Fall 2023

Clean Water Saves Lives: Improving Clean Water Access in Yeakpee Town, Liberia

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Abstract

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Keywords

Clean Water, WASH, Liberia, Water Pump, Community

Disciplines

Environmental Health | Environmental Health and Protection

Comments

Written for ES 319: Individualized Study-Internship.

Research funded by The Center For Public Service at Gettysburg College and The SHECAN (Supporting Her Education Changes A Nation) Organization.

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Civil unrest in Liberia, a West Coast African nation, has caused the destruction of essential infrastructure, particularly water, sanitation, and hygiene (WASH) systems. As a result, there is a high reliance on unsafe water sources and prevalence of waterborne diseases and health issues, particularly in the Yeakpee Town Community. Inadequate funding has hindered progress, and there are connections between gender inequalities and limited access to clean water. The Clean Water Save Lives project, launched in 2020, aimed to provide sustainable access to clean water in Yeakpee Town community by constructing a water pump with a filtration system. The project aimed to address water injustice by providing fair and equal access, promoting proper garbage disposal, and ensuring efficient management of water infrastructures. It also aimed to address health concerns associated with contaminated water and disparities in water access based on gender. The primary objective of the current project was to provide clean water and foster a healthier living environment in Yeakpee Town by repairing infrastructure and installing new water pumps. This paper provides a summary of the rationale for this work, of the steps needed to complete the work and the outcomes that resulted, and of recommendations for similar projects in the future.

Introduction:

Liberia, a small nation located on the west coast of Africa, has endured 14 years of civil unrest, leaving a lasting impact on almost every fabric of the society. The destruction caused by this unrest has affected crucial pre-existing infrastructure such as electricity, schools, hospitals, food banks, and WASH (Water, Sanitation, and Hygiene) systems, hindering the country's ability to recover and thrive (Amoak et al. 2023). With the rise in frequency and severity of humanitarian crises, it is more important than ever to ensure that impacted populations, especially in post-conflict countries, have access to clean WASH systems (Lantagne et al. 2021).

Despite ongoing rebuilding efforts, a significant portion of Liberia's population continues to struggle below the poverty line, further exacerbating these issues. According to the national census of Liberia taken in 2008, the percentage of the population with access to piped water in Liberia fell from 15% in 1986 (before the civil war) to less than 3% in 2008 (after the conflict); investments in WASH have remained dismally low in the years following the end of the civil war, with less than 1% of GDP going into sewage infrastructure (Amoak et al, 2023). As a result of this lack of access, many Liberians are compelled to resort to unsafe water sources, including contaminated wells, swamps, and wetlands, further exposing themselves to waterborne diseases and parasites.

The low availability of clean water in Liberia has serious repercussions for people's health. The World Health Organization (WHO) estimates that each year, there are 4 billion cases of diarrhea, of which 88% are attributed to unclean water as well as inadequate sanitation and hygiene (Kariuki et al, 2012). There are still approximately 2 million children who pass away every year as a direct result of waterborne diseases, and one of the primary ways to control this issue is by ensuring that clean water is accessible and that proper WASH systems are in place (Bartram and Cairncross, 2010).

Access to WASH Systems and Disease

In a study across 36 sub-Saharan African Countries, Cronk and Bartram (2018) found that, within LMICs (Low and Middle-Income Countries), an estimated 50% of HCFs (Health Care Facilities) lack a piped water source on their premises. Furthermore, 33% of these facilities lack improved sanitation facilities on-site, while 39% did not have access to soap for handwashing. Additionally, 39% of the HCFs lacked adequate infectious waste disposal systems, and a staggering 73% lacked proper sterilization equipment. Alarmingly, 74% of these facilities also lacked guidelines for standard precautions (Cronk and Bartram, 2018).

During the Ebola crisis in Liberia that occurred around the year 2014, an improvement in the access to WASH services at health facilities may have decreased the number of Ebola infections and the mortality rate. However, due to poor WASH conditions during the Ebola outbreak, anxieties and fear among healthcare personnel and affected patients were high. This fear might have hindered the use of health services such as prenatal care, malaria treatment, and other possible hygienic solutions that might have helped fight the epidemic (Amoak et al, 2023).

These data serve as just one example of the diverse range of negative impacts that can be experienced when access to something as seemingly simple as water and sanitation is lacking. These deficiencies in healthcare facilities can exacerbate health challenges, impede disease prevention efforts, and ultimately perpetuate the cycle of poverty for those already struggling.

Access to WASH Systems and Poverty

The connection between poverty and the persistence of water inequalities in economically challenged countries is evident. In larger cities, where access to WASH systems is relatively better, the cost of living becomes prohibitively high for many families. Even though

many countries have pledged targeted aid, in six out of ten countries where over half the population lives on less than a dollar a day, aid for sanitation and drinking water falls below the median per capita (Bartram and Cairncross, 2010). Consequently, those in need of clean water are left with no choice but to dig their own wells, which can be found near residences, children's playgrounds, bathrooms, waterways, and even homes, highlighting the severity of the situation. Often, those building wells lack the necessary skills to maintain and manage them properly. This lack of infrastructure leads to practices like open defecation and even the sale of contaminated water to neighbors in their communities who are also struggling (Quattrochi et al. 2021). The contamination of groundwater is another issue of concern; hand-dug wells are especially susceptible to contamination, which renders the water unsafe for drinking if it is not first properly treated.

Even though hand-dug wells and other self-supply water services are affordable and have served as sources of water for many low-income communities, there are several disadvantages of having them in close proximity to homes and city/rural wetlands (Okotto et al. 2015). Inadequately maintained toilets and latrines near sources of water pose significant threats to public health, such as the contamination of water supplies and the spread of diseases like diarrhea, cholera, and dysentery. The risk is made even greater by the lack of adequate sanitary facilities, which contributes to an ongoing cycle of illness and diminished well-being. The location of these facilities near residential areas results in several unfavorable social repercussions, including the release of offensive odors and the attraction of disease-carrying insects, which has a detrimental impact on both the quality of life for residents and the functioning of the ecological community.

Access to WASH Systems and Gender

Lack of access to clean water can lead to gender disparities, abuse, and other forms of gender-based violence that are both directly and indirectly related to clean water (Amoak et al. 2023). It has become a cultural norm in many nations in West Africa for women to take on the role of primary caregivers and caretakers in their households, including fetching clean water for household use. For instance, according to the MICS (Multiple Indicator Cluster Survey) data, women are the primary water carriers in 44 surveyed countries. There is a clear connection between the lack of access to an improved water source and the proportion of women who are responsible for fetching water: in countries with limited access to improved water sources, women often take on the role of primary water carriers (Sorenson et al, 2011).

Women, especially young girls, often face dangerous circumstances during their many-mile journeys to find water including rape and assault, and many of these instances go undocumented. Terrible road conditions, wildlife, and minimal-to-no street lights have also led several young women to get injured and face many terrifying situations that lead to other life-threatening conditions, which end up affecting their entire families (Sorenson et al, 2011). Moreover, women's health, dignity, and sense of personal worth can also be impacted by their experiences while collecting water, particularly regarding sanitation-related diseases and illnesses (Sorenson et al, 2011).

Efforts to Improve WASH Systems

There have been many efforts by several non-governmental organizations and nonprofits to help address the lack of access to clean WASH systems, but there is much work that still needs to be done. For the past eight years, the Liberia Water and Sewer Corporation has been

hard at work rebuilding piping lines to supply towns and houses with clean, sanitized water with the intent to prevent the spread of diseases and to improve the livelihood of families. These efforts are working towards achieving the 2030 Sustainable Development Goal 6 (SDG6), which aims to ensure the availability and sustainable management of water and sanitation for all by 2030 (Waddington et al, 2018). But the global water and sanitation sector is encountering difficulties in achieving universal access targets, following the endorsement of a new set of global targets by the UN General Assembly since September 2015 (Hutton and Chase 2016).

In 2020, by recognizing the urgent need for clean water and adequate WASH systems in Yeakpee Town, Liberia (Figure 1), I embarked on the Clean Water Save Lives project. Yeakpee Town is a small rural town in the capital city of Monrovia on the Old Congo Town Road with about 8,000 residents. The Clean Water Save Lives project strives to overcome the challenges posed by water injustice in the aftermath of the civil war. The devastating effects of poverty, limited funding, and damaged infrastructure have impeded access to clean water, compromising the health and well-being of the community. This project aims to promote a healthier and more sustainable future for Yeakpee Town residents through access to clean water.

The initial phase of the project involved collaborative efforts of members of the community to construct a water pump equipped with a filtration system. With the help of the Premier Mailing Cooperation of Liberia (who donated all the supplies needed for the project in 2020) and the willing efforts of hard-working young people in the neighborhood, I was able to take a step in addressing the issue. The success of the very first hand pump was evident, as over 8,000 residents of Yeakpee Town Community became dependent on it for their daily water needs. During the rise of the COVID-19 pandemic, the pump played a crucial role in providing clean water for the entire community, promoting sanitation and hygiene practices to prevent the

spread of the virus. Unfortunately, due to excessive usage, the pump was damaged and could no longer sustain the needs of the growing population (Figure 2). With the collective efforts of the community, leaders of the Yeakpee town community were able to raise funds to renovate the damaged pump to keep it somewhat functional. But, the current system is inadequate to meet the community's needs in the long term.

This paper highlights the most recent efforts of the Clean Water Save Lives project, which aims to alleviate the issue of water injustice in Yeakpee Town, Liberia, by providing sustainable access to clean water, educating people on proper garbage disposal around water facilities, and ensuring that water infrastructures are appropriately managed for long term benefits. The Clean Water Save Lives project aims to build and install multiple hand pumps in different locations within Yeakpee Town. Additionally, renovating the damaged water pump is essential to restore its functionality. By having multiple water pumps strategically placed throughout the community, the project seeks to ensure equitable access of clean water to all residents of the Yeakpee Town community. This approach will significantly contribute to eliminating water justice issues, reducing illnesses associated with the use of contaminated water, and alleviating gender-based inequalities related to clean water access.

Figure 1: Pictures of a contaminated well in Yeakpee town community that is used as a source of water.

Figure 2: Current condition of the water pump that I installed in 2020 to alleviate clean water access issues.

Materials and Methods

To address the pressing concern of water scarcity in the Yeakpee Town community, I took a structured approach, consisting of several essential steps:

Step 1: Garnering community interest in finding effective solutions. To achieve this, a meeting was arranged with Mr. Farnh, the respected community leader, and other esteemed elders. During this meeting, the problem and the project's objectives were clearly and succinctly identified, emphasizing the importance of community involvement and commitment. The community leaders expressed great interest in the project and agreed on a potential land site, drawing inspiration from the success of the previous water pump project in 2020. Their enthusiasm led to a desire to expand the scope of the new proposal.

Step 2: Acquiring external funding to support the project, given the financial constraints faced by many low-income families in the Yeakpee Town community. Seeking external funding became a priority, and an opportunity arose through the Center for Public Service (CPS) at Gettysburg College, which provided funds for peace and justice projects via its Instagram platform. Recognizing the alignment between CPS's goals and the project's objectives, I submitted a proposal for this new initiative. Throughout the funding application process, regular communication with CPS ensured clarity on any unclear aspects of the proposal. Eventually, the project secured a generous grant of 5,000 USD from CPS, and an additional 2,000 USD was awarded by the SHE-CAN organization, totaling the funds to 7,000 USD, sufficient to execute the project comprehensively.

Step 3: Devising a well thought-out plan to tackle various challenges associated with providing clean water in Yeakpee Town. The plan aimed to address immediate water needs while also creating sustainable, cost-effective solutions for the long term (see Appendix 1.1). It encompassed multiple components, such as water infrastructure development, awareness programs, and community involvement. To ensure the project's success and longevity, a diverse team of experts were invited to give helpful suggestions on what type of hand pump will provide the most benefit, especially in the long term. It was agreed that a hand pump with a built-in filtration system will be the most effective choice, and it will ensure that the quality of water is safe for consumption. The team's collective expertise and perspectives would contribute to the project's overall success and facilitate seamless joined efforts.

Step 4: Finalizing logistics for the on-the-ground work. The project implementation commenced with the journey to Monrovia, Liberia, on May 10, 2023, and the on-groundwork was initiated on May 15, 2023. During the first week of my arrival in Liberia, I focused on my visa application for re-entry to the US, I worked with the coordinator for the SHE-CAN organization in Liberia to make sure that the funds from Gettysburg College reached a local bank account in Liberia, and I reached out to construction companies to find a suitable contractor for the project. I was able to interview three contractors, and one of them by the name of Mr. Dennis stood out to me because of his work with WaterAid (an organization that works in rural areas in Liberia to provide clean water to communities in need). After hiring Mr. Dennis, a thorough analysis of Yeakepee Town's water system was conducted to identify areas of concern and prioritize the most critical needs. During this evaluation, an abandoned pump was discovered, and a cost estimate was prepared for its renovation (Figures 3 and 4).

Figure 3: Abandoned water pump (handpump) in Yeakpee Town Community before and after renovation.

Figure 4: More before and after photos of the renovated abandoned water pump.

Step 5: Raising awareness and community support. During the second week of the project, a meeting with community leaders to announce the project to the entire community and to receive the blessing of the community to proceed with the work was needed. The next task involved running errands along with the contractor and his team to purchase the materials needed to begin the work of constructing the water pump. The drive to the construction shop was two hours each way and it took a total of four trips to gather all the materials needed for the work. The leaders of Yeakpee Town and I organized the groundbreaking ceremony-a tradition of blessing of land sites from members of communities before any public work starts (Figure 5).

Figure 5: Pictures of the traditional groundbreaking ceremony with leaders of Yeakpee town community (the grey circular blocks on the far left are culverts purchased to begin the work).

Step 6: Constructing the water pump and documenting the process. The digging of the well took almost the entirety of Week 3 due to a thunderstorm, and I had to work with the contractors to get new supplies to remove the gravels and sand that re-entered the dug well and reduce the overflow of water in the well, to make progress on the work. Next, I worked with a photographer to make professional edits on the videos and pictures that I have acquired of the project and to take more pictures and videos of the finished work to compile into a documentary. This video includes pictures, short clips, and interviews with members of the community to show first-hand the problem being faced by the people and how the water pump will benefit them by alleviating those problems.The fourth week of the project was centered around finishing up the construction of the new handpump and the renovation of the old and abandoned pump.

Step 7: Celebrating our achievements. The project was completed on June 4th, 2023, and arrangements for a dedication ceremony started the following day. The arrangements included a meeting with Mr. Ngumbu from the Environmental Protection Agency of Liberia to provide an educational workshop on the day of the dedication on hygienic practices around water facilities, as well as management of the infrastructures. Other arrangements included the provision of light refreshments and incentives like notebooks and pencils for children in the community to encourage the participation of their parents and other family members (Figures 6 and 7).

Figure 6: Pictures of dedication day of the new water pump

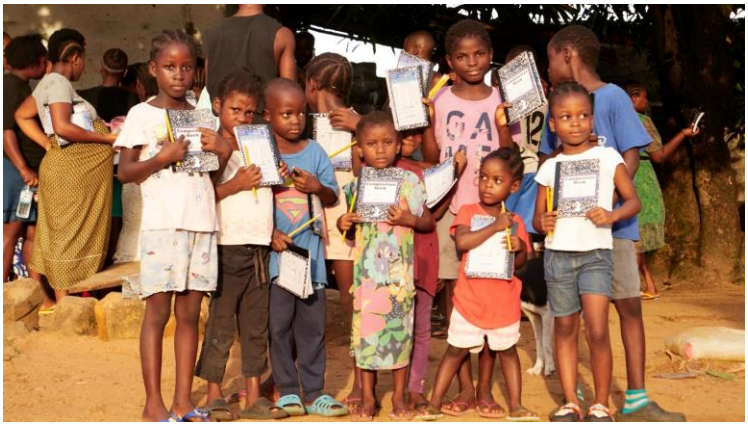

Figure 7: Pictures of children in Yeakpee Town with the notebooks and pencils for school that were given as incentives for their parents to attend the dedication ceremony.

Results:

Together, this project resulted in three water pumps (two renovated, one new) strategically spread out in Yeakpee Town community. One hand pump requires 9 strokes to provide approximately one gallon of water, and each stroke takes approximately 2 seconds on average. So, to obtain one gallon of water, it would take 18 seconds - a vast improvement over the many-mile journeys families in this region would otherwise need to take to access clean water. Since there are 86,400 seconds in a day, approximately 4,800 gallons of water can be acquired from one hand pump within that time. Therefore, three handpumps combined is enough to produce approximately 14,400 gallons of water with each resident taking home a total of about 1.8 gallons of water per day. With just the previous one hand pump, each resident of Yeakpee town was only taking home approximately 0.6 gallons of water per day. Therefore, with the

addition of 2 more functional handpumps, the number of gallons of water each resident now takes home was tripled. The result of this small effort to increase clean water access will play important roles in reducing water related illnesses especially in children, and it will help promote a healthier and more sustainable hygienic future for Yeakpee Town's residents.

Discussion

Though this project was an overall success, several improvements could have been made. With the average person using about 100 gallons of water per day (The World Counts, 2023), and a total of more than 8,000 residents of Yeakpee town, at least 800,000 gallons of water per day would be needed to provide the residents with an adequate supply of water. To obtain this amount, a total of approximately 167 hand pumps will be needed, as compared to the three hand pumps that currently exist. The distance to water facilities could also affect residents' ability to access clean water easily, leading them to resort to unsafe alternatives like hand-dug wells or swamps. Therefore, having more water pumps in every location of Yeakpee town will help reduce the burden of traveling further to fetch clean water, but more funding will be needed to carry this out. With more funding in place, the goal of providing adequate water supply will gradually be reached. Possible funding sources could include The World Bank, the United Nations Development Program (UNDP), The Global Water Fund (GWF), The African Development Bank, or other organizations whose goals are to provide sustainable development in post-conflict countries.

On a larger scale, similar strategies and lessons learned from this project can be applied in other towns and communities within and beyond Liberia, offering a broader perspective to

combat inadequate water supply. Based on lessons learned, I suggest that future projects pursue the following:

1. Conducting water quality tests on untreated wells and constructed water pumps to demonstrate the superiority of hand pumps over traditional hand-dug wells or water from swamps.

2. Researching the prevalence of waterborne diseases like diarrhea before and after water pump construction would have helped in understanding the direct impacts and benefits of the hand pumps.

3. Conducting a cost-benefit analysis of various water facilities to help promote health impacts of improved water supply and sanitation, and cost savings from switching away from more expensive water sources to a more affordable and reliable source for Yeakpee Town community (Hutton et al, 2007).

4. Understanding the life cycle of water pumps and how their lifespan can be extended to improve the long-term availability of clean water.

5. Conducting more research to identify the best time for water projects can be beneficial. Challenges like thunderstorms during the rainy season in Liberia can impede construction progress and lead to unforeseen expenses, while performing such projects during the dry season may reduce costs and improve efficiency.

There were many positive things that happened during this project. One clear example of this is seen in the involvement of community leaders, who were dedicated and committed to making the project successful. It is important to mention that the residents living in these

communities were very enthusiastic and actively involved, which was key to the success of this project. It is clear that, without the dedicated contributions and teamwork of these community members, the project's direction and results could have been very different. The project benefited greatly from the valuable ideas, different viewpoints, and strong sense of ownership that each person brought to the table. All of these helped the project succeed.

In addition, another impressive aspect of the project's success was the helpful partnership with the Environmental Protection Agency of Liberia (EPA). The EPA helped by using their knowledge and resources to educate Yeakpee Town’s residents about proper maintenance of the water facilities and they also pledged to periodically assess the quality of the water in the future for long-term safe usage. Including the EPA in the project also made the project more credible and impactful.

However, it is important to emphasize that the success of this project was not only due to outside collaborations. Key was the strong teamwork between those who were directly impacted by the problem and their unwavering commitment to finding practical solutions. The project was successful because the stakeholders actively participated. They not only identified the problem but also played a role in coming up with effective solutions and making them happen. By including and involving everyone, the approach made sure that the solutions were suitable for the specific situation, and it aligned with what the community truly needed.

Conclusion:

Liberia's civil unrest has severely impacted its infrastructure, particularly in water, sanitation, and hygiene (WASH) systems. The destruction caused by the war has left many

communities, including Yeakpee Town, without access to clean water and adequate WASH systems. This lack of access has led to the spread of waterborne diseases, particularly among children, leading to high mortality rates. The construction of three water pumps in Yeakpee Town has increased the availability of clean water, allowing each resident to take home approximately 1.8 gallons of water per day. This improvement will significantly reduce water-related illnesses, particularly among children, and contribute to a healthier and more sustainable future for Yeakpee Town residents. Involving community leaders and members in this project, from planning through to implementation, was key to its success.

Acknowledgements

I am grateful to the Center for Public Service at Gettysburg and the SHE-CAN organization for providing the grant funding necessary for the success of this project. I also want to express my gratitude to my academic advisor, Professor Natasha Gownaris at Gettysburg College for her guidance and counsel. Next, I am appreciative Mr. Jallah from the Environmental Protection Agency of Liberia for educating Yeakpee Town community on best clean water practices and water facility management as well as the contractor of this project Mr. Dennis for his expert advice and punctual service. Lastly, I want to thank my family and friends, especially Jephthah Freeman and Oghenerukevwe E. Tejevbo, for their unwavering support and heartfelt encouragement.

Appendix

1.1 Estimated cost of one hand pump

Description	Quantity	Unit Price	Total
Culverts	14 pcs	$50.00usd	$700.00USD
Set of hand pump	1pc	$450.00usd	$450.00USD
Blocks	42pcs	$0.40usd	$19.00USD
Cement	5 bags	$7.50usd	$40.00USD
Steel rods	1pc	$7.00usd	$9.00USD
Ceiling Tiles	1pc	$6.00usd	$8.00USD
Tired wires	1 bundle	$5.00usd	$10.00USD
Crush rocks	14 bags	$1.29usd	$20.00USD
Transportation of materials			$100.00USD
Travel Cost for round trip			$2,000USD

Incentivizing fees			$250.00USD
Workmanship			$600.00USD
Living expenses for 2 months(food, and lodging).			$700.00USD
Miscellaneous			$94.00USD
Grand total			$5,000 USD

1.2 Actual cost of one hand pump, plus the renovation of the old and abandoned hand pump.

Item	Description	Quantity	Unit	Rate	Total
	Preliminaries				
1	Allow for site mobilization, setting up the rig, and demobilization at completion period.	2		$50.00	$100.00
2	Digging of well				
	Digging 3x3 diameter hole from 0-30m depth	30	Feet	$15.00	$450
	Supply and Install 3x3 diameter culverts in well for good yield supply	15	pcs	$40	$600

	supply and Install gravel pack in the well	5	Bags	$5	$25
	supply and install waterproof cement for culverts joining to avoid water contamination	1	pcs	$70	$70
3	Well Development				
	Allow for water development work (Machine) of completed well unit the water is clean (for approx. 1hrs)	1	Hours	$200	$200
4	Head of the well				
	Construct head of the well, 1 meter above the ground with concrete mix	1	meter	$30.00	$30.00

	(1:2:4)				
	Construct the apron of the well for good standing position way of getting water	1 cm	cm	$200	$200
	Construct the well cover and tap	1	cm	$100	$100
5	Hand Pump installation				
	Supply and install hand pump with all necessary materials	1	set	$500	$500
	Additional pipe and guide	2	pcs	$15.00	$30
	Additional rod for pump installation	2	pcs	$15.00	$30
	Installation rope	1	roll	$30	$30
	cement for work	7	bags	$$8.50	$59.50.
	Rehabilitation for well two renovation in old road community total materials cost	all supplies		$500	$500

	bricks for apron works	50	pcs	$1.5.	$75
	Total material cost				$2999.50.
	Transportation cost (10%)				$299.95.
	Labor Cost (25%)				$749.88.
	Grand Total for rehabilitation and a new pump				$4,049.33

1.3 Overall cost plus supply costs for dedication day ceremony

Total cost to construct a new water pump plus renovation of an old water pump	$4,049.33
Flight fare round trip from USA to Liberia	$1,362.65
Living expenses for 6 weeks in Liberia (food, water, housing, etc.)	$700
Donation of food supplies to a local orphanage plus transportation	$355
Incentives and light refreshments for dedication day ceremony	$435
US Visa renewal Contribution	$80 of $160
Miscellaneous	$12.02
Grand total	$7,000

1.4 Pictures of food supplies donated to a local orphanage (10 bags of rice, Two tins of vegetable oil, and five packs of seasoning cubes).

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