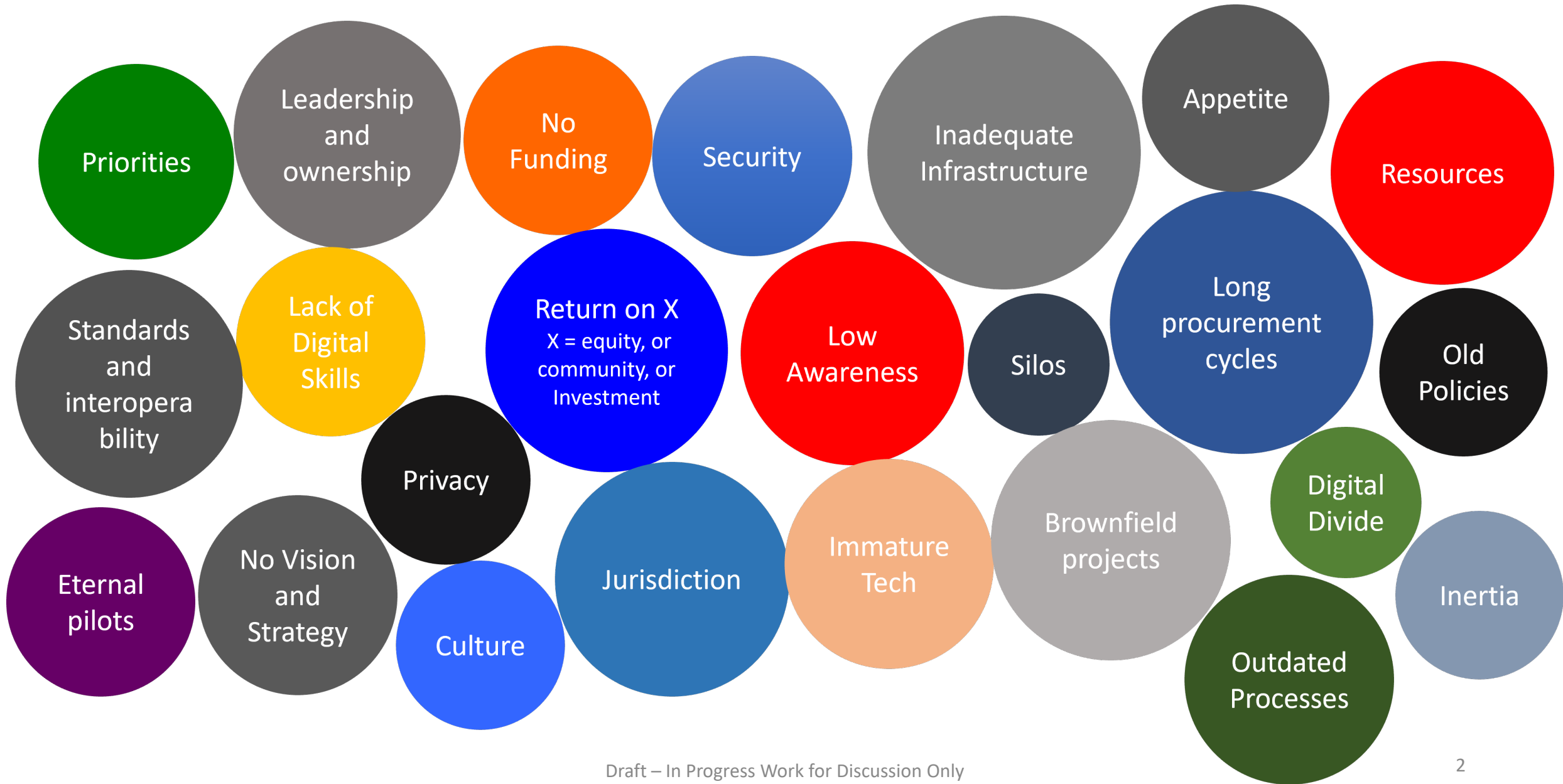# Sustainable Infrastructure Draft Recommendations
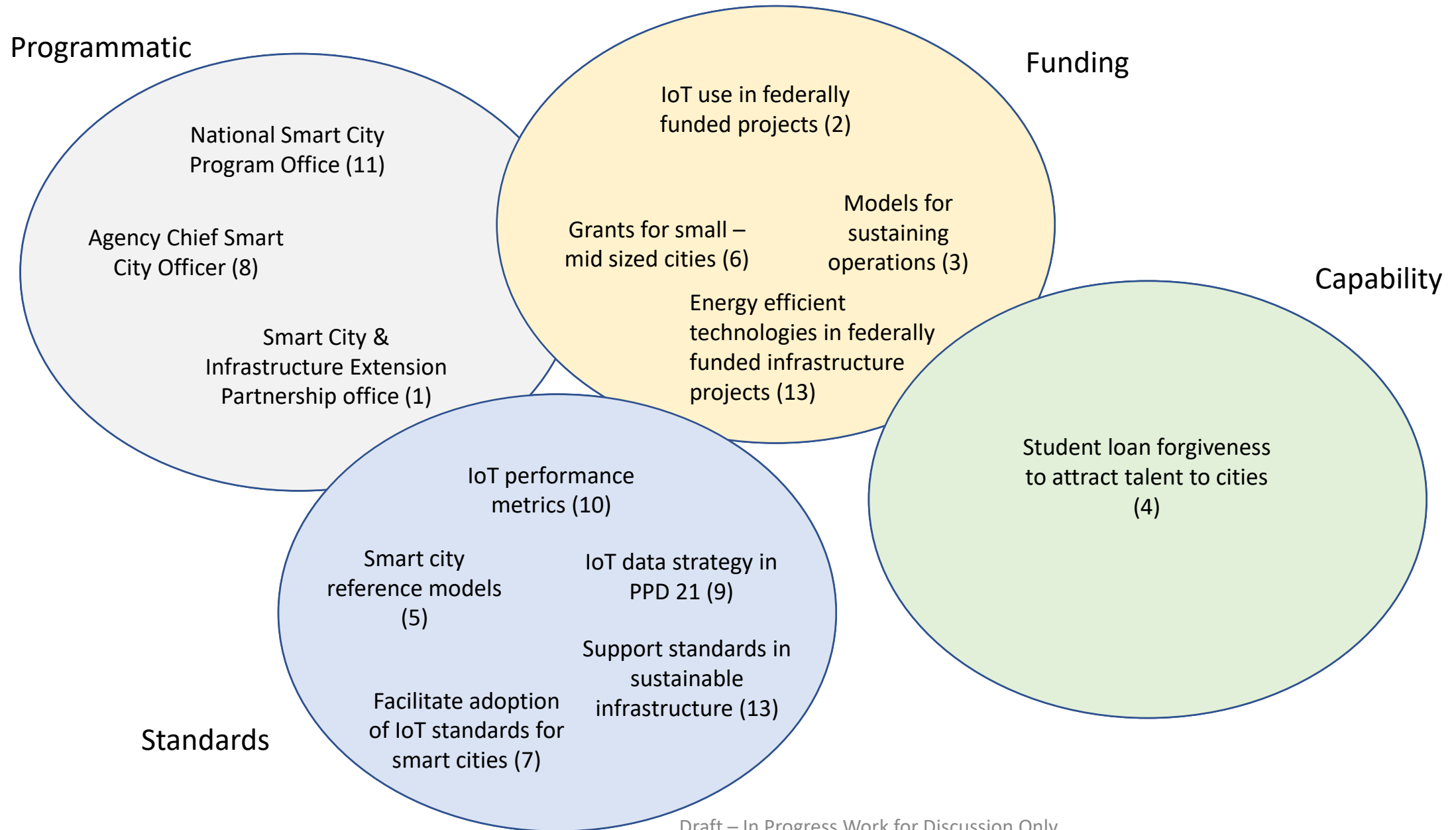
Pete Tseronis

Tom Katsioulas

Nicole Coughlin

Steve Griffith

Arman Shehabi

Benson Chan

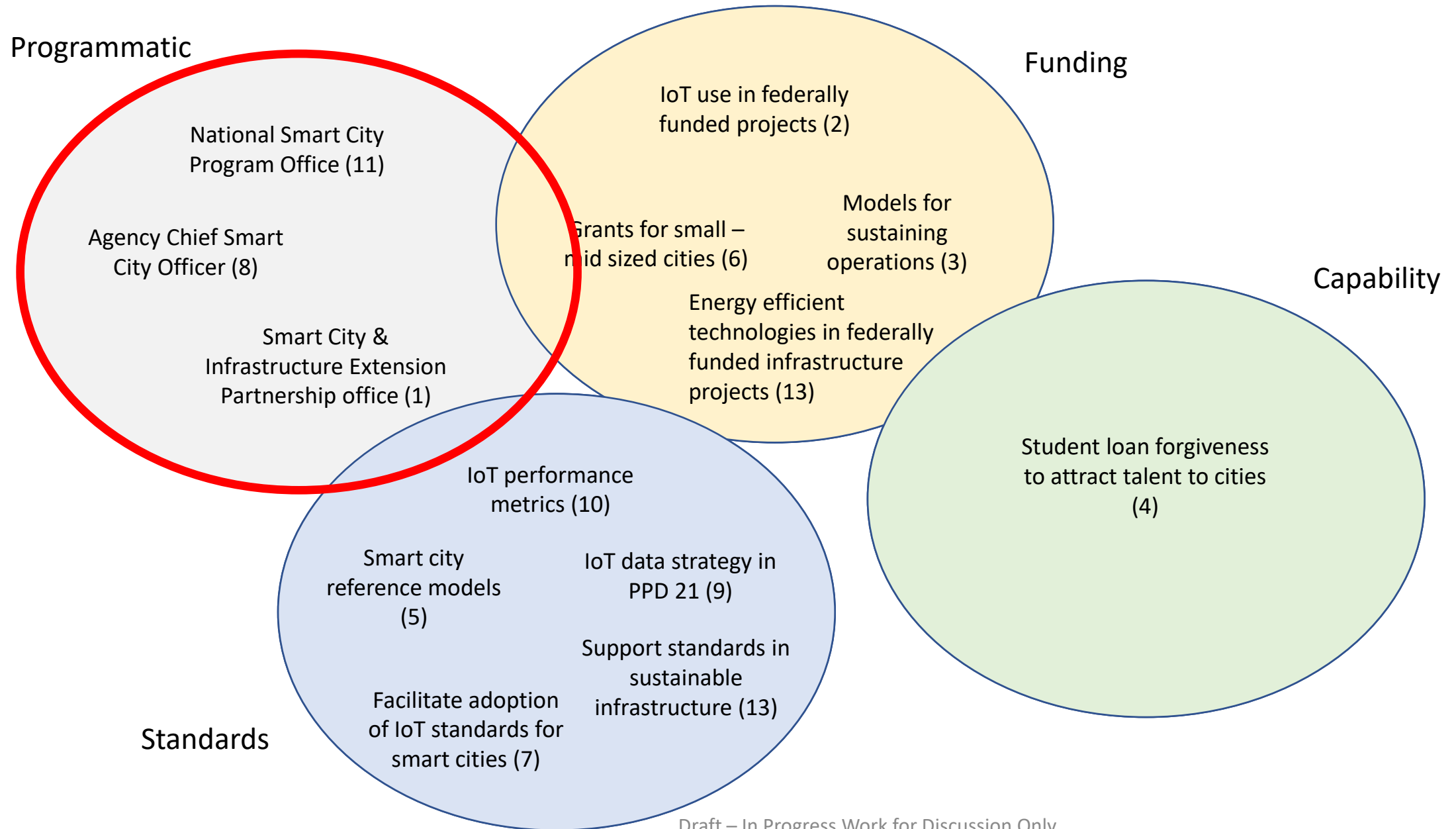May 16-17 2023

# Common barriers

# Recommendations



Programmatic

Funding

Capability

Standards

National Smart City Program Office (11)

Agency Chief Smart City Officer (8)

Smart City & Infrastructure Extension Partnership office (1)

IoT use in federally funded projects (2)

Grants for small – mid sized cities (6)

Models for sustaining operations (3)

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IoT performance metrics (10)

Smart city reference models (5)

IoT data strategy in PPD 21 (9)

Support standards in sustainable infrastructure (13)

Facilitate adoption of IoT standards for smart cities (7)

Draft – In Progress Work for Discussion Only

# Recommendations



Programmatic

National Smart City Program Office (11)

Agency Chief Smart City Officer (8)

Smart City & Infrastructure Extension Partnership office (1)

Funding

IoT use in federally funded projects (2)

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Capability

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Standards

IoT performance metrics (10)

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IoT data strategy in PPD 21 (9)

Support standards in sustainable infrastructure (13)

Facilitate adoption of IoT standards for smart cities (7)

# #1: Smart city & infrastructure extension partnership office

The federal government should consider the development of Smart City and Sustainability Extension Partnerships (SCSEP).

**Justification**

- Cities/agencies lack expertise, tools, resources
- Small cities/agencies even further behind
- IoT in smart city and sustainable infrastructure expertise in industry is limited and hard to get
- Public procurement process to engage private sector resources is challenging. New model is needed.

**Implementation**

- Multidisciplinary expertise from technical, ops, cybersecurity, etc.
- Public (local, state), industry, university partnerships
- Collaboration with regional consortiums
- Leverage USDA, MEP, state, existing infrastructure

**Barriers**

- No obvious federal owner
- Limited expertise in marketplace and resources and expertise may be difficult to get
- Establishing an infrastructure requires significant time and resources
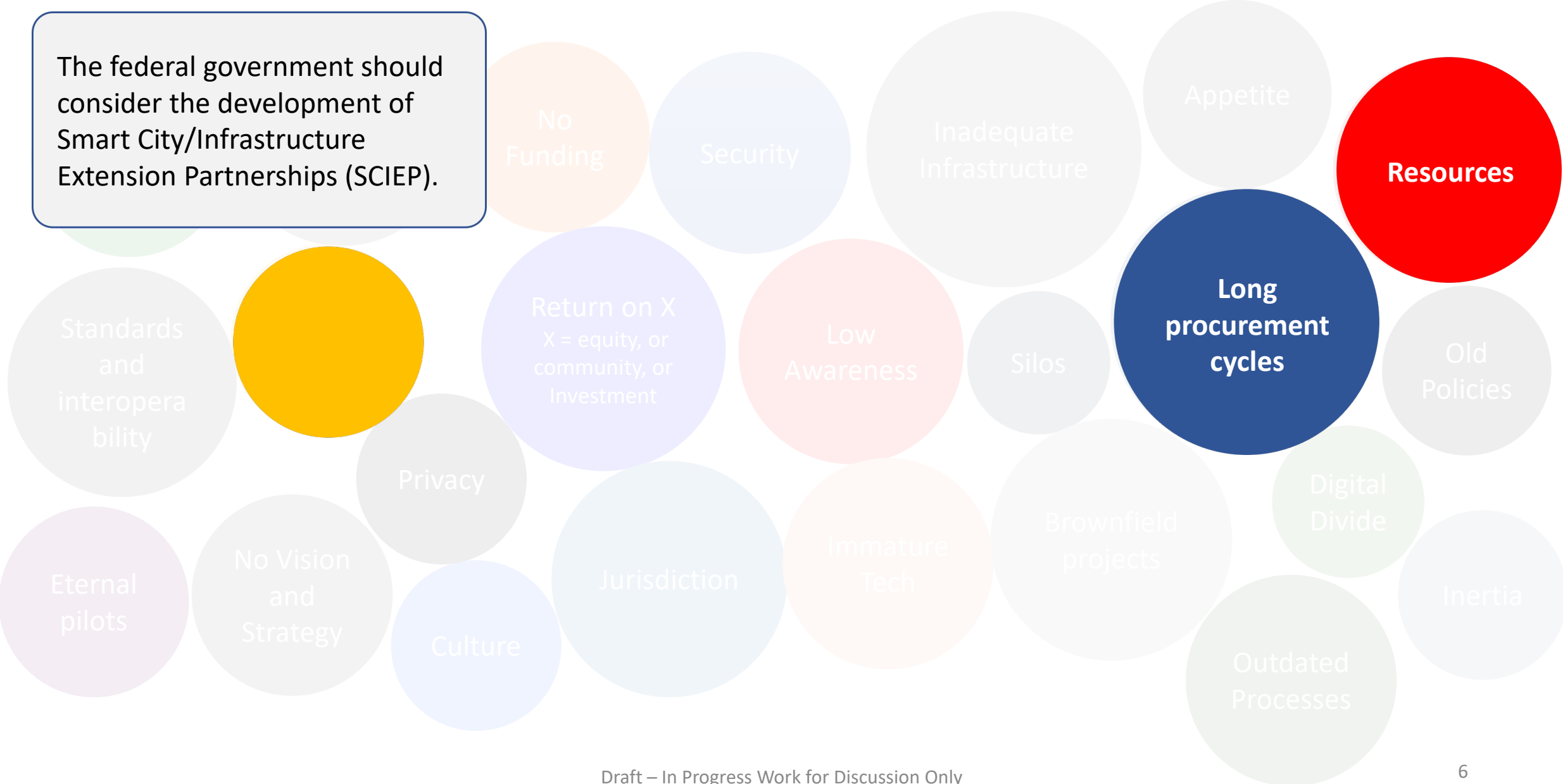
**Agencies**

- Department of Energy (renewable energy, electrification, etc.)
- Department of Transportation (intelligent traffic, roads, highways, autonomous vehicles, etc.)
- Department of Commerce/NIST (standards, cybersecurity, GCTC, regulatory, etc.)
- Department of Homeland Security/CISA (cybersecurity, etc.)

**Federal considerations**

- SCSEP in place to support projects funded through BIL and IRA
- Define role of states in supporting and enabling SCSEPs
- Consider offering some services through existing extension offices, regional consortium partnerships, or with existing state programs

# Barriers addressed

The federal government should consider the development of Smart City/Infrastructure Extension Partnerships (SCIEP).

No Funding

Security

Inadequate Infrastructure

Appetite

**Resources**

Standards and interoperability

Return on X
X = equity, or community, or Investment

Low Awareness

Silos

**Long procurement cycles**

Old Policies

Privacy

Eternal pilots

No Vision and Strategy

Jurisdiction

Culture

Immature Tech

Brownfield projects

Digital Divide

Inertia

Outdated Processes

# #8: Appoint Chief Smart City Officers in federal agencies

**The Federal Government should establish a Smart City Officer (SCO) within each of the twenty-four (24) CFO Act agencies.**

**Justification**

This positions will serve as a business executive and technology strategist, developing and governing a comprehensive strategic, tactical, and operational roadmap intended to communicate how existing and future projects are/can support organizational mission, inform resourcing decisions, and identify enterprise-wide investment opportunities

**Implementation**

Once assigned via the Agency Head, e.g., Cabinet Secretary, the SCO will be required to develop a 90-day plan to include resources necessary to carry out the SCO program.

**Barriers**

Lack of funding to support the SCO, notably in terms of staff needed (federal and contractor) and communications/outreach
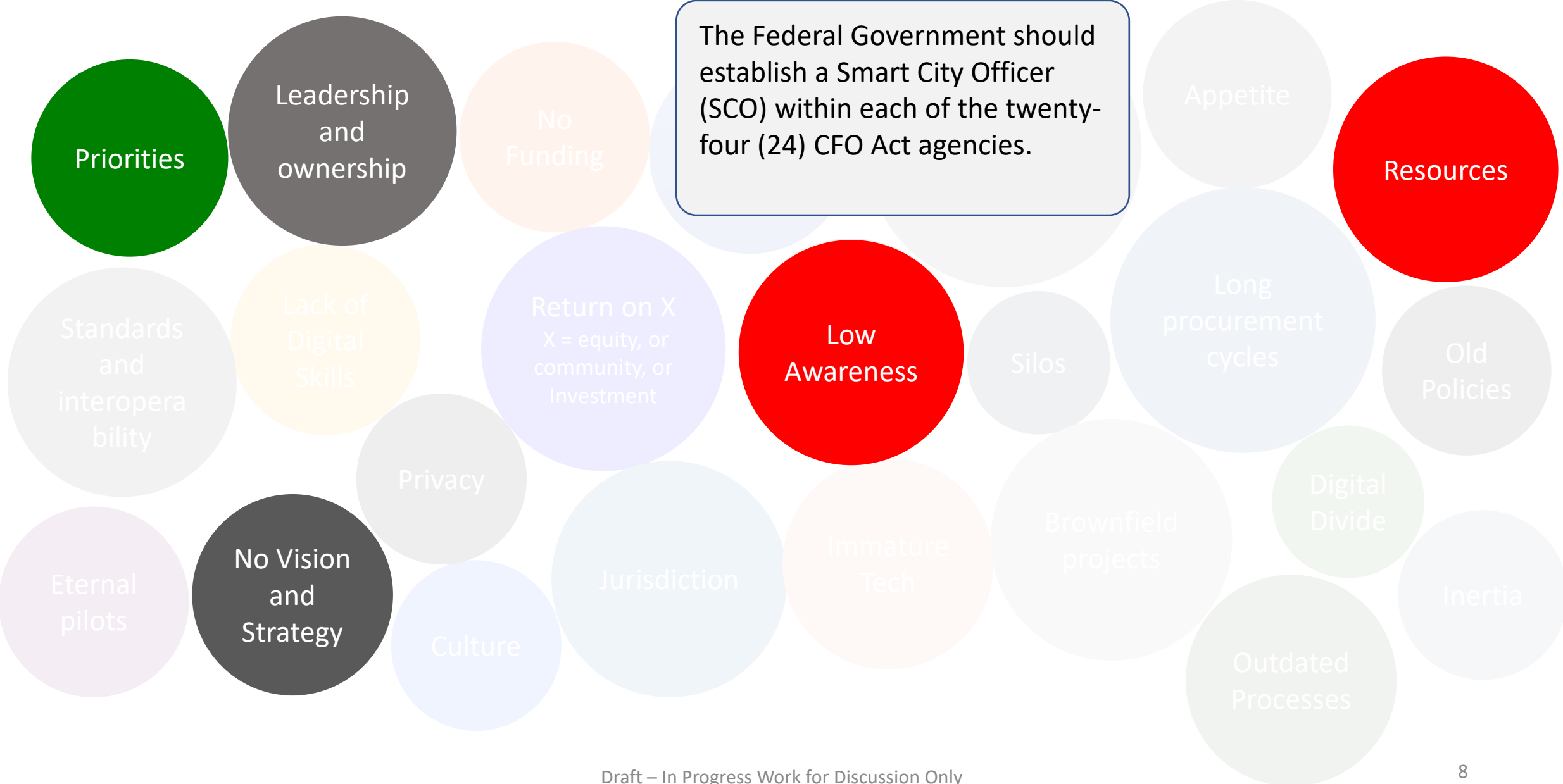
**Agencies**

The 24 CFO Act agencies, with consideration being given to the non-CFO Act agencies

**Federal considerations**

Ensure that the SCO in each agency will participate in a Community of Practice, like the Federal CIO Council format, which, in turn, will serve to convene SCOs across all agencies

# Barriers addressed

Priorities

Leadership and ownership

No Funding

The Federal Government should establish a Smart City Officer (SCO) within each of the twenty-four (24) CFO Act agencies.

Appetite

Resources

Standards and interoperability

Lack of Digital Skills

Return on X
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Low Awareness

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No Vision and Strategy

Culture

Jurisdiction

Immature Tech

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Inertia

Outdated Processes

# #11: Federal smart city program office

The Federal Government should establish a Smart Cities Program Office within the Executive office of the President to ensure that the federal government, state, and local government entities can effectively plan, implement, and manage smart city initiatives across the United States.

**Justification**

This central office will ensure that the federal government, state, and local government entities can effectively plan, implement, and manage smart city initiatives across the United States

**Implementation**

The SCPO will align with the U.S. Chief Technology Officer Team to maximize the benefits of IOT and corresponding data for critical infrastructure sectors. The SCPO will develop a 360-day approach/plan addressing how the Federal Government can help cities develop a corresponding strategic roadmap for their smart city (and IoT) initiatives. This includes identifying goals, prioritizing initiatives, and developing a roadmap for implementation.

**Barriers**

- Lack of coordination from the Executive Office
- Minimal support from designated agency leadership
- Lack of branding
- Lack of coordination, stakeholder engagement, resource allocation, and performance monitoring
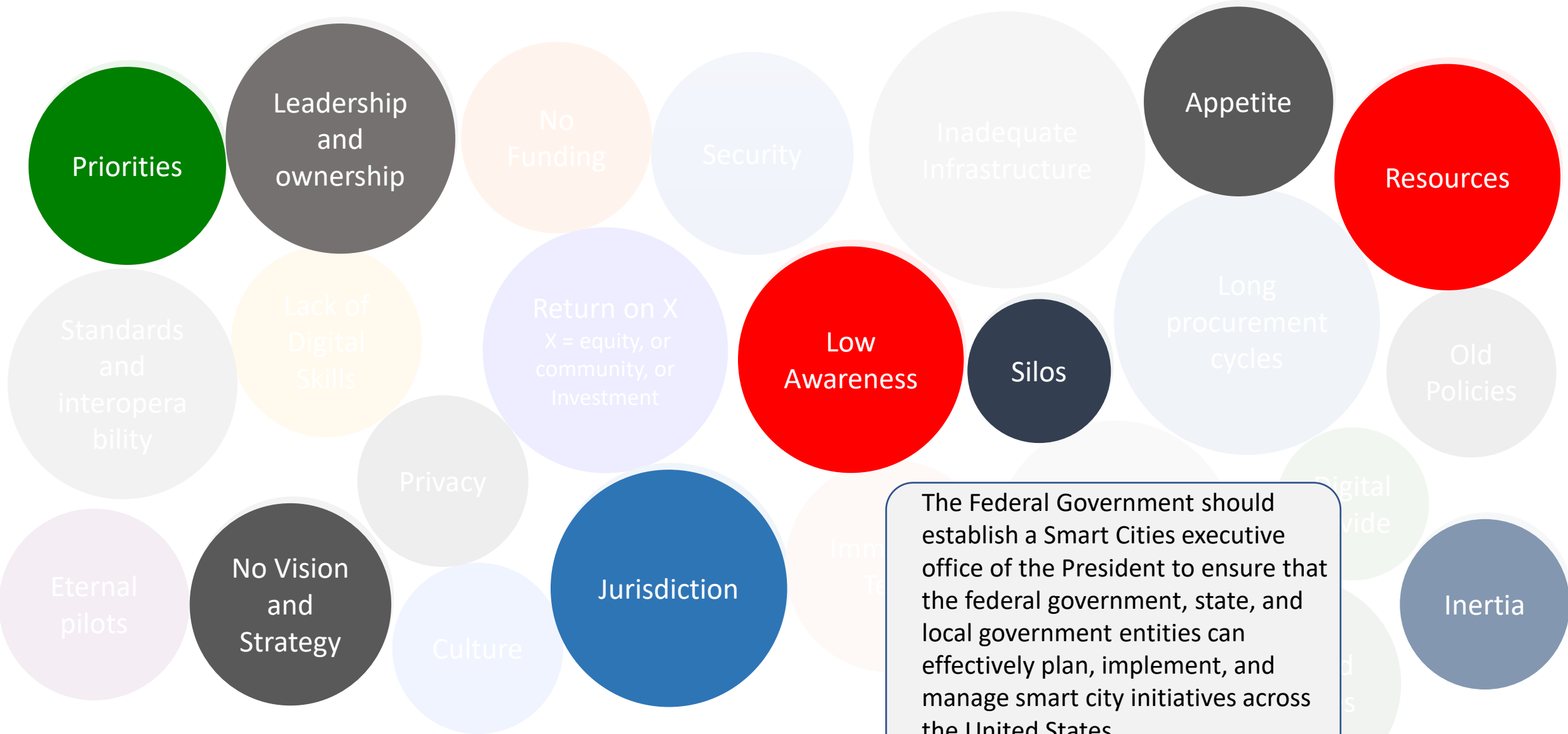
**Agencies**

This office should be aligned with the Office of Science and Technology Policy to: 1) work with federal departments and agencies and with Congress to create bold visions, unified strategies, clear plans, wise policies, and effective, equitable programs for IoT and Smart Cities modernization; 2) engage with external partners, including industry, academia, philanthropic organizations, and civil society; state, local, Tribal and territorial governments; and other nations; and 3) ensure equity, inclusion, and integrity in all aspects of IoT implementations
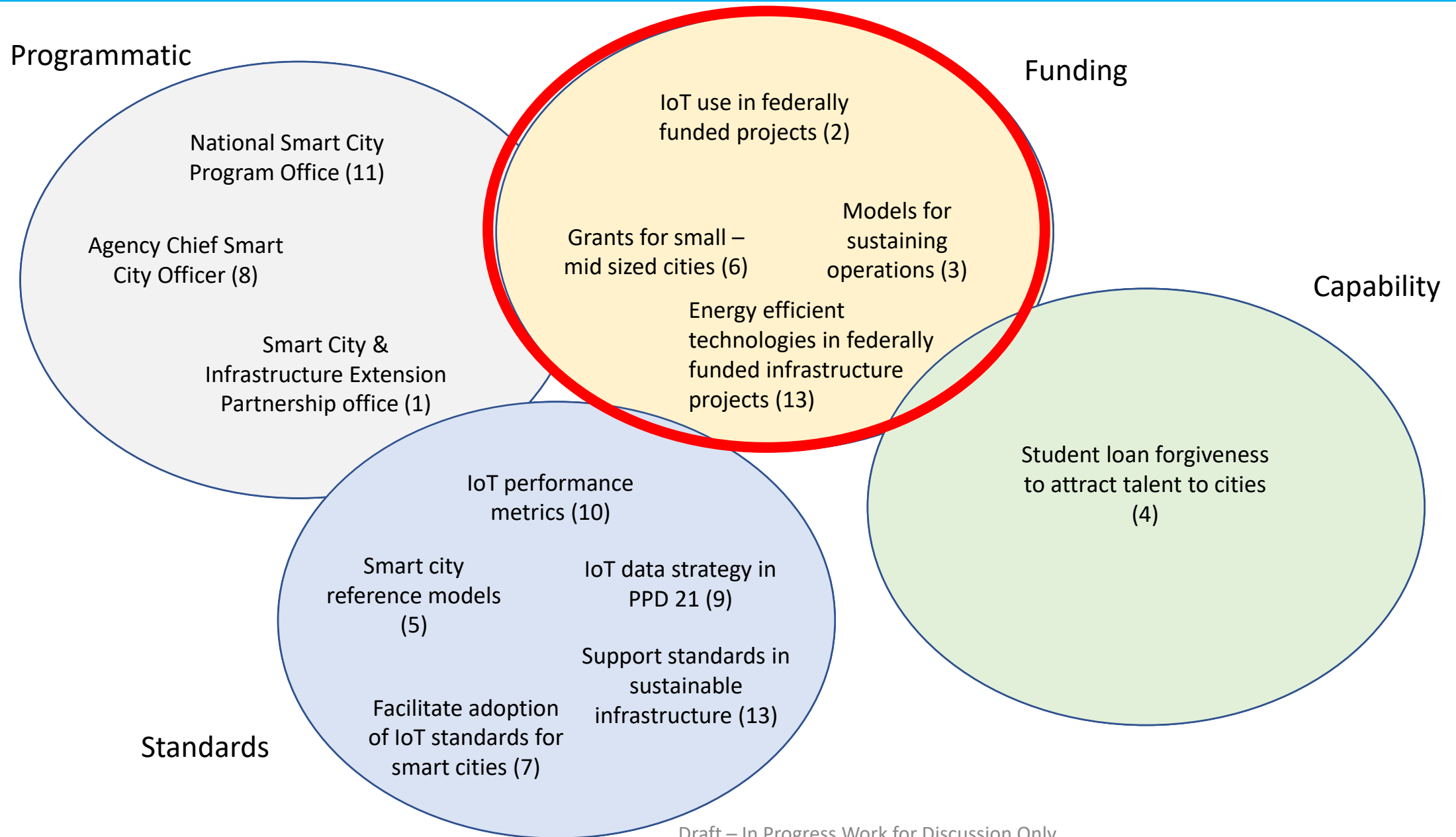
**Federal considerations**

Ensure that the Coordination and Integration with the NIST (FWIoT and GCTC) protocols are in place, i.e. IoT implementations involve the integration of multiple technologies, systems, and stakeholders. A SCPO can provide a centralized coordination mechanism to ensure that all the elements are integrated seamlessly.

# Barriers addressed

Priorities

Leadership and ownership

No Funding

Security

Inadequate Infrastructure

Appetite

Resources

Standards and interoperability

Lack of Digital Skills

Return on X
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Low Awareness

Silos

Long procurement cycles

Old Policies

Privacy

Digital Divide

Eternal pilots

No Vision and Strategy

Culture

Jurisdiction

Inertia

The Federal Government should establish a Smart Cities executive office of the President to ensure that the federal government, state, and local government entities can effectively plan, implement, and manage smart city initiatives across the United States.

# Recommendations



**Programmatic**

National Smart City Program Office (11)

Agency Chief Smart City Officer (8)

Smart City & Infrastructure Extension Partnership office (1)

**Funding**

IoT use in federally funded projects (2)

Grants for small – mid sized cities (6)

Models for sustaining operations (3)

Energy efficient technologies in federally funded infrastructure projects (13)

**Capability**

Student loan forgiveness to attract talent to cities (4)

**Standards**

IoT performance metrics (10)

Smart city reference models (5)

IoT data strategy in PPD 21 (9)

Support standards in sustainable infrastructure (13)

Facilitate adoption of IoT standards for smart cities (7)

# #2: Specify use of IoT in federally funded infrastructure projects

The federal government should consider the specification and utilization of IoT and "smart" technologies into infrastructure and other projects that are funded in full, or partially, with federal funding.

**Justification**

- No one will specify IoT on their own into projects unless project owners demand it
- Compliance drives adoption
  - DoT specification of SBA 8a resources on projects
  - USACE and GSA specifying use of BIM on federal building construction projects
- Specification in government projects signals government support, interest and confidence in IoT.

**Implementation**

- Easy to say "use IoT", but what IoT to be used?
- A broader vision and understanding of how IoT can be incorporated is needed to drive requirements and specifications

**Barriers**

- Project owners have very limited knowledge of IoT
- Limited expertise and resources in government and marketplace to support IoT projects
- IoT adds complexity, cost and potential risk to projects
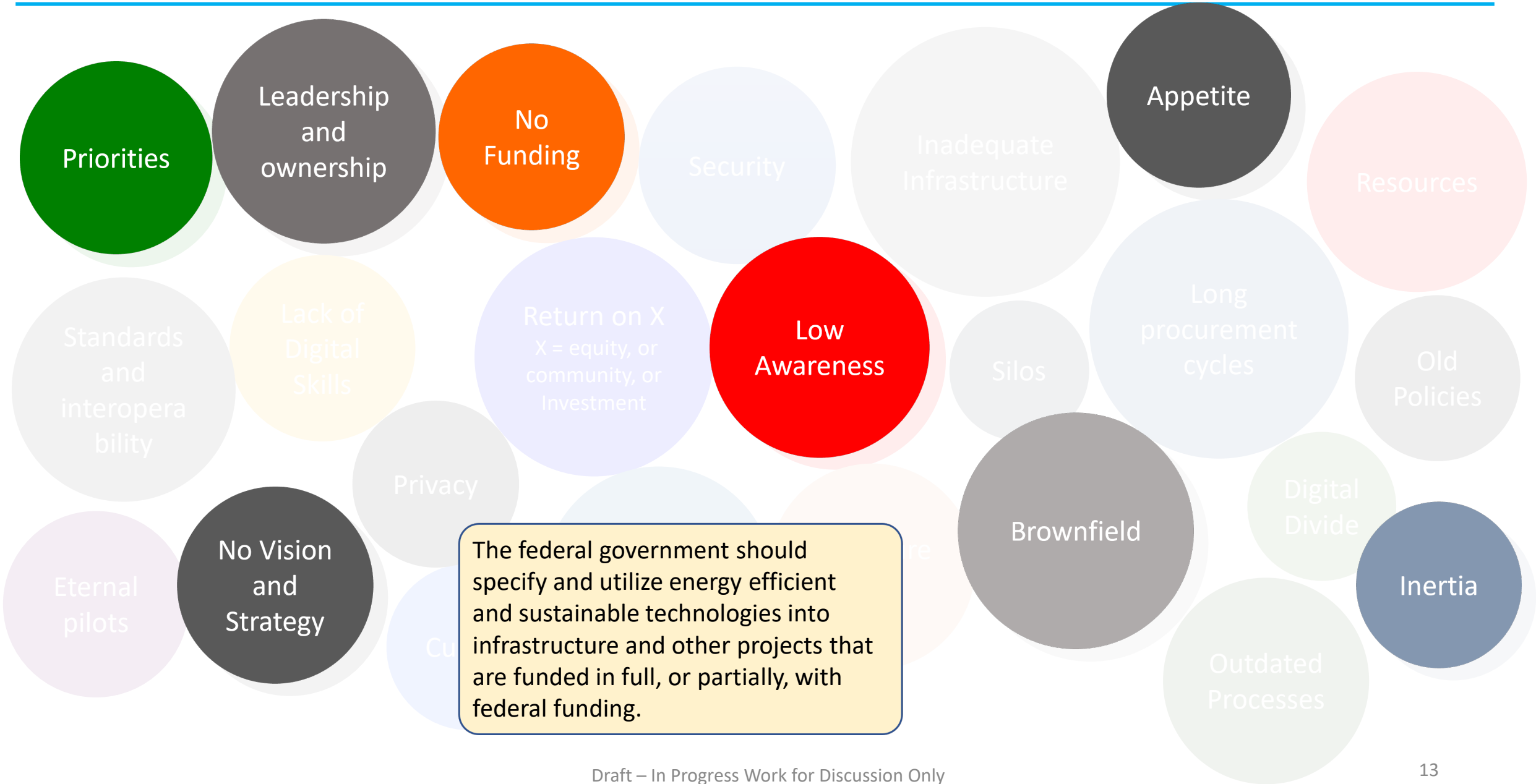- No pre-defined acceptable or allowable list of IoT types for projects

**Agencies**

All federal agencies that provide grants and funding for projects where IoT may be incorporated

**Federal considerations**

- Development of IoT reference models for projects. Work with industry stakeholders to define.
- IoT may introduce cybersecurity vulnerabilities to system. Require NIST cyber frameworks to be used
- Introduce IoT in GSA owned and operated facilities
- Incorporate IoT on BIL/IRA projects
- SCSEP could be a facilitator

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# Barriers addressed



Priorities

Leadership and ownership

No Funding

Security

Inadequate Infrastructure

Appetite

Resources

Standards and interoperability

Lack of Digital Skills

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Low Awareness

Silos

Long procurement cycles

Old Policies

Privacy

Brownfield

Digital Divide

Eternal pilots

No Vision and Strategy

Inertia

Outdated Processes

The federal government should specify and utilize energy efficient and sustainable technologies into infrastructure and other projects that are funded in full, or partially, with federal funding.

# #12: Specify use of energy efficient technologies in federally funded infrastructure projects

**Justification**

The federal government should specify and utilize energy efficient and sustainable technologies into infrastructure and other projects that are funded in full, or partially, with federal funding.

- The US is behind other countries in decarbonizing and reducing GHG

**Implementation**

- Incorporate Energy Savings Performance Contracts Incorporate building energy use benchmarking
- Adoption of building and energy codes that include language like automated demand response technologies, EV Read, EV Capable, etc.
- GSA FAR specify energy efficiency reqts for procurement in federal owned and operated buildings

**Agencies**

All federal agencies that provide grants and funding for projects where IoT may be incorporated
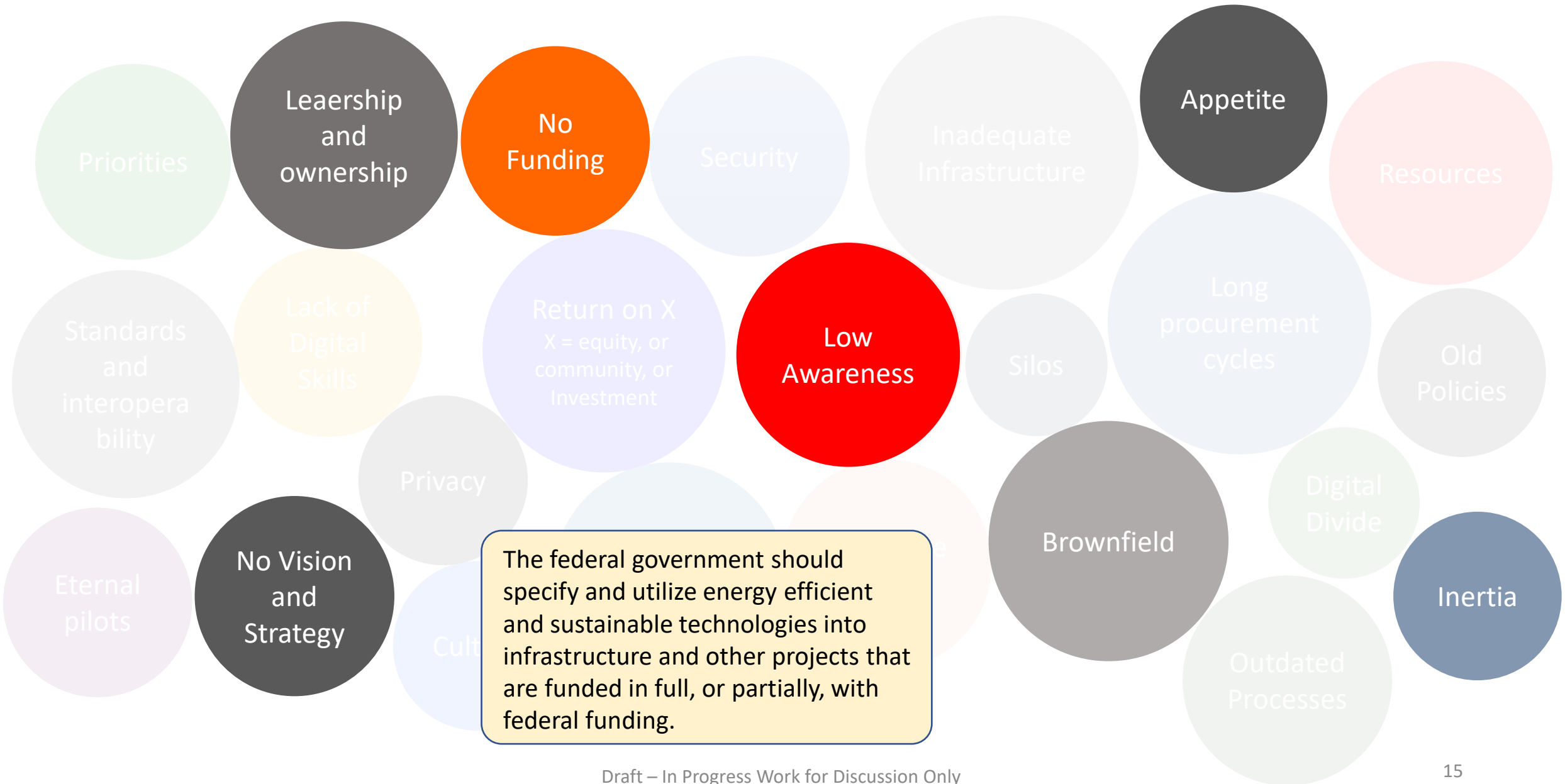
**Barriers**

- Funds: high costs to scale conversion to energy efficiency
- Supply chain: issues in distribution transformers, mining limitations for batteries, etc. that manufacturing is trying to overcome
- Legacy equipment: existing equipment, such as boilers, furnters, etc. have long lifetime

**Federal considerations**

14

# Barriers addressed



Priorities

Leaership and ownership

No Funding

Security

Inadequate Infrastructure

Appetite

Resources

Standards and interoperability

Lack of Digital Skills

Return on X
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Low Awareness

Silos

Long procurement cycles

Old Policies

Privacy

Eternal pilots

No Vision and Strategy

Cult

Brownfield

Digital Divide

Inertia

Outdated Processes

The federal government should specify and utilize energy efficient and sustainable technologies into infrastructure and other projects that are funded in full, or partially, with federal funding.

# #3: Grants for sustaining and operation of IoT and smart projects

The federal government should consider new models for sustaining and support in considering project feasibility.

**Justification**

- Grants offset acquisition and build, but many organizations lack financial means and resources to sustain ops and maintenance. They either shut down after funds run out or do not even apply

- IoT requires additional levels of support and resources that buyers may not have accounted for – s/w, data maintenance, data analysis,

- IoT enables new business and operating models, which impacts project and service economics

**Implementation**

Types of models
- Extended Funding – extending funding for O&M for select applicants (rural, tribal, small towns, etc.)
- Regional cost sharing – encourage multiple cities in a region to apply as one
- Innovative – encourage innovative models (corporate, sponsorships)

**Barriers**

- Non-traditional and innovative models may be difficult to evaluate and track
- IoT funding may be embedded into a broader funding package and not easy to separate the two
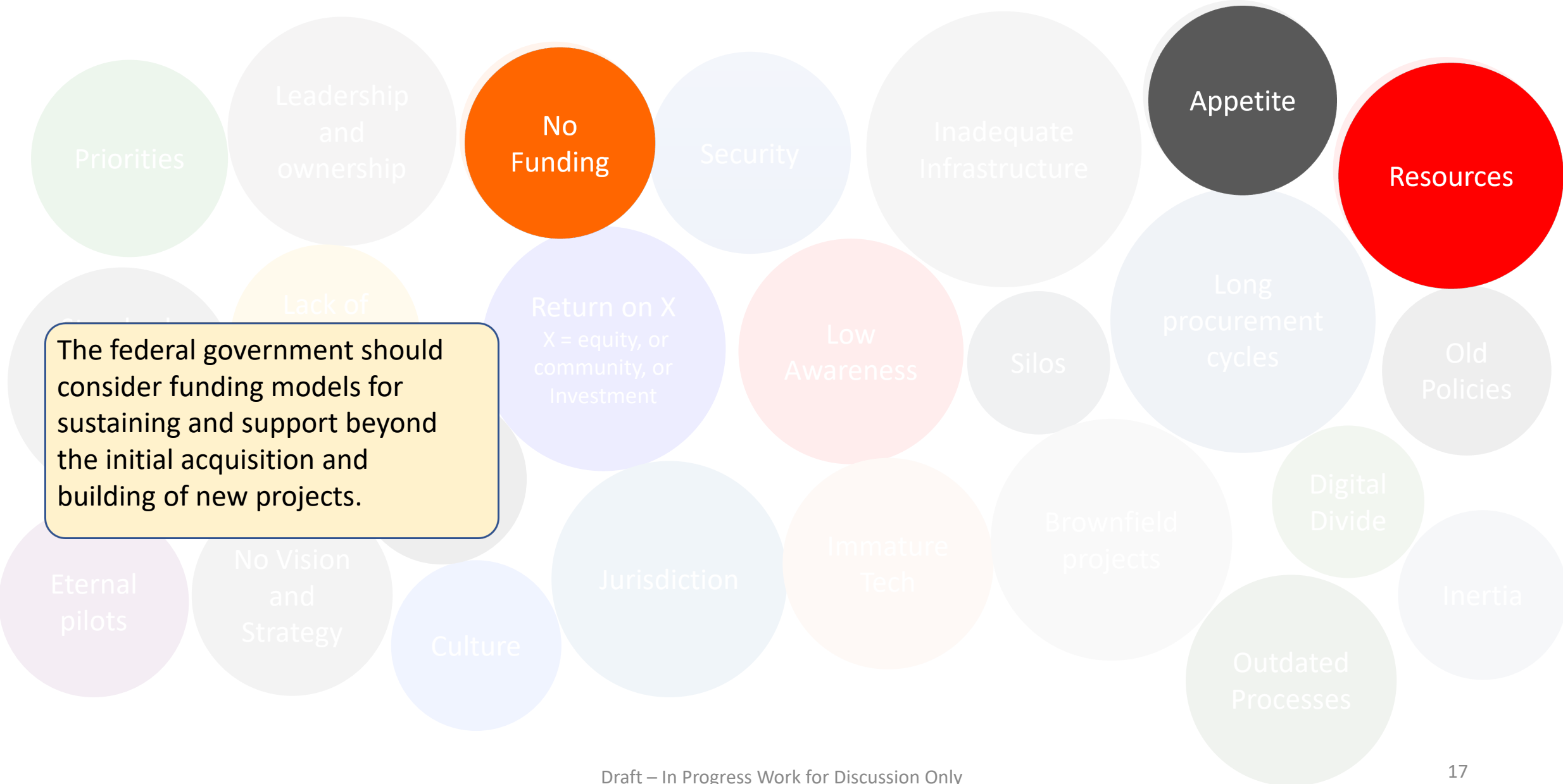
**Agencies**

All federal agencies that provide grants and funding for projects where IoT may be incorporated

**Federal considerations**

- SCSEP should consider developing expertise to help organizations sustain IoT
- Consider adding these models in some of the appropriate grants and programs funded through federal funding sources

# Barriers addressed

Priorities

Leadership and ownership

**No Funding**

Security

Inadequate Infrastructure

**Appetite**

**Resources**

Lack of

Return on X
X = equity, or community, or Investment

Low Awareness

Silos

Long procurement cycles

Old Policies

The federal government should consider funding models for sustaining and support beyond the initial acquisition and building of new projects.

Eternal pilots

No Vision and Strategy

Jurisdiction

Immature Tech

Brownfield projects

Digital Divide

Inertia

Culture

Outdated Processes

# #6: Grants for small and midsize cities/agencies

The federal government should consider offering grants to support smart city projects that target small and midsize cities and agencies.

**Justification**

- Most American cities are small.
  - 4,005 cities between 5K and 50K, 476 cities between 50K and 100K, and 238 cities between 100K and 250K

- Equitable access to benefits for smaller cities. Smaller cities are dependent on outside funding sources for many projects as they don't have the same methods as larger ones

**Implementation**

- Focus on regional projects that benefit multiple small cities (projects that cut across city borders)
- Smart city projects and outcomes different for smaller cities
- No one size fits all. Expect wide range of projects for funding

**Agencies**

All federal agencies that provide grants and funding for projects where IoT may be incorporated

**Barriers**

- ROI and feasibility criteria is different for smaller and rural areas
- Smaller cities lack pre-req digital and communications infrastructure to support smart city/region projects
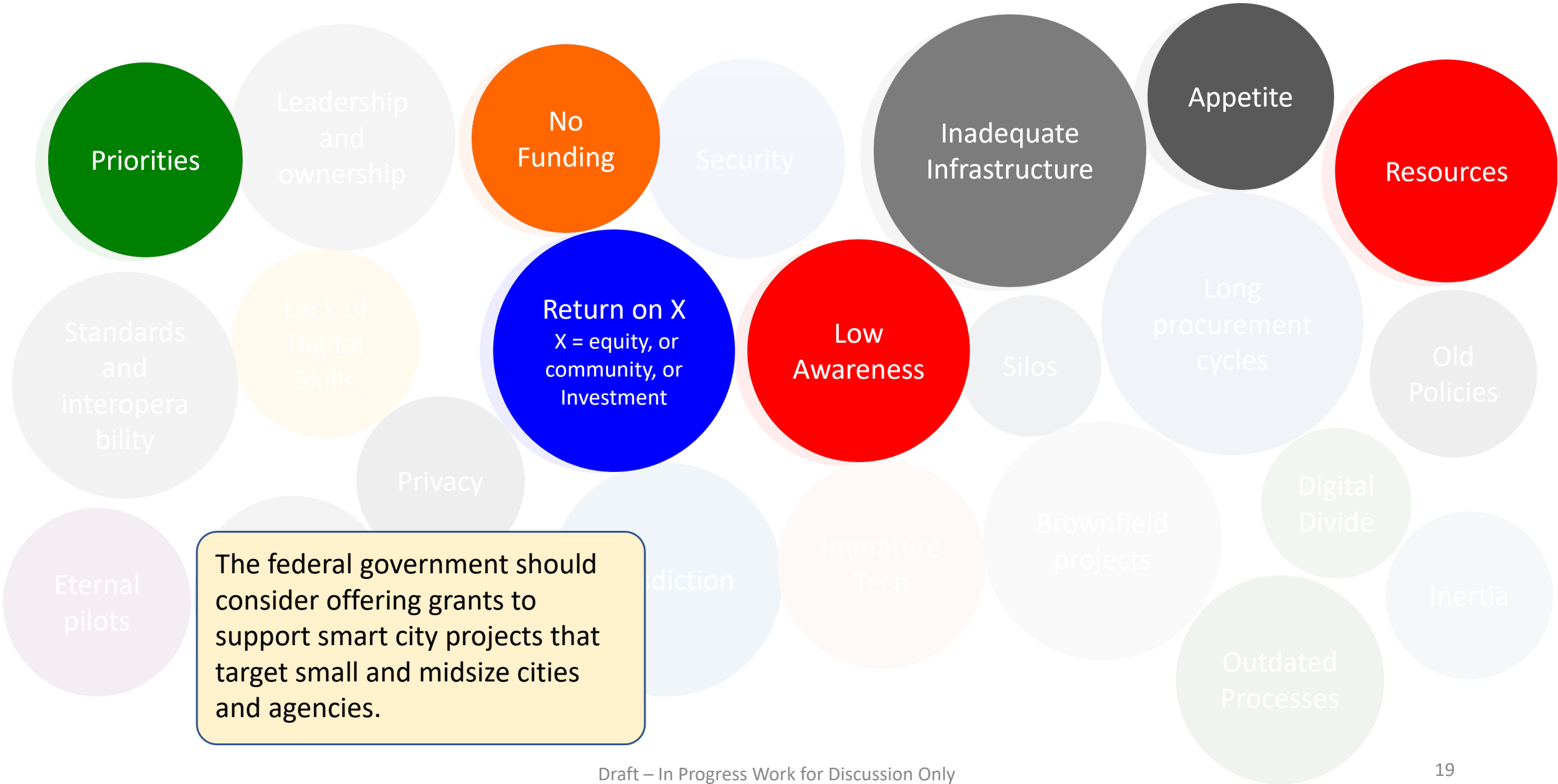
**Federal considerations**

- SCIEP may be a resource to help smaller cities secure grants and implement projects
- BIL and IRA funding for grants
- Piggyback grants in those regions that have secured BIL broadband infrastructure investments

# Barriers addressed

Priorities

Leadership and ownership

No Funding

Security

Inadequate Infrastructure

Appetite

Resources

Standards and interoperability

Lack of Digital Skills

Return on X
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Low Awareness

Silos

Long procurement cycles

Old Policies

Privacy

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Immature Tech

Brownfield projects

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Eternal pilots

Outdated Processes

Inertia

The federal government should consider offering grants to support smart city projects that target small and midsize cities and agencies.

# Recommendations



**Programmatic**

National Smart City Program Office (11)

Agency Chief Smart City Officer (8)

Smart City & Infrastructure Extension Partnership office (1)

**Funding**

IoT use in federally funded projects (2)

Grants for small – mid sized cities (6)

Models for sustaining operations (3)

Energy efficient technologies in federally funded infrastructure projects (13)

**Capability**

Student loan forgiveness to attract talent to cities (4)

**Standards**

IoT performance metrics (10)

Smart city reference models (5)

IoT data strategy in PPD 21 (9)

Support standards in sustainable infrastructure (13)

Facilitate adoption of IoT standards for smart cities (7)

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# #5: Develop integrated smart city reference models

The federal government should facilitate and support the development and use of smart city and sustainable infrastructure reference models.

**Justification**

- Smart city market is fragmented and broad. No standard definition of a smart city.
- Smart city efforts are DIY and not replicable
- Most smart city efforts are piecemealed, leading to lack of interoperability, can't scale, more costly, and have vulnerabilities.
- No standardized and usable reference models that planners can use
- Existing models look at cities, not ecosystems (communities, regions, counties, states)

**Implementation**

- NIST GCTC has existing structure and model to engage industry, academia, and government
- Consider inclusion of counties, states, regional agencies, utilities,
- No one size fits all – small vs large vs regions, buildings, etc.

**Barriers**

- Complexity of coordinating diverse stakeholders to define models

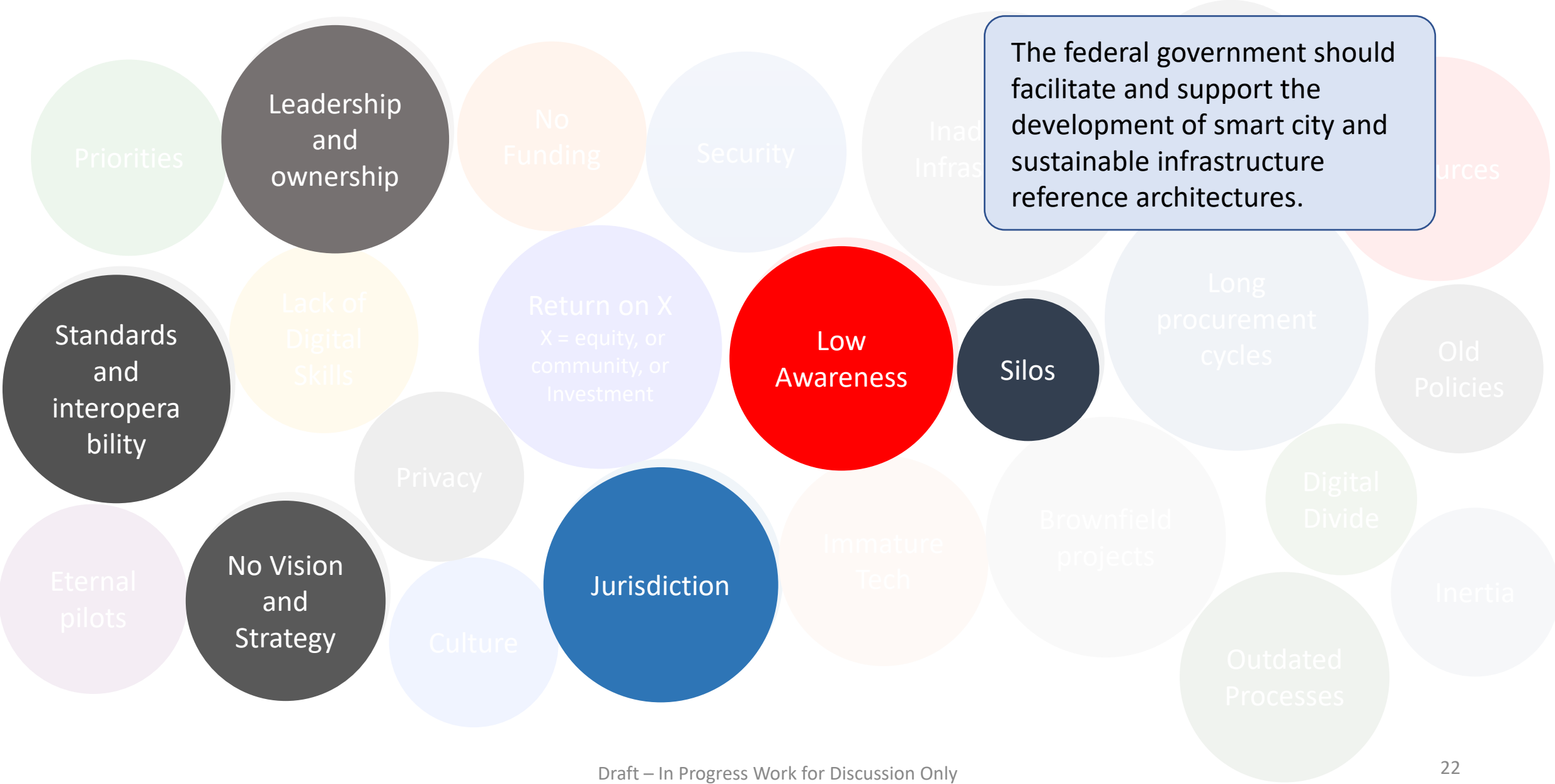- There may be work done by industry and universities. Converging may be challenging

**Agencies**

- NIST - GCTC
- NSF - Smart and connected communities
- DOE
- DOT
- DHS/CISA

**Federal considerations**

- Build on initial efforts by NIST to define smart city framework
- Consider building on reference models from private and non-profit entities
- Consider requiring projects that use federal fund to use standard models
- Leverage GCTC infrastructure and model to drive collaboration

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# Barriers addressed

Priorities

Leadership and ownership

No Funding

Security

Inac Infras

urces

Standards and interoperability

Lack of Digital Skills

Return on X
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Low Awareness

Silos

Long procurement cycles

Old Policies

Privacy

Eternal pilots

No Vision and Strategy

Culture

Jurisdiction

Immature Tech

Brownfield projects

Digital Divide

Inertia

Outdated Processes

The federal government should facilitate and support the development of smart city and sustainable infrastructure reference architectures.

# #7: Facilitate adoption of smart city standards

The federal government should facilitate and support the adoption of smart city and sustainable infrastructure standards.

**Justification**

- Technologies which may incorporate different standards, and create issues around interoperability. For example, traffic systems
- SCADA systems may not easily integrate with other systems, including more modern IoT solutions.
- Municipalities do not have budgets to change out systems. The solutions they procure need to be futureproofed.

**Implementation**

- Consider incorporating the need for open standards and/or standards body or consortium developed standards as part of the requirements for federal funded projects
- It's easy to say use standards, but which ones?

**Barriers**

- Different agencies within the govt have different requirements and standards (EPA for AQ)
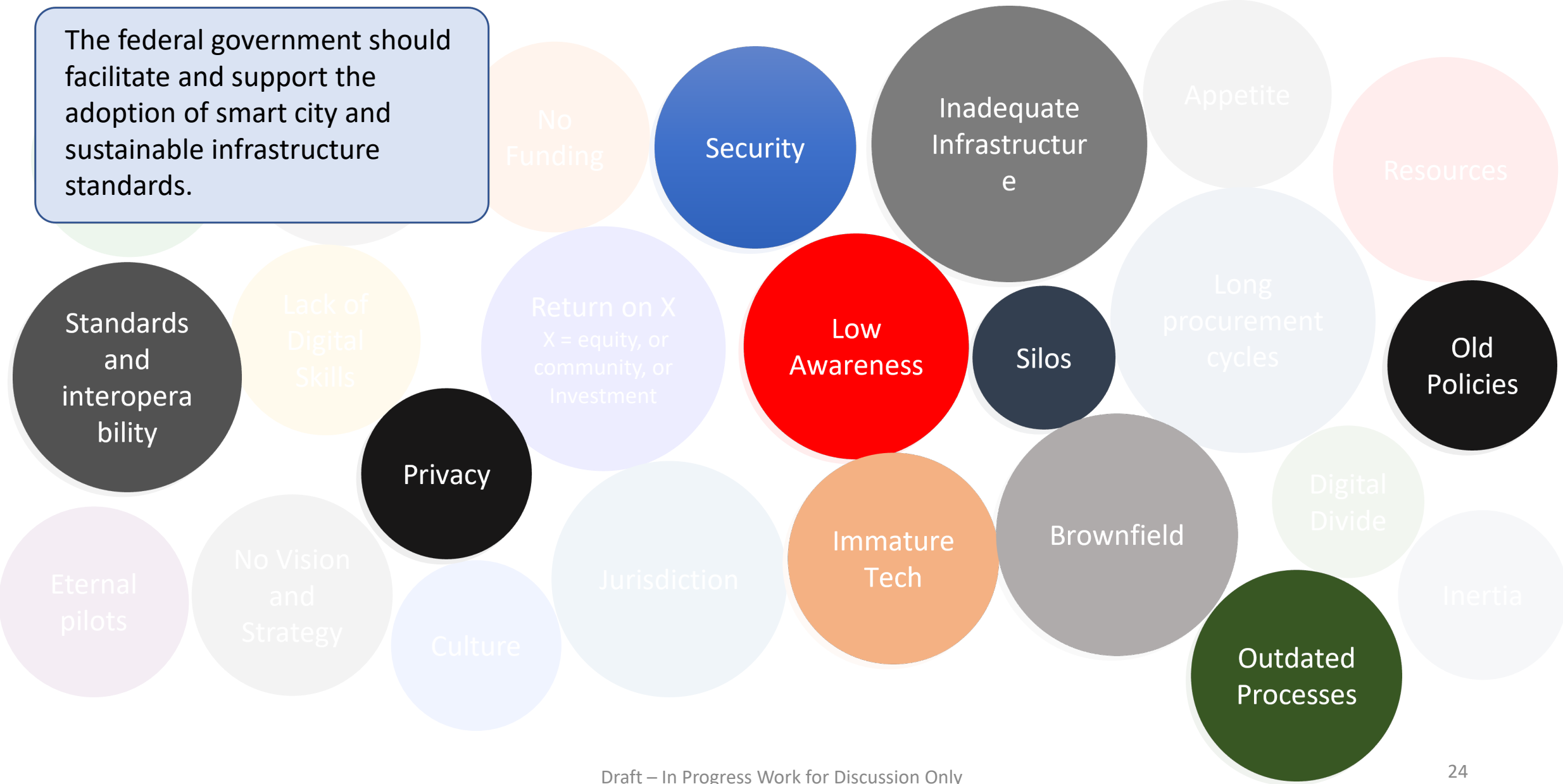- Concern for

**Agencies**

All federal agencies that provide grants and funding for projects where IoT may be incorporated

**Federal considerations**

- Consider doing this in conjunction with recommendation 2 (federal funding), recommendation 5 (models) and 6 (grants for small cities)
- Consider specifying that projects that use federal funding adhere to some agreed to set of standards or open standards

# Barriers addressed

The federal government should facilitate and support the adoption of smart city and sustainable infrastructure standards.

No Funding

Security

Inadequate Infrastructure

Appetite

Resources

Standards and interoperability

Lack of Digital Skills

Return on X
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Low Awareness

Silos

Long procurement cycles

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Privacy

Immature Tech

Brownfield

Digital Divide

Eternal pilots

No Vision and Strategy

Jurisdiction

Culture

Inertia

Outdated Processes

# #9: Update PPD 21 to include sector specific IoT data strategy

The Federal Government should update Presidential Policy Directive 21 (PPD-21): Critical Infrastructure Security and Resilience requiring a sector-specific Internet of Things (IoT) data strategy.

**Justification**

Existing Presidential Policy Directives are outdated and should be updated to reflect the current risk associated with critical infrastructure reliability, resilience, security, and sustainability

**Implementation**

- Development of the language and context should include input from the National Security Council, the Office of Management and Budget, and Intelligence Communities.
- Once developed, the language could/should be shared with additional communities of interest/practice, e.g. NERC, FERC, ISACs.

**Agencies**

All SRMAs

**Barriers**

- Lack of coordination among the key stakeholders, based on disparate missions
- Most of the critical infrastructure assets/systems are owned and operated by private sector entities, thus, requiring crucial conversations with said infrastructure owners/operators

**Federal considerations**

- Continuous and comprehensive asset visibility is a bsic precondition for any organization to effectively manage critical infrastructure risk. Accurate and up-to-date accounting of assets residing on federal networks is also essential.
- Enhancing visibility into agency assets and associated vulnerabilities, focusing on two core activities essential to improving operational visibility for a successful cybersecurity program: asset discovery and vulnerability enumeration.

25

# Barriers addressed

Priorities

Leadership and ownership

The Federal Government should update Presidential Policy Directive 21 (PPD-21): Critical Infrastructure Security and Resilience requiring a sector-specific Internet of Things (IoT) data strategy.

Appetite

Resources

Standards and interoperability

Lack of Digital Skills

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Low Awareness

Silos

Long procurement cycles

Old Policies

Privacy

Eternal pilots

No Vision and Strategy

Culture

Jurisdiction

Immature Tech

Brownfield projects

Digital Divide

Inertia

Outdated Processes

# #10: IoT performance metrics

**The Sector Risk Management Agencies (SRMAs) shall collaborate with sector partners and develop IoT performance metrics intended to strengthen critical infrastructure security and resilience.**

**Justification**

The expansive development and adoption of IoT assets and systems should map to IoT performance metrics intended to strengthen critical infrastructure security and resilience

**Implementation**

• Agency Chief Technology Officer and associated program office could serve as the nexus for convening peer stakeholders, e.g. CIO, CDO, CPO.
• Defining the performance metrics will need to be in conjunction with owners/operators of critical infrastructure assets/systems (both IT and OT).

**Agencies**

The 24 CFO Act agencies, with consideration being given to the non-CFO Act agencies

**Barriers**

• Lack of coordination from the Executive Office
• Minimal support from designated agency leadership
• Lack of branding
• Lack of coordination, stakeholder engagement, resource allocation, and performance monitoring
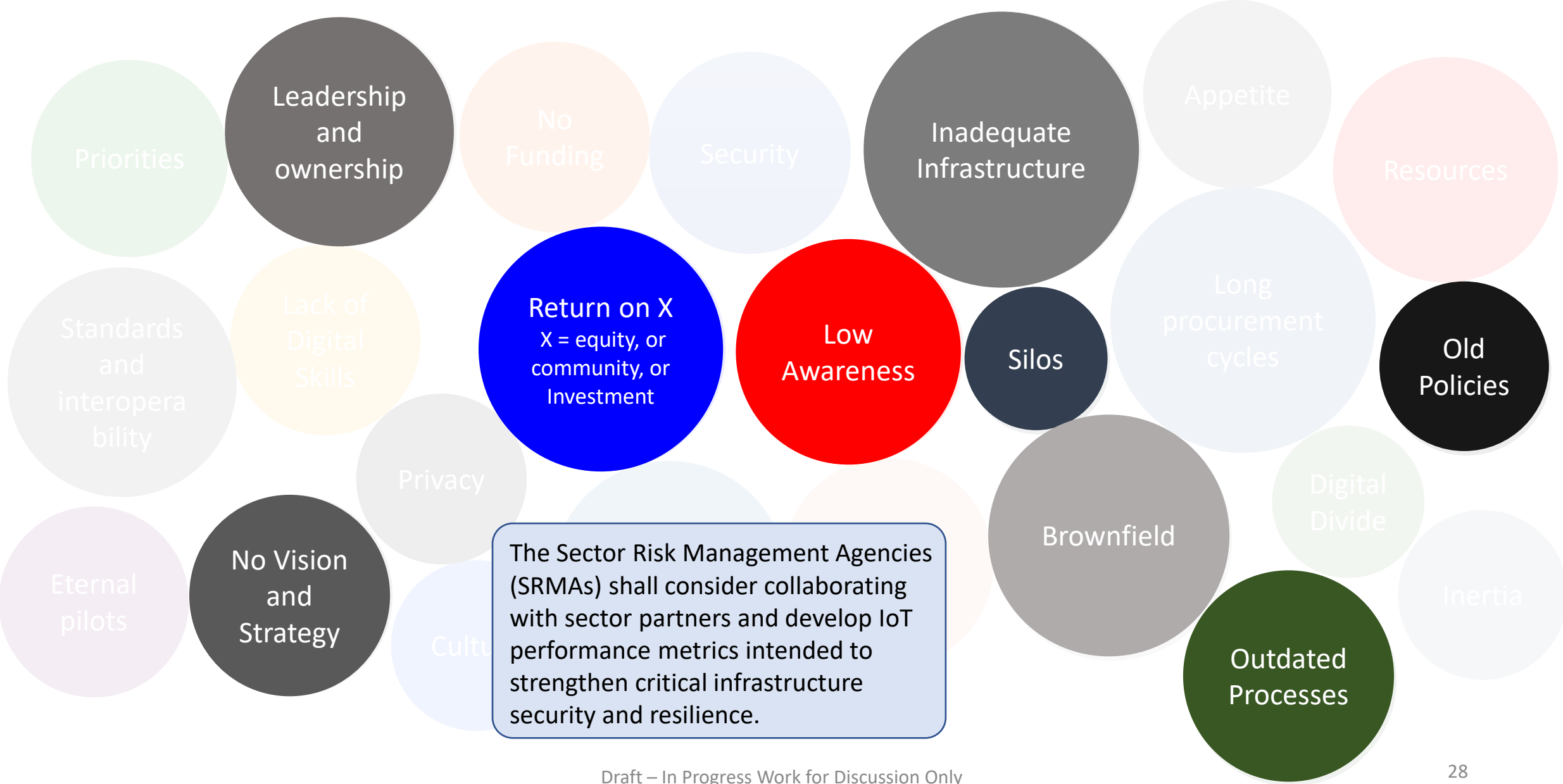
**Federal considerations**

Ensure that the SCO in each agency will participate in a Community of Practice, like the Federal CIO Council format, which, in turn, will serve to convene SCOs across all agencies

# Barriers addressed



Leadership and ownership

No Funding

Security

Inadequate Infrastructure

Appetite

Priorities

Resources

Standards and interoperability

Lack of Digital Skills

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Silos

Long procurement cycles

Old Policies

Privacy

Eternal pilots

No Vision and Strategy

Culture

The Sector Risk Management Agencies (SRMAs) shall consider collaborating with sector partners and develop IoT performance metrics intended to strengthen critical infrastructure security and resilience.

Brownfield

Digital Divide

Inertia

Outdated Processes

# #13: Support existing industry standards in sustainable infrastructure

The federal government should support existing industry standards development activities with respect to energy efficient technologies used in sustainable infrastructure.

**Justification**

- Standards efforts are not coordinated and aligned cause confusion in the marketplace
- Hindered market entry
- Inconsistency in design, operations and maintenance

**Implementation**

- Government call out existing standards in application legislation and regulation
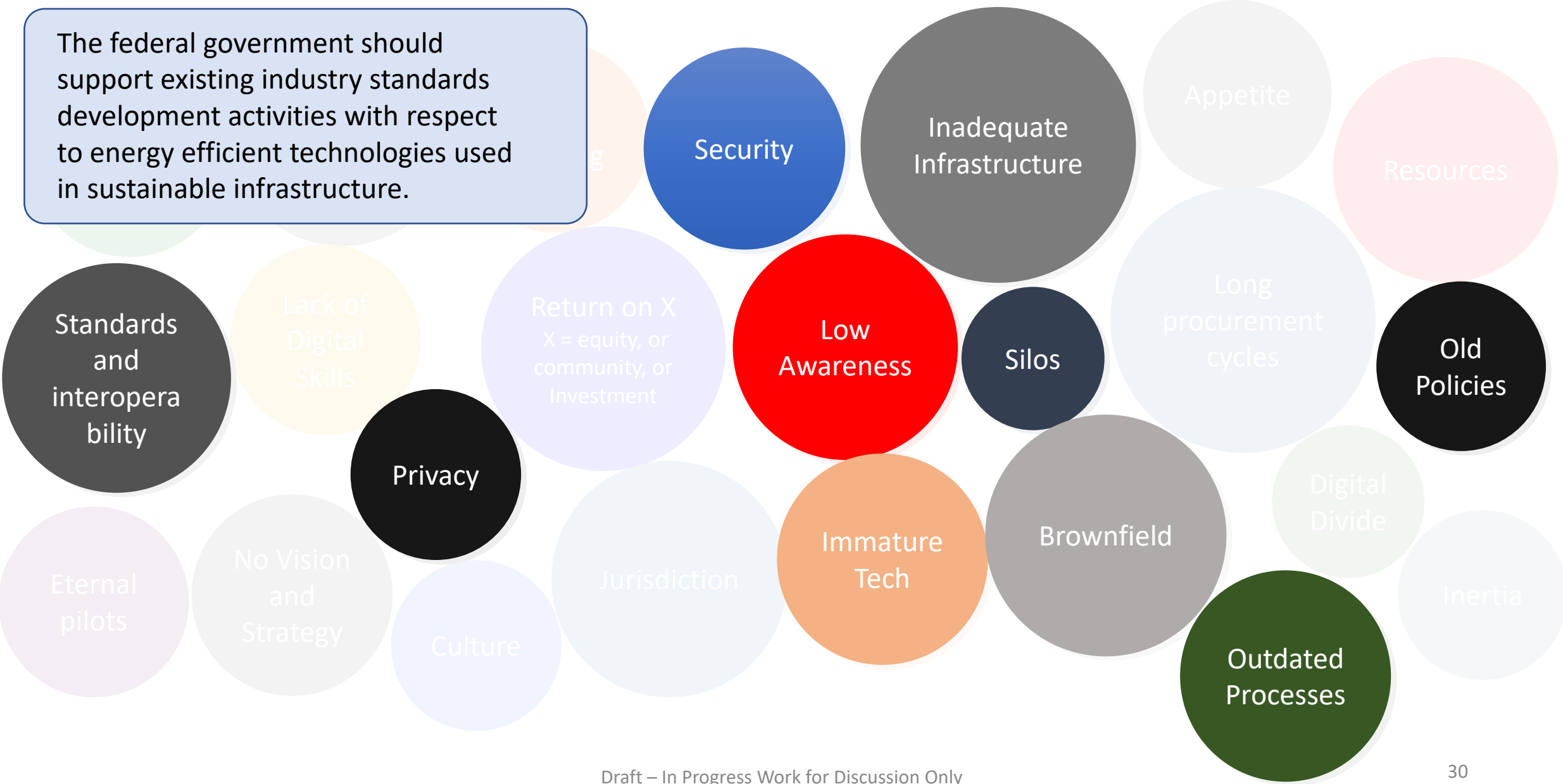- Support private sector in relevant standards development activities

**Barriers**

- Time consuming and resource intensive efforts to achieve consensus
- International harmonization adds more complexity and time

**Agencies**

- NIST
- DHS
- DoT
- DoE
- CISA
- Others

**Federal considerations**

# Barriers addressed

The federal government should support existing industry standards development activities with respect to energy efficient technologies used in sustainable infrastructure.

Security

Inadequate Infrastructure

Appetite

Resources

Standards and interoperability

Lack of Digital Skills

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Silos

Long procurement cycles

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No Vision and Strategy

Culture

Jurisdiction

Immature Tech

Brownfield

Digital Divide

Inertia

Outdated Processes

# Recommendations



**Programmatic**

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Smart City & Infrastructure Extension Partnership office (1)

**Funding**

IoT use in federally funded projects (2)

Grants for small – mid sized cities (6)

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**Capability**

Student loan forgiveness to attract talent to cities (4)

**Standards**

IoT performance metrics (10)

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IoT data strategy in PPD 21 (9)

Support standards in sustainable infrastructure (13)

Facilitate adoption of IoT standards for smart cities (7)

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# #4: Student loan forgiveness programs to attract talent to smart city projects

The federal government should consider "student loan forgiveness" programs in exchange for providing critical emerging technology (IoT, data science, cybersecurity, etc.) skills to municipalities and agencies.

**Justification**

- Cities lack critical digital talent needed
- Small cities and rural areas face brain drain
- Cities (large and small) unable to attract future digital talent at scale to make impact

**Implementation**

- Leverage model used by the National Health Science Corps
- Partner with non-profit organizations such as FUSE Corps
- Identify key roles/skills needed (cyber, analytics, software development, etc.)

**Barriers**

- Certain critical skills like cybersecurity and data science may still be hard to get
- There may not be sufficient numbers of skilled resources to make this work
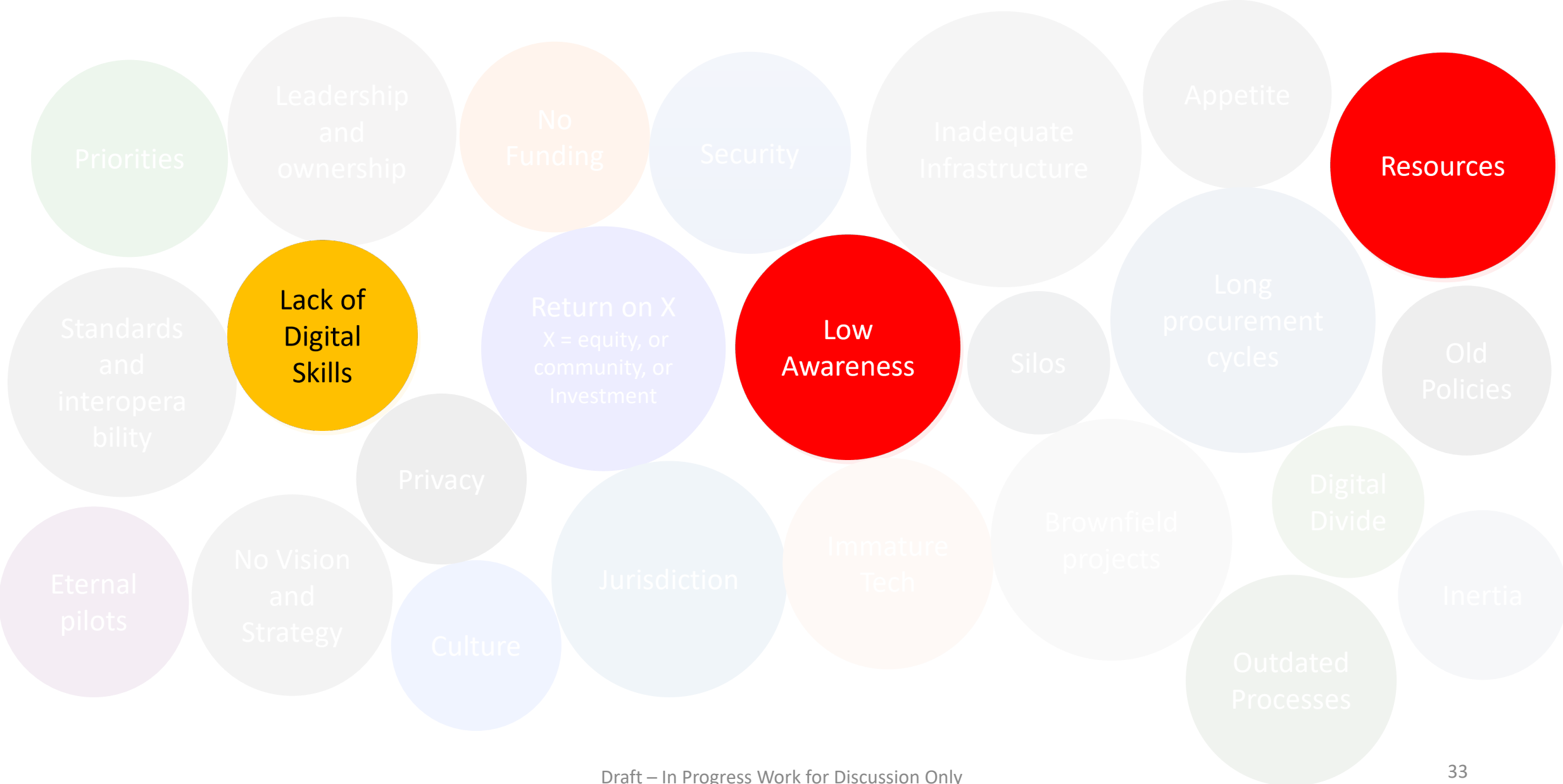
**Agencies**

- Department of Energy (renewable energy, electrification, etc.)
- Department of Transportation (intelligent traffic, roads, highways, autonomous vehicles, etc.)
- Department of Commerce/NIST (standards, cybersecurity, GCTC, regulatory, etc.)
- Department of Homeland Security/CISA (cybersecurity, etc.)

**Federal considerations**

- Consider doing this in conjunction with recommendation 1 (SCIEP) and 2 (federally funded projects), 6 (grants for small cities)

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# Barriers addressed



Priorities

Leadership and ownership

No Funding

Security

Inadequate Infrastructure

Appetite

Resources

Standards and interoperability

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Long procurement cycles

Old Policies

Privacy

Digital Divide

Eternal pilots

No Vision and Strategy

Jurisdiction

Immature Tech

Brownfield projects

Inertia

Culture

Outdated Processes

# Recommendations



Programmatic

Funding

Capability

Standards

**National Smart City Program Office (11)**

**Agency Chief Smart City Officer (8)**

**Smart City & Infrastructure Extension Partnership office (1)**

**IoT use in federally funded projects (2)**

**Grants for small – mid sized cities (6)**

**Models for sustaining operations (3)**

**Energy efficient technologies in federally funded infrastructure projects (13)**

**Student loan forgiveness to attract talent to cities (4)**

**IoT performance metrics (10)**

**Smart city reference models (5)**

**IoT data strategy in PPD 21 (9)**

**Support standards in sustainable infrastructure (13)**

**Facilitate adoption of IoT standards for smart cities (7)**

Draft – In Progress Work for Discussion Only

# Prioritization

| | Recommendations |
|---|---|
| **R1** | Smart City & Infrastructure Extension Partnership office |
| **R2** | IoT use in federally funded projects |
| **R3** | Models for sustaining operations |
| **R4** | Student loan forgiveness to attract talent to cities |
| **R5** | Smart city reference models |
| **R6** | Grants for small – mid sized cities |
| **R7** | Facilitate adoption of IoT standards for smart cities |
| **R8** | Agency Chief Smart City Officer |
| **R9** | IoT data strategy in PPD 21 |
| **R10** | IoT performance metrics |
| **R11** | National Smart City Program Office |
| **R12** | Energy efficient technologies in federally funded projects |
| **R13** | Support existing industry standards development for energy efficient technologies |