



Enabling and Sustaining Connected Communities Rooted in Solving Societal Challenges

TECHNICAL APPENDIX

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Mellon
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Appendix A: Workshop Questions and Content

During the in-person workshop, participants were assigned to one of five groups (Groups A-E) during breakout sessions. Each of these groups participated in a facilitated discussion and notes were recorded by a scribe. Facilitators led their group through 40 minutes of discussion guided by open-ended questions and then transitioned to 20 minutes generating input for how the National Science Foundation and other actors could improve connected communities projects. Below are the questions that guided each discussion.

Breakout Session 1: Enabling Connected Communities Beyond Pilot Projects

Discussion

1. What are examples of “state of the art” for deployment projects that have been scaled or integrated successfully? What are key ingredients that made them successful? How can we move technologies from controlled demonstration to real-world deployment?
2. What technologies are ripe for deployment?
3. How do we plan for and learn from cases in which technology deployments stop working or do not accomplish their goals?
4. How can we better communicate the results of both successful and unsuccessful technology deployments to relevant stakeholders so they can make informed decisions about what to try in their communities?

Input

1. What input do you have for NSF to help enable connected communities technology beyond pilots?
2. What are the transformative and incremental research gaps that need to be filled to enable connected communities beyond pilots?
3. Who should be involved in enabling connected communities beyond pilots, and what should their role be?

Breakout Session 2: Matching Community Needs With Technology Solutions

Discussion

1. How can we better match community needs to technology solutions? Who should be involved in matching communities with technologies, and vice versa?
2. What can funders and academic institutions do to better match researchers with communities that can benefit from their expertise?
3. When deploying a new technology, how can we build or re-establish trust with communities when previous technology investments have not provided expected benefits?

Input

1. What input do you have for NSF to help match community needs with technology solutions?
2. What are the transformative and incremental research gaps that need to be filled to help match community needs with technology solutions? Is there research from other disciplines that should be incorporated in this work?

3. Who should be involved in matching community needs with technology solutions, and what should their role be?

Breakout Session 3: Designing, deploying, monitoring, and evaluating technology to ensure effectiveness, efficiency, and equity

Discussion

1. What digital and physical infrastructure needs to exist for connected communities technologies to be deployed successfully? What human capacity is needed to build, maintain, and expand such infrastructure?
2. What are the unique challenges to deploying technology in different types of communities (for example, rural, urban, suburban, or indigenous)? How can we ensure that communities have equitable access to connected communities technologies?
3. What are the legal and policy factors that impact whether a technology can be deployed successfully?
4. How can we better understand how the success of technologies varies with existing infrastructure, legal and policy environment, and community context?

Input

1. What input do you have for NSF to support improving the way technology is designed, deployed, monitored, and evaluated?
2. What are the transformative and incremental research and infrastructure gaps that need to be filled to improve how technology is designed, deployed, monitored, and evaluated?
3. Who should be involved in the design, deployment, monitoring, and evaluation of technology, and what should their role be?

Breakout Session 4: Managing, sharing, and analyzing data to enhance communities' quality of life and protect privacy

Discussion

1. How do we ensure that governments and their partners have access to and can share the data they need to monitor and evaluate the impact of connected communities technology?
2. What laws and policies are conducive to securely collecting, storing, sharing, and analyzing data generated by these technologies?
3. How can we provide transparency about and accountability for how data is used and ensure that community members have recourse and influence with respect to how data is used?
4. How do we ensure that governments have the technical and skill capacity to securely collect, store, share, and analyze this data, and that the data can be integrated with data from other sources?

Input

1. What input do you have for NSF to help improve data collection, management, sharing, and analysis?
2. What are the transformative and incremental research and technical gaps that need to be filled to improve how data is collected, managed, shared, and analyzed?

3. Who should be involved in deciding how data is collected, managed, shared, and analyzed?

Breakout Session 5: Key findings and input

1. What input do you have for NSF to support integration and scaling of connected communities technology?
2. What are the transformative and incremental research gaps that need to be filled to integrate and scale connected communities technology?
3. Who should be involved in integrating and scaling connected communities technology and what should their role be?

Appendix B: Notes from Workshop

During the in-person workshop, participants were assigned to one of five groups (Groups A-E) during breakout sessions. Each of these groups participated in a facilitated discussion and notes were recorded by a scribe. Facilitators led their group through 40 minutes of discussion guided by open-ended questions and then transitioned to 20 minutes generating input for how the National Science Foundation and other actors could improve connected communities projects. Findings from breakout sessions were reported by each group to all participants in a general session. Below are the notes collected by scribes in each group for each breakout session.

Breakout Session 1: Enabling Connected Communities Beyond Pilot Projects

Group A Notes

Connected Communities Workshop at CMU – February 6-7, 2023

General session – Enabling connected communities beyond pilot projects

- Is there a need to reconnect “smart” city with emphasis on sustainability and resilience?
- Many solutions are extraneous to the day-to-day operations/the way service is delivered
- Lack of understanding for the real demand for these solutions (who is the real client?)
- Need better understanding of the city ecosystem in order to insert a solution into it
- Tradeoffs between cutting edge technology and backward compatibility/interoperability
- Need more resident engagement and bridging gap of digital literacy

Breakout session – Enabling connected communities beyond pilot projects (Group A)

Discussion questions

1. What are examples of “state of the art” for deployment projects that have been scaled or integrated successfully? What are key ingredients that made them successful? How can we move technologies from controlled demonstration to real-world deployment?
 - a. Buses – smartphone apps that are connected to the digital infrastructure on the buses, trains and the open standard for scheduling, real-time vehicle location/wait times; people felt safer and more connected by knowing when their ride was coming
 - b. Transition from paper world to digital world in transit, what was the major catalyst or pathway? There were a lot of pilots where people had different approaches for how they coded their data, so more commonality there plus the better communications technologies (e.g., cell service improvements). Having a major data player behind it (Google, in this case) was the significant push for mainstream tech, which then opened up an ecosystem around other vendors and players tied to GTFS
 - c. Digital literacy – any attempts for user interface as an enabler for tech adoption? It is making an assumption that people have a cell phone so it is targeting a more

privileged population already. This might actually make some planning decisions more difficult for portions of the population that are less tech-enabled

- d. Going back, there was huge pushback to ramp metering technology, but now they are accepted and they work to improve traffic flows
 - e. People love to hate scooters and push from transit to regulate them better because of the perception that they are taking people off public transit modes. The devices are also not mobility friendly for certain populations; however, they have been extremely popular with other travelers. Some aspects that have made them successful have also made them unsuccessful in other environments
 - f. Sensors in a shoebox – developed a versatile urban sensing kit that was easy to use and low powered, could be adopted by school-aged children. There were a lot of smart cities deployments relying on street furniture and light poles in city centers that already have ubiquitous access to power, rather than focusing on more vulnerable areas without that same kind of access. It was an opportunity to teach students to use the technology and also use the data to compare to surveys and observational data. They engaged with community members, local businesses, and peers to collect this information. It took 3-4 years to scale it up to going to a high school as part of core curriculum without researchers being hands-on. The transition was enabled through pedagogical approach, thinking more about the educational ecosystem and this solution's place in it
 - g. Tension between cutting-edge and integrating into existing frameworks
 - h. There should be pressure on the government to change the way that they work, and not that they get a pass by only fitting into existing frameworks. Municipal partners could help with the digital transition and meet the solution providers along that journey. Example that came to mind is 311 as an open standard that cities are utilizing
 - i. Defining community as who you are building for and other stakeholders who you are building with (so can government be a community in this context?). There has been a focus on funding technology but not the capabilities to actually take on the technology
 - j. Bloomberg cities programs are addressing that kind of training need / info gap – so how to pair the support for the tools with the support for using the tools?
2. What technologies are ripe for deployment?
- a. Reframing – what locations or contexts are ripe for deployment?
 - b. There is also a challenge of decision-makers not having the background necessary to evaluate the technologies that they are being pitched
 - c. Thinking about NSF connection – what is the research aspect? From NSF, there is a mindset that the communities need to be defining the problem, so flipping the university/community dynamic. New directorate, trying to push things forward to the end users, so redefining what NSF is in our minds
 - d. Example on how one solution can be stripped down to its micro level to identify other use cases that may be applicable, even if it isn't cutting edge tech, it might have novel applications that improve social engagement
 - e. Workplace learning environment to engage them with civic data
3. How do we plan for and learn from cases in which technology deployments stop working or do not accomplish their goals?

- a. Build info dissemination into all grants, even if the whole project doesn't get carried out, so there is still some kind of "final" report at the end that captures why it failed
4. How can we better communicate the results of both successful and unsuccessful technology deployments to relevant stakeholders so they can make informed decisions about what to try in their communities?
 - a. [starting to come up below with recommendations; matchmaking needs]
 - b. Community partner accountability – evaluation from their experience

Suggestions

- Input for NSF
 - Cities would like to have funding to deeply understand their problems and build capacity to establish relationships and connective tissue to deliver a successful grant project
 - Too much energy and attention can go toward grant opportunities that aren't best suited for solving the priorities that a municipality has identified, but they don't want to miss out on the resources
 - Better matchmaking tools and opportunities (partners, key priority to funding oppy, etc)
- Research gaps
 - Identifying common challenges across multiple cities (siloed from one another)
 - Platform for amplifying when a good solution has been adopted that other cities could use for a similar problem
 - Defining co-creation and how to do it successfully
- Who should be involved
 - Need to also consider incentives/disincentives for those who are involved (e.g., nonprofits have to account for every 15 mins of their time, but academics often use their time as cost share or can be more generous with their time and input)
 - Challenges with including staff time in grants when it leads to new hiring and start-up "costs" with training up on institutional knowledge

Matching community needs with technology solutions – report out notes

- Capacity issues all around – researchers not having time to get sufficient input (but why not?) and community members needing resource contributions to provide their input
- Recommendation to call out the risk-reward
- Challenge is more about social sciences and not the technology
- Mismatch in researcher incentives – earlier in career, less about real-world impact and more about published papers in order to get tenure
- Funding community needs assessments – is that something NSF can fund? Data scraping to get this information?
- Broader set of disciplines, including finance and social workers, to understand limitations on usability of technology
- Stages of readiness for community engagement (like a TRL/CRL equivalent)

Issue of consent with tribal communities that have solution providers, like telecoms or solar, come in and claim their land for deployment, get incentives, and then that land/tribe is no longer eligible for federal funding opportunities – need to know more

Group B Notes

What are examples of “state of the art” for deployment projects that have been scaled or integrated successfully? What are key ingredients that made them successful? How can we move technologies from controlled demonstration to real-world deployment?

- Simplicity is very important; sometimes what communities require to step in is simple (isn't attractive for research, necessarily)
- How do we define success? For example, is it financial success, wide adoption of a particular technology, or success in creating a technology innovation? In each case, the question is what is the next step to continue as a “successful” smart city deployment?
- Emergency response example (LA, Ontario, etc):
 - Disaster and information preparedness portal after 9/11
 - Had P to P technology; wired and wireless comms, but cities were not equipped for that (especially rural places)
 - Developed a simple tool to help people connect to information was useful
 - From there, more things can be built out
- Another example:
 - Struggle to communicate to navigation systems about road closures
 - Pain point for community members
 - Creating a relationship with people in the city and Waze
 - How do cities get this information into the hands of the people who can disseminate it out?
 - More challenging than anticipated—Google and Apple don't have technology and information systems for cities to input this information
 - Ad hoc developers working on this issue (employee turnover is a struggle here in terms of information sharing)
- Rural context:
 - No issues of traffic or mobility
 - From rural perspective, not many good examples of smart tech deployments
 - Everyday lives of people in rural places don't have tech need
 - It's not that there's a gap, but people's lives are constrained in terms of what they're doing everyday
 - Is there even a demand for smart tech?
 - Some states have good technology/app deployment to tell citizens whether roads are clear or not for construction projects, etc.
 - Agricultural economy in rural places drive need for smart solutions
- RFP for procuring the technology after a research project
 - Streamlining process of keeping technology after a research project is over
- Need a demonstration of value during the pilot period—outcome is more defined
 - Is it worth folding into operations after the pilot? How does staff time get allocated to sustainability and how can it emerge as a priority given all the competing interests that a city/town has in the day-to-day?

What technologies are ripe for deployment?

- Mobility and navigation apps

- Crowdsourced information can provide updates, but only from so many users or authorized users
- No repository for the city to provide this information
- Water reporting
 - Sometimes once a week, sometimes once a month
 - Not everyone has access to technological solutions—where is information coming from?

How do we plan for and learn from cases in which technology deployments stop working or do not accomplish their goals?

- See first bullet for details
- Tech for tech's sake isn't innovative
- Deploy beyond hotbed communities (LA, NYC, etc.) or smaller markets (making money from scaling)
- Private companies need an interface to collect feedback and fix the problem - no accountability for performance even though the data is often public or administrative data
- Tech firms want to have the best of both worlds; have their product but use public infra to deploy (occupying public space)
 - Don't ask communities what problems they may face, though, which leads to ineffective solutions
 - Not holding themselves accountable for community issues
 - Google changes their routing algorithm and neighborhoods now have immense traffic
- Every company wants to send full stack solution where you buy their product, use their network (proprietary problem)
- Syntactic plug and play—being able to talk the same language and meet the same needs
- Should be companies responsibility to take information from cities and implement it

How can we better communicate the results of both successful and unsuccessful technology deployments to relevant stakeholders so they can make informed decisions about what to try in their communities?

- How much ego is in the person who is receiving the information?
- Need a bridge between people and the platforms developing the tech, and the people who are impacted by the issue
 - Tech is supposed to make life easier to navigate and the tech folks should be responsible for this communication and dissemination, but their interest often wanes after they have invented/led creation of the new technology
- Smart metered data gave city new ways to communicate to community members who complained about cost of investment of smart tech (can show residents where spikes happened and why)
 - Negative sentiment about the cost of new technology
 - Show people in the data how costs and usage can change (direct benefit)

What input do you have for NSF to help enable connected communities technology beyond pilots?

- Incorporate the end user into the design of the project/product
- Determine responsibility/cost of public data (mobility, etc.)
- Help develop standards for data sharing and usage between private and public entities, and public entities and community members
- Ensuring all stakeholders are part of the project from the beginning
- Two periods of pilot: one period of funding for testing, and another period for transitioning into operations (resource to city to staff it—not coming out of general funds)
 - If pilot is a success, saving money or solving a problem, but lacking resources as is
 - NSF can fund/cost share the transition period (everyone has a stake in the same)
 - Pilot, transition, procurement (life cycle)
 - NSF gradually reducing the role of funding
- Phases of a pilot to implement modifications for different communities (data sources)
- NSF is risk tolerant, cities are risk averse
- Expand the transition role from creating a company to state/city dept that could be funded by NSF
 - However, an issue could be that the pilot loses institutional knowledge when people leave this dept (this work is relationship driven)
- NSF could bring in foundations to help with projects (matching funds)
 - Matchmaking relationships

What are the transformative and incremental research gaps that need to be filled to enable connected communities beyond pilots?

- Understanding of public attitudes towards government services and building trust between these entities
 - Related to this, who should've been responsible for the issue that smart tech is designed to address? Costs are passed onto consumers and that builds resentment

Who should be involved in enabling connected communities beyond pilots, and what should their role be?

- Pilots should work with an organization that's already working with communities (but, this isn't "monetizable" and it shouldn't be)
 - COGS
 - League of Cities
 - Nonprofit organizations

Group C Notes

What are examples of "state of the art" for deployment projects that have been scaled or integrated successfully? What are key ingredients that made them successful? How can we move technologies from controlled demonstration to real-world deployment?

- Grant processes should support understanding the human behavior component to technology deployment: residents and city staff
- Grant processes should make room for multi-stage pilot processes, and allow for failure and iteration
- Consider a trust building or capacity-building-phase approach: partnerships, change management assessment, behavioral studies etc.
- Data: can we consider residents as partners that ground truth data for grantmaking.
 - Learning agendas: Work with gov and communities on developing learning agendas - setting priorities collaboratively first, and then building trust to implement and sustain > Planning grants are for specific ideas, rather than setting community priorities across partners (residents, gov, academia, private, civil society)
 - Funding to support community partners
- Rural areas/ Tribal lands: Universities aren't present; but seek tribal communities as partners - research should be shared and beneficial to both parties (research is currently beneficial to fund seekers).
- Shared-benefit approach is greatly needed for all communities, especially rural and tribal. Data from research should be shared. Grant awards should be communicated and shared with beneficiaries (Residents and communities). Feedback is needed if the grant is not awarded.
- ROI on failure: What can we do with failed pilots - knowledge exchange, passing failed pilots on to other communities that can reapply for stage II funding. Document failures and share those.
- How do we sustain and scale solutions ?Who are the key players? Bridge activity is proof of concept
 - There may not be motivation for a private partner; how do you continue the service and support
- Underlying challenge #1: Local governments have contracts with prior technologies that inhibit the ability for pilots to succeed
- Underlying challenge #2: HR - Staff sometimes don't have the digital literacy, training or tools to utilize a technology
- Defining what success looks like:
 - Does it address a community problem?
 - Defining success as the adoption of a technology.
 - Success can look like pilots showing us what doesn't work; and identifying questions we didn't even think to answer
 - When we think about deployment we are often focused on the tech deployment, but we don't consider the human side. We need to understand change management and human behavior both in the workforce (city departments) and residents

- There isn't much funding available to help understand the human behavior dynamics
 - Piloting is a multi-stage process; you should expect to have some degree of failure and iterate. Grants should be structured in a way that makes room for that.
 - How does the NSF justify funding pilots that have failed, if we acknowledge that failure is part of the pilot process
 - NSF take on multi-tier piloting approach is the planning grant phased
 - From the PI perspective: Implementation sometimes hinges on "network conveners"; typically public officials that are able to push a project forward through implementation
 - Challenge-based approach to defining community priorities upfront: Defining the needs of the community as a service to researchers
 - What is the critical path to applied research?
 - Data: Can we capture lived experiences of residents as a data point/ metric? Example: policing
 - Residents can get credit for contributing to ground truthing information as a partner
 - Universities could have a requirement for a practicum - student must do a community service project
 - Alignment of faculty and student skill sets with NSF grants and community needs
- How do you get solutions to sustain and scale if they aren't profit driven
- Who is the key player to keep these things going? Community foundations? Non profits?

Group D Notes

What are examples of "state of the art" for deployment projects that have been scaled or integrated successfully? What are key ingredients that made them successful? How can we move technologies from controlled demonstration to real-world deployment?

- Pilots v. demonstration -
 - One definition - demonstration is a proof of concept; viability; Alt definition - pilots are timebound (start and end) vs. demonstrations that can be iterative learning lab
 - Funding for pilots can be easier (procurement); demonstrations are more research-based (harder)
- Need to start with community (or will fail) - don't need research to tell you that you need to engage the community.
 - Getting community input is difficult; communities are diverse; what is meaningful public engagement to make policy? In depth understanding is lacking.
- Need to change the mentality of the traditional NSF panel; add more people from industry and government

- Local government has capacity constraints; need to match needs of community with capacity of local government to execute - need to bring in right partners and the right time to scale
- For the private sector/industry, public engagement is where you go to die in the valley - would take too much time

What technologies are ripe for deployment? (state of the art deployment project)

- Best practices
 - Engage, don't preempt, local governments and communities - local government is closer to the community than states and able to connect dots to social good outcomes
 - Local governments should be the intermediary between community and industry
 - Willing industry partners are helpful - those that are willing to tweak and iterate based on local conditions
 - BUT - industry would prefer not to pilot. It is too small, too unique, too novel. Every city wants custom Not necessarily representative of what a scalable application might be. Better to do initial deployment at scale to assess across a range of contexts (maybe cohort of places?)
 - Public sector can help mitigate private sector risk (for example providing exclusivity, etc.)
 - Pilot procurement process increases transparency and identification of trustworthy solution to try
- Are all technologies created equal? Are there some that are more internal facing (e.g. systems that improve government efficiency) vs. more public facing (e.g. mobility innovations)? Are these easier to deploy?
- Plan for the long(er) view
 - Sustainability - what are the long term costs of maintaining/care and feeding technology after deployment; hidden, unexpected or escalating costs?
 - Need to have an off-ramp strategy (e.g. is there a plan for how to pivot if the company/service offering is not around after city/community is locked in and built around that system?)

How do we plan for and learn from cases in which technology deployments stop working or do not accomplish their goals?

- We (cities) need to get to the place where we can truly celebrate failure; fail forward and point that out
 - Risk is much easier to accept in pilots
 - Start up world/small entities are a great vehicle for NSF to invest in - small entities can try and fail without bringing down the whole company

- NSF can mitigate risk for both companies and localities by driving investments into smaller enterprises
- NSF should make sure there is a strategy for utility of product/assets in the event of failure of deployment
 - Data escrow (data is held by a third party; buyer could still go to get that data and use it)
 - Interoperability specifications (can unplug from one system/platform and plug into another)
 - Future-flexible infrastructure (standards and specifications - can be adapted or converted to support and enable the next generation)
- NSF should be the champion pushing interoperability specifications at the federal level
 - And make sure large companies (oracle, etc.) are not the only ones at the table
 - Interoperability can ONLY happen if established at the federal level - cities, etc. cannot do it separately
 - It is an equity issue that allows places of all sizes and resources to configure as needed

How can we better communicate the results of both successful and unsuccessful technology deployments to relevant stakeholders so they can make informed decisions about what to try in their communities?

- Need to be able to communicate the benefits and learnings of pilots (even failures)

What input do you have for NSF to help enable connected communities technology beyond pilots?

- Standardization of the contract vehicle itself would be helpful to industry (NSF could develop a universal contract vehicle for piloting)
- Push for national interoperability standards (cannot be done at local level)
- NSF should make sure there is a strategy for utility of product/assets in the event of failure of deployment
 - Interoperability specifications (can unplug from one system/platform and plug into another)
 - Data escrow (data is held by a third party; buyer could still go to get that data and use it)
 - Future-flexible infrastructure (standards and specifications - can be adapted or converted to support and enable the next generation)
- NSF should be the champion pushing interoperability specifications at the federal level
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 - Interoperability can ONLY happen if established at the federal level - cities, etc. cannot do it separately
 - It is an equity issue that allows places of all sizes and resources to configure as needed

- Have an “off ramp” planned into an early-adopter deployment
 - This would allow for the possibility of failure and reduce private/public sector risk
- Need for a better understanding of what truly defines representative/equitable community engagement

What are the transformative and incremental research gaps that need to be filled to enable connected communities beyond pilots?

- Research is more incremental than transformative
- Policy is where more transformative things are happening (e.g. Uber is not transformative - it is another model of a taxi; how it is deployed and used)
- There is need to Develop a process that is more adaptable - investments made along the way can be adapted to continuously evolving technologies that come back (e.g. plug in electric vehicle charging infrastructure → able to support conversion to induction chargers)
- Showcase the value of failure
 - How to fail forward and communicate the benefits/learnings

Who should be involved in enabling connected communities beyond pilots, and what should their role be?

- Can't just be the big-guys/large industry (that have buildings named after them)
- Need to include a diversity of contexts (different state cultures/policy or governance environments)
- Need more entities like Metro21 that can bring the best academic/research institutions/foundations/industry and connect them to local challenges on the ground; can help add capacity and make a meaningful impact

Group E Notes

What are examples of “state of the art” for deployment projects that have been scaled or integrated successfully? What are key ingredients that made them successful? How can we move technologies from controlled demonstration to real-world deployment?

- Don't want to be the first government to implement; deploy tried and true technologies
- Successes: body cameras (federal mandate with funding; raised questions about data storage and governance); police drove rebuilding of
- How do you identify & prioritize tech deployments?
- Commercialized products are scaling, whereas pilots in civic space are less scalable (political will, bureaucracy, funding limit thinking in the civic space; can we rethink public

services as services rather than products, like how ride-sharing transformed on-demand transit)

What are examples of “state of the art” for deployment projects that have been scaled or integrated successfully? What are key ingredients that made them successful? How can we move technologies from controlled demonstration to real-world deployment?

- Lack of success may be no clear customer/demand, value creation proposition
- Allow consultants to be pre-approved and shortens the procurement process for professional services (direct bidding to consultants without full RFP process)
- Took a real problem and applied tech to it & secured funding for a tech project; also had a rich partner network, so didn’t build the solution from scratch

What technologies are ripe for deployment?

- Autonomous vehicles/robots
- A lot of tech is not quite ready for deployment, but testing in “real world” (i.e., cracked sidewalks & autonomous robots) is critical
- Funding & support/resources are needed to push pilots/trials

What input do you have for NSF to help enable connected communities technology beyond pilots?

- Ensure that the projects are meeting community needs, or have a clear demand/customer
- Flexibility in who can be involved and how funding can be used:
 - Change who can be PI, coPI on grants, moving beyond tech/science expertise to include community members (experts on adoption of tech, etc.);
 - Pay community members, or at least provide services to ease their participation (e.g., childcare, transportation, meals)
- Alternative fiduciary methods with the goal of shifting funding to community partners (& avoid academic overhead charges that reduce project resources)
- Broaden the pool of proposal reviewers to include non-academics

What are the transformative and incremental research gaps that need to be filled to enable connected communities beyond pilots?

- Is scaling (replication) the right measure of success? (Scaling up, scaling out, scaling deep); scaling should reflect the problem being solved
- Additional funding to explore scaling potential? Scaling beyond the pilot (e.g., Smart Grants, Civic Innovation Challenge)
- Defining the target community and knowing how to bring “them” together

Who should be involved in enabling connected communities beyond pilots, and what should their role be?

- Broadening who is engaged, so that community members are elevated to be research partners (e.g., community fellows model), included as part of the grant planning/drafting process
 - Residents
 - Business owners, organizations
 - Experts
 - Civic leaders (both elected, appointed and informal)
 - Landowners & developers
- Intentional people to organize participation

Breakout Session 2: Matching community needs with technology solutions

Group A Notes

Matching Community Needs with Technology Solutions

Q1. How can we better match community needs to technology solutions? Who should be involved in matching communities with technologies and vice versa?

- Matching process for community needs with government/ technology / grants
- Get cities working together on similar problems (cities of similar size often have similar problems)
- Use participatory design to better understand community needs (Human Centered Design tools work great here). Usually it takes 2-4 hours and food should be involved. Need to create environments where all people can participate. Called stakeholder driven modeling at U.S. Department of Agriculture (USDA).

Interesting discussion about what we call engaging the community and if it matters.

Who is involved?

users, sponsors / implementer, technologist/researcher

How does the government start / purchase new things?

vendor/technologist identify the need, service provider identify the need, community identifies the need

How do you move from research to policy for deployment? Disconnection from the policy tools to deploy vs. the research on the technology.

Q2. What can funders and academic institutions do to better match researchers with communities that can benefit from their expertise?

Matching post successful pilots with communities who can move it into policy and integrate into operations. Pitch better defining the problem to match the successful pilots. The problem is that

most communities don't have the problems well defined and understand how best to leverage technology.

Do we have to fund a training arm on how communities can best leverage technology?

Could grants funds be used to help cities evaluate the best technology to use to address community problems?

- Develop open source solutions in one location and fund other cities to deploy it. Could also fund research into implementation and deployment? Could also focus on data standards instead of solutions? Make sure the standard is simple and actually a standard (i.e. doesn't change a lot and is constantly changing)...this is where governance around the standard is really important. Signal phase and timing messaging standard with U.S. Department of Transportation (USDOT), all the states implemented it differently so the private sector couldn't implement it.

How to deal with the issue of the pressure to develop novel solutions in academia?

FTA - research to practice program, meta analysis of research about what leads to success and expanding the learnings. Are there other industries doing similar research? Can we use local government national orgs to help match issues and collaborate on them together?

Q3. When deploying a new tech, how can we build or re-establish trust with communities when previous technology investments have not provided expected benefits?

Community defined metrics of success is a good start. Orient metrics of success around different user stories / types. Success looks different based on who is using the technology or intervention.

Identify ways that the technology could cause harm with the community at the start and try to mitigate.

Success metrics and iterative evaluation is often the weakest part of the proposal. Would need to upskill communities on how to do evaluations in real time. Independent evaluations can help with some of this work and may be important to fund.

Capacity continues to be an issue to do independent evaluation in local governments. If teams were actually multidisciplinary this could add this capacity. Grantees often don't budget enough money for social science evaluations and this could be a stricter requirement.

Set realistic expectations and don't use buzz words. We need to be clear what we can and can't do and what we know and what we don't know. Use transparent and less buzz wordy language.

Input - what are suggestions for NSF

- Help export successful ideas to other contexts and community

- What are ways to communicate what works and doesn't work so we can learn from failures
- Are there models for taking a program/tech to other communities for future testing/development
- Get a cohort big enough to define a broad set of requirements to ensure it is applicable.
 - Who leads these cohorts/conversations
 - What are the motivations/goals that can drive this - for example, standardized tech use, playbook for cities to follow
- Are there ways to help develop a process/practice and culture of evaluation on these projects - funding for people gathering data, iterative evaluation and reflection practices
- Address need for novel work

Research Gaps - What are the research gaps

- Focus on standardization (data standards, community created metrics of success, fully funded multidisciplinary evaluations requirements, requirement to communicate back to the community about the success / learnings)
- Evaluate technology that is useful to community and civic organizations
 - Consumer reports for civic tech - academic experts to assist with this?
 - Meta analysis
- Applying pilots in different contexts for evaluation
- How can we help train civic orgs for technology engagement - lack of bandwidth and expertise
- How to gather, encourage influence and report back to communities to meet their needs, and to build trust - in both directions - this also is obviously who should be involved
 - Don't use buzz words
 - Set realistic expectations
 - Communicate back to them in ways that work for the community - maybe not a white paper

Who - who should be involved in integrating and scaling

- For the academic, role could be other than the technologist and subject matter expert to help evaluate tech
- Social scientist need to be on teams
- Include policy people as part of the stakeholder in the research design (it can be very hard to get their full support when it goes to implementation)

Group B Notes

How can we better match community needs to technology solutions? Who should be involved in matching communities with technologies, and vice versa?

- Central, neutral entity in universities can truly listen to local, community needs BEFORE researchers pitch their ideas for solutions
 - The choices are already there, the need is already established, and the neutral entity should provide the connection

- Community engagement first is a valid strategy for connecting to smart city solutions
- Move away from a deficit model (e.g., “what isn’t working? What is missing? What do you need help with?”)
 - In the name of building social capital, start by asking “what is good about the community?” to identify why people are staying in an area, for example
 - Strength-building should happen among community before discussing problems
 - Collective action model—how to approach issues together in moving forward
 - Frame discussions as, how can you enhance the positives in a community?

How can we better match community needs to technology solutions? Who should be involved in matching communities with technologies, and vice versa?

- Shouldn’t frame engagement around technology solutions—issues might be agnostic to technology solutions and there is validity in learning the issues anyways
 - Communities can then choose from a ‘portfolio’ of solutions that could work for them/their community is ready for
- Idea: tech corps/foundations could be invited into a mismanaged city to implement solutions (Microsoft could take over Flint for example)
- Idea: NSF could send social scientists to 10 demographically representative cities, for example
 - Research why are they staying there? What are issues, etc.?
 - Spend money on trying to understand what’s happening and come up with academic questions they want to answer later
 - Deeply define the problem first, professionally, by those who are academically qualified
 - Needs to be willingness to not use the tool, but send the information and data to someone who can use it

What can funders and academic institutions do to better match researchers with communities that can benefit from their expertise?

- Facilitate multi-disciplinary teams
 - Fiscal/budget officers
 - More involvement with social scientists, especially in developing the research questions to ensure community centering
- Bringing awareness to an issue is only the first step in the process
 - There are policy, fiscal, political, etc. pressures of bringing solutions to communities—will the solution last? Who will communities blame for failures?
 - Pass on research findings to someone else who can implement solutions
- Needs to be ‘monitoring’ and ‘next steps’ elements of grant proposals

- Or, plan of engagement instead of next steps—if you monitor and find deficiencies, what could you do? What are the next steps? How are you committing to those?

When deploying a new technology, how can we build or re-establish trust with communities when previous technology investments have not provided expected benefits?

- Trusted community partners should conduct the engagement
- Bringing the technology can't be the end
 - To build trust, we need to stick around after tech is implemented
- There is a need to change the model of engagement to shift community perspectives?

What input do you have for NSF to help match community needs with technology solutions?

- NSF to fund community needs studies/assessments
 - Not every problem has a technology solution. NSF to flip the script and instead spend some time working with communities to identify problems and THEN challenge the tech and the researchers to work toward solutions
- Fund community capacity assessments
- Host a workshop like this one, but with community members instead
- Could fund research for using AI and data scraping to capture community needs
 - Get away from longitudinal study - (cost a ton of time and money)
 - AND think about data privacy and other concerns

What are the transformative and incremental research gaps that need to be filled to help match community needs with technology solutions? Is there research from other disciplines that should be incorporated in this work?

- There is a need for broader social science research to conduct focus groups, problem definition, etc. to explore how technology solutions can be effectively implemented, if at all
 - Addressing questions of, does the technology actually address the need?
- Other disciplines that could be incorporated into the work:
 - Public finance
 - Political science/Policy
 - Social workers—usability of the technology

Who should be involved in matching community needs with technology solutions, and what should their role be?

- Organizations like Metro21 (neutral, intermediary entities) - bringing people who represent different organizations/agencies
- “Ecosystem builders” who are community members themselves and are tapped into their neighbors’ needs

- League of Cities, COGS - and other groups and orgs that are a consortium of local local governments - not only do these institutions have access to city as an “audience” but added benefit of maybe having some ideas to scale
- Social scientists/humanists should conduct problem definition
 - Data/tech can then be a conduit to solutioneering
- Public policy experts
 - Both qualitative and quantitative experts

Group C Notes

What digital and physical infrastructure needs to exist for connected communities technologies to be deployed successfully? What human capacity is needed to build, maintain, and expand such infrastructure?

- Broadband (future proofing to meet the needs of tomorrow and not just today)
- Digital (and actual) literacy is key to understanding and leveraging digital infrastructure
- Equitable distribution of digital assets (especially broadband) so you need to disaggregate description (such as race and location)
- Existing workforce capabilities and knowledge can be a limiting factor
- Need to break down organizational silos to really leverage digital infrastructure and smart cities projects

What are the unique challenges to deploying technology in different types of communities (for example, rural, urban, suburban, or indigenous)? How can we ensure that communities have equitable access to connected communities technologies?

- Need to move from smart cities to smart regions, how do we support and build capacity as a region , communities don't end at city lines
- We are better when we work as a system (regional approach)
- Tie into workforce development (future of government workforce)
- Cross disciplinary students working on vertical integration projects.
- Sustainable Communities Grants were good and connecting and bridging the urban, suburban and rural divide
- NSF regional engine applications can help connect across jurisdictions and boundaries
- Study on governance structures that help grow collaboration on issues that cross boundaries (water, air, transportation, economic development) such as agglomeration effort in Canada.

What are the legal and policy factors that impact whether a technology can be deployed successfully?

- Political boundaries, is there a logical shed for where these types of conversations need to be taking place?

What input do you have for NSF to support improving the way technology is designed, deployed, monitored, and evaluated?

- Predevelopment grant needed to build coalitions and capacity building (workshop grants @ NSF) so communities are ready, focused and collaborating
- Flexible grant process to allow for organic development as collaboration begins, such as having rolling deadlines instead of hard deadlines for grants to avoid bullship relationships
- Cohort model to connect grantees working on similar issues
- Add success factor if NSF grant leads to sustainability (local, state, federal, foundational, non-profit, for profit)
- Create a tie in between NSF grants to federal learning agendas so that federal funding flows to support good community ideas
- Integrate community evaluation into success measures for projects
- Evaluation if the project actually benefits to people (output vs outcome assessment)

What are the transformative and incremental research and infrastructure gaps that need to be filled to improve how technology is designed, deployed, monitored, and evaluated?

- Study on governance structures that help grow collaboration on issues that cross boundaries (water, air, transportation, economic development) such as agglomeration effort in Canada.
- Support inventories of who is doing what with in the region so the partners are more easily identified (does there need to be a standardized process to collect and report on this info, such as the SEDs framework at EDA)
- Using AI to capture the different plans, recommendation and efforts and layer them within a region
- Funding outcome evaluations through academic partners (pre, during and post) including failure and learnings so they can be shared out and build the knowledge base
- Funding on process evaluations and what actually works for successful projects (meta analysis)

Group D Notes

How can we better match community needs to technology solutions? Who should be involved in matching communities with technologies, and vice versa?

- Need to define community – depends on the problem or technology - end user of the technology
- Be selective in reaching out – should be of importance of them
- Benefit of being broad – multiple cities, etc.
- How to incentivize grass roots participation

- Focus on community groups
- Researchers also need to hear from community members, understand the problem to be solved
- Work with trusted partners to get participation

What can funders and academic institutions do to better match researchers with communities that can benefit from their expertise?

- Need a type of middle person facilitator, problem of lack of funding for this role
- How do you know who is the trusted vendor? – need for a safe space
- Building the trust, using technology to solicit feedback (QR codes on lamp posts)
- Timing issue – innovation takes time – the end user isn't in the room
 - Back to the need for flexibility
 - Start with the easy wins, build the culture, build for the big win
- Mismatch of researcher incentives (publications) and incremental work
 - Potential role of social sciences who do research on implementation
- Match researchers with entrepreneurs with govt with.....working together to solve problems.
- Understanding every possible solution
- How to have ongoing communication with (potential) end users
 - Multiple tools for participation

When deploying a new technology, how can we build or re-establish trust with communities when previous technology investments have not provided expected benefits?

- Failing fast, learn from failures
- Community engagement from the beginning
- Communications
- Understanding the community risks
- Find the trusted agents
- Incremental approach

What input do you have for NSF to help match community needs with technology solutions?

- Define community – end user
- Assure capacity for the process
 - Funding operational needs in grants (staff, and more activity)
 - Guidelines re funding to assure capacity needs
 - Incorporate risk measures (Assign risk to each tech/innovation)
- Increase diversity in innovation ecosystem
 - We don't know what we don't know

What are the transformative and incremental research gaps that need to be filled to help match community needs with technology solutions? Is there research from other disciplines that should be incorporated in this work?

- Need more social science – planning, public policy
 - Problems are in the implementation not in the technology
 - Need to define community – depends on the problem or technology - end user of the technology

Who should be involved in matching community needs with technology solutions, and what should their role be?

- Need a type of middle person facilitator, problem of lack of funding for this role
- Timing issue – innovation takes time – the end user isn't in the room
 - Back to the need for flexibility
 - Start with the easy wins, build the culture, build for the big win
- Mismatch of researcher incentives (publications) and incremental work with real-world impact
 - Potential role of social sciences who do research on implementation
- Match researchers with entrepreneurs with govt with.....working together to solve problems.

Group E Notes

How can we better match community needs to technology solutions? Who should be involved in matching communities with technologies, and vice versa?

- Community needs to come first and then we need to think about technologies later. <the question above should be reversed>
- Who is “community”? What is the definition? Is that local government? If that is the case, that is a huge mistake. Co-create solutions with communities. And that would work other communities too. If we are not intentional above that, we will continue to focus on communities that will result in more inequity gaps
- Ask the communities to prioritize problems (kick-starter projects) and they had industry partners and there is also learning and teaching component.
 - Public safety one in this context did not work. Mainly the community had veto power
 - That kind of facilitated/intentional approach into a partnership (community created a non-profit (which became a strong advocate around digital equity), public and private partnership). Part of the intentionally is not asking the community recreate the problems that they have. It is moving away from it towards prioritizing it. It creates trust We already ask too much on generating things.

How can we better match community needs to technology solutions? Who should be involved in matching communities with technologies, and vice versa?

- We should have capacity building grant rather than planning grant. And capacity building grant should be before planning grant
- How can you scale that up in this case? Can you learn from one community and deploy to other communities? Bring the people together rather than technology.
- Depending on the deployment we might not need to engage the communities:
 - E.g., do we need community engagement for wireless deployments or smart traffic lights?
- Researchers need to learn how to work with communities? How to deal with government?
- Need to understand the human behaviors
- How do you weight the reluctance for change?
- University professor does not know how to talk to city governments and vice versa
 - Need to understand the priorities of communities as well as local governments (e.g, mayor's office)
- Community cannot be a roadblock on technology development, and at the same time we
- Utilize the local government to understand the community needs, but researchers need to understand the timelines for government operations, etc.

What can funders and academic institutions do to better match researchers with communities that can benefit from their expertise?

- Capacity building is needed. Communities are engaging with having a “project” and “end game” in mind. It is about building relationships and convening.
- “Economic developments” communities
 - Distributed model: deeper relationships with researchers over time. Building the relationships is important
 - Staff person to manage the relationship with the faculty and there was an external funder who supported the timeline from the university front.
 - More of innovative capacity building grants.
 - The key is the researcher does not pick what s/he would like to do.
 - Most successful interactions have been with universities with dedicated staff on this.

When deploying a new technology, how can we build or re-establish trust with communities when previous technology investments have not provided expected benefits?

- How and who can help with building relationships.
- Part of the problem is that we don't have new technology roadmap for the country. And lacking federal guidance on this and funding

- Cities also need new technology roadmap. No mayor is running around technology development perspective.
- Most of the interventions that we are thinking about needs public buyin, then the local governments has a huge mediating role. Local governments are responsible for the relationship with the community and not the researchers.
 - This strategy will work with a big city and not the midwest since most of the government roles are voluntary.
 - Also communities don't trust the government. SO, the way to engage is through a trusted organization, e.g., churches, NGOs etc. and it is difficult to identify who those folks are from outside.
- As a government, you can have a learning agenda - and co-develop that with researchers and community through capacity development.

What input do you have for NSF to help match community needs with technology solutions?

- Mismatched incentives. Giving faculty time to work with government and communities
- Mismatch on the government incentives; focus on direct service delivery
- Government and community are typically after-thought
- Civic innovation challenge was helpful. There could also be geographical priorities and NSF can also be a convener.
- It is hard people to understand opportunities without understanding each other.

What are the transformative and incremental research gaps that need to be filled to help match community needs with technology solutions? Is there research from other disciplines that should be incorporated in this work?

- It can start with transformative idea and then going back and forth and incrementally improved the solution
- You need to start with a strong community need
- Manage the risk by engaging with faculty and manage the risk by starting small. You can also derisk by community engagement models. Report on what works and what does not and share it. And then standardize on the practices. There are resources out there on the "best practices" on community engagement. Create a library of models. You can start norm building.
- Timelines of funding mechanisms do not match with the reality and the need.

How can we better match community needs to technology solutions

- Non academic Co-PIs (

What can funders and academic institutions do to better match researchers with communities

- Gov'ts -Dedicate Resources to support researchers, match solutions to community needs
- Universities - dedicate resources to gov't so they can better understand needs
- NSF - Convene meetings like these regionally, with Thematic themes so Govt and Universities can learn from each other

- NSF - Can create frameworks for how to deploy these
- When Deploying new tech - how to build or establish trust
- Start small, publish
 - Fund these resources within Gov't and universities

Breakout Session 3: Designing, deploying, monitoring, and evaluating technology to ensure effectiveness, efficiency, and equity

Group A Notes

What digital and physical infrastructure needs to exist for connected communities technologies to be deployed successfully? What human capacity is needed to build, maintain, and expand such infrastructure?

- Communities want things to be done with them, not through them.
 - Need infrastructure to connect to the communities so that the research is not extractive and harmful.
- Most of academia is not established to provide long-term services with a community. Even when they have a long-term community relationship, they are not implementing/deploying technology. Industry is the ones deploying technology.
- NSF could prioritize universities that work with communities and have well established relationship.

What input do you have for NSF to support improving the way technology is designed, deployed, monitored, and evaluated?

- Evaluation should not be pass or fail. Sometimes the failure could provide lessons learned on how it could be successfully deployed elsewhere.
- Communities needs someone to liaise with the universities and companies. Universities and businesses do not know who they should work with to deploy the technologies that have been developed with community partners. The challenge is scaling past a pilot.
- Many "in the middle problems". How do we connect all of the parties between the creator and enduser together.

What input do you have for NSF to support improving the way technology is designed, deployed, monitored, and evaluated?

- How to have early open ended conversation with communities that can be science friendly.
 - This is a capacity that universities have and should be further developed. Facilitate outreach program.

What are the transformative and incremental research and infrastructure gaps that need to be filled to improve how technology is designed, deployed, monitored, and evaluated?

- Digital literacy of end users needs to be the forefront of design and there could be research in this space.
 - Technology should be easy to use and just work.
- Leveraging existing systems could speed up deployment. Example was initial dial-up internet using home phone infrastructure. USPS
- Timeline for evaluation of success after deployment would be after the end of the NSF grant.
 - People do not like to publicize failures. The key for cities is not to not stop and to do it better the next time.
 - Lessons learned from the failures are very useful for deployment, but not well shared.

Who should be involved in the design, deployment, monitoring, and evaluation of technology, and what should their role be?

- The post-deployment challenge is that there is funding to support buying the technology and pilot projects, but there is not funding to support just basics maintenance and operation of the infrastructure once it is installed.
- Design should be community driven, but there needs to be connection to streamline scalability, regulation, permitting, etc. to allow for deployment. It can be difficult to identify the who at this stage.
- Evaluation should include the community as measure of success.

Group B Notes

What digital and physical infrastructure needs to exist for connected communities technologies to be deployed successfully?

- More robust asset management is needed
 - There is a lack of robust asset data sets and updated data (e.g., who owns poles? Do we know where they all are?)
- Data management is a major roadblock to unlocking infrastructure
- Technical protocols for data sharing can aid in successful deployment
 - On one hand, there is a lack of trust and concern about security
 - On the other hand, there is a fear among agencies that if they make themselves vulnerable to receiving data requests, they are required to answer all requests and may not have capacity to handle them all
- Publicizing data creates a rich ecosystem of other developments
 - Removes sole responsibility from agencies
 - However, there is a culture of fear that publicizing data will create more inquiries that agencies won't be able to handle

- Political agents can help shift the culture of public data and operationalize data sharing practices

What human capacity is needed to build, maintain, and expand such infrastructure?

- Clearer designation of ownership (e.g., different owners of aspects of the streets like manhole covers, rights of way, light poles)
- Better connection between complex network of departments and institutions (currently siloed which means data isn't being shared effectively between entities)
 - Many are unsure how to launch a data sharing process between operations groups in a way that minimizes risk
 - Have to make it easy and safe for people to share and communicate information
- Funding for human capital in smart city roles (difficulties funding positions with capital)
 - Relatedly, some "smart city" roles only deal with software/data, and some only deal with hardware/physical infrastructure due to organization of positions—both are needed to solve problems holistically

What are the unique challenges to deploying technology in different types of communities (for example, rural, urban, suburban, or indigenous)? How can we ensure that communities have equitable access to connected communities technologies?

- Rural and tribal:
 - Parks have cultural significance which makes it difficult to build on
 - Lands are owned by various entities which make it difficult to install infrastructure across areas
 - Infrastructure aspects are outdated and difficult to replace due to their age
- Tribal communities can share data between one another, but have to navigate different sharing agreements when dealing with the federal govt (e.g., BIA, federal, state and county lands all have their own road inventory)
 - All competing for the same dollar/transit monies which provides incentive
 - Deep root in the financing of infrastructure
- As urban areas serve as testbeds for new technology (e.g., AV), should the federal government help accelerate digital infrastructure processes to scale to other places?
 - Permitting, rights of way, EV charging infrastructure,

What are the legal and policy factors that impact whether a technology can be deployed successfully?

- There is a need to provide incentives for private sector to implement infrastructure equitably in thinking about where infrastructure is being installed (e.g., EV charging, electricity distribution, broadband)
 - Where does the ROI come from in low and moderate-income areas?
- Need to work to develop standards for determining the covenant of responsibility between public and private sector

- Rural communities are building “smart” communities from the get-go (e.g., solar to heat the sidewalks, wired homes with fiber broadband)
 - Developer advocated and advertised for a 50+ community
 - Very different from retrofitting homes to be smart after their build
- What are the implications of automation and facial recognition technology for public sector jobs?
 - Success of these initiatives looks different for various stakeholders
 - Department directors see operational and fiscal effectiveness, but inequity may exist for employees and other agents (e.g., wrongful termination because facial recognition tech may have inaccurately tracked POC employee productivity)
 - This is the easy use for technology, but is the best use for technology?

What inputs do you have for NSF to support improving the way technology is designed, deployed, monitored, and evaluated?

- Unbiased scientific entity (NSF) can take tech/tools and assess it against shared community criteria
 - Researchers would use a rubric of both industry standards and community criteria to assess effectiveness of a given tool
 - Though, will private entities let neutral research entity get data about their tool?
 - There is a need for private partners who understand social value of equity who want to improve their product
 - Private companies want to scale, so NSF’s involvement could serve as an incentive for their participation
- More organized presentation of projects/pilots/results on NSF sites
 - What are lessons learned from a project? How can this project be deployed or scaled in different communities?
- NSF can work to coordinate and connect various agencies and private foundations/entities
 - Doesn't have to be an official industry standard
 - NSF should think holistically about the phases cities have to go through (evaluation, procurement, operationalization, and commissioning)

What are the transformative and incremental research and infrastructure gaps that need to be filled to improve how technology is designed, deployed, monitored, and evaluated?

- What are the cascading effects of automation in the workplace? How can we map the environmental impacts of automation? For whom is automation improving the human condition?
- Researchers can help collect data and evaluate public good outcomes of procurement

Who should be involved in the design, deployment, monitoring, and evaluation of technology, and what should their role be?

- Trusted sources/champions to deliver information to communities
- NSF/neutral research entity to connect public to private
- Bureaucrats/city manager can mobilize research and information to offices
- Economic development planning agencies
 - Waste, water, sewer, etc. attend planning meetings to coordinate efforts
- There is a potential for more collaboration with planning organizations/MPOs
 - Funding and capacities issues arise for MPOs, though

Group C Notes

What digital and physical infrastructure needs to exist for connected communities technologies to be deployed successfully? What human capacity is needed to build, maintain, and expand such infrastructure?

- Broadband (future proofing to meet the needs of tomorrow and not just today)
- Digital (and actual) literacy is key to understanding and leveraging digital infrastructure
- Equitable distribution of digital assets (especially broadband) so you need to disaggregate description (such as race and location)
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- Tie into workforce development (future of government workforce)
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- Evaluation if the project actually benefits to people (output vs outcome assessment)

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- Funding on process evaluations and what actually works for successful projects (meta analysis)

Group D Notes

What digital and physical infrastructure needs to exist for connected communities technologies to be deployed successfully? What human capacity is needed to build, maintain, and expand such infrastructure?

- Applications side - researchers want to work with cities on impacts for 2,5,10,50 years of projects
- Fiber deployment is needed
 - Need to work with local telecoms to design beyond internet service, but also applications like hazard plans

- Not a lot of private motivation to consider these factors or install where their are not users
- University perspective: How to bring in collaborators whose career goals are about participation and not money
 - Find people informally to identify those collaborators even if they fall within other departments. Interdisciplinary approach.
- Be specific about research question and focus on real human needs (ex. Elderly individuals in impoverished communities relating to disaster response)

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What are the legal and policy factors that impact whether a technology can be deployed successfully?

- Legal
 - Need for an NDA on certain projects
 - Process can take 6 months/year
- Data issues
 - Agencies can end data sharing agreements if results from researchers do not show their findings
- Policy
 - Keeping records digitally or in the cloud. Mandating critical information is held
 - Ex. senior housing communities - convincing individuals that data will be saved
 - CCPA - as long as you can keep data secure and have access policies in place it satisfies some level of the CCPA

- If you can demonstrate you have done your best effort to protect privacy of individuals it can satisfy report

How can we better understand how the success of technologies varies with existing infrastructure, legal and policy environment, and community context?

- Proving there is inequity does not necessarily help the agency, they often already know this is the case
 - How can frame the project as support
- Class of research efforts

What input do you have for NSF to support improving the way technology is designed, deployed, monitored, and evaluated?

- From design → deployment → evaluation → impact
 - Misalignment of timelines; between government and researchers
- DEsingning to deploying is a huge step...
- Research concerns
 - Students are tied to professors, need to bring in professors
- Data gathering, testing, evaluating in communities
 - There is a lot of gatekeeping (IRB), especially for vulnerable populations.
 - Universities can shine a light on gatekeeping issues
- Struggles with sharing results of evaluation
 - Proving there is inequity does not necessarily help the agency, they often already know this is the case; How can the project be framed as support
- Designing to deploying is a huge step. Need a design for more sustained studies in a specific area.
- Evaluating and monitoring is key, but not always well supported
 - Could have more specific grants for evaluations, NSF can set the solicitation requirement for evaluators to be written into the proposal

What are the transformative and incremental research and infrastructure gaps that need to be filled to improve how technology is designed, deployed, monitored, and evaluated?

- Better understanding of national projects, cities with similar policy frameworks (procurement, data governance, etc...), case studies of successful reforms
- A lot of nonprofit organizations don't have the resources to do the work

Who should be involved in the design, deployment, monitoring, and evaluation of technology, and what should their role be?

- Issue of timelines make it difficult for early and constant communication

- Improved communication of cities and researchers for NSF intervention
- Learn what the community needs before design
 - This often requires more than planning grant efforts
 - Perhaps this is a grant to learn
- Going through phases to understand the problem
 - Building, testing, evaluating, and deploy
 - Taking an iterative, phased approach
 - Including the right stakeholders at the table
 - Bring in the right people who understand the community
- Find, identify community leaders

Group E Notes

What digital and physical infrastructure needs to exist for connected communities technologies to be deployed successfully? What human capacity is needed to build, maintain, and expand such infrastructure?

- Cost. Cost of operating hardware/sensors & supporting human capacity
- No funding to sustain the proposed technologies after the grant ends
- Lack of preparedness of (some) technologies in time of disaster
- Leadership. No vision for a “digital america” (e.g., federal funding for infrastructure doesn’t consider integrating digital infrastructure)
- Existing conditions. Challenges in modernizing infrastructure used by everyone, everyday (e.g., bridges)
- Lack of city capabilities to run infrastructure, both existing and new ones
- Importance of how the proposed technology is introduced to the communities, city staff (e.g., for accurate expectation of the tech impact - hurricane sandy / introduction of new documentation tool/paper to digital)

What digital and physical infrastructure needs to exist for connected communities technologies to be deployed successfully? What human capacity is needed to build, maintain, and expand such infrastructure?

- Equity - varying awareness levels among different programs; “evaluation” (broadband deployment evaluation —> there needs to be evaluation metrics, and equity really matters in this)
- Significant cost of operating hardware/sensors (wireless connectivity, power)
- Cost of supporting human capacity
- Lack of city capabilities to run infrastructure (e.g., city doesn’t have accurate info about existing street light/signs, which makes it difficult to deploy technology for street light/signs)

- Need early collaboration between cities and engineering teams to make informed decisions in the planning stage (e.g., air quality sensor model/version control)
- No funding available to sustain the proposed program/intervention after the grant ends; also what about disasters/disaster preparedness
- We have funding for infrastructure, but there isn't a mentality that infrastructure needs to co-mingle with digital infrastructure; we just don't have a vision for "digital america"

What are the unique challenges to deploying technology in different types of communities (for example, rural, urban, suburban, or indigenous)? How can we ensure that communities have equitable access to connected communities technologies?

- How do you integrate equity aspect in thinking about (digital) infrastructure and technologies?
- Work with the equity office - tell us how different interventions would impact different populations/communities
- Can federal governments ensure minimum amount of funding to go to specific populations?

What input do you have for NSF to support improving the way technology is designed, deployed, monitored, and evaluated?

- Evaluation. Still, many technologies/initiatives lack evaluation metrics (e.g., broadband funding). We need to have evaluation metrics carefully developed with equity considerations.

Guidelines and support

- Guideline for assessing "technological readiness of governments"
- NSF provides a guideline about "equity" and community/stakeholder impacts (e.g., model after existing guidelines for ethical data science or broadening participation)
- Appropriate structure in place for individuals to appropriately evaluate technology for all stakeholders cities, academia, and nonprofits; Guideline for the minimum level of budget required for "evaluation activities"
- Support for a "facilitator" role. Strong facilitation needs for public, academic, and community actors —> can NSF facilitate and provide support for this?

Areas of research. Communication piece: How do we talk about new technology so that people can embrace/accept disruption?

- How do we assess utility/sustainability of new technology and infrastructure? Cities have skepticism about utility of data (if it is not deployed widely) or sustainability.

Leadership. for the vision for digital america. (e.g., OSTP, NSF) - what is the vision for the united states?

- On one hand, we are talking about integrating new technologies coming from NSF in the community here. On the other hand, there is huge funding for

infrastructure at a federal level, but they seldom consider how to integrate new digital infrastructure.

- Can government agency work together to set up a vision for digital america?

Breakout Session 4: Managing, sharing, and analyzing data to enhance communities' quality of life and protect privacy

Group A Notes

How do we ensure that governments and their partners have access to and can share the data they need to monitor and evaluate the impact of connected communities technology?

- Is the data private or not? There seems to be discontinuity over this. Who is in charge of deciding this? Could there be research that informs what is private and what is not? Can this research take privacy-invasive technologies and make them privacy preserving. Who enforces this?
- What is the right of an individual to not be included in data, and how do we develop systems to accommodate this?
- Who owns the data vs. identifiable information (what do we mean by "privacy")?
- Even if we can "promise" privacy preserving sensing, will communities actually believe this?
- Data can always be acquired both others down the road. How do we manage this process?
- Communities owning their own data. Could there be something between community data and those who monetize it?
- Effective sales pitch with data is to go in saying that we will not lock you in.
- Governments typically don't want to have to deal with data. "Data escrow".
- Perhaps look at Europe for inspiration on how they are handling data (seems to be more forward thinking).
- Data as an equalizer for the "squeaky wheel".
- Including an explicit consideration of bias in all data governance processes.
- All data being considered "public", keeping in mind that all data could eventually become public.

What laws and policies are conducive to securely collecting, storing, sharing, and analyzing data generated by these technologies?

- Implementation of a "governance framework" managed by the communities (e.g., open, closed, how long we keep it), while the City or other stakeholders have "data management" plans.
- Make the penalties severe.

- Small communities/cities are overwhelmed having to deal with these guidelines etc. The smaller they are, the more likely they are to operate responsibly. Does the governance have to be one level higher?
- Real estate industry created its own standards. People (i.e., agents) have to go through certain training. What if we did this for data management?

How can we provide transparency about and accountability for how data is used and ensure that community members have recourse and influence with respect to how data is used?

- Opportunity to have academic institutions determine what secure and insecure means in a community context.
- Transparency: Working hand in hand with communities and users. How do we share along the way?
- Ties back to development of standards.
- What role can third parties play in enforcement?
- What role could universities play as neutral party (e.g., auditor) to look at how things have been enforced and draw conclusions.
- Penetration tests to see how well people are managing data and meeting community governance plans.

How do we ensure that governments have the technical and skill capacity to securely collect, store, share, and analyze this data, and that the data can be integrated with data from other sources?

- Regional centers.
- Refunneling people towards the public sector, as opposed to the private sector.
- Government moves slowly to support consensus-moving efforts, while technology moves at warp speed.
- Move people from private sector into local.

What input do you have for NSF to help improve data collection, management, sharing, and analysis?

- Communities owning their own data. Could there be something between community data and those who monetize it?
- Perhaps look at Europe for inspiration on how they are handling data (seems to be more forward thinking).
- Governments typically don't want to have to deal with data. "Data escrow".
- Data as an equalizer for the "squeaky wheel".
- Penetration tests to see how well people are managing data and meeting community governance plans.
- Constant training sessions to address that Government moves slowly to support consensus-moving efforts, while technology moves at warp speed. Move people from private into local.

What are the transformative and incremental research and technical gaps that need to be filled to improve how data is collected, managed, shared, and analyzed?

- Who is in charge of deciding this. Could be there be research that informs what is private and what is not. Can this research take privacy-invasive technologies and make them privacy preserving.
- Including an explicit consideration of bias in all data governance processes and data management.
- What role could universities play as neutral party (e.g., auditor) to look at how things have been enforced and draw conclusions. This could be a research opportunity.

Who should be involved in deciding how data is collected, managed, shared, and analyzed?

- Third-party auditor, community via governance plan, City (or equivalent) via data management plan.

Group B Notes

How do we ensure that governments and their partners have access to and can share the data they need to monitor and evaluate the impact of connected communities technology?

- If you're contracting, where does data go at the end of the data collection phase?
 - Need to negotiate for ownership and use of data during RFP phase (can license data out to vendors, though, for use of product development)
- Private companies want to own data because that's where revenue and future profits lie; may get involved in "smart city"/public good work for this reason
- Cities creating data standards allows them to encourage private companies to provide open APIs
 - However, private companies want proprietary data use for profit
- There exists a tension between municipalities being compelled to create an environment for utility companies' smart technology deployment, and managing the right of way for such deployments
 - Legislation is punitive to the city/municipality and partial to the utility companies
- Controlling and having power to provide input to colocation and franchise agreements

What laws and policies are conducive to securely collecting, storing, sharing, and analyzing data generated by these technologies?

- Culture change and capacity change within the organization
 - Hardest part of securely collecting, storing, sharing, and analyzing data
- Cities tend to outsource data management due to lack of capacity, but best case is when entities are able to own and build all data infrastructure in-house
- Partnering with universities can augment city/public capacity
- Data warehouse to store and compile information, where even if use case for a company goes away, data can still be used (sustainable access)

- Vendor salespeople pitching their data management tools take up lots of administrative time, and vendor turnover creates difficulties in efficiently managing the data for public entities (wants to minimize disruption in service)
 - Big disconnect between vendor service providers and community service providers
 - Better policies are needed to protect, preserve, and augment data services in the public sector
 - Connection between software/data management platforms could make extraction and sharing more efficient
- Greater definition around what “data” is—NOT a pdf of results, but raw and API formatting

How can we provide transparency about and accountability for how data is used and ensure that community members have recourse and influence with respect to how data is used?

- Multiple points of entry:
 - Data as a public asset—open by default
 - Rights of a user for public services—digital rights that citizens have in the EU as they pertain to government services and private entities
- Seattle has good privacy and transparency policies
- Detroit has community events where they bring data into neighborhoods and ask them to verify analysis of data—is this representation of your community accurate?
 - Community also gets to learn data skills

How do we ensure that governments have the technical and skill capacity to securely collect, store, share, and analyze this data, and that the data can be integrated with data from other sources?

- In-house or outsourced?
 - Cities tend to do better quality in-house work, but don’t have skills or capacity to execute

What input do you have for NSF to help improve data collection, management, sharing, and analysis?

- NSF can help develop a guideline/process respecting local preferences to provide metrics or performance measures in grants
 - Included in RFP stage? Included in evaluation of the data management process?
- Specialized grant for building data-informed capacity for communities
 - Research entity can be a clearinghouse for the data (engine that ingests, analyzes, and processes the data) as a service to the municipality
 - NSF can determine a “best” model(s) for capacity building in communities, and can apply that model to other cities

What are the transformative and incremental research and technical gaps that need to be filled to improve how data is collected, managed, shared, and analyzed?

- What are institutional requirements/design for a research endeavor for data capacity building in communities?
- Enabling cyber research infrastructure
 - Need to collaborate with city entities (i.e., permits) in a way that connects communities to research
 - Universities can work together with cities before submitting a grant to learn government processes and ensure true partnership
 - Shadow programming where students observe processes
 - Alternatively, a self directed researcher(s) with prepared questions could work independently within the organization to find gaps—end with a capstone of a report/next steps to give to cities
 - Consider innovative internship/fellowship methods and requirements in public agencies
 - National Research Council “renowned researcher” example
 - Deliverable-based program with an objective or outcome
 - However, legal and contractual dilemmas with sharing information and data with researchers (create a standard template for data privacy)

Who should be involved in deciding how data is collected, managed, shared, and analyzed?

- City employees
- Researchers (university students, faculty, etc.)
- Public should have a say in what data is collected and why/where its being shared
 - Rural communities are having more trouble identifying needs of community before building and deploying solutions, especially regarding mobility
 - Issue of data collection—e.g., will someone in a wheelchair need to use our public transit services?
- Public review committees of stakeholders who can help to flag data issues for public entities
 - Potential data stakeholders for the committee:
 - District representative from every neighborhood to reflect on what the desires and needs are from the data

Group C Notes

How do we ensure that governments and their partners have access to and can share the data they need to monitor and evaluate the impact of connected communities technology?

- Enable the user to provide voluntarily provide their data

- When developing these standards for creating, storing, managing, using and sharing data, how do you keep the community central?
- Standardized ways of separating the policy-informing data from identifying data, role for data intermediaries (e.g., data escrows); who's the trusted partner? Is creating a new organization (input from all but owned by none) the gold standard?

What laws and policies are conducive to securely collecting, storing, sharing, and analyzing data generated by these technologies?

- Preface any laws/policies with communication with the communities from which data is collected;
 - Do they have input on how the data is interpreted, presented and used? Data deep dives in King County, Philly's Citizen Planning Institute - could something similar be done for data science?
- Cities require data sharing by private vendors operating in and with the city (i.e., Uber & Lyft share their mobility data)

How can we provide transparency about and accountability for how data is used and ensure that community members have recourse and influence with respect to how data is used?

- Canadian nonprofit developed a series of symbols to identify the type of data collected & who owns it; QR code allows an interested person to get more information about the data & uses

How do we ensure that governments have the technical and skill capacity to securely collect, store, share, and analyze this data, and that the data can be integrated with data from other sources?

- Below mid-tier (by size) cities, they don't have the capacity for these functions
- Data governance structures are needed
- In time, technical skills might become more common in the workforce
- Data reporting by private industry is discouraged by this – standards for data management might help mitigate this, as they know what they give up

What input do you have for NSF to help improve data collection, management, sharing, and analysis?

- Development of standards/specifications, framework & tools for data collection, management, sharing & analysis, as well as private sector incentives to conform
- Validated assessment for data literacy

What are the transformative and incremental research and technical gaps that need to be filled to improve how data is collected, managed, shared, and analyzed?

- Research on data management & sharing with small communities so that privacy is maintained; tension between granularity and usefulness and maintaining privacy (e.g., evaluation of Census' attempt to make small geographies' data 'fuzzy')
- What is the critical data literacy? How is it effectively taught?
- What impact does data literacy education have on trust?

Who should be involved in deciding how data is collected, managed, shared, and analyzed?

- Whoever is the impacted population
 - K12 education: curriculum must incorporate digital literacy to empower individuals about the data being collected and awareness of management, shared, etc.
 - Pre-collection: whoever is the impacted population, recognizes that data is being collected, potential uses, and who owns the data
 - “Stewardship” of data vs. ownership
1. Robust Pre-planning process phase – about coalition building before a solution is designed. Maybe work across/with other government agencies also doing regional efforts.
 2. Bring initiatives together that were identified from needs/opportunities from multiple communities/groups
 3. Funding for standards development – for data, technology, data sharing agreements, governance development (requiring use, sharing across communities)
 4. More focus on social science research – human behavior, community needs, communications, implementation measures.
 - a. Study of critical components of process, governance – what works and how does it happens
 5. Evaluation and assessment
 - a. Why did it work
 - b. Who did it work for
 - c. New tools for measurement
 - d. Community should be a key part of the assessment (community participatory research process)
 6. More focus on social science research – human behavior, community needs, communications, implementation measures.
 - a. Study of critical components of process, governance – what works and how does it happens
 7. Evaluation and assessment
 - a. Why did it work
 - b. Who did it work for
 - c. New tools for measurement
 - d. Community should be a key part of the assessment (community participatory research process)

Group D Notes

How do we ensure that governments and their partners have access to and can share the data they need to monitor and evaluate the impact of connected communities technology?

- Aggregation is key
- Opt in programs / opt out programs are better - Opt out has to be publicized
- To get data & Sharing data so many legal steps

- Only get data that you need for the research question
- Fiber optic data can capture anonymised data for traffic management vs cameras
- Insurance companies
- PI data, but some data can be inferred from multiple sources to create personal data

What laws and policies are conducive to securely collecting, storing, sharing, and analyzing data generated by these technologies?

- Smart SA coalition - 9 authorities bound by data sharing agreement + Enterprise data sharing agreement - issues with interoperability

How can we provide transparency about and accountability for how data is used and ensure that community members have recourse and influence with respect to how data is used?

- Open Data is the way to go but with Privacy considerations / anonymised data is when possible
- UCI creating Realistic Synthetic data modeling - to get passed the PI issues
 - Use modeling - but bias needs to be taken into account
 - Go to every population / generalizable data sets is gaining popularity, what data can be used across cities / regions
 - BUT How can you model these in areas with small populations (Rural, tribal communities)
- Cultural sensitivities need to be accounted for -
- Must build trusted relationships
- Data Attestation - Notary! If we share data - force the user to prove they didn't use the data for other needs - Prove that you didn't use the data for other needs

How do we ensure that governments have the technical and skill capacity to securely collect, store, share, and analyze this data, and that the data can be integrated with data from other sources?

- Losing talent to private sector

What input do you have for NSF to help improve data collection, management, sharing, and analysis?

- Dashboards are not necessarily usable
- Educate public on Right to Know process
- Hold cities and other organizations accountable for sharing data
- Encourage adoption of state wide data collection standard (league of cities provide training throughout state)
- Enforce interoperability throughout the state on data collections
- NSF is a grant competition - so limited in ability to force adoption
- NSF grants need to pay for support to clean data for these projects

What are the transformative and incremental research and technical gaps that need to be filled to improve how data is collected, managed, shared, and analyzed?

- Data Attestation - Notary for Data
- Standardization - standardized how data is submitted for State budget (State forced adoption for budgeting process)
- Query driven process for data sharing in common data within CA for Water data – Common data layer that allows to query data
- Census data rooms for City Infrastructure - get access to infrastructure in secure controlled environment but researchers can't take data with them, only analysis
- Must have people to clean and standardize data across organizations,

Who should be involved in deciding how data is collected, managed, shared, and analyzed?

- a data steward for each department to clean, manage these
- moving towards this model but trying to get the Departments to own their data and be accountable to make it open
- Need Public Engagement for Data Privacy and Sharing
- Need to communicate with public, identifying community leaders
- Innovation academy - with university to upskill city employees on data skills
- Still figuring out what data is needed for Rural Communities -
- The community knows what the data will tell them - should bring it to them as a way of confirming their knowledge

Group E Notes

How do we ensure that governments and their partners have access to and can share the data they need to monitor and evaluate the impact of connected communities technology?

- Missing data - data may not be collected at all or not digitally
- Power dynamics of data sharing - gov't has what researchers need
 - Example of data access revoked after publishing results that did not show gov't favorably
- Data ownership, especially in context of political or other sensitivities
 - Gov't data quality issues - makes data sharing difficult because of concerns over misinterpretation
 - Possibility of academic support in improving data quality, documentation, pre-processing

How do we ensure that governments and their partners have access to and can share the data they need to monitor and evaluate the impact of connected communities technology?

- data exchange/clearing house for gov't/academic/non-profit, maybe even private sector to the extent possible
 - Needs funding

- Trust, who gets to access
- Academic institutions often have more staffing/resources to support vs. cities

What laws and policies are conducive to securely collecting, storing, sharing, and analyzing data generated by these technologies?

- Look to others who have figured out the legal questions and build from there - don't reinvent the wheel
- Centralize at the right jurisdictional unit - might have to go regional
 - Who has authority, then set up the model with academic partners with that authority
- Do grant funders need to enforce things like data sharing agreements, data governance standards
 - How prescriptive should this be? How should this be incorporated into proposal evaluation?
 - Having the right technical capacity to know what to ask for

What laws and policies are conducive to securely collecting, storing, sharing, and analyzing data generated by these technologies?

- Understanding how data interacts
 - Ex. water data could be used to identify vacant units
- Open data often driven at local level, not state or federal
- Privacy is a concern, but also has potential to turn into a non-health HIPAA/another way to say "no"
- Cities will sometimes intentionally not take ownership of data to prevent creating a public record
 - If the data could potentially be sensitive and it's unclear whether there's a public records exemption, cities may prefer to get access to BI/analytics tools for actionable insights, but never access the raw data so it can't be FOIA'd

What input do you have for NSF to help improve data collection, management, sharing, and analysis?

- Under-utilizing a lot of tech to collect, clean, curate, document and utilize data (AI, ML)
 - People are often doing this when machines could
 - Augmenting but not replacing
- Compensation for effort cities will put into data sharing
 - Could come out of grant funding
 - It's easier to fund academics than gov't
 - Finding ways to provide supplementary \$ on an awarded proposal to cities to add capacity in data seems to be a high value areas

What input do you have for NSF to help improve data collection, management, sharing, and analysis?

- Grant requirements
 - data management plans
 - Really goes beyond data management plans - curation?
 - Bonus points for doing this well?
 - What gets left behind in community after a project? Reward this
 - Is there something tangible they can take away like a data center? Or skills/capacity building, norms?
 - Broader impacts beyond the work - intended positive consequences

What are the transformative and incremental research and technical gaps that need to be filled to improve how data is collected, managed, shared, and analyzed?

- Research on incentives (ex insights?) for sharing data for different stakeholders - gov't, non-profit, community, private sector
 - Ie, how would you get participation in a data clearinghouse?
 - Reducing costs, liability
- What are the models for how NSF \$ can help stand up proof of concept data clearinghouses that then are supported long term through city/private funding?
- Understanding what community attitudes are toward different aspects of data collection or data sharing
 - Especially demographics

Who should be involved in deciding how data is collected, managed, shared, and analyzed?

- What data do you need to answer the research question? (academics)
- What is the overhead/needed to operationalize the data collection (gov't and potentially community depending on what's needed)
- Important to collect disaggregated demographic data to understand equity/disparity concerns

Breakout Session 5: Key findings and input

Group A Notes

What input do you have for NSF to support integration and scaling of connected communities technology?

- Fund planning grants, specifically for problem discovery (not a pilot project), to scope needs and opportunities with communities. Here, neutral parties should be integral to facilitating and evaluating (in partnership with communities) that interaction.

- Remove technology from the focus and putting social scientists (actual social scientists) and their evaluation capabilities front and center. That is, an impactful SCC project may actually not have innovation in the technology development.

Who should be involved in integrating and scaling connected communities technology and what should their role be?

- Define problems and opportunities in the planning phase that should be followed closely by organizations and parts of relevant local government that hold some part of the solution and its implementation. That is, we distinctly engage researchers, communities, and implementing partners from the outset.
- Evaluation and expectations (especially those of communities) need to be transparent and clear. There should be an auditor or system that tracks projects via set metrics.

What are the transformative and incremental research gaps that need to be filled to integrate and scale connected communities technology?

- Focus on standardization, such as data standards, community created metrics of success, fully funded multidisciplinary evaluations requirements, and requirements to communicate back to the community about the success and/or learnings.
- We (researchers, NSF) do not actually know, scientifically or socially, what co-creation is. Fund research on the study of co-creation itself. It is through this research that approaches to sustainable translation and scaling will emerge.

Group B Notes

What input do you have for NSF to support integration and scaling of connected communities technology?

- NSF should take a role in making sure cities understand the value proposition of being participants in these research projects—aka facilitating “matchmaking” between cities, researchers, and communities
 - Can host workshops prior to submitting a planning grant to ensure researchers are being adequately matched
 - Facilitating/requiring a guiding vision document (community needs assessment/roadmap)
- NSF should prioritize funding use-inspired, community-first projects
- NSF could expand information about ‘failed pilots’ and successes from various communities on their website so other communities can glean lessons learned, amend components, and connect with others

What are the transformative and incremental research gaps that need to be filled to integrate and scale connected communities technology?

- NSF support development of “triangle partnerships” to support standardization of emerging tech

- NSF–private dollars–city => findings => NIST standards/consumer reports
- Vetted innovation standards
- Support research for institutional capacity building and asset management for digital transformation

Who should be involved in integrating and scaling connected communities technology and what should their role be?

- Communities should play the primary role as initiator in research projects; they can vet the researchers after identifying a problem
 - Communities develop the concept and demand, and researchers determine if they can meet the need (website, open call, etc.)
- Authenticity criteria for researchers/private entities in determining relationship with community
 - Asking questions like, is the need real? How long has the engagement relationship been ongoing?

Group C Notes

Input for NSF

1. Robust Pre-planning process phase – about coalition building before a solution is designed. Maybe work across/with other government agencies also doing regional efforts.
2. Bring initiatives together that were identified from needs/opportunities from multiple communities/groups
3. Funding for standards development – for data, technology, data sharing agreements, governance development (requiring use, sharing across communities)

Research Gaps

4. More focus on social science research – human behavior, community needs, communications, implementation measures.
 - a. Study of critical components of process, governance – what works and how does it happens
5. Evaluation and assessment
 - a. Why did it work
 - b. Who did it work for
 - c. New tools for measurement
 - d. Community should be a key part of the assessment (community participatory research process)

Who should be involved

6. For this type of applied research project, need support for funding or building organizational infrastructure/ collaborative capacity and structure (including evaluation teams that understand the intervention and the process)

7. People who are impacted need to be involved – (and think about how they are incentivized to be involved) – potentially include community members/organizations/policy makers on advisory boards
8. Research problem needs community buy-in before you start

Group D Notes

What input do you have for NSF to support integration and scaling of connected communities technology?

- Funding to support for the transition from research to integration/scale (with evaluation/impact analysis) and sustainability (with funding for operations)
- Help create a playbook that includes a framework for decision making with risk assessment before a project is launched (where community needs warrants it); learning from past SCC projects (failed and successful)

What are the transformative and incremental research gaps that need to be filled to integrate and scale connected communities technology?

- Need for aggregating and connecting communities with respect to policies, regulations
- Study and address the organizational behavior issues of municipal governments to enable productivity (What are the structures?) with a coalition of partners (inclusive, diverse, trusted, etc.)

Who should be involved in integrating and scaling connected communities technology and what should their role be?

- Intentionally including/requiring designers (planners) social scientists as PIs or co-PIs - embedding them from beginning - from design stage on
- Suggest that teams include community member from organizations that are established in the area of the grant to be core part of any deployment team; for example working with extension programs, labor unions, community colleges, etc.); learning from the community partner

Group E Notes

What input do you have for NSF to support integration and scaling of connected communities technology?

- Funding for early stages of research and partnership
 - Including problem definition, partnership building, data-use agreements
 - Can take a year +
- Facilitation
 - Need communications like this with more frequency
 - Regional executive director role with influence and focus on regional innovation
 - People who have a foot both worlds
 - Provide trainings to researchers
 - Needs to be funded

What are the transformative and incremental research gaps that need to be filled to integrate and scale connected communities technology?

- Standards and best practices
 - Two levers to get people to coalesce around standards
 - Research into what standards should exist
 - Funding could require complying with standards (not just NSF - DOT)
 - Types of standards
 - Data interoperability standards
 - Communications & Language
 - “Community”
 - Government AND Community vs. People living, working, and visiting city
 - Process standards
 - Community engagement
 - Implementation processes
 - Equity
 - Technical and organizational readiness

What are the transformative and incremental research gaps that need to be filled to integrate and scale connected communities technology?

- What do communities need to BE going forward
 - Including cities, downtowns, rural towns, tribal communities

Who should be involved in integrating and scaling connected communities technology and what should their role be?

- Compensating local governments and communities (e.g., residents, commuters)
 - Ensuring government has support for technical capacity
 - Direction from NSF that we want to see compensation plans in proposals
 - Including food, childcare

Who should be involved in integrating and scaling connected communities technology and what should their role be?

- Regional Connected Communities Plans
 - Including community, civic leaders, government leaders
 - Roadmap
 - Something concrete with buy-in
 - Needs to be updated
 - Needs to be validated
 - Trust community but verify
 - Problems may differ by community
 - Funding for convenings

- Supporting sustainability and capacity building

Appendix C: Notes from Listening Sessions

Before the in-person workshop, the project team held a series of 5 listening sessions, each organized around a topic:

1. Mobility and Transportation, October 24, 2022
2. Energy, November 1, 2022
3. Multiple Applications, November 28, 2022
4. Ecosystem Services, December 7, 2022
5. Climate Resiliency, December 16, 2022

Listening sessions were moderated discussions attended by practitioners from local government, nonprofits, consulting, industry, and academia. Sessions were held and recorded via video conference and a scribe took notes. Below are the notes from each of these sessions in chronological order.

Mobility and Transportation

Monday, 10/24 - 11:30a-1:00p - Mobility and Transportation - (e.g., projects relating to intelligent transportation systems and related mobility deployments).

Future Plans

What are your actual or intended plans for the future relative to this topic of smart cities deployment?

- Focusing on how to advance initiatives that got shelved from U.S. Department of Transportation's (USDOT) smart cities challenge (aside from the winner: Columbus, OH)
 - Stay steady on fundamentals and imperative services—can't innovate if key services are lacking
- NSF could provide a procurement shield
 - For example:
 - NSF could provide a “basket” of emerging technology, an entity picks one to employ at a given price point, it's considered competitive, and then it can be implemented without all the administrative labor
- To the previous point, the value of a pilot is that it derisks
 - If NSF can help derisk, less of a need for pilots
 - Platform wants government to commit to 4 years, for example, but the government can't take the deal because they don't know if the platform will be successful
 - Government is risk averse and representing a community, different from a business

- NSF could help with language for a master agreement for tech - so if a government does deploy - other risk averse governments could just latch on to a master agreement vs iterating through their procurement process
- Cities are already getting data and using the Mobility Data Specification (MDS)
 - Taking practical uses and incorporating them to official release
 - People are going to use it
 - Co Creation process is very important for adoption and scale
 - Open source and free without strings attached is very helpful
 - Requires structure and funding
- People can use MDS whenever they want
 - A core piece of MDS with different modes
 - 4 modes:
 - Micromobility
 - Delivery robots
 - Car share
 - Passenger services: taxi/ transportation network companies (TNCs)
 - Also looking at road geometry and construction, telematics, closure data, urban air delivery drones or passengers
 - Modular in terms of data spec

What are the challenges that you face and what could NSF do to help address them?

- Interaction between capacity and funding
 - Tight budgets within 2 years
 - Not able to deploy tech within services and still sustain those services due to a lack of capacity of transit employees and administration
 - Comfort with innovation is hard
 - Why do we need to innovate if things are working? Waste of money? Cultural shift is a big roadblock
- Communities have a fear of doing something first
- Constantly changing multi mobility transportation patterns (changing ridership patterns, post-COVID makes peak period all day instead of the old 9-5 peak)
- Used to put out pilot and forget to check up on it
 - No one know show to maintain it
 - Then, public comes to expect it even if it's not the smartest idea
- How to budget for something that's new?
- Transportation was always first priority for keeping employees happy and coming to work, but don't know where we are in a post covid world
 - Used to have metrics for parking and transportation management to encourage them to come to work

- Transit ridership seems to be down for people coming to work
- How to reevaluate schedules and ridership and cost?
 - Charge people for a monthly parking lease?
 - Monthly bus pass?
 - Doesn't make sense for low employee population
 - How to measure those metrics moving forward?
 - What type of transportation do they need?
 - Parking garage within distance of scooter or autonomous vehicles (AV) that will take them the last mile?
- Governments are seeking ways to avoid procurement
 - Fighting procurement department secretly
- Different organizations have different capacities—don't have ability to iterate and deal with procurement (esp for small teams in county government, for example)

How are you looking to integrate these plans with other applications?

- Zero Emission Buses
 - Hoping that one day updates become part of what we do rather than a novel concept (e.g., automated passenger counters already on the buses to become more standardized)

Do you intend to scale up from one jurisdiction to other communities/regions? If so, how?

- Pilot programs
 - One of the biggest issues—avoided them at all costs
 - “Death” of entrepreneurs that people often fall for
 - In reality, governments aren't unique. A pilot has to work for more than 1 government to be successful. However, pilots only work for one area by definition
 - Scale issues (think for problems that 100+ cities have and solve those issues)
 - When 20 governments sign up, THEN program begins

Infrastructure

How do you plan to address infrastructure issues related to this topic of smart city deployment? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- Biggest concern is how to get people in and out of an area
- 4 lane highway probably isn't feasible or appropriate these days with multi-modal transportation
- How to use assets and right of ways?

- Rather than medians, we can reimagine how to use that space for parks, bicycle and pedestrian uses. etc.
- Tech innovation could help us figure out how to optimize rights of ways that already exist and are currently inefficient
 - How to bridge neighborhoods of different demographics and socioeconomic status with regard to mobility and transportation? Overpass? Underpass? Again, technology and modeling could help us learn how to optimize connecting communities in an equitable way
- Commitment to government is nothing if people in state agencies don't understand priorities or needs
 - State agencies pass messages through so many people, time goes by, budget goes by, government changes in political ways that influence where money goes around election seasons (pilots are frequent around election seasons but then die with the candidates)
- We need to keep bringing solutions according to needs of the community, yet the needs are constantly changing
 - Should adopt a nimble, agile, responsive approach—beholden to community but still need to create things that we need
- One big challenge is asset management and information technology (IT) department strife
 - How to actually catalog data we need into a hypothetical system? Workforce training on data and infrastructure, administrative burden, etc. should be considered
- Frequently, entities lose track of who is installing sensors and tech—is someone tracking this information somewhere?
 - Interoperability
 - Silos are further perpetuated
 - Entities all have their own device—inefficient use of resources
- Data should be funneled into the same format with vendors all supporting that same format
 - Working with existing infrastructure and data
- A city, state, organization is only as good as the technology they use
 - Need a system that all groups buy into (with staff adequately trained on how to use tech, easy to operate)
- NSF can look at technical assistance to private sector on how to create a solution that is less intrusive to transportation system and need less assets to deploy to get to same solution
- infrastructure doesn't always have to be technologically intricate

- For example, road signage doesn't always make sense, the paint/line striping is faded and unclear, etc.
- There are small things we can do to improve mobility
- infrastructure doesn't always require lots of \$
- Small things add up to really big problems
- That said, signs and paint are operational expenses which is the reason why people go for the big things—following the money
 - Harmful distinction between operational and capital budgets
 - Software is a service
 - Federal government hasn't pivoted yet to understand they're capital purchases (even if they're cloud based) because they're recurring
 - Federal government doesn't know how to deal with recurring payments
 - Federal government has profound power
 - Federal grant making should require interoperable standards
 - Difficult to operate without a cost penalty
 - MUST have open API data standards in this format so when an entity leave they can make the change quickly
- Business scales faster with more governments/clients—de-risked
 - Usually it's the more you buy, the cheaper
 - For governments, the more you buy, charge more because you know you'll need legal compliance, overhead, etc.
 - Inverts
- That said, systems are often designed for the million dollar project
 - Not set up for small problems that cost less money
 - May charge a million dollars even if it's a small problem
 - NSF—can solve small problems at scale for different communities

Cybersecurity and Privacy

How do you plan to address cybersecurity and privacy issues related to this topic of smart city deployment? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- Governments are targets, smaller companies, less so
 - International governments don't like data being in the US because government can ask for data

Data Management

How are you or plan to address issues related to data management that enables transparency while still preserving privacy? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- USDOT is “old school”—need to become more integrated into “smart” ventures
 - Refuse to work on data and training
 - Lack of consistency about ownership of data and how they use it
 - User interface can be friendly and easy, but data still lacks
 - Government thinks, ‘we don’t need it,’ and prefer to use a service like 511
 - Calling for a change of mentality and education for governments
 - People are worried about losing their job for fear that tech will take over
 - Technology isn’t going to replace you, but merely optimize the human force
 - Spread the message and educate on what we’re aiming to do
- Data *is* infrastructure
 - Most organizations don’t have in-house data
 - “Vendor locking”—what you don’t want
 - Vendors are worried about getting screwed so they ensure a company can only use the vendor’s methods, tech, software, etc.
- An alternative:
 - Vendor serves as data intermediary between data collection and practitioners
 - Solution is more money for government
 - As it is scaled, prices come down to manage all MDS data—doesn’t matter how many sources you have (aka mobility companies) as they funnel into same product
 - Data ecosystems can help control harmful vendor locking
- Cities are willing to take on data and want data, however most lack training and capacity to execute in a meaningful way
 - Money at federal level now—some cities have different capacities, many don’t have capacity at all
 - Many cities never invested in capacity of staffing, recurring ability to take advantage of technology, maintain technology, understand technology, or think about things like data interoperability standards (what is mandated by the vendor?)

Co-creation and community engagement

How do you co-create with communities (community, city government, developer/owner, and technology providers) to ensure that smart city technologies are equitably deployed?

- Looking where funding hasn’t gone in the past rather than equal shares of funding for all communities
 - Focus on equity and past investments to inform future investment

When is the best time to have this discussion? What does the timeline look like?

- I think the community input process is being updated and made more inclusive, not just a few in person meetings.
 - In the transportation and cities space, I think people are realizing standard Parks and Rec-type meetings don't work and are not productive
- Always that tension between when to bring in community
 - Need to engage community early on in the process
- Gather data first, then validate from community members with lived experiences
 - Contrastingly, another panelist felt that organizations need to show leadership and make executive decisions about what is needed for most marginalized because those communities are often hard to reach

What regulatory and/or policy innovations would facilitate this co-creation?

- Best practice to define who community is
 - Most interested people aren't usually the community that would be impacted by a program or policy
- Co-creation with the community starts with problem definition. What are the challenges communities are facing? Then leverage that input on the ask to industry. Community also should be involved in vetting solutions

Synthesized parting thoughts for NSF

- Smart cities aren't always technologically focused; be clear about outcomes, do not create project around funding opportunities
- Pilots should incorporate scale moving forward—multiple cities, multiple counties (show scale from the beginning rather than expanding individualized pilots to different places and trying to make them fit)
- Can't do all things at once
- There is a need for open, free, developed data standards and APIs as that is technical piece of whole puzzle that is essential; encouraging data standards at the federal level; cities to be able to digitally describe policies with code
- Focus on better connecting pilots with implementation plans
- Focus on problem definition
- Contemplate sustainable strategy from inception, deployment, to scaling up

Energy

Tuesday, 11/1 - 9:30a-11:00a - Energy - (e.g., projects that have deployed/used smart grid technologies in communities around the US)

Future Plans

What are your actual or intended plans for the future relative to this topic of smart cities deployment? How are you looking to integrate these plans with other applications?

- Data from smart meters—better data for energy use and buildings
- Performance oriented rather than prescriptive
- Educate building owners and architects about why healthy buildings are important
- Try to implement AC control in people's homes to provide frequency regulation
 - To better incorporate renewables into the grid
- Distributed energy resources (renewables, electric loads, energy storage)
- Demystify the infrastructure
- Community based, move technology into individuals' homes
- Renewable integration
 - New construction in the grid, lots of batteries
 - How can you control them in a more effective way?
 - How can Hawaii run completely on renewables? Battery and wind

What are the challenges that you face and what could NSF do to help address them?

- Want to be new, but not too new because there is a lack of trust within the community
- Financing always a difficulty
 - Government uses bonds to fund projects and wants researchers to use the same funding method, but then one is locked into a decision
 - Don't want to use a loan
- Lots of promises made in the past about tech improving people's lives but they don't end up delivering
 - Software issues come up; education about interfaces gets in the way
 - Trust needs to be rebuilt
 - Open platforms are a way forward from a City's perspective
 - Also don't want to invest in startups that will end up not being there later
- Where do we build microgrids?
 - Where to place charters to do minimum stress on existing infrastructure?
 - Maximize efficiency
- How to avoid additional investment into infrastructure?
 - Have to replace existing systems to make it work
 - Consider all constraints in *planning stage*
- Where to focus engineering RESEARCH?
 - Need to evaluate in conjunction with other people
 - Having trouble seeing how classical engineering programs can fit in

- Don't want to have to train yourself and students on new things that aren't already taught in academic programs—that's where engineering training is helpful
- Social science research to evaluate effectiveness—easier to see how it fits in
- In response to other panelists:
- Industry wide shift
 - People age out of the service provider field, how to continue training for older people?

Do you intend to scale up from one jurisdiction to other communities/regions? If so, how?

- Moving from single owner to smart buildings and smart campus'
- Rollouts with *actual* deployment (haven't been able to get to deployment stage in the past)
 - Start with a small campus and try it out with utility partners—how can we roll this into products?

Infrastructure

How do you plan to address infrastructure issues related to this topic of smart city deployment? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- Adding artificial intelligence (AI) into operation and monitoring system are the key
- From a commercial development view, large and missed opportunity for landlords pushing renewable energy sources
 - Lack of third party experts to guide you through the process of setting up forms of renewable energy
 - Can find a solar or window installer
 - Lack of expertise you can trust
- Almost impossible to work with utility companies—not openly opposed to helping you, but hide behind ambiguity and tariffs
 - Have to take risk to set up renewables
 - Utilities won't give guidance about rate, costs, find a way to add regular recurring costs that outweigh renewable credit
 - Find a way to make money from you
 - Lose money from energy generation
- Partners want to add more renewable energy
 - Becoming resistant
 - Lose more money in every day

- Political risk—if you pass cost through tenants, utility companies will shut you down
- Not worth it
- Is this a knowledge gap that utilities would benefit from having?
 - Yes, lack of knowledge and expertise
 - Most haven't dealt with large scale renewable energy
 - Can't figure out impact on the grid
 - Utilities are scared of it, add everything they can to protect themselves
 - If we continue putting out data and passing policies to make utility hire the right staff, knowledge around hidden fees may disappear
 - Lack of awareness in community at utility level
- Utilities have (outdated) conservative take on how much needs to be updated
 - Transformer sized for worst case scenario—how unlikely is it that everyone has shut off their appliance? Utilities using this as their standard
 - Should customers pay the cost of the upgrade?
 - What is a more realistic idea of what is the worst case scenario for utility?
- Tenants want electrical vehicle (EV) charging stations
 - Solutions proposed are so onerous that installing EV is so difficult
 - Appear to not want it though that may not be the case

Data Management

How are you or plan to address issues related to data management that enables transparency while still preserving privacy? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- Another panelist mentioned being let down by technology of past, having to overcome distrust of previous disappointments
 - Is there a recognition from technology companies of that issue? How to move forward? Is there methodology in place to reestablish trust? Backup plans when technology stops working?
- Training and continuing education for facilities managers—won't be up to speed on interactive technology—especially if they're shared across property lines
 - company views service people as best sales people—once the trust is lost, the company will be in trouble and can't make sales
 - Customers rely on expertise of service providers
 - Worried about aging workforce of service people, industry recognizes that
 - Many generations of technology by the time someone retires
 - Try to add AI/tech into control system to reduce training needs for staff
 - Reduce manual effort
 - Onsite operation—how can you add new data control to reduce

effort

- Monitoring functions—cloud systems, collect data and put it on the cloud
 - Only send recommendations back to operator, “go there, tune this”
- Don't have to do manual scheduling, system will do scheduling for you for crews and staff

Co-creation and community engagement

How do you co-create with communities (community, city government, developer/owner, and technology providers) to ensure that smart city technologies are equitably deployed?

- Universities should do sensing and analysis—if it comes from the manufacturers, is the information biased to showcase their own technology?
 - Academic side of things can provide credibility
- Financing a few houses for sensors and tell the truth about it
 - “This worked, this didn't”
 - Neighbors can walk in the house and see if the technology is working for themselves
 - Additional data collected on that (e.g., air is better, temperature is better)
 - Don't have funds to retrofit
 - Not fancy research per se, but still data, still science
 - Engineering research idea—showing validation of technology
- Challenges with utilities and operation/demand side:
 - We don't have good rate structures that reflect value
 - Decarbonization value (social benefit), literal grid value (investments can forestall other types of infra/new transformers)
 - Earn a rate of return for servicers
 - Want profit
 - Creating new ways of measuring impact (beyond peak in July and energy use)
 - Frequency regulation, varying demand to balance throughout the day
 - don't have metrics to say “if you put this technology here and manage them this way, this is the value they're offering to grid and utility rates...”
 - No marketplace there
 - Need better ways of succinctly describing value to allow both sides to meet in the middle

- Something needs to be done there on a social scale—community needs to know the benefits and details of renewables
 - Research needed: how do you engage different parties? Not just utilities. Also local community stakeholders
 - Top down approach creates blockages because information was never gathered at beginning
 - Stakeholder data needs to be taken into account at start of project
- Lack of knowledge—knowledge has not been adequately passed down to community and providers
- Community *is* the utility—feel comfortable talking with them from engineering perspective
- If you're going to work with community, need money to compensate them for their time
 - Asking community to give us time, don't have time
 - Can't just expect them to help for the good of the planet
- Land use of zoning codes for distributed energy
 - Do we have the right things in zone code?
 - What could municipalities incorporate into planning?
 - Small scale district planning would be interesting
 - More than houses and roads, build standbys

Suggestions and research ideas/questions for NSF

- Not a lot of funding for infrastructure and deployment
 - How to sustain? Built infrastructure, but when project's over, have to take it down
 - Not enough time to see all parts of assessment of impacts
 - Funding is too short of a cycle
- Rip out everything after research is a dealbreaker
 - Maybe there is a way to leave the technology and extend the grant
 - Start something in a community, needs to be a gift
 - Not take it away
 - Time for NSF to rethink leaving technology in community
- Ready made 'toolkits' for energy technology that are, already fleshed out
 - Schools, commercial buildings, homes
 - Wholesale for smart metering
 - Already designed to talk to potential or future grid updates
 - Help streamline resources
 - Addresses utility hesitancy
- Increase panel reviewer stipend for community members to entice them to provide input during their working hours

- NSF could make a requirement in each grant that there be an outreach, education, and demonstration element to the scope
 - Audience should be specific: practitioners (architects, engineers, contractors, operators, property managers) as well as end users (building owners, tenants)
- NSF-funded industrial internship could be an option—provides interns with industry labs and demonstration testbeds for NSF project demonstrations
- What are the physical limitations to transitioning to fully renewable generation?
- Another issue was related to interconnection challenges; whether it's putting batteries behind the meter, or installing PVs (what upgrades need to be made below the transformer)? Utilities have a very conservative take on what needs to be upgraded (meaning they are designing for the worst case). What is a more realistic measure to use for this design?
- How can technology serve the people? Be prepared for shift in the power grid to have a more sustainable future
- How to integrate smart buildings to avoid silos?
- How can products respond to signals from the grid? (e.g., ramping down, increasing storage, etc.)
- Where do we build microgrids?
 - Where to place chargers to do minimum stress on existing infrastructure?
 - Maximize efficiency
- How to avoid additional investment into infrastructure?
 - Have to replace existing systems to make it work
 - Consider all constraints in *planning stage*
- Knowledge is sitting in a workforce that's aging—how should we approach this issue? AI?

Multiple Applications

Monday, 11/28 - 1:30-3:00p - Multiple Applications - (e.g., projects that include multiple application systems such as transportation and safety, for example)

Future Plans

What are your actual or intended plans for the future relative to this topic of smart cities deployment?

- Regional mobility clearinghouse
 - Regional public policy when it comes to private mobility partners
 - Currently, the work is heavily siloed (e.g., traffic and public safety data are in different space than planning data and aren't adequately integrated)
 - Continued focus on data interoperability and contracts/service interoperability, too

- Mobility is so important
 - Using AV to create better infrastructure for residents and cities
 - Laying the path for a more modern infra
 - Best way to talk to people about change is via something they get and understand and care about
 - Mobility is a great gateway to talk about smart cities and technology
- We have posed the question: how do we address today's critical issues (failing infrastructure, disadvantaged communities, etc.) while still preparing for the future? Who is helping us navigate these decisions? What can we do TODAY that helps us maximize the limited resources we do have?

What are the challenges that you face and what could NSF do to help address them?

- Residents are leaving their county to pursue jobs—big issue
 - Without an overarching authority or federal support (toll roads, BMT), hard to create holistic policies around access and opportunity
 - Need bi-state and federal cooperation
- Struggle with scale
 - Decision-making around influx of data was difficult
 - We need to think more holistically about access to opportunity
- Governments and foundations fund programs, not the people
 - High turnover among staff which leads to inefficiencies in the programmatic work and loss of knowledge
 - Losing people to industry, to salaries, work/life balance, city workers are overstretched, don't have time to become data-driven decision makers because bogged down with day-to-day needs of communities
 - Cities pay badly and expect a lot
 - Burnout and feelings that staff are not seeing the results that they hoped to see lead people to become disillusioned with public sector jobs
- “Smart city” is too broad of a term—what do we really mean by the phrase?
 - Tend to treat smart city projects separately from other things rather than an evolution of existing concepts
 - Is the rest of the infrastructure there?
 - Are cities (etc.) able to handle new smart city endeavors?
 - How do you organize smart city programs? How does that match up to what chief technology officers (CTOs) and people working on infrastructure are already doing within the government, etc.?
 - Related to issue of top-down leadership

- Smart city investments take years/decades to pay off—need to keep the thesis of the project throughout lifecycle
- Conversations on smart cities often don't take into consideration what's happening outside of metro areas
 - Even rural places around metro areas are different than truly rural places (non-metro counties are defined by Office of Management and Budget (OMB) as counties outside of a metropolitan area with fewer than 25% of the population commuting in/out of the metro for work, other definitions: <https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html>)
 - Need more reflection about whether its okay to say that rural places aren't going to be part of smart city initiatives, or do not need to be “smart” by an urban definition given their specific needs and low population density
 - Equitability is a problem
 - Current urban mentality: conducting urban projects in rural areas (“lite” versions)
 - Topics of smart city work (transportation, energy) does not transfer in a way that feels meaningful to rural people
- Do not have a top-down way of doing smart cities
 - Don't have centralized funding, standards/interoperability, or vision for what we're trying to do as a nation. Who's responsible for saying that people should have access to public spaces, for example?
 - Need to focus on a guiding question: what kind of functionality do we aspire every citizen to have?
 - People primarily want to move around their cities easily, get to school, work, shop, play, places of worship - basic things of life in a community - how can we help them do this more easily/sustainably/equitably? How can we meet their basic needs?
 - How do we use NSF funding for how to develop a vision for what their community wants to do?
 - Not paying enough attention to end state of cities
- Have to reconcile with the fact that we've allowed entities freedom to lead smart cities
 - Now, we have a hodgepodge of problems we need to resolve
 - Don't have to be on the same systems, but narrow the path of options for digital infrastructure
 - Take advantage of tech, need to have more digital infrastructure to support and enable it (and keep safe/secure)
 - Need better coordination between universities and local entities
 - Love regionalism approach

- What if we operated more like the Health and Human Services administration?
 - How to take advantage of decisions to hire/plan regionally?
 - Within regions, better connect academic and government organizations
 - Still will be the problem with a regionalism approach that small and rural communities will always be outliers to the primary interests of the region
- NSF/federal government—can't have 20,000 cities approach smart city work the same
 - Start being better about what lessons will enable cities to leapfrog
 - How to leverage the National League of Cities (NLC) to standardize smart city approach

Cybersecurity and Privacy

How do you plan to address cybersecurity and privacy issues related to this topic of smart city deployment? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- In thinking about cybersecurity, we need to think about the key difference between city planning and smart cities
 - Smart cities encompass a set of technologies that are novel and allow us to understand parts of city that isn't captured by traditional way of doing things
 - If these things don't relate to people have better experiences, they're interesting, but not useful
 - Useful = the extent people are incentivized to keep using and maintaining infrastructure/tech
- Opportunity: leverage new kinds of data and new forms of analysis (sensor data, data from private providers) that are better than current data
 - Administrative data is intrinsically biased
 - Only people who want to do work with the cities get to see these data
 - Don't see all 311 data because people don't feel comfortable
 - Actually address equity with new tech
- Limited value in citizen scientist
 - Novel opportunity to the extent there is value in generating a new generation of scientific thinkers
 - Use neighborhood data and information to ground problems for future scholars and thinkers rather than an abstract set of issues about firm A and firm B, for example

- *Contrary point:* I think the notion people don't or doesn't work with data--the citizen data scientist type--is dead wrong. The "resident" encompasses non-profits, journalists, and others. These folks absolutely use data to represent their issues.
- Give people the opportunity to change their mind (regarding cookies)
- How is data solving a problem? Be open about it and share decisions with users

Data Management

How are you or plan to address issues related to data management that enables transparency while still preserving privacy? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- Data is very noisy
 - What's the purpose?
 - When looking at cities, we can classify data in categories:
 - Historical data
 - (maybe have to use today's data instead, though)
 - Cities generate data every day--how is it being managed?
 - Collecting information about people and behaviors
 - (Administrative data was requested because of ordinance or law)
 - Provides potential use cases
 - If current data isn't enough, what kinds of data do we need?
 - For rural communities and rural regions, the data is often sparse and collected only at the county level
- How can you put data collection into laws to ensure governing is adapting to today's economy?
- Ecosystem of 3rd party proprietary data that cities don't have access to
 - This is why the trend in Republican-led states to deregulate is so distressing
 - And other state pre-emption efforts taking away local control -- state legislators considered policy on autonomous trucking with NO discussion of data sharing with local governments
 - Signs in Republican-led states that people are being conditioned by the media and political discourse to be suspicious of any government-led data collection, participation in polling is way down for example
- Thinking about data from a top-down perspective is very important
 - Can do a lot of things (data), problem is that communities don't see a need for it, not generating a need for the data
 - Telling community members they want the data, but lacking a strong story about why which doesn't foster community participation

- Remove complexities from dashboard and reporting
 - Small communities and the public in communities of any size need to be able to use it to meet their day-to-day needs
 - Capacity for smart city professionals is mismatched with small communities because community members don't necessarily care about data-driven decision-making (or know what this is) and do not want to spend scarce resources to hire more educated city staff with data skills
 - Many city staff in small towns/rural areas are women who work part-time

Co-creation and community engagement

How do you co-create with communities (community, city government, developer/owner, and technology providers) to ensure that smart city technologies are equitably deployed?

- Need to think of smart city projects as driven by individuals
 - Recognize unique needs and desires
 - Can you marshall people to your cause? Intermediary group that can work with community
 - "Ecosystem builders"--networkers and local champions
- Need to build trust, especially with first group of networkers
 - Will bleed out into other groups of people
 - If there is trust, networkers will bring in other people
 - Fewer, more quality participants are often more valuable to a project than many people who aren't as committed
- A group of people who can be really important are the professionals who do planning work and community engagement such as staff at regional planning organizations, community foundations, state extension offices, state offices that collect data (like the dept of finance), county officials, utilities, etc.
- Communication in languages other than english
 - Surveys, for example
- Are cities even willing to pilot anymore with private companies coming in with new flashy ideas?
 - Tired of being tested and sampled and studied without any real outcomes
 - And staff doesnt have capacity
 - Pilots only serve as a representative of a citizen, if we're lucky
- Replicate reality with digital twins
- Data has to show advantage of smart city technology in a quantitative way to prove value to the community

- City staff and other professional working with communities are 'on the clock' when they use data and can be trained as part of their professional development to improve their skills, because it is part of their paid work it is easier to get them excited
 - Agreed on the need to educate our consultants. Also, we've been PAYING our community to participate in engagement opportunities more and more. It is SO hard to ask someone to take time out as a volunteer and these incentives have been essential to quality input.
 - Our participants in rural communities don't want money as payment for their individual time, all the communities asked us to use the stipends in our budget to support their community non-profits or projects that they are fundraising for (they already spend significant personal time doing fundraising, so they see collaborating with us as another form of volunteerism that will help pay for community projects)
- One thing that surprised me recently, that makes sense but I hadn't thought about before talking with people in rural communities, is that they have strong negative opinions about electric cars and are not thinking about autonomous vehicles (AVs) as a desirable improvement
 - Biofuels are a major economic driver in the Midwest, and residents see electric cars as a problem for agriculture and the future demand for corn (i.e. a significant portion of corn goes to ethanol production now)

Synthesized parting thoughts for NSF

- Fund the “growth curve” in making funding available after the pilot stage
- Funding comprehensively—many stakeholders involved and funding is usually focused narrowly on a “smart city” entity rather than people helping infrastructure on the ground
- Data privacy and equity—rolling out without community input and feedback about what's private and what's not
 - License plate reader, ring doorbell, etc.
- Better ways of collecting research and insights from NSF projects
 - Lots of richness in the work that's happening, are we all understanding the lessons learned? How to better integrate findings?
- More support for upscaling non-profit entities
- Focus on research questions that come out of design and social sciences
 - Need to consider socio-technical findings as the research rather than solely tech
 - And a lot of research on the social science side (that involves humans) can take A LOT longer than what engineers are used to.
 - Yet, the funding structure does not reflect the different timeline

- Nonprofits that may be good partners on messaging and broaden the reach of research findings may not also be good pilot or study partners on the tech innovation side, teams find it hard to cultivate both kinds of partners (to test technology, and then also to disseminate the work)
 - It's about how technology gets integrated into communities, not funding more technology projects
- Focus on how the data impacts decision making

Ecosystem Services

Wednesday, 12/7 - 9:00a-10:30a - Ecosystem Services - (e.g., projects relating to air quality, public parks, light pollution, clean water, etc.)

Future Plans

What are your actual or intended plans for the future relative to this topic of smart cities deployment?

- Aiming to implement a long listening/building trust phase to identify what people need
 - In order to accurately identify messy problems they deal with everyday
 - To that point, reframe community/university partnerships to be transformational rather than transactional
- Reframing the way we go about research early on
 - Extractive relationship with communities
 - Problematic foundation for university partnerships
 - How do we put the impression of co-creation at the beginning of research and innovation, rather than the tail end of the process?
- Trying to understand cities at a systems level and understand problems cities have
 - Open and connected; feedback rich; and able to deal with ambiguity (cities)
 - Openness of urban systems is something that needs to be understood to develop technology, rather than being the result of a controlled system
 - Redundancy and inefficiency are key to resilience
 - Know this from studying transformation of cities
 - Top down urban renewal
 - Don't repeat the same mistakes that urbanists did 50 years ago
 - Need to understand the type of problems cities are (complex, open and messy) in framing the solutions were seeking
 - This type of thinking needs to be applied to all tech and domains
- Interested in scaling

- Ex: community gardens and the role they play in transformations
 - Broadening our understanding of scaling
 - Scaling out and scaling deep (not just up)
 - Scaling up = increase the farm and produce more produce
 - Scaling out = who do you reach in the community? Not just with the food, but education, activities, community building and relationships, etc.
 - Moving away from singular problems and solutions to holistic understanding
 - Take a solution that can address multiple issues rather than measuring efficiency of success for one solution
 - Can have impacts greater than the intention
 - Ex: postal system
 - How can we use existing infrastructure to build community resilience?
 - Expanded perspective—not just looking at the fleet and the carrier as infrastructure that is limited by law to deliver mail
 - Think about this notion of scaling deep, how can we leverage existing infrastructure (reaches every household 6 days a week) to think about community health/disaster preparedness
 - Rich ecosystems of possible services and potential innovation that can take place
 - How can we move beyond the notion that growth is a single metric of success?
 - Need to shift away to our dependence on growth to regenerative communities
 - See this a lot with funding

What are the challenges that you face and what could NSF do to help address them?

- “Technology is the answer, but what is the question?”
 - Currently, we’re developing new technologies and obligations/innovations and *then* trying to find an environment to test these applications
 - How to reframe the processes in which we articulate the questions we’re trying to answer in a genuinely participatory way?
 - Not use communities as guinea pigs/labs
 - Deploy solutions, but think about community engagement and participation much earlier in the process
- University perspective:

- Excitement and anticipation about what technology brings to the university is palpable
- Where are the designers, though? Much of the R&D process needs to consult designers and social sciences earlier to make sure we're solving the problems that need to be solved
 - What are the possibilities? What's the potential for tech in the public realm? What are the social issues that the community needs addressed?
- What are the potential benefits to communities in terms of adding agency and building power—literally and figuratively? Each piece of technology has the opportunity to treat communities as consumers
- Engineers are abusing process of interdisciplinary teams
 - Getting around the requirement for interdisciplinary teams
 - How to approach this more effectively?
 - Bring a sense of wholeness, understand how tech fits into the social realm
 - Need a true urbanist (designer)
 - What is likely to be adopted (they have a grip on this)?
 - Ex: AV—realized that optimization only works when they're separated out from non AVs; can't avoid divergent vehicles of human drivers
 - Some areas are okay for separation (busway)
 - Look more critically at places where there are more degrees of touch like sidewalks—does it make people's lives better?
 - Are they able to partake in the tech?
 - THEN, let's go back and tell developers challenges and wins
 - Questions about community seem to be an afterthought; designers could have helped figure that out a while back
- Problems need to be part of a larger network of communities that work together to solve issue of air quality
 - Build a community of action and build awareness
 - Bigger than what can be solved by a community itself
 - Governance systems that can actually solve it
- Designer-based work gets no funding or support from university
 - The only reason we can do research is because we have the autonomy to make our own curriculum for design studio and urban ecology
 - Opportunity: more explicit conversations about how the work of architects and designers is a critical path issue for community
 - Social, governance, design solutions
 - Commit as a university and make it a competitive advantage

- NSF pushes universities in a strategic direction—designers are ready to respond and have the resources, but architects aren't answering NSF calls
 - Maybe invited to the table, and maybe not?
 - Have to seek it out yourself and that's a challenge

Infrastructure

How do you plan to address infrastructure issues related to this topic of smart city deployment? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- From a designers perspective, there are very real technical components to infrastructure (i.e., behavior of existing infrastructure, the magnitude of solution required, etc.)
 - Engineering side is so important
 - When mapped over desire (more complicated systems), we found more complex (social) problems that sensors aren't the answer for
 - How to get a main street to implement technology when you need a community to come together to make it work (property owners, etc.)?
 - Need knowledge, resources, and most of all, a social matrix that says the technology is good and something desirable
 - Can push all the money we want, but uptake isn't going to be there

Cybersecurity and Privacy

How do you plan to address cybersecurity and privacy issues related to this topic of smart city deployment? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- Haven't encountered it all that much
- Privacy related to data
 - Sensors for ecosystem does not have much implication on privacy
 - Projects are initiated with the community, we aren't imposing it on them
- By building tools that anyone can use, we circumvent privacy issues altogether
- So much divergence between the idea and implementation
 - Healthy checks and balances need to be implemented when creating a utopian vision for how something can work, but reality has to be tempered so that it doesn't come in with unintended consequences
- We are giving away so much data, people don't think twice about it because of the benefits
 - People don't understand the implications of data sharing and sensors

- Hesitant to be sensed in parks, but okay with smart phone monitoring
- Researchers are villainized; we have pushed too hard to use communities as a living lab for too long
 - Little commitment to long term sharing and relationship building

Co-creation and community engagement

How do you co-create with communities (community, city government, developer/owner, and technology providers) to ensure that smart city technologies are equitably deployed? When is the best time to have this discussion? What does the timeline look like?

- Needs to be discussed with the community; this answer will change from group to group
 - Share decision making power
- Call for formations of a formal community council
 - Pay for community members to be advisors (pay for their expertise)
 - What are the problems? What is the potential?
 - Cultivated group from many different neighborhoods and types of communities that look at research and development–deployment continuum
 - Builds literacy of the city in a formal exchange of tacit knowledge
 - Researchers and community members are equal in the exchange
- Should we be using the language of pilots?
 - Stop using community as ‘lab’
 - Don’t need to be part of an experiment that fails on researchers terms rather than community
- Hope that at a university level, we’d be able to develop ways to engage with select community groups at a longer duration and address many problems than pilots allow for
 - Come together in a few places to address many issues
 - More deep and transformational
 - Currently, we’re all entrepreneurial and doing our own thing; there is a need to build community inside and outside of the community
 - Key to changing the impact of work that we do
- Co-creation is poorly understood but trying to leverage it as a tool
 - Is there a pedagogical approach to it? Interdisciplinary understanding of the term rather than jumping in and repeating mistakes
- Co-creation is an attitude, not a phase
- Every organization has overhead costs, but universities have a different time frame and workflow

- Need an intermediary entity that can bridge the different time scales as an intermediary
 - Might be a nonprofit or other group that holds a long term that is not beholden to their curricular gap or doesn't go offline for the entire summer, etc.

Synthesized parting thoughts for NSF

- Funding needs to ask for integration of community and interdisciplinary
 - As explicit as possible about problem seeking as well as problem solving
 - NSF can ask for requests for proposals (RFPs) in a way that acknowledges hardware/software issues, governance, robust, interdisciplinary teams, etc.
- NSF questions in this session are militant and transactional
 - Too expedient
 - Participatory action research—even partnership, completely change the way we talk about cocreation
- Continuum of experience for NSF grants
 - If you don't have relationships and know each other's work in advance, won't get in and funded
 - Should have intentional community building to know where intersections are when opportunities come along
- Universities are most responsive to what NSF puts in front of them
 - NSF can fundamentally change the way success is measured for faculty
 - Have to respond very quickly
 - Communities are big, long lasting problems and we only get one year for a project
 - Can NSF look at how to invest/start a project based on problems rather than solely tech solutions?
 - NSF can tap into the community—where does this make sense? What are you working for?
 - In the community for 10+ years making relationships and working with them

Climate Resiliency

Friday, 12/16 - 2:00p-3:30p - Climate Resiliency - (e.g., projects relating to climate-induced natural disasters such as flooding, landslides, fires, hurricanes, etc.)

Current Projects (to serve as context for the broader conversation)

- Constructed stormwater infrastructure

- Adding sensors, retrofitting them with autonomous solution (i.e., gates, pumps, valves)
- Helps us understand what's going on in a more detailed way, and respond in real time
- Environmental engineering—speak to all the disciplines
 - Designing and constructing stormwater infrastructure
 - Focused work through a resiliency perspective
- Indoor air and heat
 - Community engagement research to implement smart tech like sensor networks
 - Current disparity between technology and cloud computing, community engagement, and implementation of community input into policies
- AI and machine learning to analyze urban data to give cities predictive capabilities (e.g., enabling doctors in the examination room to ask a few directed questions and input answers into a predictive model to screen for lead poisoning risk in children)
 - Instrumenting cities—array of things camera, computing, and communication
 - Desire to generalize that infrastructure—programmable and autonomously controlled in the field

Future Plans

What are your actual or intended plans for the future relative to this topic of smart cities deployment?

- Ensure environmental impact statements and requirements for future developments are prepared (prior to development?)
 - Ex: if you're building next to a highway, and you want to rezone, you will get an eDesignation placed on your site (noise, etc), meet specific Outdoor/Indoor Transmission Class (OITC) ratings to ensure interior spaces are adequate—can do this for air quality, hazardous materials, and more
- Write sustainability statements for investigating and remediation
 - More bureaucracy, more policies (developers hate it, but they work)
 - Counterpoint: in many counties/areas, there may only be one city manager in charge of zoning, development, etc. and so more bureaucracy may not be sustainable or efficient for them
 - Poor political alignment—how do you get each neighborhood to be on the same page in terms of energy systems, watersheds, and air quality?

- Necessity of human/relational side of this work
 - Multi-municipal approach has led to favorable alignment of elected officials in a given area
- Attempting to figure out: what is the smallest prototype we can make that can still have a significant impact?
 - Scale is really important, not one scale for every project or community (zooming in and out frequently)
- Capturing value in public private partnerships (involved technology installation and adoption of proven technology)
 - Ex: wastewater treatment plant; installed a methane digester and captured the methane which was then used to turn turbines to power the plant (creates electricity); this generated power is then sold to the grid
 - Installed at no cost to the city and paid for from savings from new technological advances; also, the new technology lowers the city's electric bill
 - Conversion to LED streetlights
 - Private partner can capture lower electric bill for some other benefit to point where it doesn't cost the city much
 - Opportunity in the policy world to consider how these approaches can be implemented
- Explore more project wrapping/bundling
 - Many city projects are too small for contracting, but if many cities contract together, projects are more feasible
 - Ex: the rapid bridge replacement program bundled ~550 rural bridges in Pennsylvania in one contract with the latest tech and much faster than the state could have done it
 - The current system of local control in the U.S. hinders this idea; there needs to be a policy structure that would allow municipalities to coordinate across jurisdictions and bundle projects together

What are the challenges that you face and what could NSF do to help address them?

- The reality is, we're going to live in a specific kind of world—that we created—and adaptation is becoming crucial—what kind of solutions do we need to solve these unfortunate problems relating to climate change?
 - We are currently turning out lots of technology—10 years from now, is that going to require more research and development or something else?
 - The creation of more advanced technology is not necessarily the barrier to adoption

- Municipal managers are keenly aware of the role of tech; in their roles, they are using completely different tools to solve their problems because that's what is available to them (an issue of procurement)
- Barriers aren't on the tech side, but the accessibility and community side
 - If advanced tools are only available to the wealthiest communities, we're not solving the big picture problem
 - Broader issue of usability: we can come up with cool shiny widgets and prove they're useful, but that doesn't mean they're usable
 - Did we make something new that doesn't require more training and doesn't make a new job for someone else (have to complement the workflows of the people)?
- Why are more researchers not getting their tech in the hands of real people?
 - Misaligned incentives
 - Large research organizations don't value impact—they like it, but it doesn't factor into metrics for promotion, tenure, grants, etc.
 - Teaching, pushing boundaries of knowledge, but not accounting for impact
 - Putting a lot of pressure on people who isn't their day to day
 - NSF has to support and fund this community impact incentive
- Misaligned missions and needing infrastructure and funding to bring everyone to the table, and academics, and everyone has a completely different mission
 - Happy to talk together in a meeting, but action does not register for their mission
 - Community-based researchers and practitioners have to prove value with limited resources
 - Similarly, the city is trying to make decisions about why to invest money in cooling, for example
 - Need something that can help them make decisions quickly
 - As a researcher, want to see impact on health
 - Takes a really long time sitting at many city and community meetings, need to figure out how to align research questions so we all get something out of it at the end
 - Not compensated for time spent interacting with one's community/doesn't get considered in promotion discussions, etc.

- Silo of work plans and targets
 - Experiencing that through climate plan implementation
- What does NSF value?
 - Public health is applied research, not novel enough for NSF because it's not advancing biology or chemistry, etc.
 - NSF needs intellectual merit to move research forward
 - NIH and NSF are siloed

Infrastructure

How do you plan to address infrastructure issues related to this topic of smart city deployment? What are the challenges and barriers? What do you need to address them (policy, technology, funding?)

- Installing electrical vehicle (EV) infrastructure
 - However, with new federal accessibility guidelines, U.S. praxis board and city are having trouble interpreting guidelines/rulings
 - Program is stalled out because the city was required to put in more accessibility that wasn't anticipated
 - Best spot for power isn't always most accessible area of parking lot
 - There is a need for clearer guidelines
- Communities need the internet to get smart technologies to work (sensors, update apps, etc.)
 - That said, redlined/disinvested communities have issues with cloud, wifi, and broadband
 - In communities that would benefit the most from smart research projects, there is a huge cost to get the basic infrastructure/utilities needed to get smart tech to work
 - Huge connectivity issue
- Engineers love to codify things—what works in one place will work in another
 - The problem is, we don't have enough case studies to confirm this is the best route
 - We don't know if stuff is actually working because nobody checks; only know there is a problem if someone calls
 - No one knows you exist until you don't do your job and things are broken
 - Makes it difficult to maximize personalized investments
 - Want to ensure money is going to be put to best use
 - Field has addressed this by saying every community is unique
 - Don't do enough post construction coverage

- If this is the way we decide to do things, this is what our cities will be—broken and aged
- Does it have to be the case that there isn't enough funding to do post construction information seeking and checking in?
- Maintenance and monitoring—is this built into the procurement budget?
 - Ongoing reporting is separate from procurement from construction

Co-creation and community engagement

How do you co-create with communities (community, city government, developer/owner, and technology providers) to ensure that smart city technologies are equitably deployed? When is the best time to have this discussion? What does the timeline look like? What regulatory and/or policy innovations would facilitate this co-creation?

- We, as researchers and practitioners, are *content* experts, need community members as *context* experts that can allow these [smart technologies] to scale on a human level
 - Huge miss
- The goal should be to design something in that anyone who can use a screwdriver can use the tool
 - Methods are incredibly useful to think about: who are you building this for?
 - NSF is already doing a lot of this work
 - Federal government is making a good push for these innovations
 - Venture capitalists wouldn't care about this stuff
 - Federal support is crucial and NSF is doing it
- Community-based groups are doing more work than compensated for—nonprofits that are barely getting by
 - Need more money to do this
- NSF could look at its own rubric in evaluating success for their projects
 - Want equity and all of these things but have no mechanisms for incentivizing and holding people accountable
 - To what end? How does community engagement get scored in an application or process?
- Two ways to work with communities:
 - Fix things they're concerned with (is expensive)
 - Engage them and not expect them to give their time for free
 - Pay high school teachers to come to workshops to implement a certain curriculum, etc.
- Community meetings are poorly attended
 - Not super effective at garnering community feedback

- Not integrating human feedback loops are ultimately going to take us down a road of inequity and less than efficient solutions
 - With greater reliance in smart tech, begs necessity for investment in human feedback loops and how community interacts with this
 - Model—and get better at—reconciliation opportunities
 - As much as we want to automate, humans will always be a part of this process

Synthesized parting thoughts for NSF

- How to connect researchers at regional/city level
 - NSF to convene brainstorming sessions and facilitate that type of conversation that could lead to calls for proposals
- Health is never prioritized but big reason why people will change things
 - Implement health into NSF at all
- Acknowledging what is working
 - Don't stop what you're doing because a lot of it is working really well
- De-risking initial applications with pilot programs
 - Spending local taxpayer money for new programs
 - Localities will feel more comfortable spending their funds if they've seen a program working elsewhere
- Bundling improvements across cities
 - Great workshop idea for NSF to get key leaders from each of the cities around the country—the haves and have nots—and facilitate a better way of info sharing
 - Many cities with similar issues can bundle solutions
- Evidence from local buy-in (communities and government) that this project is a priority for them and is happening in a timely way
 - Add it to rubrics for evaluation in some way