



Youth-led Innovative WASH Approaches in Lebanon

SUMMARY

UNICEF Lebanon addresses water access, water quality, and climate-related stressors through an array of methods, including those that involve youth-led innovation. UNICEF WASH and Youth teams have partnered with a Canadian-based non-profit organisation, Waterlution, to support youth-led innovative solutions for improved WASH services across Lebanon through Water Innovation Labs (WIL Lebanon).

In 2021, Waterlution Lebanon's initiatives allowed young water leaders to collaborate on solving WASH challenges in Lebanon, focusing on informal settlements and climate resilience. Moreover, with the help of the implementing partner INJAZ, UNICEF trained a cohort of youth to build innovative ideas and advance their basic business development knowledge to join incubators and innovation hubs similar to Waterlution.

These incubators and innovative platforms aim to develop youth capacities, empower women, and create innovative leaders within the WASH sector in Lebanon. Moving forward, UNICEF WASH aims to continue to support the innovation program with additional technical and programmatic guidance together with the UNICEF Youth section.

Background

The safekeeping of WASH-related resources in Lebanon and the Middle East and North Africa (MENA) region continues to be a pressing issue.

In response to water scarcity and climate change, UNICEF has collaborated with [Waterlution](#) to advance the largest Arab Water Innovation Lab (WIL) and closing the WASH needs gap in Lebanon – specifically in Lebanese ISs and addressing water quality in the Litani River Basin.

Additionally, UNICEF has taken on the initiative with INJAZ, to train marginalized youth and

enable them to partake in innovation hubs like Waterlution and similar incubators.

UNICEF aims to create innovative, scalable, youth-led solutions for water issues nationally and within the MENA region as young people can be a great driver of innovations and change in the water sector in Lebanon.

The innovations lab is envisioned at two levels with the first phase being a conceptual level and the second phase being the developmental level to materialize the solutions that have gone through the ideation phase.

Waterlution – WIL Lebanon

Established in 2019, [WIL Lebanon](#) has had three innovation lab events dedicated to finding solutions developed by Lebanese and Arab youth entrepreneurs to address Lebanon's complex water issues. Waterlution aims to empower youth throughout these labs by developing innovative solutions, fostering leadership skills, and exposing youth to the water sector's systemic challenges.

Globally, the Water Innovation Lab (WIL) program hosted by Waterlution has, to date, delivered 17 WIL programs across five continents and trained 1,350 young water leaders. In addition, WIL has been present in nine countries, engaged 275 mentors, and has initiated over 120 water innovation projects worldwide.

The modality used by WIL Lebanon aims to guide innovative ideas through developmental support to allow replicability nationally, regionally, and globally – permitting the following outcomes:

- Enable groups of young leaders to work together to solve water-related issues
- Use creative approaches to develop seamless projects through experts, incubation centers, innovation centers, field trips, etc.
- Develop resilient young leaders to have the practical and facilitation skills needed to address complex issues within the water sector in Lebanon and the region
- Provide a networking platform and seed funding to ensure the scale-up of innovative solutions

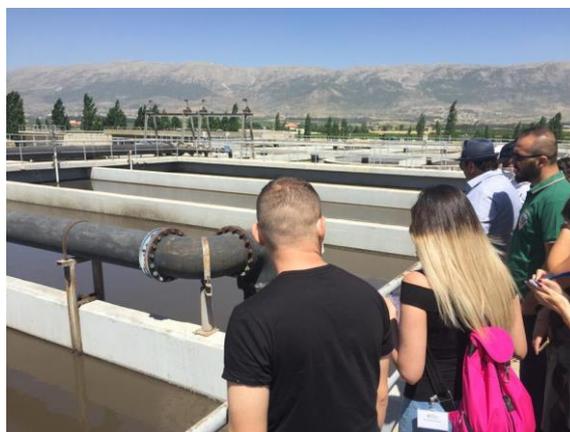
An example of WIL Lebanon's innovative approach is the 2019 seven-day camp in the Bekaa AREC Center. Participants were exposed to systemic issues in wastewater treatment plants, informal settlements, and an innovation center (Figure 2a, 2b, 2c).

Figure 2b: Der Taanayel Innovation Center exposing youth to innovative techniques



Source: Marios Nachar 2019

Figure 2b: Jeb Jennine treatment plant to familiarize youth to existing processes



Source: Marios Nachar 2019

Figure 2c: Ghazze ISs in Bekaa to expose youth to systematic challenges



Source: Marios Nachar 201

Shifting Programming to on-line based modalities

In 2020, Lebanon experienced multiple challenges due to demonstrations, the economic collapse, COVID-19, and the Beirut Blast. WIL Lebanon adapted to the evolving situation by shifting its programming system to ensure continuity; this included the following online approaches and partnerships:

- Developing a business model through [Cewas](#), a water sector global entrepreneurship incubator and accelerator (Figure 3).
- Prototype development with the support of the leading ecosystem for entrepreneurs in Lebanon, [Berytech](#) (Figure 4).

Furthermore, the shift to online-based programming has allowed WIL Lebanon to engage its global network of specialists in water and wastewater issues in Lebanon. As a result of this interactive modality, participants in Lebanon were able to gain an international perspective on how similar problems have been addressed globally through similar Waterlution modalities.

Figure 3: Cewas workshop on business models

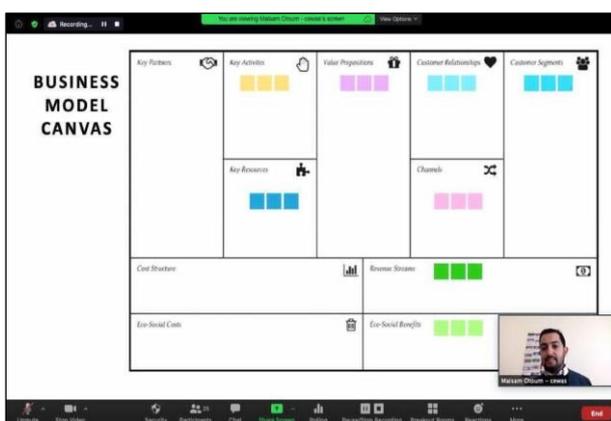
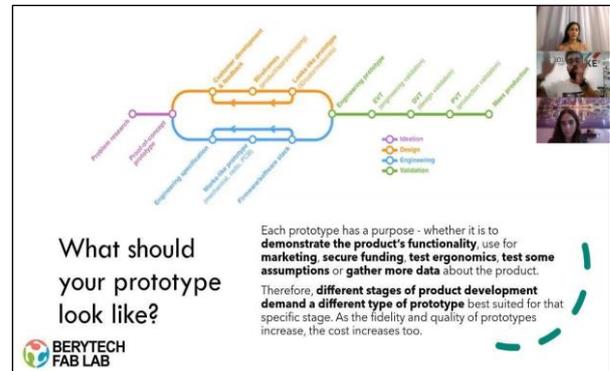


Figure 4: Berytech Fab Lab workshop on building prototypes



Lebanon Projects 2020

The Litani River Basin is an important water source for Lebanese ISs and nationals. However, the water quality has been severely degraded by nearby factories, slaughterhouses, untreated sewage effluent (a certain percentage from ISs), chemicals from agriculture runoffs, and municipal waste disposal. The Litani River Basin is the longest and amongst the most critical water sources nationwide.

Topics covered by WIL Lebanon in 2020 addressed the access and water quality issues nationally, explicitly focusing on the Litani River Basin as provided below:

- Cost-effective on-site wastewater treatment options for informal settlements across Lebanon ([CarboneVert](#) and [WOSTA](#))
- Innovative solutions for greywater and wastewater pollution in the Litani River Basin ([RIVALAND](#), [Badeal Energy](#), [Eco Pro-Whey](#))
- The use of treated wastewater, from the Zahle plant, for irrigation purposes to reduce the dependency on groundwater pumping (Feed w Stafeed)

- Ensuring equitable access to water resources for agricultural purposes to mitigate the impacts of over-pumping and over-irrigation ([SaWa](#))
- Using a two-step method to clean the wastewater produced from olive mills; ([AntiZibar](#))
- Using natural ecological engineering processes to minimize the pollution from food and beverage production ([i-Land](#))

WIL Lebanon Projects 2021

Following the success of 2020, WIL Lebanon continued to implement its projects in 2021 with a focus on climate-resilient water solutions. WIL Lebanon 2021 had the following themes:

- **Socioeconomics:** Offsetting the impacts of flooding, drought, etc.
- **Water Governance:** inclusive, effective, and efficient water systems
- **Climate Mitigation:** use of hydropower, renewable energy, etc.
- **Water Quality:** Industrial, agricultural & wastewater systems

The involvement of Global WIL participants in 2021 makes this year's lab specifically interesting. Waterlution developed a video showcasing youth participation from all over the world to highlight the importance of using external and local talent to address the water issues in Lebanon ([Video Link](#)).

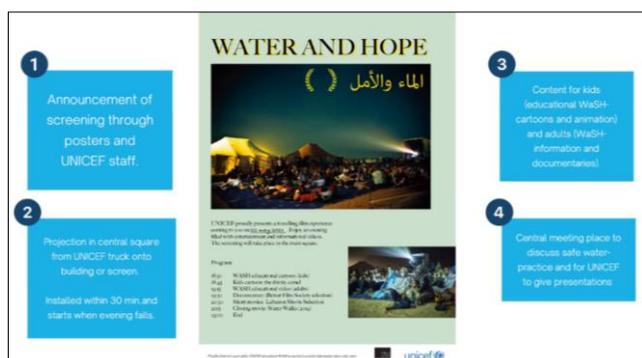
The innovative solutions presented by global youth are expected to be piloted in Lebanon and eventually scaled up across the country and within the MENA region. The projects pitched in 2021 by Global WIL participants include the following:

- **Water and Hope:** an educational initiative with a mobile film screening activity targeting informal settlers from children, teenagers, and adults about water, wastewater, and hygiene.
- **Eco-cabinet:** small and mobile wastewater treatment plants to treat Informal Settlements wastewater on-site and discharge it safely into natural waterways.
- **Water SOS:** create artificial ponds to harvest rainwater and capture snowmelt to ensure and supply informal settlements with potable water.
- **Energy Bio:** anaerobic treatment for the sludge to produce biogas used for energy production.
- **Egreenity:** an economical, community-driven composting system that empowers individuals in Lebanon's informal settlements to compost their organic waste and acts in tackling the solid waste issue.
- **The Wonder of Wetlands:** a unique mobile constructed wetland that treats wastewater in Lebanon's vulnerable informal settlements.

Figure 5: Global WIL Youth tackling water issues in Lebanon with a climate lens.



Figure 6: Youth Presentations on Innovative Solutions for water conservation in Informal Settlements.



- In 2020, the UNICEF WASH team mentored the two projects that tackle wastewater solutions within informal settlements: [CarboneVert](#) and [WOSTA](#).
- Over the years, the UNICEF Youth team sponsored the participation fees for more than 15 youth from marginalized communities through the Generation of Innovative Leaders program (mentioned below in greater detail).
- In 2021, the UNICEF WASH team contributed to each session of WIL Lebanon and WIL Global – climate-focused sessions with a roster of experts

Why Focus on Scalable Climate-Resilient Solutions?

According to the World Resource Institute, Lebanon is situated within the most vulnerable region facing extremely high-water stress – the MENA region ranks 12 out of the 17 countries in extreme water stress. Furthermore, the study showcases that Lebanon is the third country globally with extremely high baseline water stress-related impacts.

Lebanon is abundant in natural water resources, as opposed to the rest of the region, yet struggles to access quality water due to mismanagement, rapid urbanization, and climate-related stressors.

In 2021, WIL Lebanon had taken on a new mission to involve the global hub of WIL participants to address climate-related stressors in Lebanon. The global hub of WIL Lebanon participants focused on generating concepts related to climate-resilient water solutions in Lebanon alongside other themes mentioned above.

UNICEF’s Role

Over the years, UNICEF played a crucial role in driving these projects forward through technical and non-technical support.

UNICEF WASH Program

UNICEF WASH involvement has been critical, contributing to the development of multiple WASH-related projects managed by WIL Lebanon. In addition, UNICEF WASH has contributed to developing ideas in the conceptual phase and supporting various project planning processes throughout the years. Over the years, UNICEF WASH staff’s involvement has been present since the start of WIL Lebanon as specialists, panelists, mentors, and technical experts to youth entrepreneurs.

In 2020, the UNICEF WASH team was working on innovative youth-led solutions to wastewater disposal and effluent produced by ISs. The projects monitored from start to finish (2020-2021) included [CarboneVert](#) and [WOSTA](#). This is important as many Lebanese ISs lack access to the nation’s sewage systems, often leading to wastewater disposal in harmful ways. In fact, according to the WAP Report 2020, only 17 sites had access to on-site treatment, resulting in expensive wastewater storage and desludging services for the remainder of sites across Lebanon.

In 2021, UNICEF extended its support through the roster of experts and technical feedback to all teams involved in both WIL Lebanon and WIL Global – Lebanon focused sessions. In addition, UNICEF continues to support WIL Lebanon technically and financially to run a select number of projects pitched in 2021.

Innovative treatment solutions for Informal Settlements

CarboneVert:

The CarboneVert project involves transforming wastewater produced in informal settlements into *clean water* and *electricity*. This innovative solution comprises a combined treatment using two microbial fuel cells packed with activated carbon, sand, and silex to filter wastewater into effluent for irrigation.

The following modality aims to be tested out to subsequently producing a specific amount of electricity. The project is currently in the prototype

phase, allowing the team to understand better how much electricity each device can produce.

This project's uniqueness is due to its cost-effectiveness, portability, and readiness for scale-up depending on the size of a camp. It is a self-sufficient device that doesn't require energy input and is constructed of locally available and inexpensive material.

The potential uses of the produced electricity are as follow:

- Used to continuously light up latrine areas to ensure safer access for all
- To provide streetlight fixtures across the sites to increase security

Amongst many other factors, CarboneVert aims to lessen the burden of diseases related to improper disposal of wastewater in the Litani River Basin, the environmental damage of such proces processes, and the continuous displacement of refugees and Le nationals seeking better access and conditions.

Figure 7: CarboneVert MFC



BOX 1.

NEXT STEPS FOR CARBONEVERT

Currently, the CarboneVert team is in the process of developing a prototype. For the prototype, seen in figure 7, the team will need approximately \$1,000 worth of locally produced material; this considers an 18-month life cycle.

Once the prototype is finalized, the team will estimate the average amount of wastewater it can handle per day via an intermediate model and the amount of electricity produced.

UNICEF will aid the CarboneVert team through technical guidance and the mentorship of Kevin Bonel (UNICEF WASH Consultant).

The pilot project seeks to treat wastewater produced from 200 refugees to produce effluent suitable for crop irrigation. WOSTA aims to mitigate the Litani River Basin's impacts and reduce the tension build-up across West Bekaa over water resources.

WOSTA's model is based on a constructed wetland followed by an algae-based cell, resulting in an effluent that meets the Lebanese Ministry of Environment's crop irrigation standards.

WOSTA aims to construct a wetland and an algae-treatment cell for \$5,000, supporting the wastewater effluent produced by 200 refugees on average, treating approximately 10,000L of sewage.

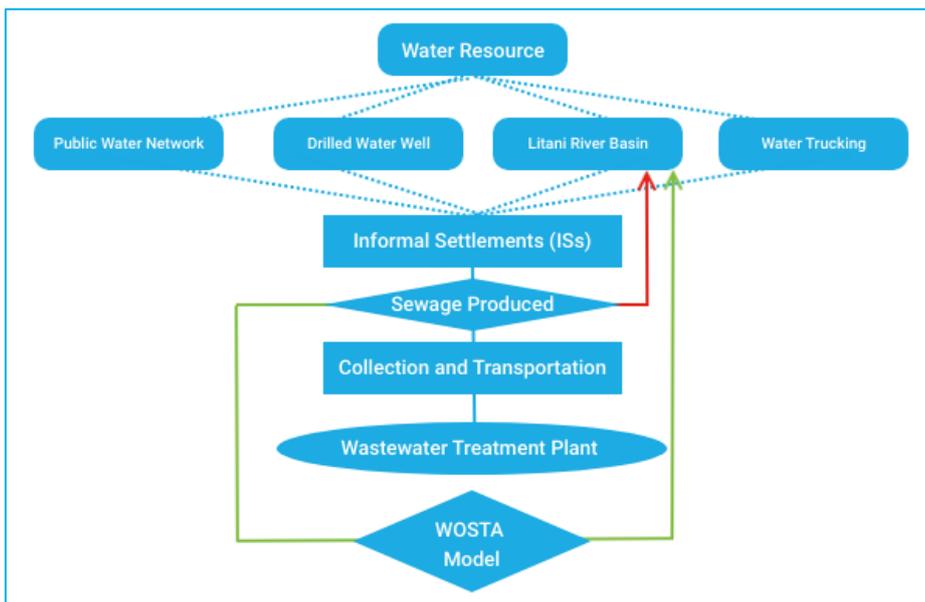
Additionally, the system's financial model is expected to cover costs through the prospect of selling bio-fertilizers produced from the algae.

Compared to conventional models and solutions available in Lebanon today, this project showcases a \$18,000 delta, making it the most cost-effective solution for intended water quality.

WOSTA – Wastewater on-site treatment action:

This project involves an on-site treatment of wastewater generated by informal settlements.

Figure 8: WOSTA Model – Wastewater On-site Treatment Action



UNICEF GIL and WIL Lebanon are releasing new initiatives to enable innovative solutions for climate change and mitigation approaches. As this challenge persists across the MENA region and beyond, the overall concept of replicability falls at the core of the solutions presented by the youth entrepreneurs partaking in these initiatives

UNICEF WASH, the GIL program, and Waterlution aim to utilize their existing networks, water technologies, and institutional knowledge to develop a community of practice that can learn and adapt projects accordingly on a global scale.

Furthermore, considering the realities of Lebanon and the impacts of COVID-19, specific measures have been taken to ensure continuity within the main innovative youth programs.

- GIL Lebanon cohorts are undergoing various online and in-person training with the necessary precautions to maintain the learning curve of existing youth and introduce new youth with a broader reach.
- Waterlution is shifting its programming to take advantage of online platforms by including expatriates and global networks to weigh in on solving water issues within Lebanon and the MENA region.

Moving forwards, UNICEF Lebanon aims to strengthen its involvement in organizations and initiatives that aim to create the leaders of tomorrow and narrow the gap of youth unemployment in Lebanon, all while having the ripple effects of creating a clean, safe, and climate-resilient environment.

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About the Series

UNICEF's water, sanitation and hygiene (WASH) country teams work inclusively with governments, civil society partners and donors, to improve WASH services for children and adolescents, and the families and caregivers who support them. UNICEF works in over 100 countries worldwide to improve water and sanitation services, as well as basic hygiene practices. This publication is part of the UNICEF WASH Learning Series, designed to contribute to knowledge of good practice across UNICEF's WASH programming. In this series:

Discussion Papers explore the significance of new and emerging topics with limited evidence or understanding, and the options for action and further exploration.

Fact Sheets summarize the most important knowledge on a topic in few pages in the form of graphics, tables and bullet points, serving as a briefing for staff on a topical issue.

Field Notes share innovations in UNICEF's WASH programming, detailing its experiences implementing these innovations in the field.

Guidelines describe a specific methodology for WASH programming, research or evaluation, drawing on substantive evidence, and based on UNICEF's and partners' experiences in the field.

Reference Guides present systematic reviews on topics with a developed evidence base or they compile different case studies to indicate the range of experience associated with a specific topic.

Technical Papers present the result of more in-depth research and evaluations, advancing WASH knowledge and theory of change on a key topic.

WASH Diaries explore the personal dimensions of users of WASH services, and remind us why a good standard of water, sanitation and hygiene is important for all to enjoy. Through personal reflections, this series also offers an opportunity for tapping into the rich reservoir of tacit knowledge of UNICEF's WASH staff in bringing results for children.

WASH Results show with solid evidence how UNICEF is achieving the goals outlined in Country Programme Documents, Regional Organizational Management Plans, and the Global Strategic Plan or WASH Strategy, and contributes to our understanding of the WASH theory of change or theory of action.

COVID-19 WASH Responses compile lessons learned on UNICEF's COVID-19 response and how to ensure continuity of WASH services and supplies during and after the pandemic.

Readers are encouraged to quote from this publication but UNICEF requests due acknowledgement. You can learn more about UNICEF's work on WASH here: <https://www.unicef.org/wash/>

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