The Other Side of the Data Horizon

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Executive Summary

With positive signs appearing of our emerging from the global pandemic of COVID-19 (though many significant barriers remain), I was curious about what positive things came out of the past ~18 months. The stressors of COVID-19 forced a global adjustment in data collection, urgency, and highlighted the weaknesses of our current system. At the same time, it also forced adaptation and innovation in data.

I spoke with over a dozen data specialists from a broad spectrum of professions — government representatives, development agencies, NGOs, corporations, and others — across Africa, Asia, Europe, and America. They shared their thoughts on what the sector learned, what they needed, and what trends they see in the WASH and data intersection. They represent both established voices in the field along with new thinkers wrestling with how best to address the challenge of WASH and data. By no means does this document capture a comprehensive understanding of future data needs. Consider it a dipstick into the future world of WASH and data.

My main takeaway from the conversations is that we're at an unprecedented moment of data fetishization with strong cries for more data, more analysis, and more information. What's unclear is if this data fetishization leads to unprecedented *understanding* of WASH. Often, the emphasis on data for data's sake obscures what decisions need to be made, *why*, by *whom*, by *when*, and what is the *least* amount of information needed to make the decision. In the absence of such clarity, we run the risk of only adding noise, confusion, and occasionally outright obfuscation rather than information.

Looking over the data horizon, data professionals are not calling for more data, but rather better use of data so that it results in actual improved understanding of where we are, what is working, and what needs to be adjusted.

At the most basic level, this is not about technology. Data professionals are looking for established accountability in data to react to the information they are receiving. Critical to this is for data to be respected within decision making, with representation of data experts at the highest levels of government and agencies. At the same time, data need to be locally relevant. Data demand from NY, Geneva, or New Delhi are often not pertinent to the data collectors — therefore data collection compliance and data quality are often low. Data context are critical — understanding the local situation makes data relevant and valuable to those who are collecting it. And, in tension with the call for localized data, is the need for standardized data at national and global levels. To be relevant, data need to be accurate, presented in an understandable format, and received in a timely manner. Data tend to flow up the decision-making chain, concentrating information along the way. It's unclear how data are being used at each link of the chain, demonstrating a need for improved data architecture to ensure the right data are reaching the right people at the right time. Finally, data needs are rarely designed with the actual end-user in mind.

Systematic development and application of use-cases would help strengthen the applicability of data.

Except the future of data kinda is about technology. Discussants expressed a strong need for improved automated water-quality data that show the shifts in quality due to agriculture, industry, and point and nonpoint source pollution. At the same time, data collection runs the risk of frequently aggregating away meaning, and more granular data are needed to be relevant for local decision-making programming and implementation. High resolution data from earth observation satellites can provide a minimum level of geographic context for any location — reflecting basic land use, and land cover, infrastructure, topography, structures, demographics, and settlements. Additionally, interviewees are looking for effective predictive data analytics utilizing Internet of Things — but noting they need to be well designed for the specific operating context.

Data are often presented in ways that obscure information, making it challenging for the data user to act upon; therefore, user interfaces need to be strengthened to ensure users receive information in an actionable form. Cross-sectoral data present an emerging opportunity to overcome the guardrails that set the parameters for WASH, including improved information on climate impacts, economic development, and demographic movements. Finally, citizen data present both an opportunity for democratizing data — including gathering data of most interest to the intended recipients of the benefits of data — as well as concerns around exploiting data information from people least able to advocate for themselves.

In this piece, I've tried to distinguish between data and information. In my own mind, I consider data to be the raw numbers from collection systems — can be human or machine. The numbers in themselves don't tell us much. Only through analysis does data become information, which is an understanding that can be acted upon, resulting in increased value. The chain then is: data -> information -> action -> value, with the development process of data architecture systems working in reverse (start with the desired value, identify the action needed, what information is required, and then what data must be collected).

And then the next step would be knowledge, but that's for another thought piece...

Throughout this document I've included selected lessons of how I've personally misused, miscollected (to coin a much-needed word), and generally misunderstood proper approaches to data. If I'm going to shame anyone about poor data management, it should probably be me. I hope these lessons serve to show the risks of poor engagement with data among well-meaning, if data-ignorant, development professionals.

Also, I use "data" as a plural noun, 'cause I'm old fashioned that way.

Approach

I spent six weeks discussing WASH and data with over a dozen thought leaders, practitioners, and regulators in the field (please see the conclusion for a full list). Over the course of the discussion, we did not follow a stock script, or interview tool, but rather we had free-ranging conversations across the topic. Afterwards, I worked to identify commonalities across interviews and find the specific insights within each interview's perspective.

Findings

The conversations covered a breadth of topics, too many to fully address here. Instead, I've tried to capture the main takeaways from the interviews and consolidate them into a handful of buckets.

a) Accountability to act upon data

The data are often there. And, usually, the information is there, too. But all too often the *accountability* is not there. There is an absence of a decision maker within governance and oversight systems to act upon the information. Interviewees across the globe consistently called for greater accountability for action within data systems to ensure the information is utilized to drive well-informed decisions.

We see the implications of this, for example, in water point mapping that report non-functioning water points for persistently long times. The data and information are there. But it's not clear who is responsible for acting upon the data to visit the water point, assess the issue, repair it, and update the data set to mark the issue as resolved.

I see several components to this situation:

1. **Who asked for the information?** Respondents noted that the drive for data collection often comes from people and organizations who are unlikely or unable to act upon it. This encompasses donors, development agencies, academia, etc. These parties ask implementers to provide information on things like latrines constructed, handwashing behavior change campaigns executed, and households connected to water systems. They also ask service questions such as, are the latrines being used, is anyone washing their hands, and does water actually flow in the pipes. But none of those stakeholders is in a position to act upon the data they receive. And the data often flow directly from implementer to donor (or development agency, academia, etc.), bypassing the agencies with authority to act. Without a clear demand from a decision maker for the information, data and information are unlikely to be acted upon.

2. **Who knows the information?** Have the data and information flowed from the mapping to a decision maker? If not, then the data and information cannot be acted upon, but ultimately, this ties back to point (1): who is requesting the information?

3. **Are there resources to act upon the information?** Another critical limitation is the persistent shortage of resources (human and financial) to address the information. If a decision maker has the information, but has neither the staff to repair the water point nor the funds to pay the petrol, spare parts, salary, etc. required to repair the water point, clearly it will not be resolved. But there is a nuance to this situation — lacking resources to act upon information certainly does not mean there isn't value in collecting the data. For example, district water officials might only have the resources to fix one water point quarterly. They can't act on all of the data collected, but the information can help prioritize the scarce resources they have.

b) Incentives to collect data

For effective data collection, fundamentally people need to want to collect data. Often the person — a district water engineer, health care worker, repair person, etc. — does not see the value in the data they are collecting, because they have not been consulted on their decision — making needs. The prescribed data collection does not make their job easier, nor do the data result in information fed back to the data collector in a timely manner in a format they can use. While challenges to data collection include technology, transportation, and funding, a key issue is **limited incentives** for data collectors at the most basic level. Incentives range from financial (e.g., cash for quality and timely data reporting), to technological (e.g., sensors on septic tanks to indicate they're full — saving a trip), to operational (e.g., the data collected are directly relevant to the collector's job). Respondents felt that, in their heart, people want to do a good job and need to be equipped with data systems that help them do this. I was most interested by the third option, as I felt the first one is vulnerable to the money running out (and may induce bias in the data), and the second one is dependent on having funding and technology to deploy (although with each additional sensor, the pricing gets cheaper and the overall system becomes very scalable), whereas the third one seems cost effective and scalable.

Or, you maximize automation of data collection, which reduces the need to incentivize people to collect data. The need for incentives then concentrates on the people who analyze and react to the data.

Effectiveness in operational incentives for data collection is predicated upon strong use cases. At its simplest, a use case is a description of how a person (or actor) who actually uses a process or system will accomplish a goal. For example, taking the case of the district water engineer, she is the **actor** with the **goal** of ensuring water supply within her jurisdiction. She would help develop the use case for data collection in her territory, including what data are collected, why they are being collected (i.e., what actions will come from them), how the data are collected (e.g., manually, automated, mobile-based, etc.), at what frequency (to ensure timeliness), how the data would be stored and transmitted, and ultimately, in what form the information would come back to her so she can act upon it. Respondents felt that while data collection must happen at the very local level, analysis need not occur at the community or district level — where there may be neither the time nor the skills base — but can be done at an aggregate level, with the resulting information feeding back to the engineer in an actionable form.

Respondents emphasized how use cases form the foundation of effective data systems. By understanding how the user (e.g., the health care worker) will actually use the resulting information, use cases help address issues of incentives in data collection, account for contextual understanding (see below), and ultimately result in better (more accurate and timelier) data as the data collector/data user has a clear interest in receiving the resulting information.

A developing area of financial incentives for data collection is for private or citizen collectors. One respondent shared that they heard of consumers in South Africa tracking water delivery trucks in their communities so other consumers could be ready to collect water when the truck came to their neighborhood. The utility, learning of this, incentivized the data collection by topping up mobile accounts and using the information to better route the trucks[1].

In India, NextDrop Water was a for-profit start up that ran for nine years based on crowdsourcing water supply data. Operating in Bangalore, NextDrop worked to address the challenge faced by consumers who frequently did not know when water would be available. NextDrop paid "valvemen" — the men who manually turn on and off the valves to neighborhoods to allow the water to flow — to report on when valves were being opened and at what pressure. In turn, consumers paid NextDrop INR10 (US$0.13)/month for real-time mobile updates on the water availability. Unfortunately, the NextDrop model was not able to overcome a typical challenge of water utilities — revenue collection. In the absence of widespread mobile money payments, the cost of collection proved too great to support the business model.

c) Data system architecture

Respondents expressed frustration that data are not flowing smoothly to the right people (see point III.a.2) at the right time. Interviewees also often commented that data tend to flow upwards in the decision-making chain, with aggregation and simplification along the way. However, *information* is rarely flowing down the chain, meaning the staff and individuals responsible for acting on the data rarely get the information they need within an actionable timeframe. This increases the frustration of the staff (and increases their resistance to collecting data) and ultimately negatively impacts the level of service to the direct consumers of WASH services. They feel this situation could largely be reconciled by broader utilization of **data system architecture**. In a simplified description, data system architecture is effectively the act of putting all of the use cases developed as a recommendation of III.b into a structured format that shows who should be receiving data (and information) when. In this exercise (which should be the first step in any data system development — it's a lot of planning up front, but the payoff is significant), data flow becomes evident and any frictions to the flow of information are highlighted. With the highlighting of frictions (for example, the holding of district - relevant information at national levels), they can be addressed and systems established to release the flow of data and information.

1 Note that this is a third-hand account, and I was not able to verify it.

d) The tension between localized data and global indicators

Interviewees emphasized the fundamental tension between highly localized data most valuable to the data collector/data user who needs to take operational action and universal indicators needed by national, regional, and global actors who need reliable information to direct policies and financing. Data indicators developed far from the point of capture may be inappropriate (see the box), impossible, or irrelevant. By grounding indicators in the local context, actionable data are more likely to be gathered. However, the utility of localized data needs to be weighed against the additional cost in defining, collecting, and analyzing the data.

Data Lesson: Context is Critical

Early in my career I worked for a New York-based organization that was an early adopter of GIS as a tool to assess the location of their water points, and correlate that with a water point's performance and service level.

From the headquarters, I noticed in Ethiopia several water points that served a population of about 250 people each, and were about half a kilometer from the center of town. Despite the proximity of the water point and low population (implying brief queuing times), reports from the communities indicated people were spending hours collecting water. The functionality of the well showed that it was operating appropriately, so it was not an issue of low flow.

A month later, I went to one of the communities to try and understand what was going on. And while the GIS information about the community and water point were accurate, the data did not show that the community was at the top of a 1,000-foot cliff and the well was at the bottom.

The context for why collection times were so long was glaringly obvious to the community and supervisors. But the New York HQ, lacking the context, was unable to understand the issue on the ground.

At the same time, global indicators necessarily aggregate information for national trends and progress against global targets. By some measures, national and global data run the risk of "aggregating away meaning", i.e., it's difficult for a health care worker to get actionable information on sanitation from a Joint Monitoring Programme (JMP) report.

And of course, the multiple reports serve multiple functions — the health care worker's collection of information on latrines will inform her efforts in boosting coverage among communities lagging in sanitation uptake. National statistics may show full coverage within her region, having aggregated enough data that the outlier community data are lost.

At the same time, respondents felt strongly about a need to standardize indicators across the sector to facilitate analysis and aggregation. One intriguing suggestion for utilities managers was establishing the **minimally viable data** required for effective operations and management. To ensure neutrality, this could be developed and monitored by the International Standards Organization.

Of course, there is an inherent liquidity? fungibility? of data at its most basic level — local coverage data are aggregated to district, national, regional, continental, and global levels, providing high-level snapshots at each step. If the local, district, national… global standards are built around the same initial data standards, each level can use the data to satisfy the specific use case needs.

While the JMP has common core indicators, they tend to focus on hardware (e.g., type of sanitation facility) and use (e.g., use of that facility — difficult to measure) for a snapshot in time. However, JMP tends to be silent on indicators (and related data) associated with the sustainability of hardware and services. For example, this includes the financial and operational viability of WASH services. Is a pit-emptying service covering its costs? Is it operating reliably and equitably? If the financial and operational data from that business are unknown, then the sanitation coverage for the community is vulnerable to sudden collapse — impacting the national and global SDG tracking. However, this leads to questions of common indicators on the service side — how do you standardize operational and financial viability? How do you standardize costs — a for-profit water enterprise may include cost of capital, whereas a non-profit enterprise would not. How do you define a customer? Someone who pays to have their pit emptied once, or someone who needs it done monthly? And most implementers have invested considerable time and resources to develop their bespoke MIS, raising additional challenges for adoption of new, universal standards that will involve further investment in adapting existing systems — if the organization even agrees to that. To manage this process, some respondents suggested establishing a disinterested, third-party agency to set the standards. Ideally, the agency would be resourced to finance an organization's adaptation of the MIS. This then has the potential to quantify and mitigate risk, and ultimately facilitate getting insurance for water points.

Most respondents said don't bother — it's too complicated.

e) The danger of assumptions in data design

Understanding local context clearly came to the fore in discussions around assumptions in data collection design. Respondents shared experiences on how assumptions from data designers based in Europe, America, or even the capital city brought assumptions to the data design that undermined the effectiveness of the approach. The assumptions were displayed in survey questions ("can your child walk to the second floor of your home" on a survey about sanitation and early childhood development. The survey region only had single- floor homes), program design ("please include your address" for a water distribution tracking system. The unplanned community did not have addresses), and target setting, ("what percent of the population served is below the poverty line?" for a water program serving an economically heterogeneous population. The water system served an impoverished customer base in line with the local socioeconomic spread, e.g., 25 percent of the population was below the poverty line and 25 percent of customers were also below poverty line).

f) Technology

While respondents felt strongly that the soft side of data collection was where cost effective progress could be made, they also highlighted a few critical technological needs. These range from new devices to better analytics to improved data representation. For example, timely water quality data came up consistently as a pressing need, and respondents felt there was an opportunity for automating water quality data collection. They cited situations where source water may be contaminated rapidly due to agricultural or industrial discharges. If water treatment systems are not designed to manage the new contaminants (e.g., new pesticides released into source water during a heavy rainfall), they may make it into the water supply system. Automated water quality systems can help react to new contaminants. However, this would need to be accompanied by rapid dissemination of the information to decision makers (see discussion above), as well as a water treatment system that can process the new contaminants, or, in a worst-case scenario, be shut down so customers are not consuming contaminated water. Even better would be to use GIS to assess risks before they occur. For instance, if you have land use/land cover GIS data, you would know where agricultural activity is occurring. Then if this is overlaid on terrain data and watershed/surface water data, you can easily see how the runoff would flow and where, allowing the utility manager to anticipate changes to water contaminants.

Data Lesson: *The Danger of Assumptions in Data Collection*

Ten years into my career I was working for a WASH funder, and part of my job was assessing programs for effectiveness and compliance with

Joint Monitoring Programme (JMP) standards. I was in Mali, outside the river town of Segou, and talking with a father. At the time, I was a few years into my own fatherhood and, with a spouse and two children, had pretty strong opinions of what constituted a family.

We discussed the sanitation facility he owned, and I asked him how many people used it. About 25, he replied. "25!" I said, "that's far too many. The latrine is designed for a single family's use."

"That is my family. I have three wives, 13 children, cousins, nieces, nephews. Which of my family members do you suggest I bar from the latrine?"

Much chagrined by my narrow world view, I did not have a good response. I changed the subject to other topics.

Operational respondents also called for improved technology — or wider application of existing technology — providing very granular data. This included more sensors on water points to track performance and functionality, better data correlation between water-point functionality and financial performance, tracking of distribution vehicles (both water supply and sludge), and sensors to assess sludge levels in pits and septic tanks. Respondents felt this would greatly reduce the cost of data collection, as well as providing more timely data, and enable them to better manage the facilities and services within their territory.

A significant data gap was noted on handwashing with soap. In a generalized push for automating data collection (many respondents were strong advocates for minimizing human hands-on data collection and analysis), respondents were at a loss as to how they can deploy technology to support data collection for handwashing. Early efforts from the last decade — such as inserting logging devices into soap bars — were proven ineffective due to bias, questions of confidentiality, and local soap practice (consumers tend to cut soap bars, potentially damaging the logger in the process). But in the intervening years, there has been little progress on this front. As a consequence, data collection on handwashing remains very expensive as it is collected manually, resulting in a poor understanding of the sector. A technological breakthrough on measuring handwashing could transform the understanding of the sector.

Data Lesson: Poor Data Visualization

In 2017 I was working for a small NGO focused on providing high-quality water to communities in Ghana. As part of their commitment to water quality and transparency, the organization tested the water regularly, and posted the results on the outside of the facility. This policy was based on the idea that customers would be able to make an informed decision about whether or not to collect water from the facility.

At 79%, Ghana has a relatively high literacy rate (World Bank Data), and it is also predominantly Anglophone. The water quality report covers 26 parameters, compares the results to national standards, and makes a recommendation at the end on the potability of the water. While the information is all there in a language many people can speak, customers have a difficult time quickly assessing the message to make an informed decision. A simpler approach — such as a redyellowgreen ranking — would represent the information captured in the data much more effectively.

As noted above, data in and of themselves are not inherently useful until they have been analyzed to produce information. Interviewees are looking at improved analytic technology and data representation to ensure rapid dissemination of actionable information. They cited persistent practices of sharing raw data with district- or municipal-level staff. The staff had neither the capacity nor the training to analyze the data and extract the necessary information. And so critical information — on leaks, non-revenue water, collections, sewage overflows, brewery discharges, etc. — were lost in the noisy data. No one was accountable, because the data had been shared, just not in an actionable form. This issue applies all the way to the WASH consumer, who is asked to make purchase and collection decisions based on poorly represented data (see the box). Exception reporting, which highlights data outside of acceptable parameters, improved graphics to direct attention appropriately, and rapid distribution of data will all help address these issues.

Interviewees were divided on the potential and opportunity for artificial intelligence and machine learning in the WASH sector. Better machine learning and artificial intelligence have the potential to improve predictions for WASH performance, as well as projections into data - scarce settings. Others were concerned that artificial intelligence constructs developed in Europe or America would include biases and assumptions that would limit its effectiveness when deployed to the global south. Against this concern, artificial intelligence advocates felt that market forces would not permit poorly designed artificial intelligence constructs to propagate in the global south.

Others felt strongly about better application of earth observation satellites (EOS) that can provide rapid, high-resolution information from sensors/lenses about what is physically at a location and its condition. EOS can provide critical information (especially during crises) on flooding, road features, urban sprawl, etc., without bias because it's not modeled like machine learning/AI is.

Utility professionals liked the ability to create digital twins of utilities, allowing them to test new technologies, tariffs, and management approaches in the safety of a digital construct.

g) Data technology to mitigate climate change

Climate mitigation came up far more frequently than pandemic prevention in the interviews, likely because climate change is a certain and present threat, whereas future pandemics feel rarer (inshallah!). In the developing world, there are strong efforts to use data in support of anticipating worsening climate change. This ranges from GIS to improve WASH infrastructure site selection outside of changing flood plains, landslide zones, and fire risks, to drawing overlaying adjacent sectors' data sets (e.g., demography, rainfall, health care) to predict where WASH services need to be deployed. Increasing satellite resolution and frequency shows how population shifts in response to climate shocks (e.g., internal migration after a flood) will impact local infrastructure. It can highlight the likely settlement spots before disaster hits to pre-place soap, latrines, water facilities in anticipation of the coming migration. Data experts are now using climate and other data sets to identify patterns to assist WASH planning, and new technologies are improving the pattern recognition.

Interestingly, in the US, respondents indicated little demand for using data to improve infrastructure siting to reduce their vulnerability to climate change. In their opinion, the market is not valuing this type of analysis, and without the market, data providers do not have an incentive to capture the information. This may well change if insurers — pressured by increased payouts due to climate-related disasters — pressure regulators to include climate assumptions in their regulations.

What's Next?

The conversations raised more questions than provided answers, but I ended discussions with the question, "if you were the queen (or king) of data, what would you hope to see in the next five years?" I've tried to capture their responses to close to this piece.

a) Universal Application of Use Cases and Data Mapping

All respondents hoped for universal application of use cases and ideally the establishment of a standard structure to ensure quality use cases. Perhaps, along with the minimally viable data set for utilities, a minimally viable use case could be developed and insisted upon by the funders of MIS, end users, and other programs — the development agencies, governments, and foundations. And while use cases are relatively common tools in developing data systems, they are haphazardly applied in the WASH sector. This may be due to the additional work required to develop them, lack of qualified professionals to develop them, and ultimately lack of resources to fund the development. Through improved and widespread deployment of use cases, interviewees felt the sector could effectively address issues of local context, assumptions, incentives, quality, and reactivity to improved data systems. Respondents were hoping that well- architected data (or well-designed data schema) would accompany the use case development.

b) Accountability to Act

Human behavior inhibiting data usage clearly was a top priority for discussants. They hoped for governments, NGOs, and other decision makers to have clearly articulated accountability on who is responsible to react to which data. Of course, this needs to be paired with ensuring sufficient resources to respond to any issues, but clear accountability will help move the needle in sustainable WASH. Given the frequently overwhelming amount of paperwork governments are dealing with, improved automation of data collection and analysis can help in accelerating accountability.

c) Finance Data

Interestingly, no one mentioned finance data unprompted. Without finance data, the sector is missing perhaps the central issue in improving both scale and sustainability of WASH services. But when prompted, respondents hoped for improved data collection, analysis, and information on financing. This encompasses both capital investments into the WASH sector (CapEx) required to build infrastructure and support behaviors, as well as the operating expenditure (OpEx) necessary for sustainable operations. It's unclear what financial data collection tools are readily available, and it seems that many organizations are creating them out of necessity for their own programs. This leads to both duplication of effort and drifting away from standards. There will need to be work on common definitions and approaches on data collection and management.

d) Standardization vs. Local Context

Many respondents spoke of a need for standardized indicators of the JMP variety, but felt an inherent tension with also identifying locally relevant indicators, which may require bespoke indicators. There is a call for establishing global minimally viable data sets on what should be collected. This could potentially be driven by the International Standards Organization, building from existing efforts such as IBNet, WPDx, SIASAR, and others.

e) Timely, Accurate, Automated, Actionable Reporting

Respondents hope to see processes and technologies delivering timely and accurate data in a format that makes easy decision making. Without this "data-service" side to the conversation, information runs the risk of being lost in the noise of unanalyzed or poorly represented data. Automation, earth observation data, and perhaps artificial intelligence may help remove some of the friction from the data flow, but locally appropriate algorithms underlying the analytics for AI need to be developed. Or, highly adaptable systems could be constructed, enabling local permutations to be accounted for.

Conclusion

As noted in the executive summary, this thought piece captures only the surface of the conversations on WASH and data. The selection of respondents was relatively small and arbitrary, with some obvious sector professionals missing. Additionally, geographically it trended towards sub-Saharan Africa (though not exclusively), with limited input from South Asia, and none from East Asia, Central Asia, Eastern Europe, North Africa, Latin America, Oceania, or the Caribbean. Sectorally, it was also biased towards where the data are — namely primarily water supply, then sanitation, with very little on handwashing. This reflects (though unintentionally) the limited data and attention to data given by the sanitation and hygiene fields (which is also a reflection of the challenge of trying to measure sectors with a dominant behavioral component). Additional conversations should be carried out with other regions, more national representation, and many of the other voices in the field.

Many thanks to the people who gave up some of their time to help me get smarter about data, information, the challenges the sector faces, and opportunities we can act upon. Talking to the data experts combined many of my favorite things — meeting new people, geeking out on hyper-specific components of the water sector, and learning more about a topic I really should be more proficient in. The conversations were much richer than I can do justice to here, and my apologies to the interviewees for information I misrepresented or omitted from this thought piece. Any fault is entirely upon me.

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