Indo-Japan Water Quality Perceptions: An Informal Pilot Survey

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Sustaining a safe water supply is widely seen as one of humanity's great challenges worldwide, going into the future. Given that water supply availability constitutes one of the five greatest risks in the next ten years, both in terms of likelihood and impact, according to the World Economic Forum Report *Global Risks 2013* (p. 10), there is no doubt that adjustment to new hydrological circumstances will challenge socie-ties around the world increasingly. Meeting these challenges in an informed way will require vastly greater participation on the part of stakeholders worldwide in monitor-ing water quality. Meanwhile water quality monitoring activities have already been shown to be an effect-ive way for raising "public awareness and involvement in protecting water resources" (WWMC web site).[1] We would therefore like to consider the type of accessible knowledge base that will be needed globally, as well as a way in which this can be implemented.

The current project will be designed to give an open information exchange system with numerous data types and parameters. We envision undertaking a project initial-ly involving school students and eventually citizens at large in crowd-sourcing information about water quality in the two countries, India and Japan. In addition, the project is envisioned to accommo-date linking of publicly available data from official water quality assess-ments. The basic concept will entail monitoring aspects of water quality in India and Japan and putting the results on a single platform. The activities will include creating a port-al that enables recording of geo-tagged data—a place where people can submit their findings, which are then contributed via crowdsourcing to a map of water quality, and where links to publicly available water quality data can easily be added. It should be able to store and display any sort of data that is related to water quality, including either the source of water or the sink (e.g., drainage inflows of treated wastewater poured back into a river) that eventually can be analyzed.

The portal is envisioned to feature a global exchange system, accessible on any internet enabled devices. Starting with a blank GIS map as a baseline, each parameter of water quality could be built in as its own

[1] World Water Monitoring Challenge web site. Accessed on May 7, 2013 at: http://www.worldwatermonitoringday.org/default.aspx

layer, added or removed as required by any given use of the data. Various analytical tools are envision-ed, to facilitate artificial intelligence (AI) capacity. Supposing one needs to study the spread of some disease in a certain village of Bundelkhand in In-dia or waterborne contaminants somewhere near the Fukushima disaster site; such a system would allow one to compile, mix and match the information available with online data to interpolate plausible condi-tions. Eventually simulation of hydrological scenarios based in a world-wide database of information is envi-sioned, providing a graphical analysis to the researcher to ponder upon and publish results in a single place for others to take benefit from it. This could be used as a tool for estimating vulnerability in various regions to different water related environmental and social risks, in-cluding drought, flooding, disease, pollution, etc., over space and time.

In the first phase of portal development, available GIS data online and data from some official sources could be mapped, such as rainfall, water availability, major pollutants, etc. Following this phase, school children from both India and Japan could be involved in collecting and uploading data, in a second and more integral phase of the project. In preparation for school-based data collection activities, students should be primed with basic knowledge about water monitoring, its value, and methods of measuring water quality, as well as relevant information about their local environments. Involvement of teachers, students and parents should all contribute to a community acquisition of improved water literacy.

In subsequent phases active involvement of NGOs, governments and research organizations is envisioned, and the portal could serve as a passive recipient of data relevant to water availability and quality from all of these sources. The portal will be able to import any sort of data relevant to water and it will be a sandbox for water research globally.

While there is no standard platform where all data can be collected, maintained and various parameters put together, there exist various guidelines on monitoring of water quality worldwide, which may serve as a reference and springboard for considering the possible form of a water quality monitoring portal. The guidelines and pollutants differ from one place to another, demonstrating the need for a system which will overlay all sorts of data under one map and with its own AI and smart analytical tools, and upon which researchers can make various relevant inferences.

It should be able to incorporate water availability data, as well as water supply data, along with all information that one can explicitly upload about water-related problems in a given area or access from an existing government-related or other source. Water availability data, including rainfall, groundwater, riparian sources, etc., could be notated in the map separately as per official records or inputs from local actors. Water supply data, including hours per day of running tap water, tankers per week delivered in a given village, etc., can as well. Anyone should be able upload an innovative water solution that has been adapted to a location along with geotagged photographs or a video that can give better understanding. This data should be available globally for research, analysis and data sharing.

Circumstances and Parameters for Monitoring Across Regions

All sorts of basic parameters that define water quality like overland flow, dissolved oxygen, turbidity, pH, conductivity, temperature as well as the possible presence of radioactivity on the edges of streams may be considered. In imagining the sorts of water quality data to be accommodated on such a portal we examined water quality monitoring activities, taking into account selected projects for water monitoring in India, Japan, and the US, found on the world wide web. Here, a brief synopsis is given of activities in these three countries.

On the Indian Side, the following comprise Nine Core Parameters used by the Indian Ministry of Environment and Forests: PH, Temperature, Conductivity, Dissolved Oxygen, BOD, Nitrate -N, Nitrite-N, Fecal Coliform, and Total Coliform ("Water Pollution: Monitoring..."). The Clean India Programme, started by the NGO Development Alternatives, uses "Jal TARA" [water star] kits to teach young people to measure the physical parameters (pH, Temperature, Turbidity, Hardness), chemical parameters (Arsenic, Chloride, Fluoride, Iron, Nitrate, Residual Chlorine, Dissolved Oxygen, Phosphorous, Ammonia), and biological parameters (Coliform Bacteria, Benthic Diversity) of water. The government of India is trying to obtain water quality information and after extensive research, they have decided to collect and GIS map relevant water quality data for water sources as well as drains (Press Information Bureau). However integration of project generated data with state-level data in various older formats is challenged by the possessiveness of the latter ("National Aquifer Mapping – Expectations and Challenges"), which may make it difficult to understand changes over time.

In Japan, water quality monitoring is at a high level nationally, and, according to the Oyalox Clean Service Total Sanitation web site,

> "Drinking water quality standards in the Waterworks Law, Article 4, are as follows:
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> 1. Drinking water must not be contaminated by bio-contaminants or contain living matter or other materials that cause concern of pathological bio-contamination.
> 2. It must not contain cyanogen, mercury or other dangerous materials.
> 3. It must not contain more than the permitted amount of copper,

iron, fluorine, phenol, or other dangerous materials.

4. It must not emit abnormal amounts of acid or alkaline.
5. It must not emit abnormal smells, aside from antitoxin smells.
6. Its external appearance must be nearly transparent.

("Suishitsu Kensa Ni Tsuite" [*About Water Quality Testing*], translated by author)

However, on March 17th, 2011, after the Fukushima Disaster, the criteria for acceptable radiation levels in drinking water was dramatically changed from 10 becquerels to 300 for radioactive iodine and 200 for radioactive cesium (Hashimoto, 2011, pp. 23-24). According to a staff member at the City of Tokyo Water Authority, it was then set for 100 becquerels for liquids ingested by newborn babies on March 21, 2011. April 4th, 2011 was the last time radiation was detected in drinking water, and on April 1, 2014, the radiation standard was changed to 10 becquerels for all sorts of drinking water. Today, drinking water radiation is regularly monitored by a *sokutei gerumanyuumu handoutai kakushu bunseki sochi* [germanium semicon-ductor multiple analysis measure-ment instrument] which costs ap-proximately 20 million yen (roughly US$200,000; City of Tokyo Water-works staff, personal communication, May 2, 2013).

In the US, the Environmental Protection Agency gives separate water monitoring parameters for different environments, including cropland, forestry harvest, grazing land, industrial discharge, mining, septic systems, sewage treatment plants, construction, and urban runoff ("Water: Monitoring..."). Thus separate groups of parameters may need to be accommodated ultimately. The basic test kits used by the World Water Monitoring Challenge (headquartered in the US and the UK), tests for very basic parameters: pH, dissolved oxygen, temperature, and turbidity, and these are uploaded on a world map by schools from around the world. Currently, however, there is no such data from either India or Japan uploaded on their global map (see the Data Map on the WWMC web site, Footnote #1).

Considering various parameters used internationally to monitor water quality, in light of the possibility of involving students in crowdsourcing, it was deemed necessary initially to try to understand how water quality is perceived. To this end a pilot survey was conducted as a first step to better understand what Indian and Japanese people see as water quality issues in their countries. The pilot survey was informal, and conducted in preparation for further analysis of relevant questions for a larger survey to be conducted in the future.

The Current Pilot Study

As an initial step in staking out the potentially relevant aspects of water quality, we set out to understand differences in the perception of water quality among residents in the two countries. For this purpose, we began an exploratory pilot survey among students and staff where we work to begin the task of grasping what concerns people in urban India and Japan hold regarding the water they use.

Methods

A written survey was conducted among acquaintances of both authors (students or staff) in Tokyo, Japan and New Delhi, India. Five responses were obtained in each location. The five respondents from Japan included the Japan-side author and four of his students: two Japanese and two American. Only one was educated in Japan, but all four students were enrolled currently in a Japanese university, and all five were living in Japan. In India 5 people living in and near New Delhi, including the India-side author and 4 company staff living in suburban-rural areas. Among them, three respondents lived nearby and worked at same place and the remaining two lived in other areas of New Delhi. One of the people living in a rural area is a doctor. All of them were Indian citizens and residents.

Findings from Japan-side responses

Three of the five Japan-side respondents (including the Japan-side author) knew the sources of their water supply to varying degrees of certainty, and two did not know at all. One of the former group commented that she did not pay attention to her water source until the Fukushima disaster in March 2011. Of the latter group, one (American student) commented that he trusted Japan's drinking water to be safe. Moreover, the respondents expressed little concern in general with being contaminated by rain water, although acid rain was mentioned as somewhat of a concern by three Japan-side respondents (including the Japan-side author). Nevertheless, some concerns pervaded.

All five Japan-side respondents reported drinking tap water directly from drinking fountains and sinks, depending on the situation. Perceptions of water quality and safety were generally positive, with one respondent distrusting public tap water and two others commenting on a bad aftertaste. One respondent underscored his trust in Japan's water safety by pointing to its widespread public use with no evident ill effects, but one respondent expressed concern with long-term effects of drinking tap water. Two Japan-side respondents felt water needs filtering, and one did not. The other two were ambiguous about the need for filtering, viewing it as a precautionary measure and acknowledging possible contamination from older faucets.

Only one Japan-side respondent reported drinking straight tap water all the time. One Japanese respondent reported drinking tap water only in her home town, never in metropolitan Tokyo. Four of the five respondents reported drinking filtered water (self-bottled at a supermarket). Three reported using filters at home. Reasons for filtering included removing a bad taste; removing microorganisms and chemicals such as chlorine; and distrust of the government after the nuclear disaster. Four of the Japan-side respondents (excluding the Japan-side author) reported purchasing bottled water, but one just for emergency use, one for chilling the water and for the taste, and another for traveling to foreign countries. One reported drinking bottled water outside the home.

Perceptions of water quality degradation over time were ambiguous, with one (the Japan-side author) seeing dramatic change from childhood, one observing no changes, and three having some uncertainty or having been told of degradation from others. Only one Japan-side respondent had gotten sick (diarrhea) after drinking water (in a rural area), but another respondent had heard of constipateion from drinking water in a different location than one was used to.

India-side Responses

All of the respondents knew the source of their water supply with certainty. However it is concluded that people are highly dependent on government systems for the supply of their water, be it from groundwater or some fresh water source (rivers, lakes, etc.) People seem to be shifting towards private water sources both because of availability and quality.

All but the Indian-side author reported that they do not necessarily use water purification techniques for drinking water. In rural areas none of the respondents use filtration techniques. Two of them did not filter their water because they are consuming groundwater from the second stratum (typically less affected by surface impurities than the first stratum, but more expensive) and others were ignorant on this matter.

Discussion

In Japan, water quality concerns (e.g., long-term buildup of residue) were greater in urban areas, whereas in India water quality (basic drinking water quality) is a rural problem, and sometimes consumers compromise on water quality altogether in water scarce regions. One thing that can be inferred is that respondents in India have come to accept water impurities in various locations within their own region, relying on the body's ability to acclimate to local water quality. However for drinking, people tend to use a simple water filter (or purifier) if the source is not groundwater, which is generally pure. In Japan, in contrast, water consumers are more particular about water quality and more easily distrustful of slightly poorer quality drinking water. Respondents in India generally managed to secure adequate water quality in their homes. However while travelling, people tend to carry water from their homes and in other cases they purchase bottled water if they can afford it. To the India-side author, it seems villagers and farmers in India while travelling primarily trust the quality of drinking water provided by the government at train stations or fill their bottles and consume water from a local government-provisioned water supply or from groundwater using a hand-pump. In Japan, foreign travel occasions carrying a water bottle for quality and water safety, but most respondents reported they would not hesitate to drink public water in Japan.

The issue of water quality degradation got a mixed response. The India-side author saw it as degraded. In early years of his life he cared very little about the quality and source of water. But nowadays he and his acquaintances are careful about water quality, because throughout India people can, in fact, get sick from drinking water. Thus anecdotal evidence exists for water source degradation, but public perception may be a different matter.

In the future, a survey should be formalized to incorporate a large sample with a greater focus on the rural side, where availability and quality are known issues; where willingness to participate is assumed to be considerably strong; and where water supply is not regularized, as in urban areas. Furthermore, lacking water resources, many rural residents in India have limited options to obtain safe drinking water. Participants should therefore be drawn from both urban and rural locations in both countries, affording a comparative view of water quality perceptions.

Based on a better understanding of perceived water quality needs in multiple locations, a monitoring agenda can be constructed. Working with information from and in cooperation with other crowdsourcing projects (e.g., World Water Monitoring Challenge; see web site, Footnote #1), this portal can serve as a growing source of various aspects of water quality information across regions.

References

Clean India Programme. Jal-TARA Water Testing Kit. *Development Alternatives.* Retrieved May 2, 2013 asasd at: http://www.taraenviro.com/?page_id=15

Hashimoto, Junji (2011). Hoshanou Osen; Mizubusoku; Suidou Teishi: Anzen na Mizu wa Dou Kakuho Suru? ["Radiation Contaminants; Drought; Water Supply Stoppage: How Can We Secure Safe Water?"]. Tokyo: Shufu no Tomo Shinsho.

"National Aquifer Mapping – Expectations and Challenges" (2013). Journal of the Geological Society of India, Volume 81 (February), pp. 294-295 (News and Notes). Retrieved June 16, 2013 at: http://www.geosocindia.org/abstracts/2013/feb/news_7.pdf

Oyalox Clean Service Total Sanitation Web Site. Suishitsu Kensa ni Tsuite ["About Water Quality Monitoring"]. Retrieved May 3, 2013 at: http://www.ocsweb.co.jp/water.htm

"Minister for Water Resources Releases Atlas on Aquifer systems of India" (2012). Press Information Bureau, Ministry of Water Resources, Government of India (28 September). Retrieved June 16, 2013 at: http://pib.nic.in/newsite/PrintRelease.aspx?relid=88037

"Water: Monitoring & Assessment. Chapter 5, Water Quality Conditions." United States Environmental Protection Agency. Last updated on Tuesday, March 06, 2012. Retrieved on May 2, 2013 at: http://water.epa.gov/type/rsl/monitoring/vms50.cfm

"Water Pollution: Monitoring Network." Environmental Information System Central Pollution Control Board, Min-istry of Environment & Forests, Go-vernment of India. Retrieved on May 2, 2013 at: http://cpcbenvis.nic.in/waterpollution/network.htm

World Economic Forum (2013). Global Risks 2013, Eighth Edition. Insight Report. An initiative of the Risk Response Network. Accessed on May 7, 2013 at: http://reports.weforum.org/global-risks-2013/section-one/executive-summary/#read