Engaged Scholarship as an Alternative to Public-Private Partnerships

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Public-private partnerships enable the private sector to provide service that would otherwise fall under the responsibility of the government. Proponents argue that they enable the public sector to harness expertise and efficiencies that would be otherwise unavailable or cost-prohibitive. While this approach has its benefits, there is a potential misalignment between the goals of the public (public good) and private (maximizing profit) sectors. An alternative approach is to engage the academic community in public-*public* partnerships. Such partnerships could allow state-of-the-art technology to be deployed and refined quickly with community input and widely disseminated to others. Such an approach enhances both the speed and reach of emerging technologies from the lab to the community. The current paper explores this idea through a case study of FloodRISE, a UC Irvine-led research project, supported by the National Science Foundation, to promote resilience to coastal flooding in Southern California. FloodRISE uses advanced computer models to map flood hazards on a parcel level and communicates it to community stakeholders through innovative strategies. Findings aim to not only meet the immediate need of the partner communities but also to provide generalizable tools, models, and strategies for use in flood sensitive communities throughout the world.

Introduction: Public-Private Partnerships

Governments are facing increasing pressures to provide more and more services to the public with less and less available resources. Citizens continue to demand more services at faster rates from the government at a lower cost. There are immense expectations for the government to provide these services to their people and to keep the confidence in the government at a high level. For example, in financing climate change adaptation efforts, from local community outreach to major infrastructure improvements, "calls for creative sources of funding to stretch local government's limited budgets" (California Adaptation Forum, 2014).

One of the ways to alleviate this pressure on the government is through development of a Public-Private Partnerships (PPP). A basic definition is "a cooperative venture between the public and private sectors, built on the expertise of each partner, that best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards" (Canadian Council for Public-Private Partnerships, 2015). Common examples include provision of utilities (e.g., electricity, water, waste management) and transportation, with governments contracting to the private sector to build roads and provide public transportation options for the public.

Such partnerships can "take various forms and include both collaborative (non-legal binding) or contractual (legally binding) agreements" (NASCIO, 2006, p. 3). One key distinction of PPPs is the way that risk is transferred between partners (NASCIO, 2006). Typically, a private entity would be fully responsible for the risks associated with their investment but often in the case of PPPs, the public entity retains some responsibility for providing the contracted public good and therefore both risk and responsibility are shared. Even if a project or service does not make a profit from sales alone (e.g., Amtrak), it may still be in the public interest to provide it and therefore alternative funding models are common.

Advantages of Public-Private Partnerships

Public-Private Partnerships allow the private and public sector to work together and use their resources and expertise to provide services to the public. Three primary benefits that PPPs provide are expertise, economies of scale, and economies of scope.

Expertise is the most commonly cited benefit of Public-Private Partnerships. "Partnering with the private sector can afford government access to technical expertise and established networks for complementary resource sharing" (Brinkerhoff & Brinkerhoff, 2011, p. 5). This is especially the case in specific fields such as information and communication technology (ICT) where a high level of expertise is needed to provide successful service (Bovaird, 2004).

PPPs can also create economies of scale (Bovaird, 2004), when a single private entity can provide a similar good or service across jurisdictions at a significant cost advantage. With a lower cost of individual production, the private sector can afford to provide goods and services for a cheaper price, resulting in better prices for the public. Such a partnership may allow for more efficiency than a system in which each individual government provides a similar service.

Furthermore, PPPs can provide economies of scope as they take advantage of the resources, capabilities, and competences of the partner and increase the variety of services provided. This creates a decrease in cost of production while providing more variety for the public (Bovaird, 2004). Brinkerhoff and Brinkerhoff (2011) describe PPPs as promoting businesslike practice and thinking, including bottom-line enforcement mechanisms and competition. It is important to note that this is based on the belief that "the private sector is inherently 'better' at management than the public sector" (p. 5).

Disadvantages of Public-Private Partnerships

Although public private partnerships have become around for decades and are becoming more and more common in the 21st century, issues remain. Most of these stem from the differing goals of financial and public good (Bovaird, 2004). While a private entity may provide goods or services that meet the public good, its primary responsibility is to its shareholders and its primary goal is profit. Alternatively, the primary responsibility of a government entity is to its citizens and its primary goal is serving the public good. When the two come into conflict, this may cause issues for both the private and public entity involved in such a partnership.

In some cases, it is the private sector that has more to lose, due to the transfer of risk from public to private sector. Grimsey and Lewis (2002) evaluate the risks associated with public-private partnerships, including technical, construction, environmental, revenue, financial, and regulatory/political specifically related to public infrastructure facilities (e.g., freeways, toll roads, dams). For private partners, these risks are primarily financial in nature. The greatest risk for a private partner is that revenues do not materialize or meet projections and there is also a "risk of losses arising from a changing political climate toward the provision of public services by the private sector" (Grimsey & Lewis, 2002, p. 111). However, the types of goods and services provided by PPPs are not those that the public sector can typically afford to let go so they often share risk with private entities and subsidize projects, as needed, so as to continue service. The greatest risk to the public sector is that private entities may value profit over quality of service and that the overall quality or equity of service provided will falter when put in conflict with a profit motive. This may actually be the case for some PPPs but even for those that are maintaining a high standard of quality, the public perception may remain that the government is "selling" services that it is their own responsibility to provide, thus eroding public confidence.

The University as an Alternative

Partnerships with universities may be able to address some of the above risks while still meeting the key roles of PPPs (e.g., leveraging expertise and allowing economies of scale and scope). When a university partners with the government, there is a flow of resources and information to the government that may otherwise not take place. Universities, by their nature, are home to some of the most highly trained experts in a region. They recruit and attract scientists into faculty and research positions and provide them with the infrastructure and administrative capacity to manage both basic and applied scientific endeavors. Faculty at research universities are promoted based on the breadth and depth of their scholarship and expertise and therefore they are incentivized not only to conduct as much research as possible, but to conduct high quality and rigorous research. And they are often among the leading experts on a topic - who better to work on issues related to prison overcrowding than a leading scholar who has studied prison populations for decades?

In addition to expertise, the primary mission of university research (to create and disseminate knowledge) lends itself quite well to both scale and scope. While solving a problem for a unique community requires attention to and partnership with that community, the goal of science is to determine what can be known and inferred beyond the specific case and these insights are often published and shared writ large with the global community. As such, solutions gained within one government or community partnership can have benefits that scale to many others across the country and world. Understanding what is unique and what is scalable about a program is a key issue for applied scholars and public partnerships ensure that scientists are able to test the practical validity of their theories and lab findings in the real world.

While such engagement is obviously not appropriate for all types of PPPs (one could not imagine a university providing services such as waste management), the University may be ideally suited to help improve the efficiency and effectiveness of services via research and community engagement practices. These can offer parallel benefits to those of PPPs and/or may be able to increase the efficiency of production such that government are better able to offer services internally without engaging private partners.

Engaged Scholarship

Engaged scholarship is a form of collaboration between a research university and the community that integrates their different perspectives and helps generate functional knowledge for both. In recent years, there has been an incrementing concern amongst management scholars and organizational communication researchers, in regards to the relevance between research and informing practice, as well as, influencing the community (Barge & Shockley, 2008). Therefore, the identification of community engagement as a fundamental mission of higher education is increasing (Gelmon, 2013; Barge & Shockley, 2008; Small & Uttal, 2005). Engaged scholarship is one way of bridging the gap between theory and practice, that will allow for research to be relevant to organizations within the community.

Engaged scholarship can provide similar benefits to those of PPPs while addressing inherent issues of such partnerships. For example, the university holds as a basic value extending its epistemology and methodology to benefit the community. University students benefit because they are able to assess contemporary critical problems and learn how to address them. They are able to participate, assist, organize, reflect, and contribute in a meaningful way to the long-term goal of the project (Peterson, 2009). As a result, students are able to develop problem solving skills "in action", along with emotional and social development (Peterson, 2009).

The public may benefit from engaged scholarship through of the resources provided, change implemented, and innovation in services. Additionally, leveraging the reputation of universities can increase public confidence in governmental partnerships. Scientists are often ranked among the most trusted individuals to the public and, as such, may be seen as a more trusted partner for public services than a private partner.

While there are several key benefits to university partnerships, they are not without their concerns and obstacles. Jacobs (2003) argues that while the university is an ideal venue for developing solutions to pressing social issues, they may not be ideal for active engagement with the outside community. Reasons for this include a dependence on grant funding to sustain active projects and the wide use of graduate students, who typically leave after a few years, reducing the institutionalization of knowledge over extended periods of time. Additionally, the departmental structure within the university often prioritize single-discipline contributions over applied interdisciplinary projects such as those needed to solve complex social issues and the incentive structure does not actively reward participation in applied settings or translation of scientific findings outside of the academic community (e.g., journal articles, conferences).

The Role of Boundary Organizations

When establishing a partnership between the university and the public, effective collaboration must be achieved so that both parties benefit. Due to potential misalignment of goals (as discussed above), some have suggested the development of *boundary organizations* to help translate between university research and community stakeholders. A boundary organization is a formal structure designed to enable better information exchange between scientists and the community they aim to serve. Thus, they serve at the boundary between scientists and

community stakeholders to ensure that the goals of one mutually reinforce rather than undermine the goals of the other (White et al., 2008).

Boundary organizations serve a key role in both translation and mediation between producers of information and their users (Feldman & Ingram, 2009). Translation is an aid to network communication by taking the technical difficult to understand jargon and turning it into useful information for users and public. Mediation refers to activities that "provide common vehicles for conversations and training and for tailoring information to specific applications" (p. 15). So they are intermediaries between two groups, mostly between scientists and decision makers. Boundary organizations help to overcome the "loading dock" model through their translation function. They do this by converting technical, scientific, and technological jargon into information that is usable by decision makers or the intended users.

Much of the literature on boundary organizations assumes a clear-cut distinction between science and policy. However, the university-based boundary organizations are best understood as working in a hybrid space where science and politics co-mingle. Furthermore, they take the perspective of "stakeholder" and often include non-academic staff trained in public policy, urban planning, and non-profit management. "In this context, boundary management is not the act of stabilizing the 'boundary' between abstract sets of principals in either the science and policy domains. Rather, it is a continuous process of negotiating multiple tensions deriving from inconsistent sets of demands placed on the boundary organization by multiple, diverse stakeholders" (Parker & Crona, 2012, p. 6)

The success of a boundary organization can be dependent on several key factors (Feldman & Ingram, 2009). The first is leadership - someone who is able to incorporate the knowledge, skills, resources, and perspectives of their organizations and the groups and other

entities they serve. The second is funding – stable funding will give long-term stability and trust by enabling researchers to focus on user needs over a long time and allowing decision makers to develop confidence that researchers will be around awhile to work with them. And the third is integration – they need people who can bridge different ways of knowing about issues. For example: managers and decision makers with particular training in science, or they can be scientists who are good at communication.

Boundary management can be made more effective through a set of key practices. These include strategic timing and by being explicit with stakeholders about when their demands will be addressed. Organizing focus groups with each stakeholder group to examine what it desires and expects is another best practice. Additionally, ensuring that there are key advisors from both scientific and community groups is vital. Such practices can increase not only the effectiveness of the boundary organization, but also its legitimacy to the communities that it aims to serve.

Case Study: Flooding and the UCI FloodRISE Project

Climate change presents governments both local and national throughout the world with a unique and increasing set of environmental challenges for which many are ill-prepared to address. The International Panel on Climate Change Fifth Assessment Report (2013) describes our planet as having already undergone unequivocal and profound changes, unprecedented over decades to millennia. Global sea levels are expected to rise on the order of 0.5–1 m by 2100, and financial impacts to coastal cities of US$1 trillion per year are a possibility by 2050 as a consequence of socio-economic and climate change (Hallegatte et al. 2013).

People experience the environment as a hazard only when it intersects human populations carrying on activities, possessing wealth, and having values (Kates, 1976). Flood risk is expected

to be amplified due to climate change impacts including sea level rise, and change in rainfall patterns and storm frequency. Floods affect natural and built environments and pose a human health risk, representing one of the most hazardous environmental risks of our time (Miceli, Sotgiu, & Settanni, 2008). The present day 100-year coastal flooding event is expected to become an annual occurrence by 2050 (Tebaldi et al., 2012).

Not only is flooding an economic peril, but a threat to social well-being and lives, particularly the residents of the rapidly expanding towns and cities in developing countries (Jha, Block, & Lamond, 2012). Successful implementation of flood risk management and emergency preparedness measures have resulted in a decrease in immediate loss of life from flooding, however, fatalities still remain high in developing countries where flood events have a disproportionate impact on the socially disadvantaged (Jha et al., 2012). Risk can be mitigated by engineering but, still, lack of preparedness can result in great damage and loss, especially in urbanized areas where development can marginalize residential location, often on the fringes of a flood plain (Fatti & Patel, 2013).

Traditional Relationships in Flood Management

Floodplain management engages "complex web" (Morss, Wilhelmi, & Downton, 2005) of local, regional, state, and federal government employees; elected officials; private consultants; professional associations; private businesspeople; and members of the public. Specifically, decision-makers in flood management range from local community floodplain managers to Federal Emergency Management Act (FEMA) employees to private sector engineering consultants (p.1595).

Jha et. al (2013) explains an integrated flood risk management approach to be a "combination of flood risk management measures which, taken as a whole, can successfully

reduce urban flood risk" (p. 32). Traditionally, floods are managed through structural and non-structural controls. Structural controls, measures such as hard-engineered (p.32) or natural buffers, often redirect flood waters. Non-structural controls reflect measures that help to build capacity of the people living in flood-prone areas to cope with flooding. Structural controls are highly effective but are often accompanied by environmental concerns and high cost. Implementation of non-structural controls involve a communication process with stakeholders that is often time consuming and requires a large investment (Jha et. al, 2013).

Many actors participate in the implementation of both structural and non-structural controls and policy-making process such as public servants, politicians, business and private householders. In England, for example, Thaler & Priest (2014) have observed flood management shifting to a more partnership-oriented governance. In integrated flood risk management, many of the different actors may display a strong interdependence of interest, which could be beneficial in meeting the local's needs while meeting federal standards. With many parties involved, conflicts can be provoked.

There are several examples of how the public and private sector play a part in flood management and address flood hazards through an integrated approach. In the United States, FEMA is the leading flood management agency. FEMA helps to plan, prepare, and mitigate before, during, and after disasters (FEMA, 2015) as observed in major events such as Hurricane Katrina, and more recently, Hurricane Sandy. However, the recovery of areas after hazards are dependant on the many factors, include condition of flood control infrastructure and suitable planning, and are shared among many agencies and organizations. In addition to providing flood insurance, both public and private sectors also play a role in developing computer flood modeling to estimate flood hazards for hazard planning.

Flood insurance may help to cover damages from flooding, but only residences in the FEMA designated flood zone are required to purchase flood insurance. Other residences may be left unprotected after flooding (Wetmore, 2007). The National Flood Insurance Program of FEMA distributes insurance through private insurance companies, and they usually have low uptake but high premiums. According to Crichton (2008), "The program lost $23 billion after Hurricane Katrina. It suffers badly from adverse selection and would not be able to operate in a free market for very long" (p.586).

Despite the multiple roles shared by public and private entities, according to Arceneaux (2006), when disasters strike, people tend to hold local government responsible. Citizens expect emergency services delivered and will evaluate local officials on how situations are handled (p. 44). Despite the official role of FEMA, attribution of responsibility can be shared. Crichton (2008) argues that by enhancing structure controls such as making accurate assessments and building infrastructure accordingly could reduce potential damage. However, lack of community participation, high costs assessments, and failure to tailor national policy with local circumstances become challenges for both public and private sectors in hazard planning (p. 589).

FloodRISE

FloodRISE (Resilient Infrastructure and Sustainable Environments) is an interdisciplinary project funded by the US National Science Foundation (NSF) to study the communication of advanced flood model simulations to a range of decision-makers with the goal of enhancing flood risk planning and policies and promoting cost effective interventions. Research takes place in the lowlands surrounding the largest estuaries in Southern California: Tijuana River and Newport Bay.

FloodRISE seeks to understand what factors and conditions allow parcel-level prediction of urban flooding to catalyze behavioral change in flood vulnerable communities. It is hypothesized that a parcel-level flood prediction model, coupled with transformative communication strategies, is a more powerful tool for people to understand vulnerability, visualize flood risk, and plan for future hazards than coarse-level modeling conveyed via a singular disaster narrative. To test this hypothesis, this project focuses on the two largest estuarine systems in Southern California, a region where the damages from a major flood are expected to be greater than from a major earthquake of the same probability, and one to which national sea level rise studies point as being among the most likely to experience increased flooding.

The project convenes an interdisciplinary team of researchers and a broad range of stakeholders and partners to understand the type of flood risk information that is needed to catalyze behavioral change. The members of the research team cover the fields of hydrology, civil engineering, urban planning, economics, policy, communications and social psychology with experience in community engaged sustainability scholarship. FloodRISE is comprised of three teams: the modeling team, the social ecology team, and the integration and impact team. A brief description of the role of each team follows here.

Modeling Team. The modeling team specializes in environmental hydrodynamics and has been at the forefront of flood modeling and water quality research in California, most notably in previous NSF-funded flood modeling work. This prior support has enabled this team, led by Principal Investigator Brett Sanders (Engineering) to develop a flood model that predicts location, depth, and speed of flooding at a resolution in the range of 2-10 meters in urban areas.

Social Ecology Team. These models will only be useful in flood planning if they are designed and presented in a way the public can interpret and use. Therefore, the project has a social ecology, led by co-Principal Investigator Richard Matthew (Political Science) working to examine the root causes of flooding challenges within the test communities to develop solutions leveraging the these models to empower and protect communities. After identifying community needs via a series of interviews and focus groups, they will focus on communicating flood modeling to stakeholders based on theories of science communication and social psychology. Co-Principal Investigators in urban planning, GIS, water policy, and economics are developing baseline studies on policy, risk perception, and economic evaluation to inform ongoing program development.

Integration and Impact Team. Finally, the integration and impact team serve as the boundary organization for the project, balancing the scientific goals and needs of the project with the goals and needs of the communities they aim to serve and community partners they work with. The team integrates the project across discipline, activity, and field site and includes members who provide stakeholder management in both study sites. They manage communication between science and practice so that the insights derived from both are mutually beneficial and further both the scientific and the practical goals of the project.

Preliminary findings. To test the underlying hypothesis of the project (e.g., that improved modeling will aid in public perception and response to flooding) and also to better understand public perceptions of flood risk in the target community, the team carried out a household survey of flood risk awareness in Newport Beach, California. Figure 1 shows two flood maps of the 100-year flood zone that were prepared for respondents: the FEMA Flood Insurance Rate Map (FEMA Map), where the flood zone appears as simple binary classification,

and a map developed by the research team that displays find-scale differences in flood depth (UCI Map) predicted by a 3-m resolution hydraulic model (Gallien et al. 2011). During the survey, respondents were given a tablet device with an interactive flood map viewer and randomly assigned to examine one of the two maps in detail. To measure the effectiveness of each map as a flood risk communication tool, respondents were also asked to rate their level of awareness of flood risk before and after viewing the flood maps. Results indicated differences in the effectiveness of the UCI and FEMA maps at communicating the spatial distribution of flood risk, gender differences in how the maps affect flood understanding, and spatial biases in the perception of flood vulnerabilities.

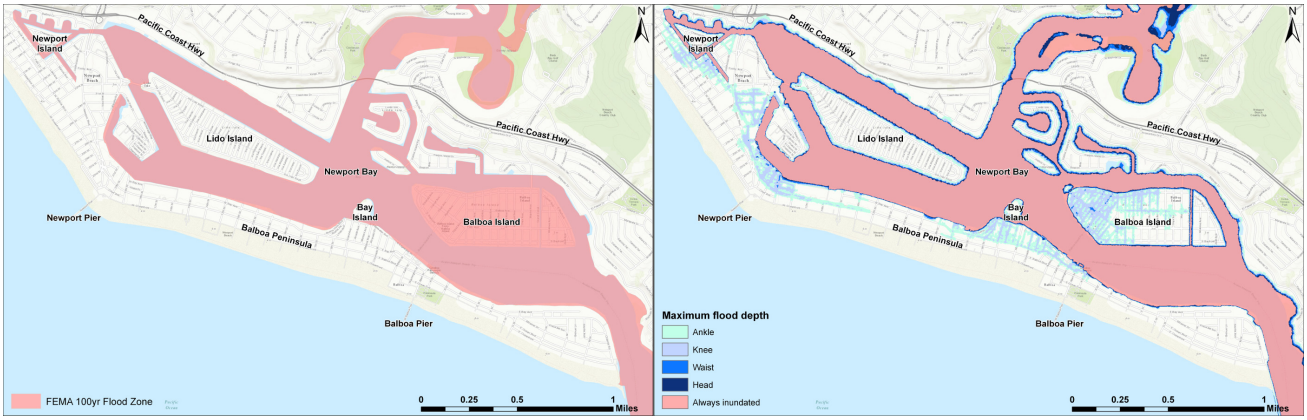

Figure 1. Flood maps of Newport Beach, CA produced by FEMA (left) and UC Irvine researchers (right).

Projected Outcomes. As engaged scholarship, this project has both intellectual (scientific) and applied (community) outcomes. Scientifically, the project aims to foster innovative interdisciplinary science that builds a broad knowledge base for flood resilience, may reveal a strategy for more effectively translating climate science into actionable information to catalyze behavioral change, and will advance understanding of whether and to what extent parcel-level flood data can contribute to more flood resilient communities.

Broader impacts are inherent to the research approach. The flood model is a cutting edge decision-making and planning support tool for understanding, visualizing, and adapting to flood risks at the parcel level. The project aims to accomplish the following goals:

1. Use the flood models to evaluate resilience options with community stakeholders
2. Train hazard practitioners through workshops that facilitate two-way communication
3. Inform local climate action planning through targeted infrastructure recommendations
4. Present lessons learned to national and global climate action planners
5. Train emerging hazards scholars through a specialized education programs
6. Deliver teacher training and bilingual education for adults in vulnerable communities
7. Maintain a website to disseminate research and education materials to external audiences
8. Inform national security by encouraging the model's use in other vulnerable locales

As a whole, the project aims to both serve an immediate need in California and Mexico and also lead to far-reaching insights that can help flood resilience throughout the country and world.

FloodRISE as an Alternative to Traditional Flood Management

Coastal communities around the world face significant and growing flood risks that require an accelerating adaptation response, and high-resolution urban flood models could serve a pivotal role in enabling communities to meet this need. Such models depict impacts at the level of individual buildings and land parcels - the same spatial scale at which individuals are best able to process flood risk information - constituting a powerful tool to help communities build better understandings of flood vulnerabilities. Additionally, these models are dynamic and interactive, which allows communities to identify and test cost-effective interventions within the model before making costly infrastructure decisions.

Models are costly, demand large data, and are by their nature, uncertain (Jha et. al, 2013). Local floodplain managers, for example, must act within federal, state, and local regulations and guidelines, and their capacity to incorporate new science and technology is limited by the

technical ability of the private consultants who provide most of their flood-risk estimates (Morss, 2005). Within FloodRISE, however, there has been exciting progress in the development of flood simulation tools for visualizing flooding scenarios, notably metric resolution dynamic models that are tailored not only to the geometrical complexity of urban infrastructure but the numerous drivers of coastal flooding including extreme high tides, waves, rainfall and watershed runoff (e.g., Gallien et al. 2014). This has resulted from an explosion of new data sources available to flood modelers (aerial and terrestrial lidar scanning data, shapefiles containing infrastructure data, etc.) as well as improved simulation algorithms and high performance computing systems (e.g., Bates 2012, Sampson et al. 2012, Sanders et al. 2010, Schubert & Sanders 2012).

Thus the University is providing a resource to both community field sites (Newport Beach and the Tijuana River Estuary) to help inform their floodplain management efforts. Moving into the future, without these parcel-level models, these communities may have either continued to rely upon broad FEMA maps for planning, less advanced flood models provided by private consultants, or due to the cost, employed no models at all.

FloodRISE also presents an alternative way to provide "non-structural controls" to the the two partner communities. The projects' three-team structure seeks to ensure research impact on society, both through direct service and through creation and dissemination of scientific knowledge. Within the two field sites, FloodRISE can serve an additional non-structural control to build capacity of the people living within the two target communities Since it also serves a scientific goal, they are able to justify the time and financial expense of extensive data collection needed to understand and incorporate community voices into the process.

The UCI FloodRISE project has the potential to serve a leading role in developing new models for applied university research, enabling a enduring and sustainable impact on some of our most pressing issues. We look forward to following its continued growth and impacts in the months and years to come.

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