GRAHAM SUSTAINABILITY INSTITUTE
UNIVERSITY OF MICHIGAN

Catalyst Grant Final Project Report
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Project title: *Linking Research and Management for Safe and Sustainable Water Supply by Drinking Water Utilities*

Project team

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Summary

This project addresses challenges of global safe drinking water provision and development of effective partnerships across established and emerging national economies: USA and Gabon. Catalyst Grant funding solidified a partnership between the drinking water utility in Gabon, Society for Energy and Water of Gabon (SEEG), researchers in the United States (University of Michigan, U-M), researchers in Gabon (University of Science and Technology at Masuku, USTM), and the Gabonese government's National Center for Scientific Research (CENAREST). This award broadened what had been an academic exchange to include utility based specialists, building on internally funded training of and collaboration among research team members (with visits to U-M by Gabonese PhD student Franck Kumbe and Professor Adelaide Nieguitsila, visit by Gabonese masters level student Djessi Tchouty, and visits to USTM by Vedrin and Hardin) under the auspices of the REFRESCH project. Catalyst funds sponsored a visit by Gabonese external partners and collaborators to Ann Arbor for in-person learning exchange and planning research collaborations. Critiques of colonial and postcolonial research practices globally note that mobility is too often restricted to researchers from developed countries, hence fostering "extractive" research economies rather than reciprocal problem driven exchanges. We sought to create balanced collaborative practice with our partners, what U-M President Schlissel has termed "symbiosis," while pioneering a model for integrative water quality capacity within Gabon, a freshwater rich site on the African continent.

The Catalyst Grant underwrote two weeks of intensive professional and social exchanges, including visits to two drinking water treatment plants and one wastewater treatment plant, as well as tours of both rural and urban areas for discussions of how water distribution systems articulate with wells at the interface of these two types of residential areas, both in Gabon and the U.S. Outputs include podcasts for bilingual learning modules on water quality, formal presentations at the U-M Sustainability & Development Conference (SDC) and the African Studies Center (ASC) STEM Africa conference, budding research exchanges on data analysis for integrated water quality monitoring of natural water and treated drinking water, and foundational practices for cross-national analysis of water supplied by municipal drinking water utilities in these two countries.

Project background and approach

This Catalyst Grant project addresses challenges of global safe drinking water provision and development of effective partnerships across established and emerging national economies: the USA and Gabon. The United Nations' proclaimed Human Right to Water and Sanitation demands that drinking water be affordable, accessible, safe, [aesthetically] acceptable, and in sufficient supply for every person around the world. One of the primary ways people obtain drinking water globally is through piped potable water supplies, making such water providers a critical institution in the effort to realize the human right to water. Developed countries generally have been more successful than developing nations with providing continuous safe drinking water supply to their citizens. However, there are fundamental challenges to piped drinking water provision that pervade across nations of various economic levels that provide an opportunity for symbiotic exchange and collaboration where such partnerships do not normally exist. Thus, among the United Nations Sustainable Development Goals we focused on addressing water sustainability challenges (Goal 6 - Clean Water & Sanitation) through building innovative cross-cultural partnerships (Goal 15 - Partnerships) that stands to benefit nations of all levels of economic development.

The project's external partners come from the national drinking water utility in Gabon, the Société d'Énergie et d'Eau du Gabon (SEEG), as well as Gabon's national center for scientific research, Centre National de la Recherche Scientifique et Technologique (CENAREST). Two upper management employees from SEEG, directors of water quality testing and data management, and one researcher at CENAREST were recruited through our university research collaborator in Gabon, Dr. Nieguitsila. SEEG employees have interest in applying data science techniques to their own large base of historical water quality data, similar to some of the work we are pursuing in Ann Arbor. In addition, the Gabonese collaborators seem hungry for thinking about ways to improve drinking water services in Gabon through eco-systems thinking and data-driven decision making. Furthermore, just like in the US, there tends to be a disconnect between the quality of water that leaves the treatment plant versus the quality of water that is received in the home due to the piping network that delivers water. Gabonese colleagues recognize that many challenges they face are a result of the piping network and learning that we have the same challenges here opened the door for interesting discussions and ideas for data exchange.

The following main partnership building activities took place during the visit:

- Thursday Oct 10: driving tours of Pinckney, Dexter, Ann Arbor for a sense of rural/urban matrix
- Friday Oct 11: practice presentations for joint session at Sustainability & Development Conference (SDC), attended SDC opening reception
- Saturday Oct 12 – Monday Oct 14: attended SDC conference, presented at U-M/Gabon joint session on Monday
- Tuesday Oct 15: U-M research presentations for visitors, Gabonese presentations for U-M team, attend Biology on Tap (community science event) in evening
- Wednesday Oct 16: Gabonese presentations of data collection by SEEG for U-M team
- Thursday Oct 17: tour drinking water and wastewater treatment plants in Detroit
- Friday Oct 18: tour Ann Arbor's drinking water treatment plant, record podcast on water quality to accompany French version of Michigan Sustainability Case on 1,4-dioxane, attend African Studies Center (ASC) STEM Africa conference opening session
- Saturday Oct 19: presentation at ASC conference, arrival of Prof. Jean-Jacques Taty from Howard University (liaison to His Excellency Michael Moussa, ambassador to US from Gabon)
- Sunday Oct 20: attended ASC conference, farewell dinner at Rebecca's home with Taty, and U-M REFRESCH faculty Johannes Schwank, Roy Clarke, and more.

Findings

The visit to Ann Arbor by the Gabonese delegation primarily established a sense in both parties of the short and long-term opportunities for collaboration and a starting point from which to embark on a path together. This is evident in the fact that since the October 2019 visit we have shared and explored historical water quality data, as well as supported development of a literature review in anticipation of related water quality field work in Gabon by Dr. Nieguitsila. Furthermore, this visit in October 2019 was the first time our U-M research team had been able to engage upper management employees at Gabon's water utility to understand what drinking water infrastructure and management is like in the country. Both the Gabonese visitors and the U-M research team gained insight on the other country's drinking water systems such that we were able to identify common challenges across contexts related to water quality changes occurring between treatment and point of use, implementing sensors and other (near) real-time data collection systems, and using the vast historical bases of data to make decisions that improve system management and customer satisfaction.

Outputs

Output 1 - White Paper

Dr. Nieguitsila completed a French version of a White Paper that summarized the visit, discussions, ideas, and potential collaborations moving forward. This document was sent to all parties and all parties reviewed and approved the document. However, our original plans to have all parties sign the document did not materialize. Since our collaborations have continued, we are not concerned about the lack of signatures on the document itself.

Output 2 - Informal & Formal Presentations

As part of the visit, the U-M team and Gabonese colleagues participated in two separate conferences and gave the following presentations at the Sustainability and Development Conference:

- Q. Melina Bautista. Contrasting water quality in intermittent vs. continuous water supply. 2019 Sustainability and Development Conference. 2019 Sustainability and Development Conference. Ann Arbor, MI.
- Lutgarde Raskin. University of Michigan Challenges and opportunities for collaboration across research and professional sectors toward sustainable clean water supplies. 2019 Sustainability and Development Conference. Ann Arbor, MI.
- Matthew Vedrin. Applying distribution system modeling and water quality monitoring to assess the impact of distribution system characteristics on water quality in Ann Arbor, MI. 2019 Sustainability and Development Conference. Ann Arbor, MI.
- Adélaïde Nieguitsila. Establishing coordinated water quality monitoring across natural and engineered water systems in Lambarene, Gabon. 2019 Sustainability and Development Conference. Ann Arbor, MI.

In addition, all four Gabonese visitors gave informal presentations to the U-M team over the course of the visit. These presentations and the energetic discussions that ensued actually took up most of our time together on Tuesday and Wednesday of the visit.

Output 3 - Podcast Contribution from Gabonese Collaborators

During the visit, Prof. Hardin interviewed and recorded a podcast segment in French of the Gabonese visitors' comments on Ann Arbor's 1,4-Dioxane plume issue. This segment is being integrated into a French version of the Michigan Sustainability Case on the 1,4-Dioxane issue that Frank Kumba Binze translated for use in universities and professional development activities in Gabon[1]. Binze is now pursuing his doctoral studies in the Department of Language Education at the University of Western Cape in South Africa, focusing on knowledge transmission about water quality. UWC also boasts a strong cross disciplinary Institute for Water Studies, established in 2009 and boosted by recent drought conditions in South Africa that make water a high priority for academic research and teaching[2]. That campus is incorporating the English language version of the learning module[3], currently used both at U-M's School

of Public Health (for Human Health Risk Assessment courses by Dr. Rita Loch Caruso) and at the School for Environment and Sustainability for Ecological Risk Assessment courses by Dr. Alan Burton).

In short, our team creates not only research collaboration and deliverables, but also a transnational community of practice for teaching and training deliverables that are crucial to creating stronger partnerships for global water management that strengthen national and regional water monitoring and delivery systems. Decision cases, long used in business, medical and law professions, are needed in environmental fields. Cases have the added benefit of sharing the problems and challenges that decolonize knowledge transmission, by acknowledging that issues of pollution, eroded public trust, and growing urban populations are common across our very different countries and can prompt collaborative learning and work toward solutions.

Output 4 - Fledgling practices of cross national water monitoring

This output will not be shared publicly because it contains data that water providers wish to keep private. However, the document reported on preliminary data exploration of historical water quality data in Gabon. The dataset only contained a small fraction of parameters and time points compared to the vast historical data in order to keep the first pass of data exploration to a manageable size. The report was sent to Gabonese collaborators and additional communication from SEEG collaborators is expected this summer. Ultimately, this output demonstrates methodological exchange across national and cultural contexts regarding best data analytics practices for water quality monitoring at a city scale. We know that such methodologies are direly needed in the U.S. for future management of water supplies and we know our Gabonese colleagues recognize the same urgency for similar novel approaches in Gabon.

Output 5 - Writing and upcoming article submission of review on particular waterborne diseases in environmental and drinking waters in Gabon

Dr. Nieguitsila is leading this effort to publish, in French, a review of the microbiological, public health, and engineering related knowledge of the parasitic pathogen Cryptosprodium aimed at highlighting the lack of applied research of the pathogen in Gabon. The article is in its final stages of writing before submission to a peer-reviewed journal. It is a culmination of Dr. Nieguitsila's ASC and REFRESCH sponsored residency at U-M in 2018 as well as of discussions from the visit in October 2019 supported by the catalyst grant. Vedrin and Hardin are set to be co-authors on this publication alongside one of Nieguitsila's colleagues at USTM, with Nieguitsila as first author.

Outcomes

This Catalyst Grant has truly served as a catalyst in partnership development between drinking water researchers across Gabon and the United States. This is by far the greatest outcome of this grant project. The REFRESCH work in Gabon that preceded this Catalyst grant laid a foundation of connections that opened the door for the type of collaborations that have been achieved through this Catalyst Grant. Thus, while REFRESCH continues to develop long-term cross-national partnerships at high levels of power (i.e. the Gabonese government and the University of Michigan), this Catalyst Grant allowed for a targeted approach to collaboration among researchers across countries that can be dually leveraged in REFRESCH leader's ongoing efforts. With the start of information flow between researchers and water industry professionals both within and across each country, there are doors now open for short and long term comparative research studies of drinking water quality provision. In the short term, this will influence both Vedrin and Kumbe's PhD dissertations, providing potential comparative analyses of both environmental and linguistic datasets across countries in the future. In the long run, there are now possibilities of collaborative studies within Gabon between SEEG and the University of Science and Technology at Masuku, as well as the possibility of a joint water quality sampling effort in Gabon led by Nieguitsila and Ondo.

References

[1] https://www.learngala.com/cases/pollution-par-le-panache-de-dioxane

[2] https://www.uwc.ac.za/Faculties/NS/Water_Studies/Pages/default.aspx

[3] https://www.learngala.com/cases/dioxane-plume