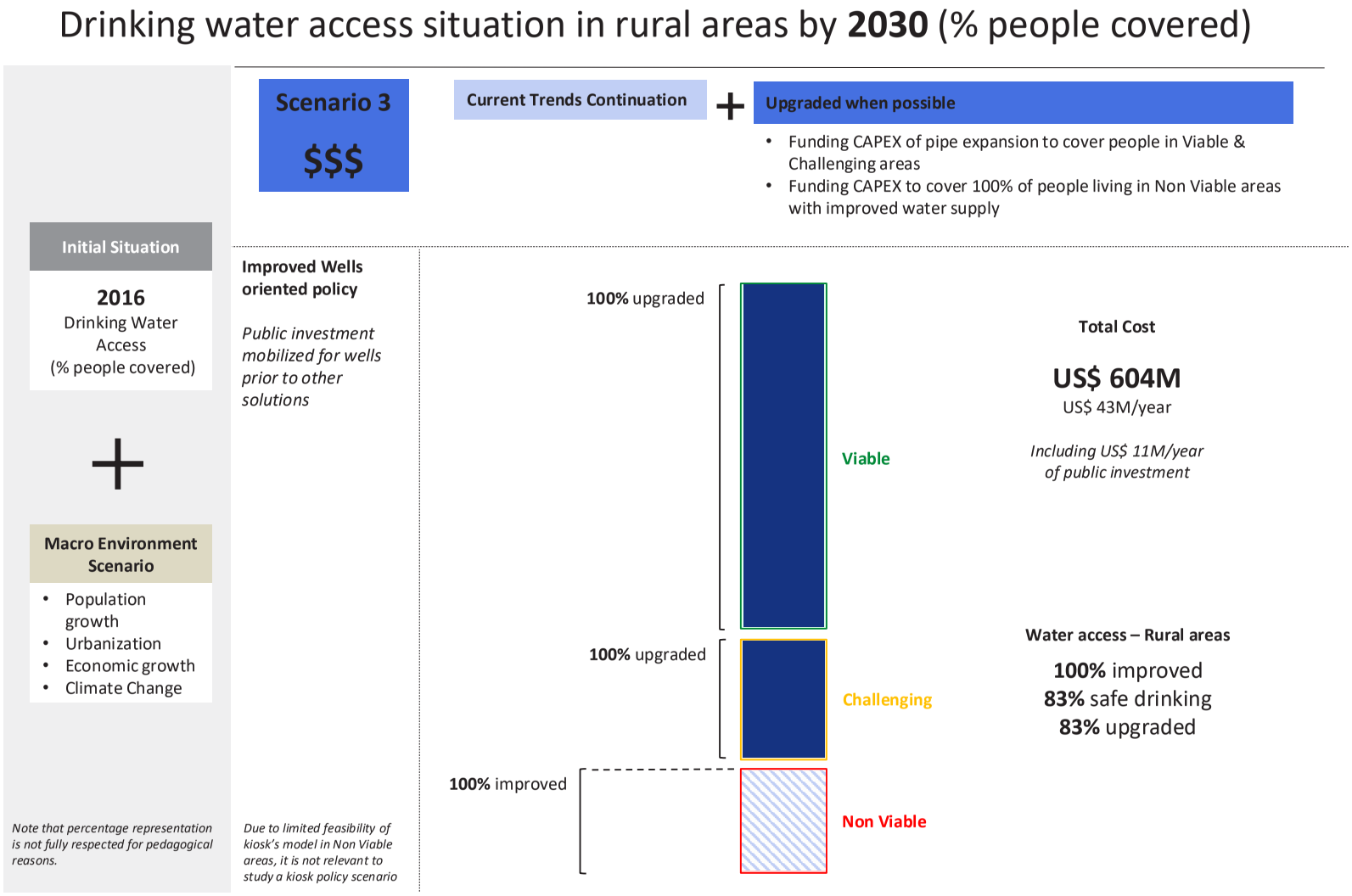


Figure 67: Results of prospective scenario 3, current trends continuation and additional programs to maximize upgraded water access

Scenario 1: Current trends continuation

With an estimated US$ 9M invested per year including only US$ 1M of public investment in rural areas, the scenario leads to think 75% of people in rural areas could get covered by an improved water supply. This shows that the current trends are far from being sufficient to reach universal access to improved water not only by 2025 but also by 2030.

Moreover, if no additional effort is made compared to today, only about 30% of rural people would get covered by a safely managed pipe service.

Finally, a change of policy between improved wells development in favor of community ground water fed kiosks could greatly impact the drinking water coverage. Mobilizing public financing for kiosks development to provide safe drinking water access prior to unlimited water through wells would result on the overall in an increase of 15% of safe drinking water coverage and a gain of 10% of people covered by improved water supply. All of this by "saving" US$ 10M of investment until 2030.

Note: The fact that current trends continuation's investment need to rely by 90% on private sector make the future development of water access development very exposed to an economic development slow down.

Scenario 2: Current trends continuation and targeted program

This scenario allows to see in which extent the addition of well targeted programs can leverage drinking water coverage in Cambodia. Based on only two specific programs weighing for US$ 1M per year, covering 100% of people living in viable and challenging areas by an improved water supply becomes achievable. This would mean reaching almost 70% of safe drinking water access on the overall for rural areas.

As a matter of fact, fostering the development of additional kiosks in populated rural areas and combining this action with subsidies for pipe extension of existing WSP in challenging areas would increase drastically the access to a drinking water supply.

Scenario 3: Current trends continuation and upgraded coverage when possible

Due to the ultimate objective of providing the largest access to safely managed pipe, this scenario shows what it would mean in terms of investments. The change of trends would be considerable with an increase of yearly investment 10 times higher than in the previous scenarios (additional US$ 9M per year). It clearly shows that this scenario is unrealistic based on current situation.

As a conclusion, this prospective analysis gives first hints of what an efficient and realistic way to leverage the sector's strength combined with a safe drinking water oriented policy could result into. With the addition of US$ 1M budget per year properly used for the most disruptive solutions of drinking water access per type of zones and people to address, the level of access by 2030 could reach 90% of rural people covered by improved water supply, among which 70% could get access to safe drinking water.

CONCLUSION & RECOMMENDATIONS

GENERAL CONCLUSION

Recovering from the Khmer Rouge rule that put the country near to nil, the current 54% of access to improved water in the country is the result of 25 years of efforts that made Cambodia the fastest growing country in the world in terms of water access increase. This access rate is nevertheless unequally distributed: The urban population, which represents only 20% of the total population, has an access rate to improved water of 83%, while the 80% that live in rural areas have an access of a mere 47%. To reach the ambitious government access to water objectives: "Universal access to Improved water by 2025" & "Universal access to Safe water by 2030", the main challenge lies therefore in tackling the water issue in rural areas. So far, the 2 main ministries in charge, the Ministry of Industry and Handicraft (MIH) responsible for all commercial solutions of water access and the Ministry of Rural Development (MRD) responsible for all community based or other non-commercial solutions, have relied heavily on both private investment and private or non-governmental initiative to tackle the water issue in rural areas. Indeed, donor/government funded non-commercial pumping & harvesting solutions (protected wells, rain water harvesting...) have proved themselves far from sufficient to tackle alone the water issue in rural areas. With a limited governmental budget, Cambodia is fortunate to host two real and unique specificities among the global rural water sector: 1) its thriving network of small & independent private water service providers (WSP) that have naturally emerged and currently provide water through pipe networks to more than 1M rural end-users, and 2) its young but important network of 20L bottle water community owned kiosks that already provides water through a delivery service to more than 300,000 end-users. These two types of actors have been so far very effective in reaching new beneficiaries as they have enabled within the last 5 years the provision of improved water to 8% of the total unserved population. This established, with the universal objectives of the government in mind, several aspects remained to be clarified: 1) the capacity of these actors to cover all rural areas, 2) the quality of the water and service provided, 3) the level and nature of actors' interactions, 4) their capacity to scale-up and 5) the actions required to maximize access to water.

In terms of water quality and service, the range proposed is very broad: from small unlicensed WSPs that provide 65 L/day of untreated surface water per person to bigger licensed WSPs providing 77 L/day of healthy water to an average beneficiary in terms of piped water, but also bottle water kiosks that provide 1.5 L/day of healthy water. As a whole, only bottle water kiosks and large WSPs can be currently considered as safely managed drinking water solutions. In addition, even when fully potable, WSP's water is seen more as a commodity than a source of drinking water and as such, is barely used for drinking prior to other usage.

In terms of coverage, there is still room for further expansion. Currently both solutions mainly target more densely populated rural communes with sufficient access to raw surface water (viable semi-rural areas), which fortunately host the majority of the overall rural population. However, in these viable zones, only 8% of the people are currently being supplied by safe drinking water solutions. This also means that people who live in viable rural areas but are not supplied by a safe drinking water solution represent 60% of the total rural population without access to safe water, highlighting the massive potential of market-based solutions to tackle water access issues.

In terms of potential to increase access levels, existing operators are a first and major lever that could allow to rapidly reach new populations. Indeed, as of now water operators have an average communal penetration rate of around 20% only. To extend their supply to this vast majority still unserved but easily accessible, they can work through two means of action: On one hand, they can work on their coverage rates, to ensure that everyone has the possibility to become a client. On the other, they can work on their connection rates, to ensure that people inside coverage zones do become real clients.

Concerning actors' interactions, two timeframes must be distinguished and considered: Until the 2020 horizon, kiosks are not in competition with most WSPs. They are rather providing complementary services to people. The study draws

up many complementarities to reach both quality and quantity water access when supplementing a small WSP (which still represent today 70% of all the WSPs). For larger ones, the complementarity of their service with kiosks is much more questionable since they manage to reliably provide quality water. On a post-2020 vision, due to the encouraging current trends of regulation, business and quality improvements within the WSP's sector, it can be assumed that every licensed WSPs will safely manage their water supply. Thus, the optimum articulation between pipe and kiosks' solutions would be a post-2020 development of kiosks focusing only on unlicensed WSP or non-covered communes.

Following the last 5 years' trends and including the current policies of the two ministries, the projected situation of rural water access situation by 2030 could be modelled as follows:

- 75% of improved access (people covered by wells, kiosks and or WSP)
- 50% of safe drinking access (people covered by kiosks and/or licensed WSP)
- 30% of upgraded access (people covered by a licensed WSP)

Thus, without any additional supportive program, reaching universal access to improved water source by 2025 seems unlikely. Furthermore, 50% of rural people could remain left apart from safe drinking water access. Therefore, although the natural capacity of development of both WSPs and kiosks is significant, it will not be sufficient to reach universal access in rural areas.

Based on the results from the modelling exercise, the following principles could be adopted to maximize the impacts of water access: 1) Going further than basic improved access especially when safe water access solutions can be implemented; 2) Favoring market-based solutions when they are fully or partially feasible. Water supply through licensed WSP should therefore be favored whenever feasible. When not feasible, the priority should then be given to bottled water solutions that for now only encompass the kiosk model but which distribution models could be diversified with the development of the sector. Thus, with a combination of targeted public and private investments and a change of policy favoring quality over quantity, significantly higher levels of access could be achieved.

For example, with US$ 1M of additional public investment per year and a more targeted strategy, that would devise preferences by area such as:

- In viable zones, the promotion and fostering of piped water and bottled water.
- In challenging areas, in already covered zones, the support of existing WSPs in their scaling up process. For uncovered zone, a support favoring piped or bottled water –whichever is more relevant- over wells.
- In non-viable zones, the promotion of market-based solutions when feasible (in this case kiosks), with wells for the remaining zones since it is the only suitable solution for most isolated areas.

The situation by 2030 in rural areas would be more likely of 100% of improved access and 70% of safe drinking access, 34% of upgraded access.

To conclude, 3 priorities can be highlighted to reach sectorial objectives both in numbers and in quality within the desired time frame.

1. **Increasing the penetration rate of existing covered zones both for piped and bottled water solutions**. This would allow an increase of the number of actual beneficiaries and a strengthening of the viability of supplying solutions, especially as 5 Million people without safe water access live in communes with WSPs.
2. **Tackling pipe licensing issues & and further compliance with regulations when necessary**. For every WSP that faces critical barriers to apply & comply with the new MIH *Prakas*' conditions (especially the 90% of the commune covered within 3 years and water quality requirement) adapted supporting actions should be implemented.
3. **Matching each solution with its optimum impact and fostering the kiosk model when best adapted**. To enable this, an initial mapping of all national resources -both human and natural- to allow informed targeted action would be required. Furthermore, the development of bottled water solutions should be, whenever viable, favored to that of wells, as it ensures a safe access and sustainable access for a minimal cost.

RECOMMENDATIONS

Taking into account these priorities, a number of recommendations have been laid out to try and best meet all of the government objectives.

Table 33: Recommendations

Category	Description	Easiness	Cost	Impact	Priority
A. Increasing the penetration rate of existing solutions	A.1 OBA (Output-based Aid) programs to support connection fees (piped water) or first bottle purchase (bottled water) for poor households in order to increase penetration rates	Easy	Low	High	P1
B. Supporting WSP with potential but facing difficulties for scaling up	B.1 Technical and financial support for small WSP investment to allow a scaling-up of these operators in order to attain quality standards and reach more beneficiaries	Hard	High	High	P2
	B.2 Studying the feasibility and profitability of renewable energy installations for WSPs in order to decrease operating cost and reduce environmental impacts. Devising ensuing action plan	Easy	Low	Low	P1
	B.3 Encouraging a shift in investments in order to support either bottled water suppliers or licensed WSPs prior to well in viable and challenging zones.	Easy	Medium	High	P2
C. Matching each solution with its optimum impact area and fostering the bottled water model when best adapted	C.1 Developing groundwater fed kiosks in Arsenic-free challenging zones to guarantee a safe water access	Hard	Medium	High	P2
	C.2 National study on water resource and availability to better map viable and challenging zones and have a more targeted action plan on supporting different solutions	Medium	Low	Medium	P1
	C.3 Reflection on the future of communes where present operators will not be able to meet official requirements and following action plan	Medium	Low	Medium	P3
	C.4 Studying how to scale-up the bottled water distribution in rural areas taking into account the existing actors (kiosks, family businesses and regional companies)	Medium	Low	Medium	P1
	C.5 Diverting wells implementation from viable zones to challenging ones as to stop competing with commercial solutions & focus on populations in non-viable zones	Easy	Medium	Medium	P1

Detailed analysis of comparison criteria

The detail of how each recommendation was graded in term of easiness of implementation, cost and impact can be found hereunder, as well as a quick overlook on the chosen axes of reflection.

Increasing the penetration rates of existing solutions

A first axis of work consists in acting on covered areas to increase the number of people using the service. As it was seen throughout the study, even when implemented in an area, actors have relatively low penetration rates (in average 20% in rural and semi-rural zones). This gap between their potential and the reality is represented by the **4.9 Million rural people** that live in WSPs' covered communes but are not connected, to which can be added the **1.2 Million** who live in kiosk's covered areas without using the service. Thus, supporting actions need to be taken to ensure that all actors serve the maximum of people in their coverage area.

Table 34: Recommendation A.1

A.1 Recommendation		**P1**
OBA programs to support connection fees (piped water) or first bottle purchase (bottled water) for poor households in order to increase penetration rates		
Easiness of implementation	Such programs already exist and poor households are already identified through the ID poor system.	**Easy**
Cost	If the support program commits to half of the connection fee, it represents US$ 35 per poor household, or an average US$ 7.5 per new beneficiary for WSP connection. The price is even lower for bottled water, where the first bottle costs only KHR 12,000, being more a psychologic barrier than a real one	**Low**
Impact	By allowing poorest households to connect, it could enable a major rise in penetration and real access rates.	**High**

Supporting WSP with potential but facing difficulties for scaling up

WSP are not equal in the quality of the water they distribute. If large ones can be considered providers of an upgraded access, the smallest ones or the unlicensed cannot be trusted with the quality of their water. Hence, it is important to accompany all these small operators in their services' upgrade and scaling up in order to ensure the quality of the water they distribute, but also to raise their impact through rising penetration rates.

Table 35: Recommendation B.1

B.1 Recommendation		**P1**
Technical and financial support for small WSPs' investments to allow a scaling-up of these operators in order to attain quality standards and reach more beneficiaries		
Easiness of implementation	Two phases are needed for this intervention: - A first assessment of operators to target for scaling up. - A second phase to bring technical and financial support to these operators in order to engage the scaling up. Such support also requires a combination of simultaneous actions from multiple actors.	**Hard**
Cost	Due to the need for diversity and simultaneity of approaches required to support small WSPs, technical support on quality, business development support, financing support (grant, loan, guarantee facilities…), cost of such a measure can be expected to be high	**High**
Impact	With the scaling-up and licensing of operators come new guarantees regarding the quality of the water and the number of reachable beneficiaries. A program of the kind could thus indirectly have an important impact on beneficiaries.	**High**

Table 36: Recommendation B.2

B.2 Recommendation		P1
Study the feasibility and profitability of renewable energy installations for WSPs to decrease operating costs and reduce environmental impacts. Devise ensuing action plan		
Easiness of implementation	With most WSP having similar business plans, evaluating the possibility for solar installations would necessitate only: - A few different case studies to evaluate costs and necessary installations depending on the size and capacity of the WSP. - An assessment of the financing capacity of each type of WSPs to recommend different financing solutions.	Easy
Cost	The cost of solar has drastically decreased. Investing in such systems wouldn't represent a too high burden over the lifetime of the system. The issue would nevertheless come from the high upfront costs that diesel genset or grid don't bare.	Low
Impact	With energy expenses being such a large part of WSP's OPEX (from 45 to 70%), ensuring an independent access to energy would allow reductions that could translate into a higher profit or easier viability that could entail easier expansion.	Low

Table 37: Recommendation B.3

B.3 Recommendation		P2
Encouraging a shift in investments in order to support either bottled water suppliers or licensed WSPs prior to wells in viable and challenging zones		
Easiness of implementation	Seeing how these solutions are commercially viable and sustainable, favoring them would mostly mean directing initial investments towards different actors. Moreover, such solutions do not need permanent maintenance or continuous monitoring from the public sector.	Easy
Cost	Upgrading from an improved access to a safe one does not entail larger sums from the public sector or donors. However, to reach an upgraded access, investments needed are far greater, but mostly covered by the private sector.	Medium
Impact	If the shift is made, it would mean that all people in viable zones could realistically contemplate the idea of safe water coverage in years to come.	High

Matching each solution with its optimum impact area and fostering the kiosk model when best adapted

To best maximize the impact of public investments and to optimize the real access to water, a targeted strategy and action plan must be taken. This requires initially to have a perfect in-depth knowledge of all the country resources –human or natural-, and then to promote in consequence different solutions. In particular, one has been relatively overlooked in the past national action plans: bottled water distribution. Today, with a solid structure and proven example of an efficient safe access, such as TS1001 kiosk model, bottled water distribution appears as a major solution in many zones of country, one to be supported and fostered.

Table 38: Recommendation C.1

C.1 Recommendation		**P2**
Developing groundwater fed kiosks in Arsenic-free challenging zones to guarantee a safe water access.		
Easiness of implementation	This task would entail two successive parts: - A first one would be an exhaustive analysis of the soil and Arsenic risks to ensure the safety of the water- A second one would be, parallel to the setting up of the kiosk, the drilling of the wells in order to have this water supply.	**Hard**
Cost	Comparing to surface water kiosks, those supplying on groundwater would need a higher CAPEX to cover the price of the wells. However, it represents a reasonable supplement in costs, majoring the fee by an estimated mere 20%.	**Medium**
Impact	If kiosks were to consider going to surface water free areas and supply on groundwater, it would allow challenging zones to welcome safe drinking water solutions.	**High**

Table 39: Recommendation C.2

C.2 Recommendation		**P1**
National study on water resource and availability to better map viable and challenging zones and have a more targeted action plan on supporting different solutions.		
Easiness of implementation	With different actors already interested in the subject and a certain level of charting already done, this task would mainly have to reunite all the existing information. The difficulty however lies in the following action plan that will have to assign each zone with a preferential solution.	**Medium**
Cost	This study can be undertaken by an institution or a consulting company. If it represents a certain amount, it is negligible when considering the size and budget of the sector.	**Low**
Impact	Armed with this study, national and international action plans would be a lot more efficient in assigning each area of intervention with the adapted solution. Results from this report would influence the guidelines for the years to come.	**Medium**

Table 40: Recommendation C.3

C.3 Recommendation		**P3**
Reflection on the future of communes where present operators will not be able to meet official requirements and following action plan.		
Easiness of implementation	As the deadline for the first three-years extension of license is coming, it is for now hard to foresee the future of the most vulnerable WSPs. However, actions will have to be taken to manage the transition for all depleting actors or to support those who are still relevant. It will demand for cases to be taken one by one, ensuring a certain level of weariness.	**Medium**
Cost	This represents however only case studies, which have a limited cost when taking into account the financial weight of the sector.	**Low**
Impact	If at one point in their scaling-up WSPs represent a perfectly trust worthy solution, they are in the first step often providers of a low quality water. As such, their presence in areas with no growth potential blocks the market and does not in return guarantee a safe water access. Which is why it is preferable to favor sometimes safe solutions or a combination of solution that fit better the situation and can have a sustainable role.	**Medium**

Table 41: Recommendation C.4

C.4 Recommendation		P1
Study on how to scale-up the bottled water distribution in rural areas taking into account the existing actors (kiosks, family businesses and regional companies) with required action plan.		
Easiness of implementation	Such study will need to meet the different actors of bottled water distribution and deeply analyze 1) how each solution could contribute to the development of the sector, 2) what changes/evolution of models of distribution would be necessary to provide at scale in challenging and non-viable rural areas access to safe water. As family businesses are very informal actors, it won't be easy to analyze at a sectoral level what are their actual potential and what actions to take. In addition, the generalization of kiosks models, like TS1001, would need to be considered by actors such as the government.	Medium
Cost	The cost of this measure corresponds to the cost of a sectoral study and as such remains quite low compared to other measures.	Low
Impact	Finding out a way for bottled water distribution such as kiosk model to really be part of the access to water solutions is crucial since piped water will clearly not be able to fulfil all the needs in rural Cambodia both in terms of speed of connection and numbers. Just on viable areas, an estimated 7 million people are currently without access to safe water of whom a big part won't be covered by pipe even by 2030.	Medium

Table 42: Recommendation C.5

C.5 Recommendation		P1
Divert wells implementation from viable zones to challenging ones as to: - Stop competing with commercial solutions; - Focus on populations in non-viable zones.		
Easiness of implementation	As of today, most wells' programs target populated rural areas. Turning from these areas to only challenging ones would make sense. And, seeing how wells are a micro-scale solution (they serve an average 25 households), even the most rural areas engulf settlements of this size and are thus fit for well solution.	Easy
Cost	Upgrading the access targets from an improved one to a safe or upgraded one would not entail a significant raise in support programs. If well targeted, a simple US$ 1 million per year could allow that scaling up in quality for viable areas.	Medium
Impact	Ensuring access to commercial solutions instead of wells in economically viable zones would ensure a better quality access for populations, upgrading from an improved one to a safe or even upgraded access.	Medium

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APPENDICES

Appendix I - Provinces of Cambodia

The following table presents the 26 provincial municipalities of Cambodia:

Table 43: Provincial Municipalities of Cambodia

Province	Municipality	Province	Municipality
Battambang	Krong Battambang	**Mondul Kiri**	Krong Saen Monourom
Banteay Meanchey	Krong Paoy Paet	**Oddar Meanchey**	Krong Samraong
	Krong Serai Saophoan	**Pailin**	Krong Pailin
Kaeb	Krong Kaeb	**Preah Sihanouk**	Krong Preah Sihanouk
Kampong Cham	Krong Kampong Cham	**Preah Vihear**	Krong Preah Vihear
	Krong Stueng Traeng	**Prey Veng**	Krong Prey Veng
Kampong Chhnang	Krong Kampong Chhnang	**Pursat**	Krong Pursat
Kampong Speu	Krong Char Mon	**Ratanak Kiri**	Krong Ban Lung
Kampong Thom	Krong Stueng Saen	**Siem Reap**	Krong Siem Reap
Kampot	Krong Kampot	**Svay Rieng**	Krong Bavet
Kandal	Krong Ta Khmau		Krong Svay Rieng
Koh Kong	Krong Khemarak Phoumin	**Takeo**	Krong Doun Kaev
Kracheh	Krong Kracheh	**Tboung Khmum**	Krong Suong

Appendix II - Water sector governance in Cambodia

At a national level:

Table 44: Description of national institutions related to water suppply in Cambodia

Lead Institutions	Roles
Primary institution for urban water supply	
Ministry of Industry and Handicraft (MIH) – General Department of Potable Water Supply (DPWS)	Responsible for urban water supply including water quality control and the regulation of commercial piped water supply throughout the country (both private and public operators): 1) sets policy and prepares sector plans; 2) issues regulations on drinking water quality standards and service levels; 3) mobilizes resources from development partners; 3) controls implementation of capital expenditure (CAPEX) of public water utilities except for the autonomous Water Supply Authority of Phnom Penh and Siem Reap (PPWSA; SRWSA); 4) supervises, through its provincial line agencies (PDIH), service provision and performance of the 13 public operators in the provincial capital (i.e. municipalities); 5) licenses private operators; and 6) regulates tariffs of all public and private operators, at least in theory1.
Secondary institution for urban water supply	
Ministry of Public Works and Transport (MPWT)	Responsible for urban sanitation due to its role in drainage. But MPWT is also involved in water supply since the construction of road is closely linked with the construction of water piped network.
Ministry of Land Management, Urban Planning and Construction	Responsible for checking the compliance of new development for water supply arrangements in urban areas. Where new developments have a floor area of less than 3,000 square meters all responsibilities can be delegated to the provincial departments of the relevant line ministries.
Primary institution for rural water supply	
Ministry of Rural Development (MRD) – Department of Rural Water Supply (DRWS)	Through its DRWS, the MRD is responsible for providing water supply services in rural communities. It implies policy setting, planning, regulation, financing, and overall coordination of projects on the provision of water supply: 1) sets policy and prepares planning (MRD has recently released its National Action Plan for Rural Water Supply, Sanitation and Hygiene 2014-2018); 2) oversees CAPEX implementation and institutional capacity building through its Provincial Department for Rural Development (PDRD); and 3) regulates service provision. The Department of Rural Water Supply (DRWS) is responsible for the provision of water in the rural communities with different roles and responsibilities assigned at different levels of government.
Secondary institution for rural water supply	
Ministry of Youth and Education	Responsible for promoting sanitation and hygiene activities in schools and thus is involved in providing adequate water, sanitation and hand washing facilities in schools, in coordination with MRD.

Ministry of Health (MoH)	Responsible for adequate water, sanitation and hand washing facilities in health-centers, in coordination with MRD.
Over institutions linked with water supply	
Ministry of Economy and Finance	Responsible for allocating annual budget to the sector.
Ministry of Water Resources and Meteorology (MWRAM)	Responsible for managing the water resources of the country, including regulating the issuance of environmental compliance certificates.
Ministry of Interior	Through the Secretariat for the National Committee for Democratic Development, in charge of facilitating and supporting sub-national planning and project delivery mechanisms to villages, communes, districts, municipalities and provinces under the Commune Administration 2001 and Organic Law 2008

At a provincial level:

Table 45: Description of provincial institutions related to drinking water supply in Cambodia

Key provincial actors	Roles
Provincial Department of Industry and Handicraft – Water Supply Office	The PDIH is responsible for: 1) preparing the annual investment plans of the province and submitting these to the MIH for funding; 2) supervising projects of public waterworks funded through the MIH; 3) liaising with interested private providers; and 4) overseeing operations of public waterworks which are responsible for operating and maintaining public water supply facilities at the provincial/municipal level, 5) Supervising the construction of water supply systems in small towns that are operated by the private sector, where financing is provided by development partners through the government.
Provincial Department of Rural Development – Rural Water Supply Office	The PDRD is responsible for planning and project implementation, and works with local authorities. In charge of 1) Provincial Action Plan implementation & management, 2) Coordination of implementing agencies and reporting at Provincial level, 2) Review and update PAP annually

At a commune and village levels:

Table 46: Description of communal institutions related to drinking water supply in Cambodia

Key local actors	Roles
Commune Councils (CC)	Responsible for the planning, implementation, and financing of rural infrastructure. They prioritize and formulate their needs and prepare annual plans (Commune Investment Plan). Owners of water facilities, CCs make agreements with implementing partners and private sector and legal aspects. It is the key actor for rural water supply implementation and operation management.
Village development committees – [Water Management Committee - Water Sanitation User Group]	Responsible for managing, operating, and maintaining communal water supply and sanitation facilities following MRD guidelines. WSUGs are responsible for repairing and maintaining pumps. Minor repairs are funded by the communities, while major repairs are submitted to the central ministry for funding from the national budget. For community piped water systems, there is a WMC in charge of collecting money and hire a local entrepreneur to operate the system.

Appendix III - Policies of the water sector

Table 47: Water supply major policies

Water Supply Major Policies	
Name	**Comments**
National Policy on Water Supply and Sanitation 2003	It is divided into three parts 1) urban water supply, 2) urban sanitation and 3) rural water supply and sanitation. This policy promotes six main sector visions for 2025: 1) Supply Driven and Demand Responsive Approaches; 2) Private Sector Participation; 3) Water tariff; 4) Protecting the Poor and Subsidies; 5) The autonomous Public utilities; 6) The Urban Water Supply Regulator.
NDWQS - 2004	National Drinking Water Quality Standard - Define the minimum standards of water quality for drinking water supply from MIME.
MoU MIME-MRD 2005	Urban water supply and piped water supply for commercial use are under the supervision of the MIME when rural community piped water supply systems development are under the supervision of the MRD.
Rectangular Strategy - phase III 2013	Launched in 2004, the Rectangular Strategy includes the following consideration for water supply: • Expansion of the capacity and coverage of clean water supply, development of the legal framework, institutional capacity and human resources in the water sector. • Further expanding the coverage of clean water supply to rural and urban areas through the rigorous implementation of The National Strategy for Rural Water Supply and Sanitation 2011-2025.
National Strategic Development Plan 2014-2018	Present the vision of development and objectives to reach in 2018 including for rural and urban water supply sector

Table 48: Major urban water policies[1]

Major Urban Water Supply Policies	
Name	**Comments**
Action plan 2009-2013	The action plan was finalized in 2010 by the DPWS. It identifies main objectives and goals: 1) reform the public sector; 2) strengthen sector policy and regulatory frameworks; 3) improve the technical and economic efficiency of public and private entities; 4) encourage participation of the private sector in service provision on a competitive and transparent basis; 5) Address the specific needs of the poor including engaging them in defining the service levels that they are willing to pay, and; 6) minimize adverse environmental and social impacts and incorporate mitigating measures.
MIH becomes the line Ministry for urban water supply - 2013	MIME is broken-up into two Ministries. The Department of Potable Water Supply is placed under the General Directorate of Industry under MIH (Ministry of Industry and Handicrafts).

1. World Bank, "Strengthening Sustainable Water Supply Services Through Domestic Private Sector Providers in Cambodia," January 28, 2016.

Ministerial Decree from MIH issued regarding the licensing process: - ***Prakas*** on Procedures for Issuing, Revising, Suspending, and Revoking of Permits", accompanied with, - ***Prakas*** on "Standard Conditions of the Permit" 2014	• It covers all natural persons or legal entities that may be a public enterprise, public-private partnership and a purely private enterprise engaged in the provision of water service, but excludes 18 water service providers with special contracts (such as Design-Build-Lease and Design-Build-Operate schemes) • It sets the term of permits at 20 years for purely private enterprises and unlimited for public enterprises and public-private partnerships. • It contains procedures for the issuance and replacement of water permits and the issuance of the necessary operating certificates (5 years) allowing licensees to continue operations in case of compliance with the permit conditions • In addition to a direct granting process, it contains provision for a competitive granting, where feasibility studies are made available to shortlisted bidders and permit is granted to bidder with lowest tariff • It stipulates the necessity to submit a feasibility study with the application, including a systems-and build-out-plan indicating how the area will be served within a five year period • It includes procedures for requesting expansion licenses covering adjacent communes/service areas with basic services and maintain records and reports in format of MIH. • It provides for Tariff and Fees in the permit and stipulates that MIH shall study the tariff every 5 years for adjustment based on real circumstances • It contains procedures for suspension, revocation of licenses in case of non-compliance with the obligations under the license

Table 49: Major rural water supply policies

Major Rural Water Supply Policy	
Name	**Comments**
NSDP for Rural Water Supply, Sanitation and Hygiene 2011-2025	Establishes a clear set of objectives for Cambodia: 50% of rural population will have access to improved water supply by 2015, and 100 percent by 2025. • Increase in access to water supply services by 1) Providing new water supply facility using fund from government, donors and community, 2) Rehabilitating existing infrastructure using fund from government, donors and community, 3) Identifying more appropriate technology, 4) Encouraging private sector • Application of water quality standards by 1) Developing procedures for water supply scheme to conform to water quality standards 2) Promoting water quality safeguard • Improvement in operation and maintenance
National Rural Drinking Water Quality Guidelines - 2015	The NRDWQG supersede the January 2004 "Drinking Water Quality Standards". Objectives of the NRDWQG are to establish and define: • Measures for water quality comparison and actions related to water quality. • The minimum requirement for monitoring and surveillance, the roles and responsibilities
NAP - Rural Water Supply, Sanitation and Hygiene 2014-2018	The Technical Working Group for RWSSH has initiated and led the process to create NAP. It provides a "road map" for implementing the NSDP from 2014 through 2018, and for putting the RWSSH sector on a path to achieve the Sector Vision.

Appendix IV - Prospective study methodology

Solutions studied within the prospective study

The study comprises the analysis of the future development of the following solutions:

- Piped water
- 20L bottled water through community owned kiosks
- "Improved water": pumped & harvested water[1]

The prospective analysis is divided into two parts

According to 1) different macro environment factors' scenarios established (see below) and 2) the modelling of 3 scenarios of development of water access solutions in Cambodia (see below), a prospective analysis has been conducted between 2016 situation and 2030. It aims at projecting access to water figures, trends of sector development and numbers of PIN to determine what could be the best articulation of water supply solutions in the near future. Thus, to determine what's at stake to reach the government's access targets. To do so, the prospective analysis has been designed into two parts:

1. **Macro analysis**

Without going into the details of the different solutions' development, this part consists in estimating the yearly amount of PIN to address and the level of resources needed to achieve national objectives[2]. The goal is, at a macro point of view, to assess how achievable the targets are.

2. **Solutions' oriented and investment needs' analysis**

It consists in assessing what reaching universal access by 2025 and safe by 2030 would mean in terms of solutions' development based on current trends continuation and eventually additional targeted programs. In other words, the idea is to anticipate the most likely development trends of water access coverage in rural areas and identify what could be the most efficient articulation of solutions as well as the most impacting programs in the next 15 years.

Macro environment factors' scenario definition & selection

Scenario definition

To describe the macro-economic environment of Cambodia by 2030, 4 parameters have been analyzed:

- Population Growth
- Economic Growth
- Climate Change
- Urbanization rate

Based on a meta-study from the available bibliography, for each parameter, two hypotheses have been described with a "low hypothesis" and a "high hypothesis" from now to 2030. From the 16 possible scenarios, 2 short-term scenarios considered as the most likely ones have been selected and analyzed. The table below shows a summary of the general assumptions selected. Each scenario is described below. Each hypothesis and the associated consequences are also described in appendices.

1. In Cambodia, "improved water" mainly corresponds to improved standards wells and improved standards rain water tanks. Protected springs pumping solutions are not included due to a lack of information available and their very limited expected development.
2. 100% of improved water access by 2025 and 100% of safe water access by 2030

Table 50: Description of macro-environment prospective scenarios

Horizon	Title	Scenario	Occurrence Probability	Hypothesisw			
				Population growth	Economic growth	Climate Change	Urbanization rate
Short Term	Business As Usual	1	0,288	High	High	High	High
	Current trends continuation with economic slow down	2	0,288	High	Low	High	High
Long term	Decentralization	3	0,072	High	High	High	Low
	Population Stabilization	4	0,072	Low	High	High	High
	Decentralization + economic slow down	5	0,072	High	Low	High	Low

The long-term trends have not been directly included in the analysis but 3 main additional trends have been identified as the most likely ones). But while the selected scenarios facilitate the short-term analysis the long-term trends draw an interesting analysis window for the consequences of the short-term scenarios.

Presentation of the selected scenario

Scenario 1 – Business as usual

This scenario results in the continuation of the observed trends in the last years. In this scenario, economic growth, urbanization, population growth and climate change continue to intensify in the next years. The main consequences of this scenario are listed below:

- A higher need of structure investment in particularly in peri-urban centers
- An increase of the number of people with a difficult access to basic infrastructures (WASH, energy, transportation…)
- A reduction of poverty incidence
- A better access to basic services (banking, transportation, energy…)
- The concentration of economic and human activities in urban and peri-urban centers and the isolation of rural population
- A reduction of quality and availability of natural water resources

Scenario 2 – Economic slow down

An equally possible scenario has been studied. In this case population growth, urbanization and climate change continue to intensify. However economic growth slows down as it was observed between 2007 and 2010. Several factors could lead to this hypothesis:

- A slowing down of the global economy
- An implosion of the potential economic bubble in the real estate sector in Cambodia
- Repeated floods and droughts due to climate change destabilizing the agrarian system at the bottom of Cambodia's economy

The main consequences of this scenario are listed below:

- A higher need of structure investment in particularly in peri-urban centers
- An increase of the number of people with a difficult access to basic infrastructures (WASH, energy, transportation…)
- The concentration of economic and human activities in urban and peri-urban centers and the isolation of rural population
- A reduction of quality and availability of natural water resources
- A lower financing capacity per capita
- A risk of weakening of the poorest people

Long term trend 1 – Decentralization

The first long term trend that has been studied is the intensification of the decentralization process that is already in process in Cambodia. In this trend, the urbanization is slowing down after 2030. This trend would imply:

- The increase of the economic development in rural areas
- The strengthening of rural population
- The development of the rural transportation systems (small roads…)
- A higher need of investment to provide WASH access in rural areas

Long term trend 2 – Population stabilization

The second long-term trend imply the stabilization of the population growth after 2030. This trend would lead to:

- The increase of the average age
- The decrease of the number of children and young people
- A higher financing capacity per capita

Long term trend 3 – Decentralization and economic slow down

The last long term trend combines the consequences of a decentralization process and an economic slowdown:

- A higher need of investment to provide WASH access in rural areas paired with a lower financing capacity per capita
- A better resilience capacity in the rural area

National analysis and people in need projection

The methodology of the people in need projection for each type of access is described in this section. All the data resulting from these projections are also presented below.

Population Projection

In terms of demographic growth, the projections of this report use a central hypothesis based on the mean value between the low hypothesis and the high hypothesis.

Table 51: Population projection

	Population						
	Urban share	Semi-rural share	Rural share	Urban population	Semi-rural population	Rural population	Population projection (central hypothesis)
2015	20%	55%	25%	3 115 580	8 567 844	3 894 475	15 577 899
2016	21%	55%	25%	3 251 627	8 601 077	3 880 974	15 733 678
2017	21%	54%	24%	3 390 166	8 634 330	3 866 908	15 891 404
2018	22%	54%	24%	3 531 243	8 667 597	3 852 265	16 051 105
2019	23%	54%	24%	3 674 903	8 700 874	3 837 031	16 212 808
2020	23%	53%	23%	3 821 193	8 734 155	3 821 193	16 376 541
2021	24%	53%	23%	3 970 160	8 767 436	3 804 737	16 542 333
2022	25%	53%	23%	4 121 852	8 800 712	3 787 648	16 710 212
2023	25%	52%	22%	4 276 319	8 833 976	3 769 913	16 880 208
2024	26%	52%	22%	4 433 611	8 867 223	3 751 517	17 052 351
2025	27%	52%	22%	4 593 779	8 900 447	3 732 445	17 226 671
2026	27%	51%	21%	4 756 874	8 933 642	3 712 682	17 403 199
2027	28%	51%	21%	4 922 950	8 966 802	3 692 213	17 581 964
2028	29%	51%	21%	5 092 060	8 999 920	3 671 020	17 763 000
2029	29%	50%	20%	5 264 259	9 032 990	3 649 089	17 946 338
2030	30%	50%	20%	5 439 603	9 066 005	3 626 402	18 132 011

From national objectives to the people in need projection

From the national objective, and the coverage rate for each type of zone (Rural/Semi-rural/Urban), the repartition of People In Need (PIN) is determined. The number of people with an improved access is also determined. The difference of people with an improved access between two years gives the number of people to be targeted in order to achieve the national objectives. This number is subtracted from the people in need in each area following this order of priority PIN in urban areas, PIN in semi-rural areas and then PIN in rural areas.

In the end, there is still some PIN in urban and semi-rural areas since these areas present a positive demographic growth. This process is repeated each year of the simulation. This process is the same for safe drinking access projection but different initial conditions have been used.

Projection results for Improved drinking water access

Table 52: Improved water access projection

		Improved water access projection			
	Population projection (central hypothesis)	Improved water access projection (Ministry of Rural Development)	Projected PIN	People with an improved access	Targeted People per year
2015	15 577 899	53%	7 344 979	8 232 920	497 320
2016	15 733 678	55%	7 043 443	8 690 235	457 315
2017	15 891 404	58%	6 735 307	9 156 097	465 863
2018	16 051 105	60%	6 420 442	9 630 663	474 566
2019	16 212 808	66%	5 581 838	10 630 970	1 000 307
2020	16 376 541	71%	4 725 802	11 650 739	1 019 769
2021	16 542 333	77%	3 852 000	12 690 332	1 039 593
2022	16 710 212	82%	2 960 095	13 750 117	1 059 785
2023	16 880 208	88%	2 049 740	14 830 469	1 080 351
2024	17 052 351	93%	1 120 583	15 931 768	1 101 299
2025	17 226 671	99%	172 267	17 054 405	1 122 636
2026	17 403 199	100%	-	17 403 199	348 794
2027	17 581 964	100%	-	17 581 964	178 766
2028	17 763 000	100%	-	17 763 000	181 036
2029	17 946 338	100%	-	17 946 338	183 338
2030	18 132 011	100%	-	18 132 011	185 673

Table 53: Improved water PIN repartition

	Improved water access PIN repartition					
	Improved Urban	Improved Semi-rural	Improved Rural	PIN in urban areas	PIN in semi-rural areas	PIN in rural areas
2015	83%	62%	15%	529 649	3 255 781	3 310 304
2016	94%	62%	15%	208 380	3 289 014	3 296 803
2017	96%	63%	15%	**138 539**	3 203 323	3 282 737
2018	96%	67%	15%	**141 077**	2 903 102	3 268 094
2019	96%	76%	15%	**143 660**	2 079 732	3 252 860
2020	96%	86%	15%	**146 290**	1 239 534	3 237 022
2021	96%	96%	15%	**148 967**	382 189	3 220 565
2022	96%	96%	28%	**151 692**	**33 275**	2 710 848
2023	96%	100%	52%	**154 467**	**33 264**	1 818 228
2024	96%	100%	76%	**157 292**	**33 247**	907 467
2025	97%	100%	100%	**160 168**	**33 224**	-
2026	97%	100%	100%	**163 095**	**33 195**	-
2027	97%	100%	100%	**166 076**	**33 160**	-
2028	97%	100%	100%	**169 110**	**33 118**	-
2029	97%	100%	100%	**172 199**	**33 070**	-
2030	97%	100%	100%	**175 344**	**33 015**	-

Projection results for Safe drinking water access

Table 54: Safe drinking water access projection

	Safe drinking access projection									
	Safe drinking access rate (projection)	Safe drinking PIN Projection Target 2030	People with access	Targeted people per year	Urban access rate	Semi-rural access rate	Rural access rate	PIN in urban areas	PIN in semi-rural areas	PIN in rural areas
2015	22%	12 150 761	3 427 138	852 423	75%	9%	6%	778 895	7 796 738	3 660 806
2016	27%	11 454 118	4 279 560	869 255	96%	17%	14%	**136 047**	7 096 764	3 647 305
2017	32%	10 742 589	5 148 815	886 400	96%	43%	14%	**138 539**	6 382 155	3 633 240
2018	38%	10 015 889	6 035 215	903 866	96%	50%	14%	**141 077**	5 652 633	3 618 597
2019	43%	9 273 726	6 939 082	921 658	96%	58%	14%	**143 660**	4 907 912	3 603 363
2020	48%	8 515 801	7 860 740	939 781	96%	65%	14%	**146 290**	4 147 702	3 587 524
2021	53%	7 741 812	8 800 521	958 243	96%	73%	14%	**148 967**	3 371 707	3 571 068
2022	58%	6 951 448	9 758 764	977 049	96%	80%	14%	**151 692**	2 579 626	3 553 980
2023	64%	6 144 396	10 735 813	996 205	96%	88%	14%	**154 467**	1 771 152	3 536 245
2024	69%	5 320 334	11 732 018	1 015 719	96%	96%	15%	**157 292**	**945 972**	3 605 394
2025	74%	4 478 935	12 747 737	1 035 597	97%	104%	15%	**160 168**	**103 767**	2 814 660
2026	79%	3 619 865	13 783 333	1 055 845	97%	100%	44%	**163 095**	**33 195**	2 039 110
2027	84%	2 742 786	14 839 178	1 076 470	97%	100%	64%	**166 076**	**33 160**	1 141 405
2028	90%	1 847 352	15 915 648	1 097 480	97%	100%	85%	**169 110**	**33 118**	224 961
2029	95%	933 210	17 013 129	1 118 882	97%	100%	107%	**172 199**	**33 070**	-
2030	100%	-	18 132 011	185 673	97%	99,6%	100%	**175 344**	**33 015**	-

Macro Analysis - Results of the main parameters evolution analysis for the scenario construction

Demography - trends

According to the Census of Agriculture 2013, the population of Cambodia should be of 18.3 million in 2030, with an annual growth rate of 1.01%.

Two hypothesis have been analyzed. The first one is the most likely outcome and forecasts a demographic growth rate between 1% and 2% per year. The second and less likely hypothesis forecasts a stabilization of the demographic development of the country.

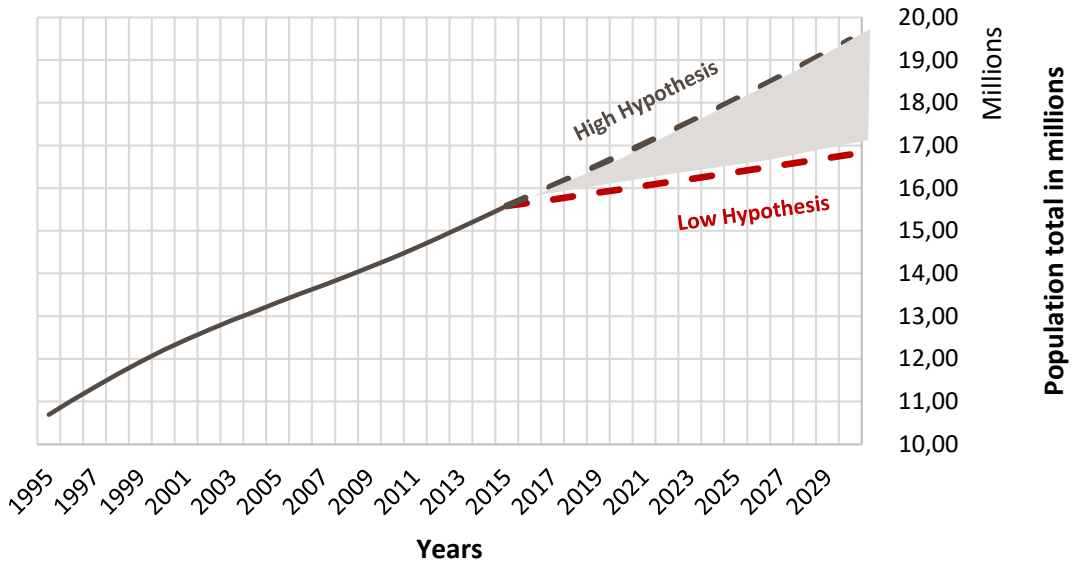

Figure 68: Cambodian population growth scenario by 2030

Table 55: Cambodian population growth hypothesis by 2030

	Probability	*Indicator*	*Consequences*
High Hypothesis	0.8	Official Projection (1.4%) and tendencies for similar developing countries: [1% - 2%]	• Higher need of structure investment (WASH, energy, transportation…) • Lower financing capacity per capita • Risk of an increase of the number of people with a difficult access to basic infrastructures (WASH, energy, transportation…)
Low Hypothesis	0.2	Stabilization of the demographic growth like observed in developed countries [0% - 1%]	• Population ageing • Higher financing capacity per capita

Economy - trends

For the coming years, two hypothesis considered as the most likely ones are presented below. The first one forecasts a rapid and continuous (between 4% and 8%) economic growth as it was observed before 2009. The second hypothesis is less optimistic and represents a slowing down of the economy with a nominal growth between 2% and 4%. Depending on the different hypothesis on GDP growth and demography (please see below), the GDP per capita in 2030 is expected to be between US$ 1,500 and US$ 2,500. Both hypothesis have been estimated as equally possible.

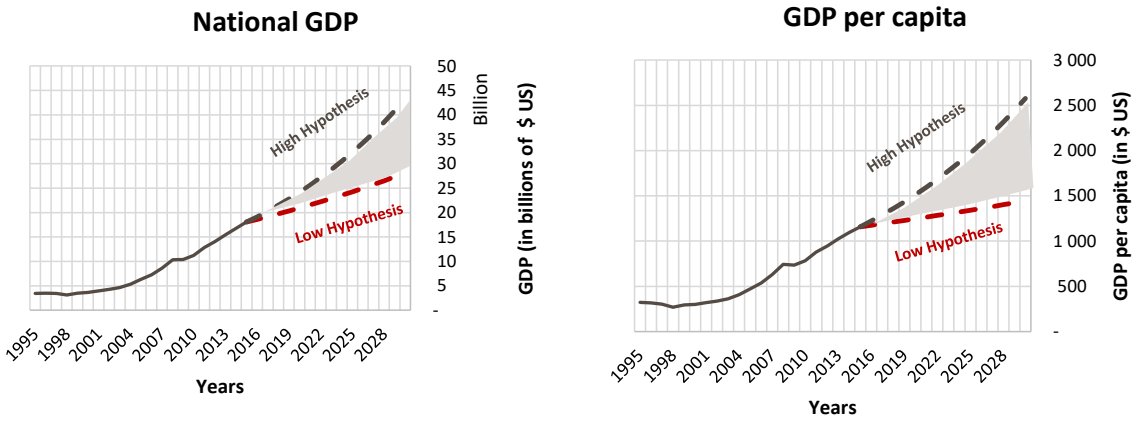

Figure 69: Economic growth in Cambodia by 2030

Table 56: Cambodian Economic Development by 2030 hypothesis

	Economic Development[41]		
	Probability	***Indicator***	***Consequences***
High Hypothesis	0.5	Official projection and post 2010 tendency: [4%-8%]	• High financing capacity • Better access to technology • Better access to energy • Better access to transportation • Better access to WASH services • Higher risk of water pollution • Reduction of poverty
Low Hypothesis	0.5	Economic slowdown as observed in 2009: [2-4%]	• Low financing capacity

Trends show a reduction of high poverty but the speed of this reduction is not confirmed.
According to the National Strategic Development Plan of the Royal Government of Cambodia projection, only 5% of the population will be under the national poverty line after 2018. Despite a significant decline of poverty since 1990, this trend seems to radically slow down between 2008 and today. Based on the trends of the last 3 years, the poverty rate in 2018 is more likely to be approximately of 10%.

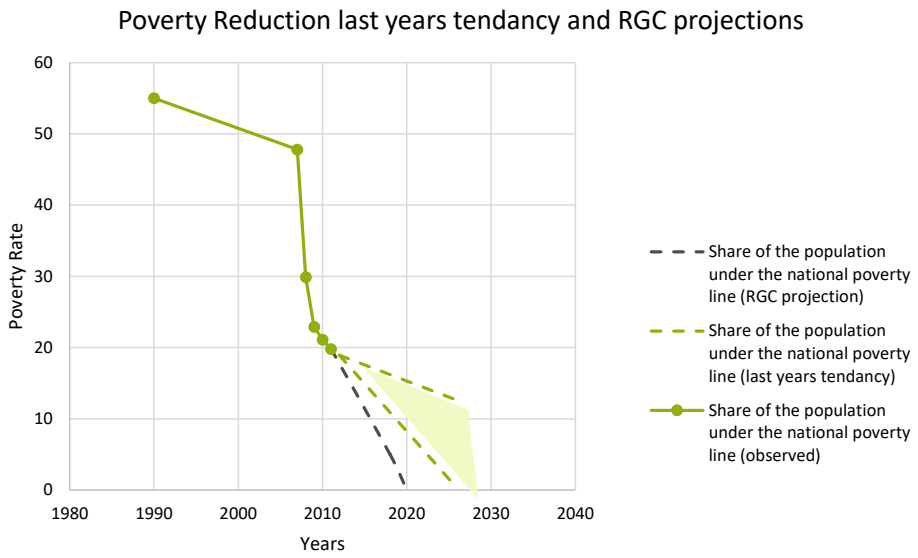

Figure 70: Reduction of the Poverty Rate in Cambodia

Urbanization - trends

Two different hypothesis have been analyzed. The first one and most likely forecasts that 25% to 30% of Cambodian population will live in urban and peri-urban areas in 2030. A less likely hypothesis forecasts the stabilization of the urbanization between 20% and 25%.

Several factors could slow down this trend:

- A better balance between investments in rural and urban areas
- A reinforcement of the decentralization reform
- The development of economic activities in rural areas

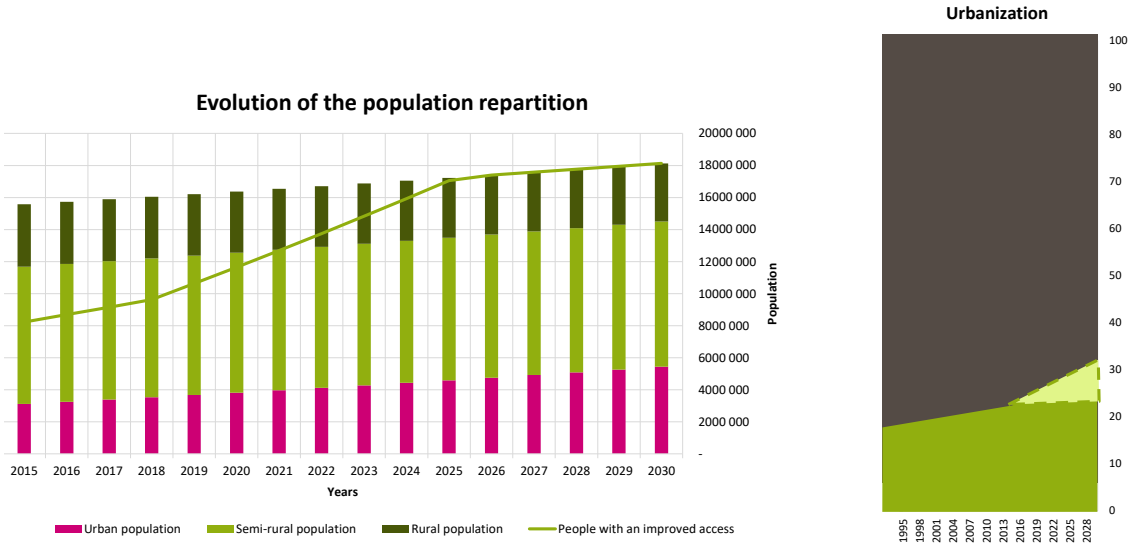

Figure 71: Share of the population in rural and urban areas

Table 57: Urbanization hypothesis in Cambodia by 2030

	Urbanization rate		
	Probability	**Indicator**	**Consequences**
High Hypothesis	0.8	Official Projection and tendencies for similar developing countries: [25% - 30%]	• Concentration of the population in the urban centers • Concentration of the economic activity in urban centers • Risk of tensions on the food delivery in cities • Development of the transportations services (roads, trains...) between big cities • Higher needs of investment to provide WASH access in the urban centers • Less people in rural areas but more isolated groups • Lower investment attractiveness in rural areas • Impoverishment of the economic structure of rural areas • Risk of slums creation around the urban centers
Low Hypothesis	0.2	Stabilization the demographic growth due to a decentralization reform: [20% - 25%]	• Economic development in rural areas • Strengthening of rural population • Development of the rural transportation systems (small roads…) • Higher needs of investment to provide WASH access in rural areas

Climate change - trends

Climate change is likely to impact demographic growth, urbanization and economic development in Cambodia.[1]

The analysis demonstrates that a high population growth rate, especially in more populated areas, unaccompanied by improvements in infrastructure and socio-economic conditions, might increase Cambodia's vulnerability.

Climate change will impact Cambodia economy beyond the water sector

Greater climate variability, such as increased rainfall irregularity, is expected to intensify competition between the extraction of water for sectoral uses (e.g. domestic water supply, agriculture and industry) and the in-stream water requirements for flow maintenance and ecological preservation.

1. Sources: Climate Change Impacts to the Water Environment and adaptation options in Cambodia, MOE, Cambodia, 2010
Second National Communication on Climate Change in Cambodia (SNCCCC), MOE, Cambodia, 2013
Cambodia Intended Nationally Determined Contributions (INDC), MOE, Cambodia, 2015
Global climate risk index 2015, Germanwatch, 2015
Climate Change Is A Global Mega-Trend For Sovereign Risk, S&P, 2014.
Effect of current pledges and policies on global temperature, Climate Action Tracker, 2015

Finally, climate change will have a tremendous impact on Cambodia's global economy. For instance, the agricultural sector accounts for 35% of the national GDP and 85% of the population are farmers. A collapse in the production yields between 20% and 70% could lead to a global GDP direct losses between 6% and 20%. As it will impact the food and water access in the next year, climate change may also impact urbanization and demographic growth. In the most pessimistic hypothesis, climate change could greatly aggravate poverty.

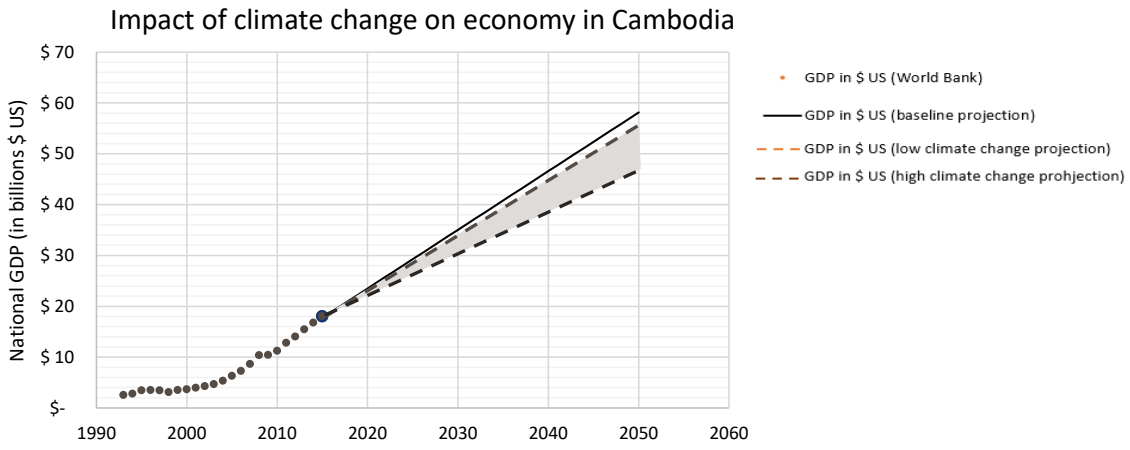

Figure 72: Impact of climate change on economy in Cambodia

Table 58: Description of external environment prospective scenarios description

	Probability	*Indicator*	*Consequences*
High Hypothesis	0.9	Business as usual scenario (IPCC) : [+4°C - +8°C] in 2100	• Access to water will be difficult between 6 and 8 months per year • Risk of saltwater intrusion • Higher drought risk and more intense events • Higher flood risk and more intense events • Higher need of irrigation systems (additional need of investment in the irrigation system) • Higher risk of food scarcity • Larger risks of tropical diseases transmissions (malaria, dengue fever...) • The poorest will be even more vulnerable • Risk of economic decline/collapse • Opportunity of the climate finance investments
Low Hypothesis	0.1	Respect of the Paris agreement : +2°C in 2100	• Minor changes with the actual situation

Solution's oriented prospective and investment Analysis

For this second part of the prospective analysis, the following tasks have been conducted:

1. Estimating the evolution of the population and its distribution by 2030
See macro environment factors scenarios and results

2. From the initial situation of water access coverage in 2016, estimating the number of PIN to address by 2030 with more investments
Establishment of hypothesis on evolution of coverage per solution without any investment following the ones that are already planned.

The main hypothesis taken were as follows:

- For WSP:
  - » No further pipe extension whether it is intra or extra communal expansion
  - » 100% of 2016 licensed and waiting for license WSP are still operating by 2030
  - » 50% of current unlicensed WSP are considered not to be active anymore by 2030
- For kiosks:
  - » No further additional kiosks
  - » 100% of existing kiosks are still operating by 2030
- For Improved – wells:
  - » No additional wells are built
  - » 80% of existing wells are considered not to be active due to a lack of investment in O&M

As a result, both the numbers of people covered by each solution and the number of people in need by type of access (improved / safe drinking / upgraded) that will need to be reached through private or public investments are calculated.

3. Costing analysis: estimation of coverage costs by type of solution and differentiated by type of zones (viable, challenging and non-viable) and type of people to cover (intra-communal expansion, extra communal expansion and penetration increase)

Table 59: Costs estimations differentiated by type of solutions, type of zones and type of people to address

Cost (US$/ person)	Upgraded - Pipe									
	Viable zone - covered	Share of public	Viable zone - served	Share of public	Challenging zone - covered	Share of public	Challenging zone - served	Share of public	Non viable zone	Share of public
Extra-expansion	60	0%	79	5%	110	45%	126	3%		
Intra-expansion	25	0%	35	11%	50	50%	60	49%		
Penetration increase			4	100%			4	100%		
Sustainability: O&M	0								0%	

Cost (US$/ person)	Safe Drinking - kiosk									
	Viable zone - covered	Share of public	Viable zone - served	Share of public	Challenging zone - covered	Share of public	Challenging zone - served	Share of public	Non viable zone	Share of public
Extra-expansion	4	100%	7	100%	5	100%	8	100%	6	100%
Intra-expansion										
Penetration increase	0								100%	
Sustainability: O&M	0								100%	

Cost (US$/person)	Improved - Wells			
	Viable zone	Challenging zone	Non viable zone	Share of public
Extra-expansion	24			100%
Intra-expansion				
Penetration increase				
Sustainability: O&M	2.4			100%

4. Modelling of the different scenarios of drinking water coverage development

3 different scenarios have been evaluated based on the level of ambition in terms of water access coverage.

Scenario 1

$

Current Trends Continuation

Same level of support of the sector than over the last 5 years
- Growth rate of coverage of WSP is maintained until 2030
- Same growth rate of kiosk implementation until 2020, then stagnation
- US$1M/year of public investment for rural areas

Scenario 2

$$

Current Trends Continuation + **Targeted Program**

2 targeted programs to leverage Viable & Challenging coverage
- Funding CAPEX of additional kiosks to reach 100% of safe drinking access in viable areas by 2030
- Funding CAPEX to leverage intercommunal expansion in challenging areas

Scenario 3

$$$

Current Trends Continuation + **Upgraded when possible**

- Funding CAPEX of pipe expansion to cover people in Viable & Challenging areas
- Funding CAPEX to cover 100% of people living in Non Viable areas with improved water supply

5. Outputs of the prospective analysis: Investment needs and level of water coverage by 2030

- Calculation of the overall budget needed for each scenario including the share of public investment that would be required.
- Estimation of the water access situation by 2030 by type of zone (viable, challenging, non-viable) and type of access (improved, safe drinking, upgraded).

6. Optimization of the access to water scenario

For each one of the 3 scenarios described above, modeling of a more ambitious development in terms of level of access to water keeping a similar level of budget.

Appendix V - Probable impacts of Climate change

Climate change is likely to impact demographic growth, urbanization and economic development in Cambodia.[1]

The analysis demonstrates that a high population growth rate, especially in the most populated areas, unaccompanied by improvements in infrastructure and socio-economic conditions, might increase Cambodia's vulnerability.

The following table shows the main expected impacts of climate change in Cambodia:

Table 60: Cambodia Vulnerabilities to Climate Change[2]

Agriculture	• Agriculture accounts for 35% of the national GDP and 85% of the population have at least a share of their revenue directly linked to it. Most of them are living in low elevation and rural areas. • Most of Cambodia's agricultural areas will be exposed to higher drought risks. • Under the high emission scenario (SRES-A2), wet season rice yield (rain-fed) will continuously decrease until 2080. Wet season rice yield (rain-fed) could fall by up to 70% of current yield levels. Dry season rice (irrigated rice), yields for crops planted in November and December could decrease by 40%. • Under the low emission scenario (SRES-B1), the yield decrease is much less ranging from 60% to about 20%. • Cambodia's coastline of 435 km would be affected by sea-level rises, while low-lying farming areas would be exposed to saline intrusion causing damage to crops.
Forest	• Under emission scenarios SRES-B1 and SRES-A2, until 2050 most of the lowland forest will be exposed to a **longer dry period,** • **water deficit period** of between six and eight months or more
Sea Level	• More than **10% of Cambodia population lives at an altitude of 5 meters** above sea level. • impact coastal systems in several ways, including **inundation, flood and storm damage, loss of wetlands, erosion, saltwater intrusion and rising water** tables • Cambodia presents 435 km of coastline and a low elevation altitude. **25,000 ha will be permanently inundated** by a sea level rise of one meter, increasing to 38,000 ha at a sea level rise of two meters.
Malaria	• The area under high **transmission risk is larger in SRES-A2 (**high emission) than in SRES-B1 (low emission). • In both emission scenarios, the **transmission risk tends to increase until 2050**, and then decreases again in 2080.

1. Sources: Climate Change Impacts to the Water Environment and adaptation options in Cambodia, MOE, Cambodia, 2010
Second National Communication on Climate Change in Cambodia (SNCCCC), MOE, Cambodia, 2013
Cambodia Intended Nationally Determined Contributions (INDC), MOE, Cambodia, 2015
Global climate risk index 2015, Germanwatch, 2015
Climate Change Is A Global Mega-Trend For Sovereign Risk, S&P, 2014.
Effect of current pledges and policies on global temperature, Climate Action Tracker, 2015
2. Data from MoE, 2015

Endnotes of the appendices

1. The MIH is still working on assessing which tariff to set with the support of the World Bank.

2. GRET, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market – Cambodia" – 2013 and Interview of an expert of the sector, Clement Frenoux.

3. Sevea Phone and Field Interviews.

4. Sevea data collection

5. GRET, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market – Cambodia" – 2013

6. GRET, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market – Cambodia" – 2013 and Sevea database analysis

7. CWA, "Situation of Private Water Supply and Way Forward" - 2016.

8. GRET, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market – Cambodia" – 2013

9. Sevea Database analysis

10. CWA, "Situation of Private Water Supply and Way Forward" - 2016.

11. Sevea Database Analysis

12. GRET, "How have privately-managed water supply systems in Cambodian small towns evolved" – 2016.

13. CWA, "Situation of Private Water Supply and Way Forward" - 2016.

14. Sevea, "Behaviour Change Analysis" - 2015.

15. World Bank, "Study on domestic private water operator service to poor households" - 2016

16. World Bank, "Study on domestic private water operator service to poor households" - 2016

17. Numbers tested by 1001 fontaines on a sample of WSPs present in communes where they were implanted.

18. GRET, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market – Cambodia" – 2013

19. All three reasons come from the crossing of sources: Field interviews, interview with CWA or GRET 2013 report.

20. RDI, "A Study of Options for Safe Water Access in Arsenic Affected Communities in Cambodia", 2012.

21. GRET, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market – Cambodia" – 2013

22. GRET, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market – Cambodia" – 2013

23. Sevea Database Analysis

24. GRET, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market – Cambodia" – 2013

25. CWA, "Situation of Private Water Supply and Way Forward" - 2016.

26. All numbers from this factor are taken from :
- CWA, "Situation of Private Water Supply and Way Forward" - 2016.
- GRET, "How have privately-managed water supply systems in Cambodian small towns evolved" – 2016.

27. GRET, "Global Study for the Expansion of Domestic Private Sector Participation in the Water and Sanitation Market – Cambodia" – 2013

28. Interview with 3i.

29. All numbers from this part come from the analysis of field and phone interviews undertaken by Sevea.

30. Figures from Sevea's interview

31. Interview with François Jaquenoud, founder of 1001 fontaines.

32. 1001 fontaines, "Cambodia Sustainability Report 2016" - 2016.

33. 1001 fontaines, "Cambodia Sustainability Report 2016" - 2016.

34. All analysis from Sevea "Behaviour Change Analysis" - 2015.

35. 1001 fontaines, "Cambodia Sustainability Report 2016" - 2016.

36. Sevea Database Analysis.

37. 1001 fontaines, "Cambodia Sustainability Report 2016" - 2016.

38. Interview with François Jaquenoud, founder of 1001 fontaines.

39. All Revenues are taken from: 1001 fontaines, "Cambodia Sustainability Report 2016" - 2016.

40. All Costs and Expenses are taken from: 1001 fontaines, "Cambodia Sustainability Report 2016" - 2016.

41. National Strategic Development Plan 2014-2018, RGC, 2014, Cambodia National Institute of Statistics, World Bank database, 2016

Sevea is a consulting company offering strategic and operational support to Corporations, Organizations, Projects & Social Entrepreneurs that seek to develop, in developing countries, their impact strategies in the Water & Energy sector and/or engage with BOP markets.

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