

A Unified Vision of Innovation in Water Management

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Thank you Congresswoman Titus and Conference Chair Bennett. I am very honored to have been invited here to speak with you all today.

This is the third time I have attended the Conference. I was here in 2010 as an executive at CDM Smith and Chair of IWA's Cities of the Future Program; and again in 2013, as a Visiting Professor from the University of South Florida's Patel College of Global Sustainability.

Today, I'm here as the owner of my own firm, currently providing program management for a 150 million-gallon-per-day regional recycled water project being evaluated by the Metropolitan Water District and the Los Angeles County Sanitation District. It would provide purified water for recharging Southern California's groundwater basins – a great assignment that highlights how challenging it is to re-purpose our urban water infrastructure in on a very big scale.

Of course as you know, everything important doesn't happen at a big scale. In fact, some of the most important changes we have experienced in Southern California over the last several years have happened at the individual, neighborhood, and community scale where conservation measures, evolving societal norms (like turf isn't stylish), and changes in personal behavior have saved us from the worst of the current drought.

And while I've been working for Metropolitan and the Sanitation Districts, I have also volunteered with groups like the Council for Watershed Health and Water LA, both of which are actively pursuing fundamental bottom-up change, the micro-scale technologies that, if deployed on a city-wide scale, could dramatically change the fabric of urban water infrastructure and the role of individual citizens in its quality and maintenance.

This personal experience reflects innovation happening at two very different scales. The essential repurposing of large-scale centralized infrastructure on one hand, and the micro-scale re-invention of urban landscape, stormwater management, and the built environment – one tiny change at a time – on the other. It reminds me of the dilemma posed by Dr. Seuss in the children's book *Horton Hears a Who!*, where a sensitive elephant struggles to save the community of Who-ville, which is located on a small speck of dust balanced precariously on a clover held at the end of his trunk (Seuss 1954).

So my question to you is the following: Can we span this apparent divide between the large-scale top-down and the micro-scale bottom-up worlds of innovation to arrive at a more unified vision of adaptation and change? And can we speed up the adoption of both the top-down and the bottom-up simultaneously?

First, let me provide a definition of “innovation,” which I’ve taken from a book entitled *The Innovator's Way: Essential Practices for Innovation* written by Peter Denning and Robert Dunham. They state:

Most thinking about innovation is dominated by invention. To many, it seems that most innovations begin with a clever invention. It seems that to strengthen our ability to innovate, we need to strengthen our inventiveness by fostering climates in which creative, imaginative thinking can flourish. What if the supposition that invention causes innovation is wrong? What if our low innovation success rate is tied to our lack of clear distinction between invention and innovation? . . . Since the acid test of innovation is adoption, we have defined innovation . . . as "new practice adopted by a community." (Denning and Dunham 2010)

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That definition resonates with me because I feel that we have been witnessing the rapid development of technological inventions in water for some time. And the availability of new technologies is not the central problem confronting us – rather, it's the slow adoption of these technologies that stands as our biggest challenge. And so, I want to focus on the adoption of new practices and what we can do to accelerate that process.

Going back to my two questions: yes, I believe that we can develop a unified vision of the top-down and bottom-up activities that currently co-exist in our urban water management world. And I also believe we can speed-up the adoption of new practices at both scales, but it will require at least three significant changes in how we view water management and the processes that generate and regenerate urban infrastructure.

1. *Competition and the Optimization Trap*. The first relates to competition and what I'll call the “optimization trap.” It involves relaxing an expectation that everything we do must fit neatly into a top-down structure of cost-effective, prioritized, capital planning – resulting in a series of perfectly synchronized investments.
2. *Institutional Barriers to Change*. The second relates to standardization, regulations, and other institutional barriers to change. They all derive from important public health and environmental protection goals but can present impediments to innovation in our industry.

3. *Re-engagement of Individual Citizens.* And finally, I want to close on a less obvious requirement, the re-engagement of individual citizens in the process – the reconnection of people (including ourselves as water users) to the technologies we have been kept apart from for decades.

Let me talk about each of these separately, and let's start with:

Competition and the Optimization Trap

Now when I use the words “optimization trap,” I’m defining them as the false belief that every solution to a problem can be optimized, and no action should be taken until it has been optimized. But I’ll come back to that.

The Optimization Trap:

The false belief that every solution to a problem can be optimized, and no action should be taken until it has been.

The solutions that have the greatest potential of making us sustainable are the ones that re-connect people (all people) with the natural and technological systems that sustain everyone. As we know, our industry is comprised of many communities advocating for solutions that function within overlapping but largely discrete market sectors, that may appear, at times, to compete with one another. And certainly within the context of large utility and governmental budgetary processes, they do

compete for policy priority and public funding. There are obvious constraints on top-down funding that force us to make choices, and the need for choices force us to compete with one another – often forcing decisions and debates on choices as disparate as an elephant versus a speck of dust (where recall the entire community of Who-ville resides).

Some level of competition is no doubt a catalyst for innovation and change -- but when it appears to be a zero-sum game, that sense of competition and win-lose outcomes may exhaust our capacity to collaborate at a higher-level and achieve more rapid adoption of the innovations we are all attempting to promote. How did we get to this point?

As a nation, we have been on a long, often reactive, path towards top-down, large-scale infrastructure since the nineteenth century and before. In his often-quoted speech at the Sorbonne in 1910, where he lauded the individual citizen as the foundation of a successful republic, President Theodore Roosevelt specifically singled out water-supply and drainage as examples of societal problems best solved by government.

Individual initiative, so far from being discouraged, should be stimulated; and yet we should remember that, as society develops and grows more complex, we continually find that things which once it was desirable to leave to individual initiative can, under changed conditions, be performed with better results by common effort. . . . For instance, when people live on isolated farms or in little hamlets, each house can be left to attend to its own drainage and water-supply; but the mere multiplication of families

in a given area produces new problems which, because they differ in size, are found to differ not only in degree but in kind from the old; and the questions of drainage and water-supply have to be considered from the common standpoint. (Roosevelt 2004)

Addressing issues like water-supply and drainage from "the common standpoint" resulted in the formation of top-down functional bureaucracies that remain the primary approach taken by municipal utilities, both large and small, to this day.

And with it came a long tradition of what could be described as "utility invisibility." "We'll take care of you." "Don't worry about it, just pay your water bill." And for many of us living in urban settings no individual initiative was called for at all. We were separated from the technology and natural systems that had for centuries been a daily worry – and for most of the world's population still is.

We could easily assert that today's conditions justify an equally compelling argument that the future of water supply and drainage demands that we invite individuals back into the process. Empower them to employ technology and drive changes in values and behavior to reduce the burden on large-scale centralized infrastructure. And at the same time, enlist their help as we repurpose, re-plumb and restore the integrity of those large investments we have already made, wherever possible.

So as I was thinking about our top-down versus bottom-up innovation question, my search took me to a recently published book by two researchers at the MIT Senseable City Laboratory named Carlo Ratti and Matthew Claudel, entitled *The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life*. And they took up the question head-on:

A merger of top-down and bottom-up systems can invite wide spread engagement and mean effective implementation of solutions, ideally resulting in livable urban spaces. Pure optimization quickly becomes obsolete, but a hybrid model with a measure of chaos may be a more sustainable form of efficiency."

They go on to say:

Allowing citizen participation requires vulnerability, slackened control, and the possibility of failure. But if hacking catches on, the productive integration of top-down and bottom-up urban paradigms may yet realize tomorrow's city . . . (Ratti and Claudel 2016)

Is this an optimal expenditure of public funds? There is no optimal. If that question seems sensible to you, you may already be caught in the optimization trap. Realizing tomorrow's cities presents so called "wicked problems," that is problems that "[defy] complete definition, for which there can be no final solution, since the resolution generates further issues, and where solutions are not true or false or good or bad, but the best that can be done at the time." (Brown, Harris, and Russell 2010) And there are no such thing as optimal solutions to wicked problems. Local engagement should be encouraged and understood to be intrinsically chaotic but fundamental to shaping sustainable urban environments.

Optimization (which is enormously useful in the design of mechanical systems) requires a finite number of known variables with sufficient stationarity to allow for reasonable forecasts of their future behavior. Of course in the water management arena stationarity (as it applies to expected future weather conditions) has been pronounced “dead” (Milly et al. 2008). And consequently we should be a little suspect when it comes to relying upon the long-term forecasts that generally support our decision-making and optimization analyses. Picking winners and losers is much harder to do these days. So why do it?

Often we experience the effects of a binary win-lose world because most of what we do in the world of water, nearly everything in fact, functions within a highly standardized structure of laws, regulations, rules, ordinances, and licensing requirements.

Standardization and Barriers to Change

And this brings me to the second topic, standardization as a barrier to innovation. Of course, we're part of an industry that is already conservative and deliberately skeptical in its adoption of institutional, technological, and regulatory innovations.

Our codes and standards provide strict templates of how things should be done for protection of public and environmental health and safety. It's a triumph of Progressive Era and Mid-Twentieth Century reforms and responses to the destructive aspects of the industrial revolution. It has produced amazing benefits for those who live within its purview – and for most of the world it stands as an aspirational vision of what the future should look like. And while it has within it processes for amendments and revisions – those processes are purposely designed to work slowly and deliberately.

From something as apparently simple as a curb-cut to redirect street runoff into an infiltration basin, to the something as complicated as large-scale applications of biologically active membrane systems to produce drinking water, there is a prudently deliberate process of study and demonstration built into decisions including broad involvement of diverse and multi-disciplined stakeholders.

In that context, since it's likely we cannot (and probably should not) speed that process up too much, then we must consider embarking on more new innovation initiatives simultaneously, encouraging apparently redundant efforts to accelerate adoption in the hopes of producing sufficient numbers of acknowledged successes to meet our needs – investing in many real options for a deeply uncertain future.

It's not the optimal solution. It's the optimist's solution – someone who believes in the transformational power of disruptive innovations when they're allowed to exist. To do that we need a bottom-up revolution that will generate countless examples of both successes and failures, hopefully at a rate that keeps pace with the unfolding challenges ahead of us.

We should re-plumb and repurpose the big innovations of the past, while we encourage the viral change of individual urban hackers. Both require institutional enabling legislation and

regulations that redefine constraints designed to prevent both hazards and new technologies from surprising us.

Let me close this topic with a quote from *The Global Risks Report 2016* published by the World Economic Forum's Global Competitiveness and Risks Team.

The increasing volatility, complexity and ambiguity of the world not only heightens uncertainty around the "which", "when", "where" and "who" of addressing global risks, but also clouds the solutions space. We need clear thinking about new levers that will enable a wide range of stakeholders to jointly address global risks, which cannot be dealt with in a centralized way.

And that brings me to my final topic.

Re-engagement of Individual Citizens

We cannot ever be spectators. We must be in the arena. We must care about what we're doing. This is a subtle concept that tries to bridge the separation between the technology and the individual. It has been expressed in many different ways. Marshall McLuhan, referring to Buckminster Fuller's 1963 book, *Operating Manual for Spaceship Earth*, stated it this way "There are no passengers on Spaceship Earth. We are all crew."

And in his brilliant book devoted entirely to this topic entitled, *Zen and the Art of Motorcycle Maintenance*, Robert M. Pirsig documented his extraordinary personal and philosophical journey exploring our relationship with technology.

His story starts on a cross-country road trip with Pirsig and his son Chris on one motorcycle, and two friends John and Sylvia Sutherland on another. The narrative quickly focuses in on the differences Pirsig sees between John's relationship with his motorcycle and his own. Pirsig and his motorcycle are essentially self-sufficient (except for the occasional parts – some of which he learns to mill himself). John, on the other hand, won't touch a motorcycle except as its rider. John relies entirely on paid mechanics. Every one of Pirsig's experiences with so-called mechanics seems to make things worse. After seeing his motorcycle inadvertently damaged in the shop, Pirsig reflected on the failings of those mechanics:

At 5 P.M. Or whenever their eight hours were in, you knew they would cut it off and not have another thought about their work *on* the job. In their own way they were achieving the same thing John and Sylvia were, living with technology without having anything to do with it. Or rather, they had something to do with it, but their own selves were outside of it, detached, removed. They were involved in it but not in such a way as to care. (Pirsig 2000)

These ideas of "quality," "being crew," of "caring," and having an engaged relationship with technology and natural systems are sometimes hard to find among the users of our water products and services. It may be easier to spot in smartphones and even solar panels which are ubiquitous, sown into the fabric of our lives in new and obvious ways. Our water management

solutions, however, are designed to be invisible, taken for granted, underground and behind walls.

I saw a cartoon recently that depicted this point very succinctly. Below a hand-drawn heading stating “How we get water in our homes,” it presented a sketchy illustration of a cloud with rain streaming down on the far left side of the panel, and a tap with water running from it on the far right. And in the middle, drawn with a crude dashed line, is a large empty box, with a note attached, stating, “I don’t have any information on this bit.” I would argue most people don’t want any information on that bit – between the falling rain and the tap. And for decades, we’ve worked hard to keep it that way.

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The solutions that have the greatest potential of making us sustainable are the ones that re-connect people (all people) with the natural and technological systems that sustain everyone. Not just spectators, free riders on this spaceship, but caring, engaged participants in the real business of living on a blue planet. That means better apps, more sensors, greater dependence on crowd-sourced solutions, smaller more intimate infrastructure that is outside your back door and beside your porch, knowingly using water that might have passed through

your plumbing once before, that you understand the source of, the value of, and the personal importance of every single day.

We are among the few people on earth that have the luxury of living with this totally detached relationship to water. And have accepted the notion that everybody deserves to be detached like us. That is wrong. We’re all crew. We all need to care about the resources we employ because as Buckminster Fuller noted in his *Operating Manual for Spaceship Earth*, “no instruction book came with it.” (Fuller 1969).

As you all know, it goes well beyond seeing things in terms of “demand management,” which is an expression that reflects the perspective of a large utility manager. When I am removing my lawn and adding solar panels to my home, my purpose is to provide for my own well-being, not eliminate my demands on the power grid or various water utilities. I am doing something affirmative. I am engaging with technologies not withdrawing my demands. I am making change happen not making something go away.

And finally, think of your role and how you make change happen. Do you spend too much time on "advocacy" related to your invention, your new idea, your specialized technology, your better solution? Can we all spend more time, working with each other (yes, with our competitors) focused on the adoption of the enabling changes that could open doors to many new ideas, better solutions, and broad community transformations?

That means all of us supporting each other. It's not an either-or proposition. We've seen it happen during and in the aftermath of disasters. The coming together around recovery and

restoration of broken communities and failed infrastructure. What we put back is generally different from what preceded it. In emergencies we are often at our best.

We are in an emergency now.

Draw energy and renewed commitment from your colleagues and go home with increased confidence in (and passion for) the imperative to get things done – even if those things don't appear to fit neatly into the master plans and capital budgets of your respective organizations and employers. Be catalysts for change and the limitless possibilities that can derive from creative collaboration. Don't be content to wait in the wings. Be center stage – even if you must erect that platform yourself. Remember it's not just the scale of the fix that matters, it's also the number of times it's repeated. When every single citizen of Who-ville spoke up, even the skeptical beasts in the jungle listened and paid attention.

Thank you all very much.

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