The Exploration of Digital Public Administration and E-Government in the Management and Engagement of California's Drought

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ABSTRACT

California's ongoing drought presents definite environmental and economic implications for statewide water governance, though the extent to which political and social dynamics will change is uncertain. This uncertainty is compounded with the advent of the Internet and digital technologies as platforms for the broadcasting and administrative functions of government, as well as with the varying civic dispositions of California communities to embrace collective participation in conservation strategies.

As E-government and open data may be explored and implemented to cultivate new strategies for public engagement and drought awareness in modern governance, the perception of these tools by water agency general managers – a crucial leadership group in effectuating changes – will be vital in establishing future policy strategies and engagement campaigns.

Surveys to water agency general managers yielded overall positive perceptions of civic cohesion and digital public administration within their service districts, with relatively more positive responses reflecting optimism about civic cohesion and e-government from general managers who are newer to the field and have more familiarity with the role and their service district. These trends, along with takeaways from specific responses and areas of interest, may be able to inform scholarship and practice of public leadership and digital engagement in the context of California's ongoing drought conditions and shifting water ecology.

INTRODUCTION

California's ongoing and persistent drought has stressed the limits of the state groundwater levels, reservoirs, and water systems. The 2015 drought State Of Emergency declaration highlights the severity of the modern drought in calling all water authorities to reduce water consumption by 20% over the next ten years (California Governor's Executive Order B-29-15 2014).

As a result, California's drought-prone environment has become a proving ground for water-efficient engineering and management practice, and many of the state's largest water authorities are engaging the public to examine and implement new approaches in water savings.

California's water system faces hydrological resource contraction from increased population, environmental conditions, and failing infrastructure. While the primary benefit of technological advances can include creation of new opportunities for tracking data, they can also co-produce new methods of digital public administration and engagement.

Our research will investigate:
- **the intersection of civic cohesion and E-government as conservation tactics;**
- **how attitudes of water agency leadership towards these intersections matter in defining participatory solutions to drought management; and**
- **salient areas of future exploration for consumer-side water management interventions.**

Taken together, these three areas of inquiry form the basis for exploration of E-government digital infrastructure in consumer-side strategies for California drought management. To examine these topics, we administered surveys to California water agency general managers to gauge their perception of these topics. After establishing a literature review, we provide an explanation of our survey instrument and methodology. Lastly, our discussion section describes our three analyses of the survey and how findings may be connected to future policy suggestions. Our findings may be able to provide insight on alignment between water agency leadership and their service area constituents with E-government tools as conservation solutions.

California has a long tradition of innovation in addressing water management. In the past, solutions to water shortages have involved expansion of the water supply through infrastructure investment and expansion. California is facing a supply contraction and, unlike the past, there are no new sources of water within the greater southwest region of the United States. As the drought continues, water managers have been examining new ways to improve public conservation efforts. These concepts include the ongoing development of civic cohesion and digital social capital to empower relations between communities and their governments in making better use of available water resources. In the next section, we briefly examine California's water history and delve deeper into civic cohesion and digital social capital as water management and planning concepts.

Overview of California Water Management History

Given California's diverse topography and human geography, water management and distribution have been core public management issues for generations, with disparities in how regions across California held different levels of water saturation, storage, and runoff. Strategic planning and control of water was essential for the emerging agrarian economy of early California, which led to the establishment of a riparian water right system that granted water usage rights to the water source owner (Wiel 1979). The population growth experienced during the California Gold Rush placed further strain on water supply and prompted legislation to meet development needs, including creation of dams and reservoirs to establish new water management systems across California.

By 1900, California's water-abundant northern mining and logging economy diverged from the arid southern agricultural economy. Northern California's water support network was more conservative, focused on keeping pace with population growth, while Southern California had fully utilized the two natural water systems in the Los Angeles basin (Los Angeles River) and San Bernardino Valley (Santa Ana River). By 1905, Southern California was facing a potential water crisis to service a quickly growing population, and infrastructure projects such as the Los Angeles Aqueduct in 1913 were established to transform the region into the largest agricultural exporter in the nation. Since the 1970s, with the passage of the California Clean Water Act, there has been a concentrated effort to bring together the disparate water management systems throughout California (Gray 1993).

In the 21st century, digital- and Internet-based strategies are new mechanisms for both the management and communication of water and water-related issues. The recent drought has further transformed California's climate and prohibited ease of using distant water sources to augment the increasing limited supply of water. As a result, water agencies and municipal governments are examining the role of public participation and engagement in improving public conservation efforts as the supply of water is unlikely to increase given the current environmental conditions.

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Civic Cohesion and Digital Social Capital

As an information and communication system, the Internet contains many socialization opportunities to encourage civic engagement (Pasek, more, Romer 2009). City websites can coordinate information and activities to create opportunities for civic involvement (Kang and Gearhart 2010). In previous studies of digital social capital, Internet use as a means of information exchange held positive associations with social capital measures such as trust, engagement, knowledge, and peer network size (Shah, Kwak, and Holbert 2001). In this manner, the Internet can be a socializing tool to create a "virtual community" and foster social networks and relationships (Delli Carpini 2000).

Though the Internet has some limitations on capital development without face-to-face personal interaction, it holds significant merit as a tool to help build civic engagement and political knowledge across diverse populations as E-government strategies. E-government offers communities a chance to co-create value with public services and can facilitate engagement through competitions, mobile applications, and open-source databases (Nambisan and Nambisan 2013). Expanded technological connectivity, government application program interfaces (APIs), and other digital engagement campaigns can help citizens participate in public service innovation.

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Current efforts are evident in recent state-and local-level awareness campaigns, including the Save Our Water program from the Association of California Water Agencies and the California Department of Water Resources, the H2ouse website from the California Urban Water Conservation Council and the U.S. Environmental Protection Agency, and "bewaterwise.com" from the Metropolitan Water District of Southern California.

These Internet-based movements are representative of global shifts towards a network society (Castells 2000), in which public input is amplified through technology to create better citizen-government relationships and political legitimacy (Schellong and Girrger 2010). A networked social structure is a system that can integrate technological innovation and draw new social actors; in the context of California's ongoing drought, new structures of public engagement and participation can be especially valuable in fostering data-driven water conservation.

Digital technologies have also previously enabled peer-level comparisons of energy usage, which has been linked to behavioral changes and decreased consumption. As previous studies have examined energy usage in commercial (Orland 2014) and domestic settings (Faruqui, Sergivi, Sharif 2010), the perception of E-government and digital technology in water management can become a viable area of study. In contextualizing resource usage with comparisons to baseline and peer group levels of consumption, these efforts have been able to produce cognitive changes through increased awareness and access to information (Connolly 2012). The ongoing presence of this type of awareness and information bodes well for future monitoring and engagement.

Water agencies operate across diverse geographic and urban landscapes, and mangers within the water system may have different relationships with residents and communities within the water service authority. Understanding administrative culture is important to gauging the efficacy of E-government as a participatory mechanism for publics to engage in drought management. Other studies have examined perceptions of E-government in capacities such as privacy, efficiency, and citizen relationships (Edmiston 2003; Welch 2004; Garson 2006).

Taken together, these digital tools and strategies may have a profound impact on the future of water governance in California. Given the complex history of state and regional water management, coupled with an uncertainties arising from persisting drought conditions, exploration of how water agency managers view and consider the impact of these digital engagement and outreach tactics will be important in determining legislative and policy suggestions going forward. This report will examine the sentiment and perceptions of water agency managers regarding civic cohesion within their service district and their attitudes towards the future of E-government and public participation. In doing so, we hope to contribute to scholarship and practice for water conservation strategies across California.

METHODOLOGY

This study collected data through a Web-based survey sent to the email contact information of California water agency general managers gathered from water authorities' websites. Recipients were sent an initial invitation email, and two follow-up emails to remind them of the survey between October 26, 2015 to November 13, 2015. The study was approved by the University of Southern California Institutional Review Board on October 12, 2015. The study was introduced as a student-led project asking respondents about their perceptions of innovation in water conservation in E-government.

Questions included opinions of civic cohesion within service areas, personal attitudes towards participatory solutions to drought management, their professional and educational backgrounds, and other open response items to public-side drought conservation procedures. We e-mailed surveys to 316 public e-mail addresses and received 44 completed surveys. Our total completed response rate was 13.9%, representing 6 private water authorities and 38 public water utility companies.

Survey Instrument Measures and Format

Following is a brief introduction of each of the question groups and our rationale for their inclusion as part of the survey instrument (Figure 1). Topical areas covered perceptions of local civic cohesion, E-government, professional identity, and open-ended responses for additional feedback on previous items. The two sets of categorical ordered data were converted to numerical scores in ascending order of extent of agreement (Questions 1.1, 1.2, 1.3, 1.4, 2.3, 2.4, 2.5, 2.6) or perception of impact (Questions 1.5, 2.1, 2.2). These conversions (Figure 2) were intended to assign respondents' more positive or optimistic perceptions to the higher point values (4, 5) and more negative or pessimistic values to lower point values (1, 2), thus leading to numerical consistency in examining the two response scales.

Results may be biased as many water agencies operate in service districts that are not conducive to providing insight on the types of questions posed: districts that serve non-contiguous or wide-ranging areas, are not primarily residential, or are otherwise decoupled from contact with their service population may not have the experiential basis for answering many questions in this survey. Conversely, the survey may have been more likely to draw complete answers from respondents who have stronger relationships with their client base and may have been more familiar and predisposed to answer the types of inquires posed by the survey.

An official's familiarity with their service district may be attributed to numerous factors not examined in this study, including size of service area, client base demographic characteristics, organizational structure, or personal temperament and style of management. Thus, the responses gathered in this sample are not fully representative of the survey population, and following analyses are only meant to explore and convey value within this sample. Our analyses include (I) examination of the aggregate survey responses, (II) a sub-aggregate analysis examining responses of the specific quantifiable reported measures, and (III) a qualitative assessment of themes emerging from open-ended questions.

Figure 1: Survey Instrument Question Categories	
Civic Cohesion	This measure utilized some questions augmented from the 2006 Phoenix Area Social Survey (PASS). The PASS has been administered to Phoenix, AZ area neighborhoods with questions intended to gauge residential-level perceptions of environmental issues and traits of neighborhood cohesion. They are included in this study to assess how water agency leadership views civic cohesion in their regional service areas.
E-government in Public Participation	Questions regarding water agency managers' perceptions of E-government in public participation, were predicated on literature review regarding evolution of E-government, civic engagement as enabled by these changes, and how these coupled perceptions matter for drought conservation strategies. If continued E-government advocacy and development for water conservation is to be implemented for cities and regions across California, the extent to which they are viewed as valid strategies by water agency leadership is a necessary field of inquiry for the policy making process.
Professional Identity	Questions regarding water agency managers' professional identity, including educational history, years of service in water management, and years at current position, were included to assess how different administrative backgrounds impacted views of E-government efficacy and local civic capital.
Open-ended	Respondents were invited to share additional information and feedback about consumer-side conservation measures.

Figure 2: Point Conversions for Survey Questions						
Questions	**Responses**					
1.1, 1.2, 1.3, 1.4, 2.3, 2.4, 2.5, 2.6	Don't know	Strongly Disagree	Somewhat disagree	No opinion / neutral	Somewhat agree	Strongly agree
1.5, 2.1, 2.2	Don't know	No impact at all	A small impact	No opinion / neutral	A moderate impact	A big impact
Numerical Score	0	1	2	3	4	5

Figure 3 summarizes the average point value for each question within each category across the entire respondent sample. The majority of respondents had positive responses for all Civic Cohesion and E-Government in Public Participation questions, with highest average responses for Q1.5, Q2.5, and Q2.6 and between 69% and 98% of respondents providing positive responses (either "strongly agree or agree" or "big impact or moderate impact," accordingly). The questions with the largest amount of negative or neutral responses were Q1.1, Q1.2, Q1.3, and Q2.3. These reactions may be indicative of E-government as a generally viable policy strategy for water agencies to advocate as a means of engaging service area constituents and collaborating with other digital government strategies of state, regional, and municipal public agencies.

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Figure 3: Aggregate questions and average response score (n=44)		
Civic Cohesion	Q1.1: My organization's service area(s) are characterized by close-knit neighborhoods.	3.67
	Q1.2: Neighbors do favors for each other such as watching children or pets, lending tools, helping with shopping.	3.77
	Q1.3: If there was a serious problem in my neighborhood, residents would get together to solve it.	3.71
	Q1.4: Residents of the neighborhoods in this area do not get along.	2.07
	Q1.5: Overall, how much of an impact do you think residents can have in making the neighborhood a better place to live?	4.51
E-government in Public Participation	Q2.1: What type of impact do you think your agency is making for citizen engagement and awareness about the drought afflicting California?	4.08
	Q2.2: Based on what you know today, what type of impact will digital technology and E-government in civic engagement make in the future of water management?	3.84
	Q2.3: The rise of open and publicly available data portals is valued by residents of my service district.	3.62
	Q2.4: My agency is moving in the right direction regarding E-government and digital technologies in drought management.	3.89
	Q2.5: My agency is moving in the right direction regarding data-driven leadership.	4.15
	Q2.6: My field is moving in the right direction regarding data-driven leadership.	3.95

ANALYSIS II: SUB-AGGREGATE BY PROFESSIONAL HISTORY

To compare how respondents' professional histories informed their responses to Civic Cohesion and E-government in Public Participation survey questions, we created reference groups using information from the Professional History category, which included the following questions:

- **About how many years have you worked in public sector water management?**
- **About how many years have you worked at your current position?**
- **What is the highest level of school you have completed or the highest degree you have received? What were your fields of study in post-secondary education (if applicable)?**

Our first comparison, Comparison #1, used the sample median professional background of 20 years in public sector water management to create two comparable groups of 0-20 years of experience and over 20 years of experience (Figure 4). Our second set of comparison groups, Comparison #2, used respondents' current years at their position and the sample median position length of six years to create two reference groups of 0-6 years at their position and over six years of experience. Though the sample size is not large enough to be representative of the entire survey population, trends emerged in comparing these groups with aggregate averages that could be explored in further research. Results could be improved with additional responses to reduce bias and generate sufficient sample size for more robust statistical analyses.

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Comparison #1 yielded higher average point values through more optimistic responses* for nearly all questions among respondents who have been in public sector water management for fewer than 20 years compared to those who have been in their field for 20 and over years. While Comparison #2 featured more parity in higher average point values per question, the respondent group with more than six years of experience at the position had higher average point values for most of the E-government in Public Participation questions.

These trends may indicate that managers who are less experienced or newer to the field, as well as those who have relatively stronger familiarity with the role and their service district, may be more optimistic regarding intersections between digital technology and civic participation in regional water conservation.

In both comparisons, lower average scores from Q1.4 were treated as more optimistic responses.

Figure 4: E-government questions and responses, aggregate and sub-aggregate average comparisons by professional history	Comparison #1: Years in public sector water management		Comparison #2: Years at current position	
Questions	**Average score (n=44)**	**0-20 years (n=20)** / **20+ years (n=21)**	**0-6 years (n=21)** / **6+ years (n=20)**	

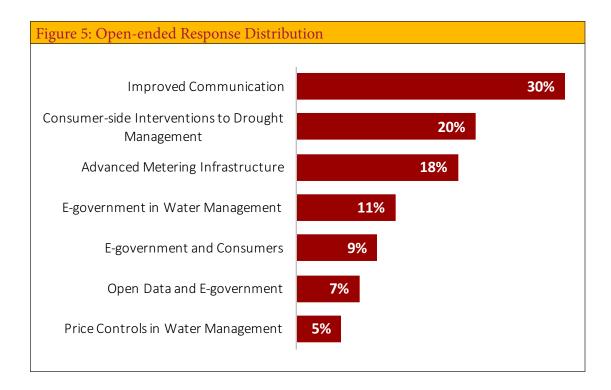| **Questions**	**Average score (n=44)**	**0-20 years (n=20)**	**20+ years (n=21)**	**0-6 years (n=21)**	**6+ years (n=20)**
Q1.1: My organization's service area(s) are characterized by close-knit neighborhoods.	3.67	**3.74**	3.63	3.60	**3.75**
Q1.2: Neighbors do favors for each other such as watching children or pets, lending tools, helping with shopping.	3.77	**3.94**	3.65	3.50	**4.00**
Q1.3: If there was a serious problem in my neighborhood, residents would get together to solve it.	3.71	**3.94**	3.54	**3.75**	3.63
Q1.4: Residents of the neighborhoods in this area do not get along.	2.07	**2.00**	2.13	2.05	**2.00**
Q1.5: Overall, how much of an impact do you think residents can have in making the neighborhood a better place to live?	4.51	**4.58**	4.46	4.50	**4.55**
Q2.1: What type of impact do you think your agency is making for citizen engagement and awareness about the drought afflicting California?	4.08	**4.11**	4.05	3.75	**4.40**
Q2.2: Based on what you know today, what type of impact will digital technology and E-government in civic engagement make in the future of water management?	3.84	**4.06**	3.65	3.84	3.84
Q2.3: The rise of open and publicly available data portals is valued by residents of my service district.	3.62	**3.63**	3.60	3.60	**3.63**
Q2.4: My agency is moving in the right direction regarding E-government and digital technologies in drought management.	3.89	**4.00**	3.79	3.89	3.89
Q2.5: My agency is moving in the right direction regarding data-driven leadership.	4.15	**4.26**	4.05	**4.26**	4.05
Q2.6: My field is moving in the right direction regarding data-driven leadership.	3.95	3.95	3.95	3.85	**4.05**

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In addition to questions regarding local civic cohesion and the role of E-government in public participation, respondents were also asked open-ended questions regarding areas of improvement for consumer-side efforts in drought conservation:

- **Where do you see places for consumer-side efforts to improve in addressing the drought?**
- **Any other thoughts you'd like to share regarding E-government and open data for better consumer-side interventions to drought management?**

The open-ended questions focused on exploring water managers' experiences around the role of technology within the water management space. The emerging areas of interest within the open-ended questions were:

- improving communication within the water authority and their service districts;
- identifying what consumers can do to improve efficacy within the water system;
- implementing advanced metering infrastructures to improve water management;
- engaging with E-government for both water management and consumers;
- embracing the role of open data as a public communication tool in response to drought conditions; and
- utilizing different pricing strategies to complement technology improvements.

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Brief syntheses of responses along these emerging themes, along with select quotes, are provided in the following pages, and highlight the diverse political and social dynamics in play with regards to improved conservation strategies. Figure 5 shows the percentage of respondents who specifically addressed these themes within the open-ended questions section of the survey.

Figure 5: Open-ended Response Distribution

Theme	Percentage
Improved Communication	30%
Consumer-side Interventions to Drought Management	20%
Advanced Metering Infrastructure	18%
E-government in Water Management	11%
E-government and Consumers	9%
Open Data and E-government	7%
Price Controls in Water Management	5%

Improved Communication

- "Continuous communications in educating the consumer is key in addressing the drought."
- "We can change water fixtures to be more efficient with water and we can provide education, but can you quantify reduction of water use from people's personal habits?"

Improved communication strategies form a natural intersection between civic cohesion and digital technology and can confer gains in digital social capital for more attuned behaviors and awareness of consumption. These recommended changes included usage of multiple channels ("web, apps, chat, text, live") in establishing two-way communications, widespread availability of automated meter information (AMI) to show people how they use water, and more information on locally sourced water sustainability and food systems.

According to one respondent, communications are key because they must stay informed in taking responsibility for their personal use and implementing specific actions for water consumption. Another respondent noted their agency is implementing "a comprehensive social norming program [to develop] conservation budget based rate structures which sends price signals to the consumer bases on their water needs."

Consumer-side Interventions to Drought Management

- "Climate appropriate residential landscaping, more widespread understanding of water use per capita per day standards."
- "There has been little effort to replace lawns with drought tolerant landscaping. More outreach needs to occur, as well as expansion of incentive programs to replace lawns."

Respondents provided feedback for consumer-side residential use, including responses about improved domestic landscaping and irrigation controls. In educating consumers about climate appropriate landscapes, water-efficient irrigation and stormwater harvesting, managers saw an opportunity to make drought-tolerant residential landscapes a more pervasive trend and call to action for constituents. In understanding appropriate irrigation needs for their specific location, communities may be able to curtail unnecessary outdoor water use.

At the same time, a respondent from a single family residential district noted that drought tolerant landscaping must enhance property appearance as barren landscapes may contribute to dust issues, losses of older trees, and undesirable 'absentee owner' appearances. Otherwise, many of the neighborhoods within this district were cited as embracing changes for more attractive drought tolerant plants.

Advanced Metering Infrastructure and Irrigation Systems

- "[Implementing] climate landscaping and related irrigations systems."

Various changes to improved AMI and irrigation systems and were seen as complements to drought-compatible domestic landscaping choices. These changes included improved automated leak detection, weather- and soil-based controls, and better scheduling of system maintenance and repairs to monitor infrastructure and preempt issues.

E-government and Open Data in Water Management

- "[E-government] is a big issue from what consumers can do to how the state regulates water distribution. This is complex and will only be achieved if everyone has the vision."
- "Open data movement in our organization, and in other areas, has improved transparency and trust and expanding open data to drought management can do the same. Open data should extend to water management, not just drought. California must re-think how we move, store, manage and consumer water."
- "My concern about consumer use of e-government and open data is maintaining its use over the long term … Use the current drought, while customer awareness is high, to affect policy and rate changes to save more water, and to support infrastructure projects."

The rise of open data portals and Internet-based tools in accessing water information received varying responses among respondents. Situating E-government and open data in context of peer comparison and benchmarking seemed to be viable strategies for how water agencies can establish meaningful behavioral changes in public consumption.

As a possible connecting point between personal statistics, including usage and finance, and their broader overall context between neighborhoods and regions, E-government and open data portals were cited as reasons for optimist in providing the sort of impactful information and feedback needed to drive short-term and long-term changes. In addition, these platforms enable transparency with regards to how a given water utility is performing in meeting the state mandates for conservation.

However, despite general support, some respondents were wary of E-government as a panacea for public participation and conservation measures, citing issues with privacy, generational divides on usage of these strategies (with higher perceived value skewing towards younger populations) and unified assessments of E-government's worth across communities. In addition, other respondents noted that digital interactions are not indicated for their older customers or rural irrigation districts where they are on a first-name basis with farming customers, as neither group has actively sought digitally-based information interfaces.

Pricing Controls in Water Management

- "Provide customers with a better understanding of water bills and the opportunity to select differing levels of water supply reliability in exchange for differentiated pricing as is common practice in the electric industry."
- "Using allocation-based tiered rates to send strong pricing signals associated with water use efficiency."
- "Most water agencies send bills out and list water use as cubic feet … It's better to list gallons on water bills. Everyone understands that!"

Different pricing structures were cited as possible public interventions, though not to the same extent as communication strategies or E-government. Respondents mentioned improved education of billing, allocation-based tiered rates, and a true value cost of water (opposed to subsidized cost).

CONCLUSION

In examining respondents within this sample, we have seen that there is little reluctance to innovation as a characteristic of the field or of their constituent publics. The generally positive attitudes associated with local civic cohesion and E-government strategies within water agency leadership may suggest that digital social capital is a valid resource for ongoing conservation strategies. Previous studies have examined if there is a perceived effectiveness gap in the perception and reality of E-participation and online engagement mechanisms (Royo, Tetano, Acerete, 2014). Our findings are consistent with previous literature regarding positive opinions of E-government as a structure of public participation.

In particular, high average values for Questions 1.5, 2.1, 2.5, and 2.6 suggest that creating additional opportunities for E-government and digital engagement strategies at a community-level scale would be valued and utilized by local residents. The higher amount of neutral or negative responses for Questions 1.1 to 1.5 compared to Questions 2.1 to 2.6 may suggest that this sample was not as certain of their constituencies' sense of civic cohesion, compared to their personal assessment of digital technology and E-government in improving communities. However, generally positive responses for each group of questions indicates optimism for civic cohesion and communication technology within agency leadership.

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This optimism is reflected in the array of responses provided in the open-response section. Given minimal direction on the type of feedback sought, this sample spoke to several areas of improvement within public-side conservation efforts. While there are some perceived issues as noted in Analysis III, the consistency with positive answers from the preceding questions may suggest that several service districts with constituencies who value civic cohesion would benefit from ongoing development of data-driven E-government conservation strategies.

The significant findings of this study are as follows:

- **The sample population was optimistic of the strength of civic cohesion in their service districts and viewed E-government, open data, and digital communications strategies as viable tools in helping communities navigate California's drought.**
- **This optimism was greater in managers who were newer to the field of public sector water management (less than 20 years) and more experienced at a given role (6 and over years).**
- **Other consumer-side efforts are wide-ranging and included improved communications strategies, personal landscaping, and the ongoing evolution of E-government to contextualize water usage.**

This study is intended to highlight how California's water leadership views the propensity of their service area's residents towards civic participation and how these perceptions may be connected to E-government strategies in drought management. While survey results are not indicative of the entire sample population, they provide insight into current practice and perception of E-government as a tool in promoting civic cohesion within water conservation.

Improvements in communication technology have allowed e-government to be an engagement portal in addition to a service delivery mechanism. In aggregating public information and engagement opportunities, governments and water agencies are at opportunity to elevate local political behaviors and attitudes towards consumer-side drought management.

BIBLIOGRAPHY

A., Schellong., P., Girrger. (2010). Government 2.0 in Beta Phase: An Analysis of eParticipation and Web 2.0 Applications of Germany's 50 largest Cities and 16 Federal States. *CSC Public Sector Study Series.*

A. Faruqui, S. Sergici, A. Sharif. (2010). The impact of informational feedback on energy consumption—a survey of the experimental evidence, *Energy*, 35:41598–1608, http://dx.doi.org/10.1016/j.energy.2009.07.042, http://www.sciencedirect.com/science/article/pii/S0360544209003387.

Castells, M. (2000). Toward a Sociology of the Network Society. *Contemporary Sociology* 29:5, 693-699.

Connolly, T., Boyle, E., MacArthur, E., Hainey, T., Boyle, J. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education* 59, 661-686.

Delli Carpini, M. X. (2000). Gen.com: Youth, Civic Engagement, and the New Information Environment. P*olitical Communication*, 17 (4), 341-349. http://dx.doi.org/10.1080/10584600050178942

Edmiston, K. D. (2003). State and local E-government – prospects and challenges. *American Review of Public Administration* 33(1), 20-45.

Garson, G.D. (2006). Public information technology & e-governance: Managing the virtual state. London: Jones & Bartlett Publishers.

Gray, B. (1993). "The Modern Era in California Water Law." Hastings LJ 45: 249.

Nambisan, S., Nambisan, P. (2013). Engaging citizens in co-creation and public services: lessons learned and best practices. *IBM Center for the Business of Government, University of Wisconsin-Milwaukee.*

Orland, B., Ram, N., Lang, D., Houser, K., Kling, N., Coccia, M. (2014). Saving energy in an office environment: A serious game intervention. *Energy and Buildings* 74, 430-52.

Pasek J. , more e., Romer D. (2009). Realizing the Social Internet? Online Social Networking Meets Offline Civic Engagement, Journal of Information Technology & Politics, 6:3-4, 197-215, DOI: 10.1080/19331680902996403

Shah, D., Kwak, N., Holbert, R. (2001). "Connecting" and "Disconnecting" With Civic Life: Patterns of Internet Use and the Production of Social Capital. *Political Communication* 18:141–162

Welch, E., Hinnant, C., Moon, M. (2004). Linking Citizen Satisfaction with E-Government and Trust in Government. *J Public Administration Research and Theory* 15.3, 371-391.

Wiel, S. (1979). Water Rights in the Western States. Vol. 1. Arno Press.

Zhang, W., Gearhart, S. (2015). The Effects of Internet Use and Internet Efficacy on Offline and Online Engagement. *Online Journal of Communication and Media Technologies* 5.4.

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