

Addressing Cambodia's Clean Water Infrastructure

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ABSTRACT: Cambodia in the 21st century is an underdeveloped third-world nation that lacks the resources to address its economic problems. One of the principal problems is the lack of infrastructure for the delivery of clean, sanitary water. Lack of all types of infrastructure in Cambodia is the result of a series of unfortunate historical events—collateral damage from the Vietnam War, the atrocities of the Khmer Rouge, and difficulties establishing a stable government, each of which contributed to Cambodia losing its academic, professional, and business classes. Now, a majority of its citizens are under the age of 24; the country lacks leaders and role models on which to base social, political, and economic development. One of the major problems that cuts across all three of these sectors is the absence of access to clean, sanitary water for personal, agricultural, and industrial uses due to underdeveloped infrastructure for the delivery of clean water. Factors that contribute to the problem are government inefficiency, lack of coordination in allocating government resources, and lack of expertise to address these issues. For Cambodia to improve its economy, it must address its infrastructure for the delivery of sanitary water.

KEYWORDS: Cambodian Economic Development, Clean Water, Sanitation, Infrastructure

Background and History

To understand the problem with Cambodia's struggle to provide clean water and sanitation to its population, we have to look at Cambodia's history to see how the country arrived at its current state. An appropriate place to start is with the colonial years of the 20th century when Cambodia was under French rule. The French had a significant impact on Cambodia's economy. Transportation and industry were developed by the French in the 1920s, with significant construction of roads and railways to develop commerce. Production of rubber, rice, and corn increased. In the 1930s, the French required Cambodians to pay taxes, which Cambodians resented, leading to a rise in nationalism.

At the outset of World War II, the Japanese took control of Cambodia but allowed the French to remain in their posts. As the war neared its end, and Japan was in danger of losing, it tried to curry favor with Cambodians by capitalizing on the population's sense of nationalism by arresting French officials and declaring Cambodia an independent state. However, Cambodia's newly claimed independence was short-lived. When the Japanese surrendered, the French regained control (Slocomb 2010).

During the second colonial period under France, the Cambodians were allowed to have political parties and create a functional constitution. The country was declared semi-independent by a treaty signed in 1949. This democracy was short-lived; Norodom Sihanouk, the grandson of King Sisowath Monivong, took control and dismissed the government of the nascent republic. In 1953, the French gave Cambodia full independence. Elections were scheduled, and Sihanouk abdicated to support his father, King Suramarit, who had formed a political party. Suramati won and controlled Cambodia until his death in 1960. Upon the death of his father, Noradam Sihanouk regained control, declaring himself the head of state, and led the country through the 1960s. His reign crumbled under pressure from the communist revolutions led by North Vietnam, which was sweeping all of Indochina. The situation deteriorated when the United States, believing that Cambodia was helping the Vietnamese, conducted devastating aerial bombardments. In 1970, the national assembly voted to remove Sihanouk as the head of state.

In 1970, General Lon Nol forced Prince Sihanouk into exile and assumed power, establishing the Khmer Republic. However, the Khmer Republic's leaders were unsuccessful in

resisting Vietnamese control, leading to disunity. In 1975 the communist insurgents—the Khmer Rouge led by Pol Pot—exploited the political unrest to seize control.

The advent of the Khmer Rouge began a reign of terror to establish an “idealistic” communist society. Pol Pot envisioned a utopian agrarian society, and so forced the evacuation of all cities and towns, including the capital city of Phnom Penh. His idea was to relocate citizens to rural farms. However, during the attempted relocation thousands died as a result of the lack of food, agricultural equipment, and medical care (Lee).

In 1975 the worst era in Cambodia’s history began. When Pol Pot decreed that Cambodia would become an agrarian society, Cambodians were forced to move to the countryside, and Pol Pot focused on eliminating intellectuals. Those who wore glasses or could speak a foreign language fled or were executed; academics, political dissidents, leaders of business and industry were also on Pol Pot’s execution list. Thus, all who could have been instrumental in improving societal institutions, including the healthcare system, were removed. Pol Pot is estimated to have killed at least 1.5 million people.

Pol Pot set an unrealistic goal of doubling the agricultural production in the country within four years. All private property was appropriated by the regime; the citizens were required to produce three tons of rice per hectare. Many people died from hunger and exhaustion. The tyranny was unchecked until Vietnam invaded Cambodia in 1978 (Slocomb 2010).

Pol Pot tried to resist Vietnamese incursions through guerilla warfare, but was ultimately unsuccessful. The Vietnamese took control, and did not withdraw until 1989, a move that was ratified by the Paris Peace Accords of 1991. A provisional government was installed; in 1993 a constitutional monarchy was formed with King Norodom Sinahouk, who returned from exile to resume his prior role. Elections were held, King Sinahouk abdicated, and his son Norodom Sihamoni became king and head of state.

As a result of the sequential devastation, including aerial bombardment by the United States, genocide under Pol Pot, civil strife with Vietnam, and political upheaval, Cambodia was a country lacking the basic human resources and physical infrastructure to succeed in the emerging global economy. Although the country has potential, Cambodia has been a nation of poverty ever since the unrest during the latter half of the 20th century.

The Health of Cambodia's Citizens

The effects of turmoil—the bombing during the Vietnam War, political upheaval, followed by the genocide during Pol Pot's regime—left Cambodia with the residual of major health issues among its people. In his attempt to make Cambodia a model of agrarian society, Pol Pot ended up destroying the healthcare system of the country—medical personal, hospital infrastructure, equipment, supplies, and the supporting structures—power, sanitation, and transportation. Of all the damage that was caused during this time, the reduction of the population from seven million people to four million people within three years, continues to this day to have a negative impact. After all the damage was done, the country was left with only 45 doctors, 20 of whom left the country out of fear of being targets. There were only 26 pharmacists, 28 dentists, and 728 medical students who remained (Rosenboom 2011).

Health problems are difficult to solve in the absence of water, sanitation, transportation, and education. After the country became fully independent with leaders that had realistic visions for the country, many people moved from the countryside to the capital Phnom Penh. Those who moved were not used to urban life, so they didn’t know about hygiene and sanitation. Although the government is putting effort into educating people on ways to maintain health and hygiene while trying to make a living in the towns, the problem is hard to solve in an environment where clean water is inadequate (UNICEF 2019).

Those left in rural areas have difficulties obtaining medical care. The geography of the country and the lack of proper infrastructure makes it almost impossible to access rural areas from the capital. Available medical personnel are reluctant to work in places of isolation due to the lawlessness in the rural areas. However, even if those areas were accessible, and enough

antibiotics and vaccines were available, those areas lack the necessary facilities to store and distribute medical equipment and supplies (Macleod 2014).

The significant reduction in the population is being offset by a surge in the birth rate. Most of the casualties of the late 20th century were males, which has led to the country's unequal gender distribution. The sudden baby boom, however, comes with other challenges. For the preceding 20 years, most of the population were children, and as pointed out, the remaining adults—stripped of intellectuals, academics, businessmen, medical professionals, and engineers—left a void in the leadership class. These conditions make it difficult to care for and protect the newly born, which has led to one of the highest infant mortality rates in the world: 120 deaths per thousand for children under one year of age, and 200 deaths per thousand for children between the ages of one and five years (Wang 2015). Reports from different NGOs show that these high child mortality rates are caused by the lack of proper sanitation, leading to malnutrition, diarrhea, malaria, and respiratory infections. Safer childbirth is also required, including education in the community to improve care for newborns. Medical staff in all provinces have been trained to ensure safe deliveries along with baby care to reduce the mortality rate. Although the training is not as consistent as it ought to be, the structures seem to be in place and the rate of childhood mortality is decreasing (Wang 2015).

The provincial health care system in Cambodia remains ineffective. Only 29 provincial hospitals, 157 district hospitals, and 1725 functional infirmaries are operational. (Guech Heang 2013). Trained medical personnel are overburdened. Most hospitals lack a dependable supply of electricity, receiving power only for a limited time each day. The most common health issue experienced throughout the country are amputations due to injuries sustained in the ongoing unrest with each hospital performing an average of ten amputations per month. Malaria is also an endemic concern (MacLeod 2014).

The Health of Cambodia's Economy

Sanitation plays a significant role in a country's economy. When a country has frequent health issues stemming from the lack of proper sanitation, the economy is threatened. Much of the resources in the country are directed to controlling the health issues brought about by the lack of sanitation. In the case of Cambodia, in the year 2005, the economic loss due to poor sanitation and hygiene was \$448M (Slocumb 2010). Research showed that 42% of the money was spent on healthcare as a result of disease due to poor sanitation and hygiene. By improving sanitation, more financial resources are available for other pressing needs.

The lack of clean sanitary water adversely affects diverse segments of the Cambodian economy. Tourism is the major source of foreign exchange for Cambodia, contributing 16% to the total economy (Guech Heang 2013). The sanitation crisis impedes attracting tourists, which is a big obstacle to improving the overall economy. The sanitation issues also have a lasting effect on children such as handicapping childhood growth in both health and education. In addition, the general academic achievement of the children is low, which stunts the growth of the country as Cambodia depends on its younger generation to develop the country. Sanitation problems have led to the pollution of water sources, leaving it with the lowest sanitation coverage in Southeast Asia. The government focuses more on cleaning the water, and not enough on delivering it to areas where it is needed, such as in the operation of power plants and use in agriculture. The country does not provide sufficient opportunities for the private sector to engage in providing both the capital and methods through which improved sanitation can be achieved.

In 2005, Cambodia suffered 9.5 million deaths due to lack of sanitation. Although the government has improved the availability of sanitation to 84% in its capital, Phnom Penh, other areas are still in crisis with only 16% improvement in sanitation (De Walque 2005). Clearly, the government must step up its efforts to improve hygiene through clean water.

Benefits of Improved Sanitation in Cambodia

Improved sanitation has great benefits for a country. For this reason, Cambodia should take some initiatives to ensure improved sanitation in the country. The country loses \$448M annually just in terms of healthcare costs (Guech Heang 2013). Improved sanitation and hygiene ensure that this money is utilized in more suitable ways to boost its economy.

Ironically, because of its geography, Cambodia has multiple sources of clean water. Proper sanitation and hygiene should include protecting these sources from pollution. The drain of money needed for healthcare lessens what is available for protection from pollution and economic development. Money could be used to build power-generating stations and setting up industries that would, in turn, improve the country's overall economic well-being. Clean water can be used in irrigation projects or in industries requiring water for their manufacturing processes. Clean water for irrigation ensures that the country has enough food not only for consumption but also for commercial agriculture—a major feature of economic development in other countries.

Poor sanitation most directly affects the health sector. Increased diseases and high mortality rates reduce the prospects for economic health. Reversing the effects of poor sanitation is a great benefit: it reduces the rate of diseases caused by poor sanitation; it promotes and enables development of the industrial sector, and is essential to agriculture. If Cambodia can solve the problem of universal delivery of sanitary water, disease would be more manageable, and the mortality rate could be improved. The country could then focus on improving its healthcare system. Better hospitals, proper training of medical personnel, and the establishment of storage facilities for vaccines and medicine in the different provinces of the country would result.

Obstacles to Improving Cambodia's Water Delivery Systems

One of the largest challenges to improving water delivery infrastructure is Cambodia's status as one of the poorest in South East Asia. The government has the responsibility to manage the available resources and respond to urgent crises. The most urgent is frequent social unrest and violence; the country must ensure that bloodshed is prevented and peace is maintained. Common sense dictates that prior to directing resources to provide clean water, a country has to protect its people and structures from destruction due to violence. Moreover, the country lacks the required technological expertise to ensure that the available fresh water is clean for use. The lack of expertise dates to the killings among the intellectual, engineering, technological and entrepreneurial classes between 1975 and 1978. For the country to quickly acquire such expertise requires importing it, a choice it cannot make due to an inability to attract suitable human resources to a nation in such poverty.

Water sources that are clean and efficient for Cambodians to use exist. After the Pol Pot regime, and his commanders and soldiers were overthrown, people flocked to the cities and towns so that the new government could protect them. This led to more people concentrated in densely populated regions rather than in the countryside. The rural areas had better water sources, but the insecurity and lack of facilities in those areas led most Cambodians to leave (Ouk 2014). The government, however, lacks the resources to avail these new residents with the water they need. Infrastructural development in the country was impaired by Pol Pot's rule. The country continues to suffer from developmental deficiencies preventing it from providing even the most basic services for its citizens.

The country lacks the necessary facilities and expertise to clean and transport available water, creating a challenge to implement projects. Cambodia must import the necessary equipment and personnel, an expensive proposition considering its economic status (Irvin 1993).

Possible Solutions to Improve Cambodia's Water

The fastest method for the country to acquire clean water would be to dig boreholes and wells in different parts of the country. However, scientific research shows that most of the underground water

in Cambodia is contaminated with arsenic (Open Development Cambodia 2016). Arsenic is a naturally occurring water-soluble compound found in the earth's crust. People can ingest arsenic through drinking, cooking, and bathing. Long exposure to arsenic has these effects on the human body: cancer, skin lesion, diabetes, cardiovascular disease, negative cognitive development in children, and increased deaths in young adults.

UNICEF has stepped in to help people living in areas where they are dependent on water from wells, and boreholes. Tests on the water show that these water sources were not only contaminated with arsenic, but also E. coli bacteria. The United Nations is working on ways to ensure that this water is suitable for domestic use. Meanwhile, they are helping set up water collection points so that local communities make use of water from other sources like rain. Also, they have invested in teaching Cambodians the importance of hygiene, including using toilets and washing hands with clean water and soap. Their main goal is to change how the locals of Cambodia approach sanitation and hygiene. By making children understand the importance of using toilets and not disposing of faecal material improperly, they are creating awareness in the whole community (Joshi 2013). The U.N. tries to ensure that hygiene is maintained in schools, the community in general, and among individuals. Educating the young is a sure way to attain the appropriate level of sanitation in Cambodia (Awan 2015) and also to break the cycle of improper sanitation.

Finances are the major challenge to Cambodia's lack of sanitation especially in rural areas. Help has been sought from the Water and Sanitation Program (WSP) of the World Bank, which supports the government in delivering sustainable sanitation service to its citizens. The bank is also advising the government on plans to decentralize sanitation for locals. This would ensure that there is a mandate and resources at the district and the community level to implement sanitation programs. While creating awareness of the government's plans and initiatives to make sanitation better, some individuals have taken it upon themselves to contribute a portion of their resources toward the common goal of achieving universal success in sanitation programs. The leaders in the districts, in collaboration with the local community and NGOs, are setting up microfinance institutions to furnish small loans to help poor individuals with no financial capability of constructing latrines or private toilets for their households. Access to cash by families with no reliable source of income is instrumental in ensuring they have the opportunity to be among the universal program for improved hygiene in Cambodia.

Other than financial support from banks, NGOs, and individual citizens, the government is welcoming innovative ideas. Designing and manufacturing sanitation systems, and availing them to locals at an affordable price, is an initiative that the government of Cambodia is ready to support. The easy latrine, for example, is one of the ideas the country has embraced due to its affordability and effectiveness. The latrine can be easily installed using locally available materials. The sanitation system consists of a pan-like structure; a water container fixed with a ladle connects to pipes which lead to a septic pit. The toilet is effective in disposing of waste materials. The pit, once filled, can be left for some time and later used as compost for agriculture (Awan 2015). With such ideas, the government can make the country cleaner, free from the diseases with which it has been afflicted.

Effectiveness of the Government's Efforts

The effectiveness of the government's effort has been evident over the years. Healthwise, there has been a decrease in the infant mortality rate. The drop has been 53%, falling from 124 deaths per 1000 births to 64 deaths per 1000 births in recent years (Wang 2015). Immunization coverage has been on the rise. The coverage has increased 58 % from 2000 to 2010, per a report published by the kingdom of Cambodia (Rosenboom 2011). Malnutrition, however, has been an indicator that there is some level of impairment in progress. The number of citizens who are still not afforded at least one meal per day is still high. The problem—initially a major crisis in a country with a high number of births that were not attended by skilled health personnel—has been slowly but steadily decreasing.

However, the significant change is only visible in the urban areas; rural areas still have substantial numbers of births being unattended by trained medical personnel. The overall increase can be attributed to the public's trust in the measures taken by the government in establishing medical centers that attend to the health issues of the citizens. A high percentage of expectant mothers are now delivering their babies in public health facilities reducing the number of births unattended by trained medical personnel.

Economically, a drastic improvement is a result of healing from diminishing violence. Economic growth has led to an influx of foreign direct investment. Investors do see a future of growth in the economy of Cambodia. The country's GDP per capita has also increased due to the growing and stable economy of Cambodia. In 1992 the GDP per capita was \$216. In the year 2011, the GDP had almost quadrupled since—to a staggering \$909 per capita (Guech Heang 2013).

Current Status of Improvements

In terms of water resources, the government, with the help of NGOs, the World Bank and UNICEF, has come up with ways of eliminating arsenic present in underground water to make it more suitable for both personal and industrial use. It has set up water collection points to ensure they collect and store rainwater which has no arsenic. By doing so, they can make clean water available for school children, the community as a whole, and each person as an individual. Water pollution, the major reason why there is a lack of clean water in the country, has been addressed through the use of filtration systems to filter and sanitize water making it clean and safe for public use. This is one of the most efficient and effective methods the country is using.

To ensure that clean water is available for everyone, the government is setting up pipelines for all provinces from the different filtration points installed in the country. This way, the clean water is available to the locals for both domestic and agricultural use. The government has sought help from the World Bank and other humanitarian organizations in an attempt to compensate for their lack of funds. It is acquiring financial assistance to help build the necessary structures for its citizens.

The country is in the process of overcoming the loss of its learned and intellectual citizens who would have been instrumental in designing ways through which the country can meet the challenges they face. Today, the country is opening opportunities for individuals with the expertise to design and engineer innovations. These are ways Cambodia is attaining the goal of a cleaner, safer, and more productive country.

Conclusion

Cambodia faces challenges to its health, economy and general development. Recent social and political upheaval has impeded recovery. Despite these problems, the country has continued to struggle to achieve holistic stability. The progress made in the recent past promises a bright future. Poverty continues to be a major challenge that Cambodia must overcome. Seeking help from other countries and organizations is an effective way to solve its financial challenges. Modern Cambodians recognize that a unified effort to achieve global standards for delivery of clean, sanitary water will go a long way toward solving the problems afflicting the health of the populace, as well as the health of its economy, both industrial and agricultural.

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