

# **UNDERSTANDING PERCEPTIONS AND ADOPTION OF GREEN STORMWATER INFRASTRUCTURE**

AWRA-NCR Water Resources Symposium - April 6, 2018

# *Introduction*

- What is green infrastructure?

*Green infrastructure is an adaptable term used to describe an array of products, technologies, and practices that use natural systems - or engineered systems that mimic natural processes - to enhance overall environmental quality and provide utility services. As a general principle, green infrastructure techniques use soils and vegetation to infiltrate, evapotranspirate, and/or recycle stormwater runoff (EPA)*



## *Introduction*

- Stormwater management in the US and green infrastructure
- Despite increasing awareness of the benefits of stormwater management systems integrating green infrastructure, transition to this approach is still slow
- Relevance of attitude of stakeholders involved in the adoption process
- Limited knowledge on municipal staff's attitude toward adoption and key factors influencing adoption at the local level

## *Goal*

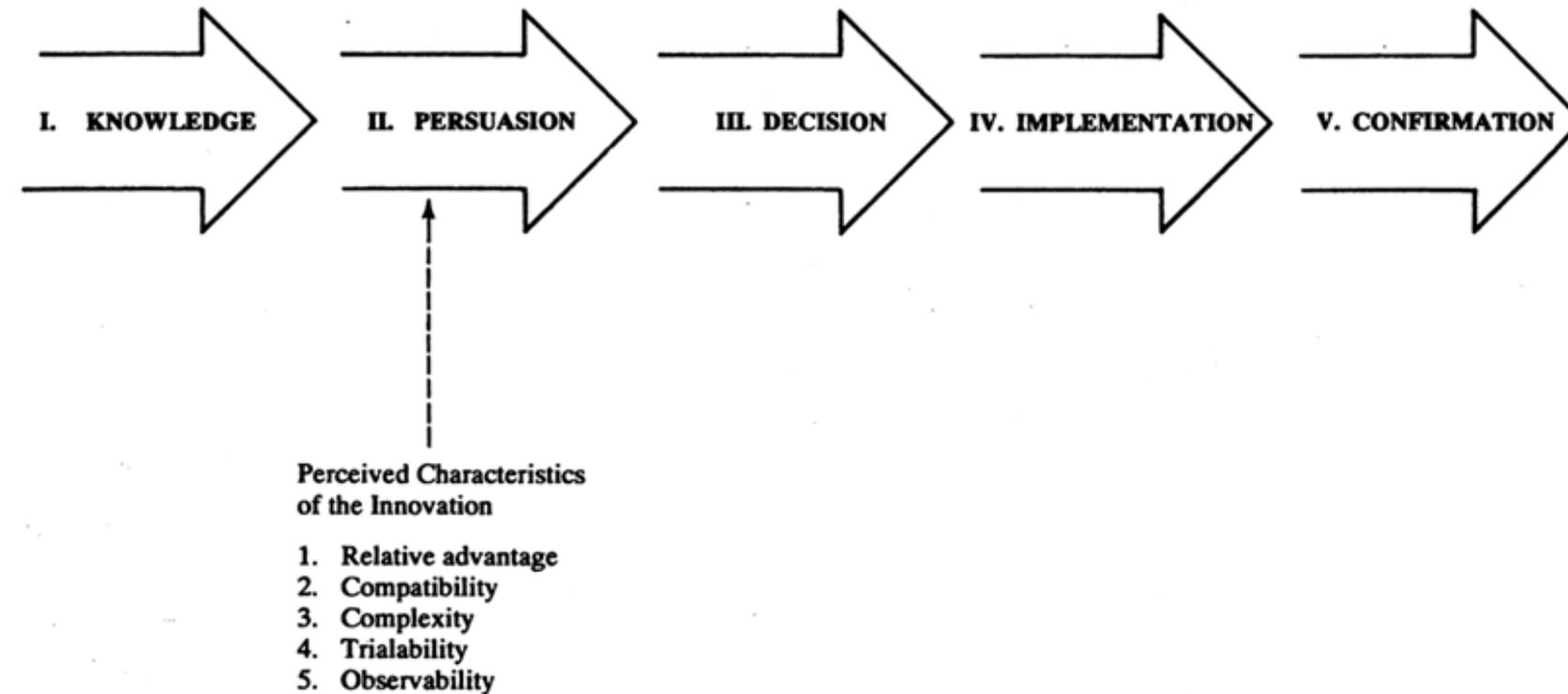
The purpose of this study are:

- Investigate how municipal officials' perceptions of attributes of green infrastructure influence their attitude toward adoption
- Understand drivers of green infrastructure adoption at the local level

## *Green infrastructure tools*

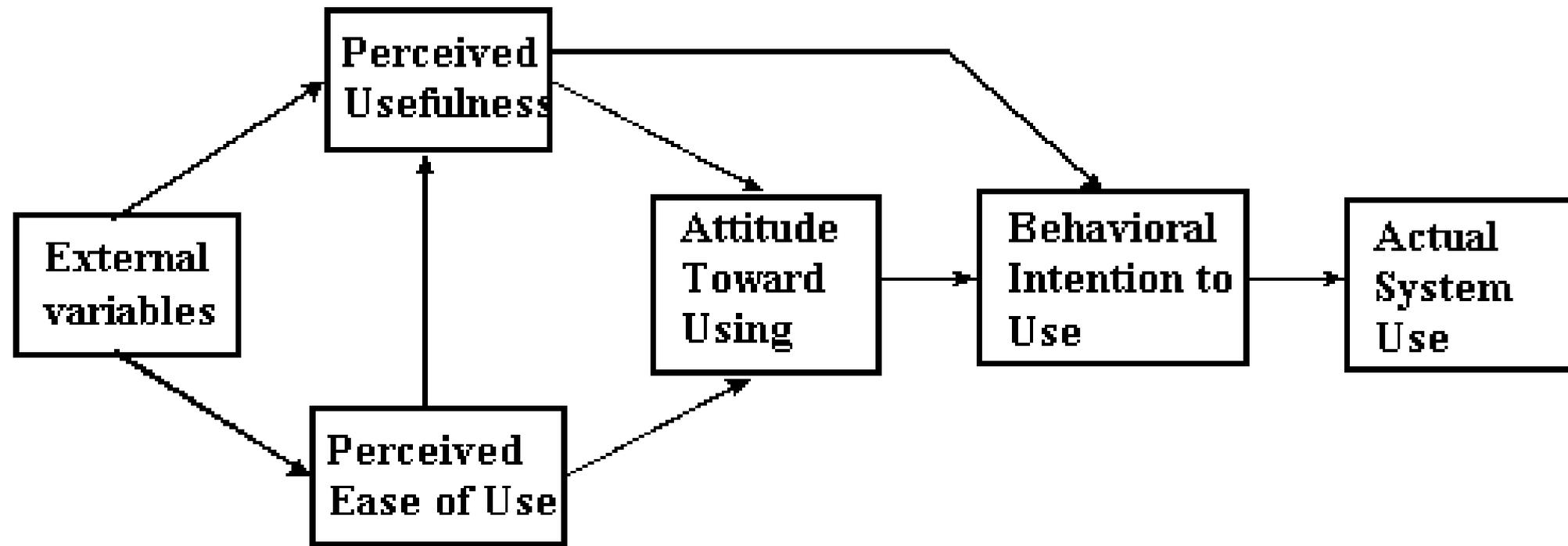
- Green roof
- Rain garden
- Rainwater harvesting (e.g. rain barrels)
- Bio-swales
- Porous pavement
- Planter boxes
- Downspout disconnections
- Land conservation
- Green Parking
- Urban tree canopy
- Green streets and alleys
- Other

# *Theory background*



- Rogers (2003)' five-steps model of the innovation-decision process and perceived innovation attributes

## *Theory background (continued)*



- Davis et al. (1989)' Technology Acceptance Model (TAM)

## *Theory background (continued)*

Studies on innovation adoption based on internal determinants and regional diffusion models:

- Internal determinants (e.g. Vasi 2006, Daley & Galand 2005, Godwin & Schroedel 2000, Matisoff 2008)
- Regional diffusion models (e.g. Daley & Galand 2005, Matisoff 2008, Kern, et al. 2006, Brueckner, 1998, Vasi 2006)

## *Research questions*

1. Is there a relationship between the following perceived attributes of innovations - relative advantage, compatibility, complexity, trialability, observability, perceived risk, and perceived resources as outlined by Rogers (2003), Moore and Benbasat (1991), Dupagne and Driscoll (2005) – and local jurisdiction officials\*' positive attitude toward adoption of green infrastructure?

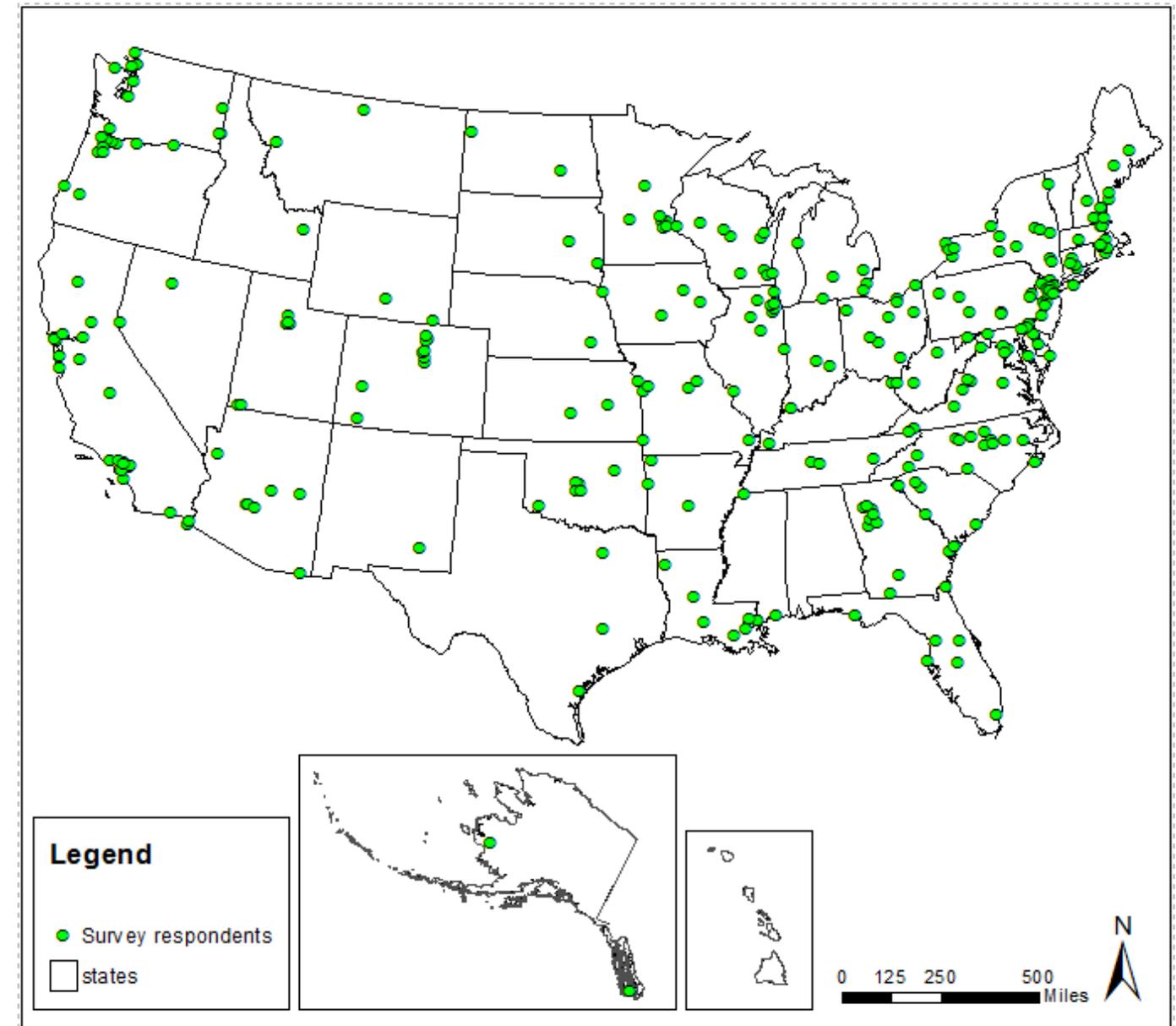
\* *Officials include engineers, planners and other staff members*

## *Research questions (continued)*

2. What factors influence municipal officials' attitude toward green stormwater infrastructure adoption?
3. What factors have a positive influence on adoption of green infrastructure strategies at the local government level? Is adoption determined primarily by internal characteristics of adopting jurisdictions (e.g., socio-economic status, existence of interest groups and green infrastructure champions)? Is the adoption driven by external factors?

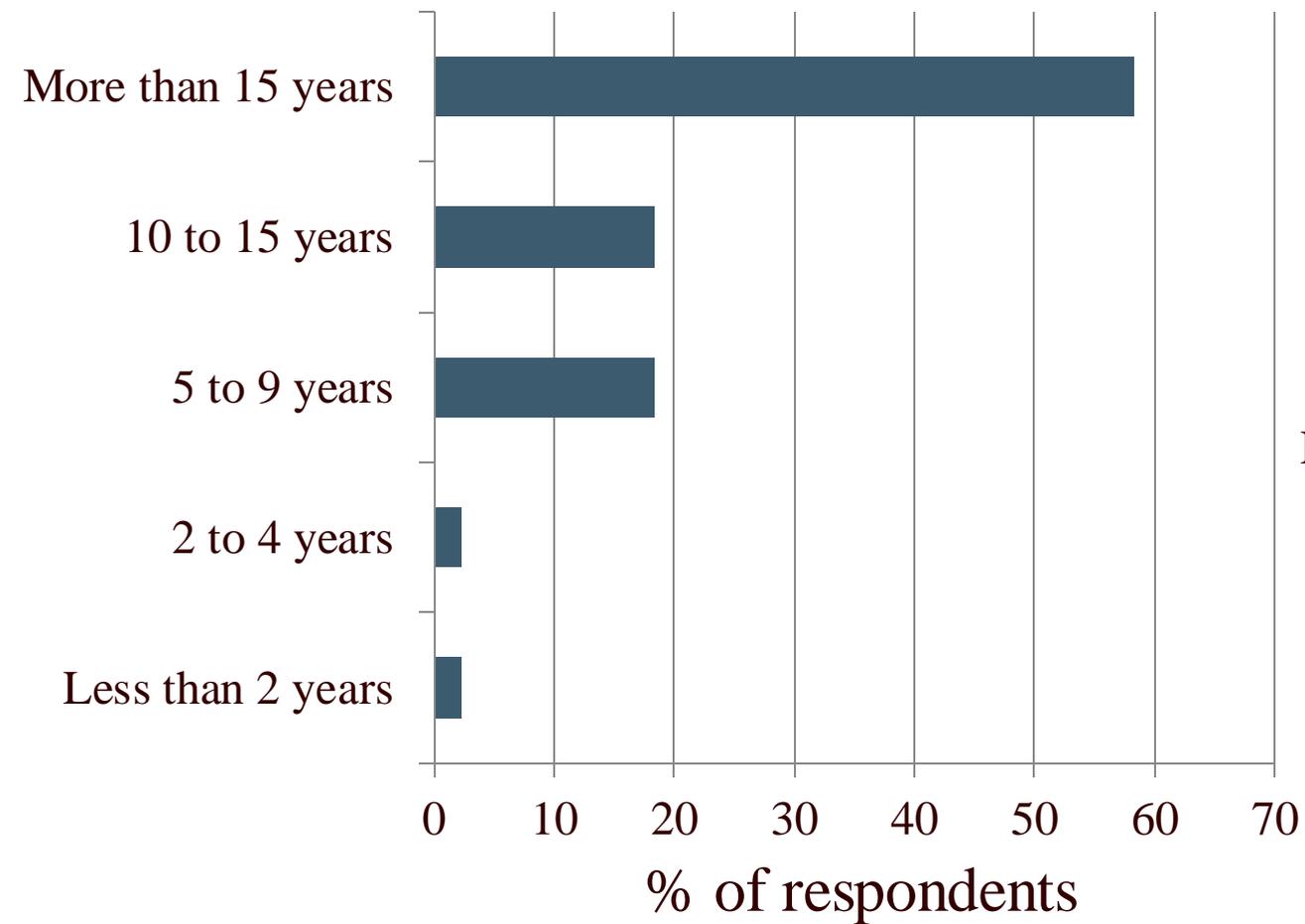
# *Nationwide survey of engineers, planners and other municipal staff (“officials”) from 840 municipalities (cities, villages, ...)*

- Response rate: 35%
- Mean population of municipalities in the sample frame: 30,761
- California is the most represented state (22 respondents)
- Midwest region (IL, IN, MI, MN, OH, WI) is the most represented area (44 respondents)

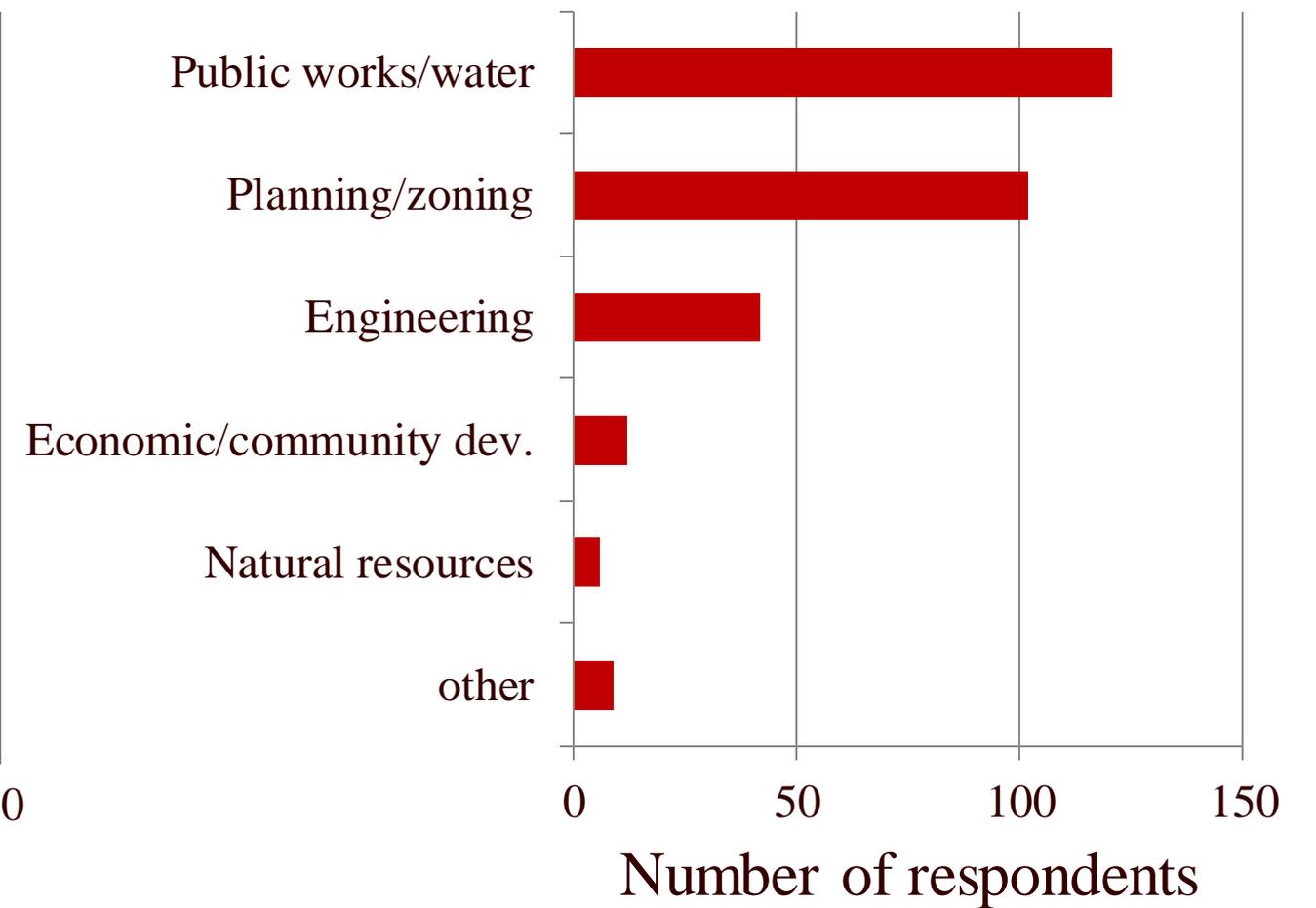


# Survey (continued)

## Years of experience

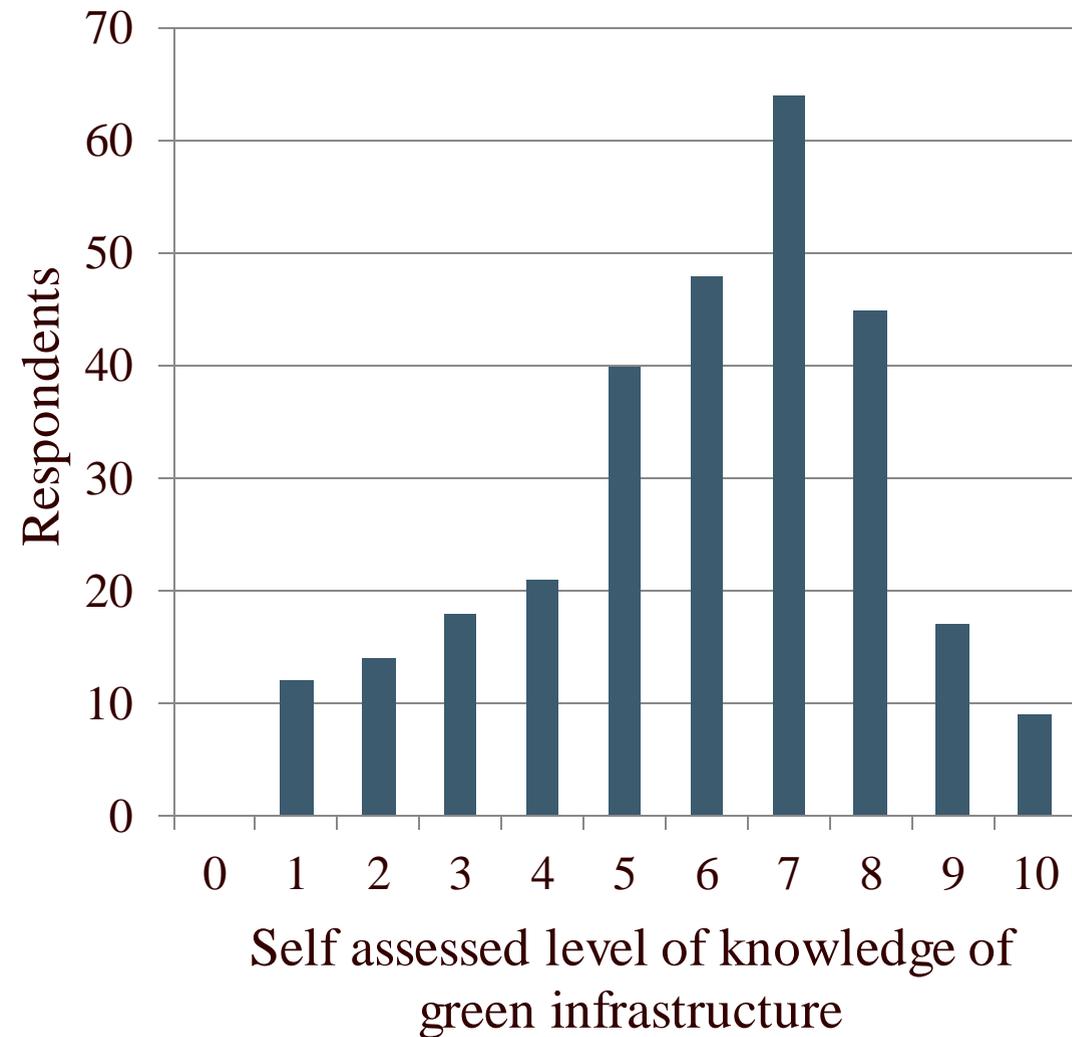


## Department



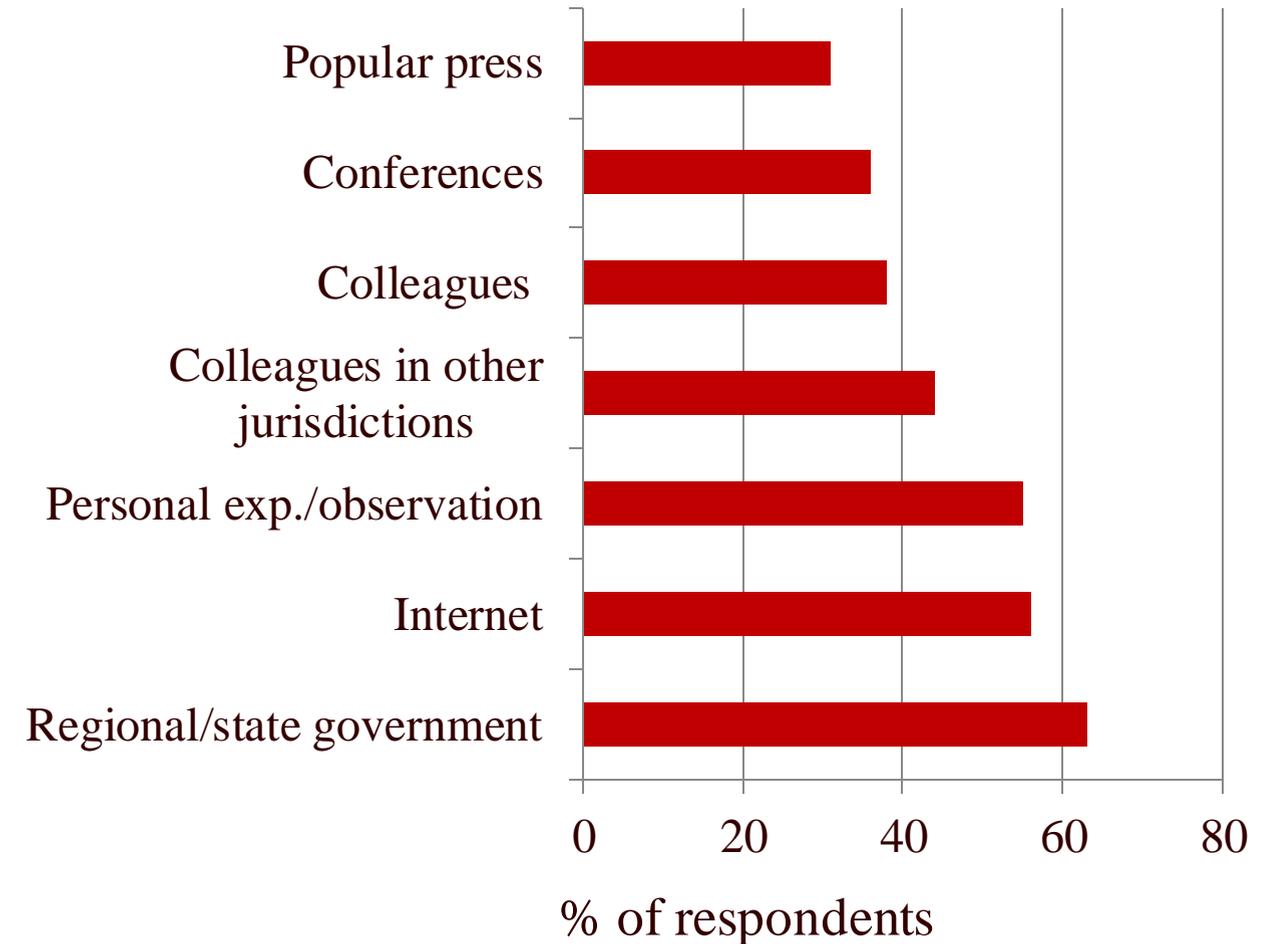
# Survey (continued)

Q: How informed do you consider yourself to be on green infrastructure? Place yourself on a scale from 0 to 10, with 0 indicating not at all informed, and 10 indicating extremely well informed



Q: From where do you personally get most of your information on green infrastructure? Please check all that apply

## Source of information

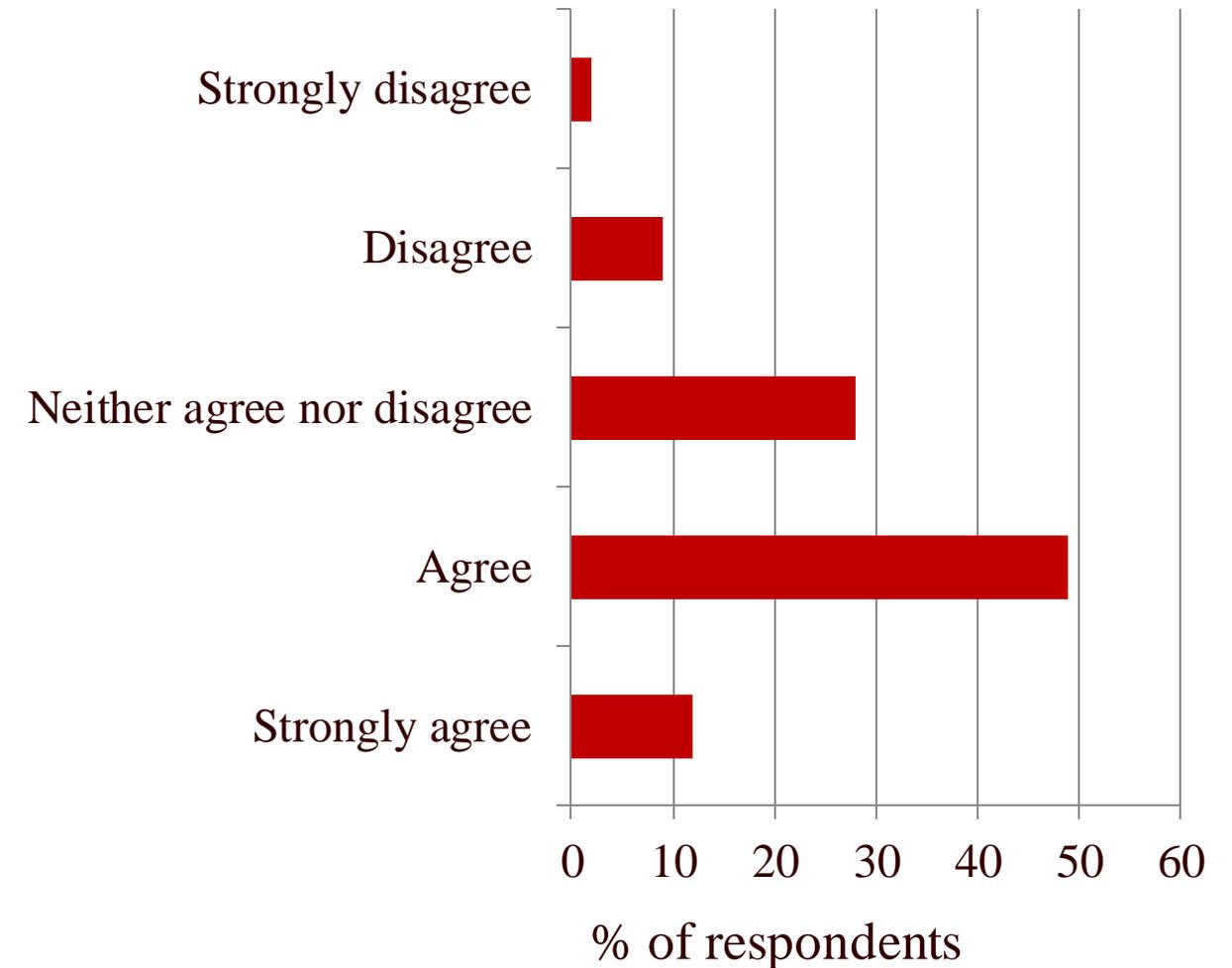


# Survey (continued)

Q: Considering the pros and cons of Green Infrastructure for stormwater management, I believe adoption (or continuous use) of these tools in my jurisdiction in the near future would be

<b>Extremely Good</b>	21.4%	48.0%	25.3%	4.3%	1.0%	<b>Extremely Bad</b>
<b>Extremely Easy</b>	1.3%	10.9%	40.8%	38.0%	9.0%	<b>Extremely Difficult</b>
<b>Extremely Beneficial</b>	20.2%	51.3%	25.2%	2.0%	1.3%	<b>Extremely Harmful</b>
<b>Extremely Likely</b>	4.3%	24.6%	41.3%	21.0%	8.8%	<b>Extremely Unlikely</b>

Q: I have not doubts adoption of green infrastructure would provide multiple benefits to my community



## *Methods*

- I used a heteroskedastic ordinal logistic model to investigate the applicability of Rogers' theory as it relates to measuring the perceived attributes of green infrastructure
- Structural equation modeling to test the applicability of a models combining elements of diffusion of innovations and technology acceptance model to explain attitudes toward adoption
- Negative binomial regression model to test the influence of demographic, economic, environmental predictors on the extent of green infrastructure adoption, as measured by the number of green infrastructure tools adopted by municipalities

## *Results*

- Overall, the results of this study provide a useful application of theories of innovation adoption and technology acceptance applied to the domain of green stormwater infrastructure and local government innovation adoption
- I found that three attributes - relative advantage, compatibility, trialability- together with perceived resources, perceived risk and age, to be statistically correlated with attitude toward adoption of green stormwater infrastructure

## *Results (continued)*

- Results indicate that attitude of local officials toward green infrastructure adoption is influenced by perceived usefulness
- Analysis confirms significant indirect effects of perceived internal readiness and perceived ease of use of green infrastructure on respondents' attitude toward adoption
- The expected number of green infrastructure tools adopted by a community increases significantly with the presence of a green infrastructure champion and environmental interest groups within a community

## *Recommendations*

- Based on the analysis results, to increase positive attitudes toward adoption, proponents of green infrastructure should focus on promoting the relative advantage/usefulness of green infrastructure, increase the understanding of its benefits, real cost and applicability to a variety of environments
- To emphasize the advantages of implementing stormwater systems that integrate green infrastructure, I recommend to establish a communication campaign, activate peer networks, and encourage peer support within the target population

## *Recommendations (continued)*

- Complete high profile projects to demonstrate green infrastructure can improve adoption by encouraging people to understand these technologies as being compatible with their systems of values and beliefs and reducing uncertainty and perceived risk associated with adoption
- There is an opportunity promote awareness and provide education to the municipal officials community. Based on the role that knowledge plays in forming attitudes towards and innovation, proponents of green infrastructure should not overlook the opportunity to shape a positive opinion towards these strategies

## *Recommendations (continued)*

- Education programs at the local level should be established to diminish uncertainty associated with implementation
- Younger professionals with a positive attitude toward green infrastructure could be recruited to champion these tools, increasing both their and the public's awareness and knowledge



*Thank you*