

Use of Diffusion of Innovation Theory to Enhance Adoption of Innovative Stormwater Management Strategies in Municipal Populations

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Introduction

Decision makers bear the majority of the responsibility for managing the impacts of development, population growth, and climate change—all of which pose challenges to sustainable water resource management. Decisions aimed at moderating negative impacts from these pressures should be informed by, and make use of, effective innovations in water resource management science. However, in practice, the simple dissemination of scientifically-robust information about the effectiveness of new strategies is unlikely to result in the desired adoption of these strategies by decision makers [1,2]. Studies suggest that cultural and social transmission processes are much more important to understanding the diffusion of innovations than is often assumed by most theorists [3,4] and thus more emphasis has to be placed on linking scientific research to decision-making [5]. Building on the research of many others who have sought to explore the importance of contextual and situational attributes to the translation of research to practice [5-8] this paper develops and tests an approach to assess a municipal entity's relative likelihood of engaging effectively in consideration of implementation of academic and research-oriented innovations. This research is focused on water resource management innovations specific to stormwater management and Low Impact Development (LID) or Green Infrastructure (GI), however, it is anticipated that the general approach is relevant to other environmental management issues.

Methods

A combination of qualitative and quantitative research methods were used to assess the adoption profiles of communities that were weighing decisions with respect to innovative stormwater management. To identify quantifiable metrics through which to weigh municipal experience and propensity to adopt innovative stormwater management strategies, a focus group and a scoping study was conducted to generate affirmative criteria. Invitations to focus group participants went out to the 42 municipalities and 7 Rivers Advisory Committees across the watershed. A final focus group of 18 members participated in over 8 meetings to develop affirmative criteria. Participants included municipal staff, volunteer board members, elected and appointed officials, subject matter experts, planning commission representatives, consultants, and academic partners. Results were a collaborative answer to the question

“what would it look like if a community were to successfully incorporate an innovative stormwater management approach into their water resource management efforts?” The following metrics were developed through the focus group, the combination of which represent the metrics for a complete community approach to stormwater management:

- a. Adopt ordinances and regulations for new development that mandate the use of stormwater filtration to clean runoff and infiltration practices to reduce runoff.
- b. Require improved stormwater controls for reducing runoff for redevelopment projects or other significant construction and for site improvements, such as repaving or building renovations.
- c. Apply conservation strategies, such as protection of naturally-vegetated areas near water bodies and wetlands, and limit the size or percentage of allowable impervious cover in high value natural resource areas.
- d. Reduce existing impervious cover through targeted site improvements and stormwater management changes in high impact locations, i.e., those that contribute high amounts of polluted runoff.
- e. Make a long-term commitment to fund and maintain stormwater controls, along with an accounting mechanism to track long-term benefits of these strategies. Consider innovative funding mechanisms such as impacts fees, exaction fees, and stormwater utilities.
- f. Provide opportunities for outreach by sharing plans and progress with citizens and business owners through community newsletters, cable access, and on-site signs that explain what steps are being taken to protect waterways or improve stormwater management.

To identify patterns of diffusion, independent surveys of the 42 municipalities a number of information sources were reviewed and assessed to determine which communities satisfactorily met conditions embodied in the complete community approach, including published planning and regulatory documents, such as zoning ordinances, site plan and subdivision regulations, master plans, and information collected regionally in the Piscataqua Region Environmental Planning Assessment (PREPA) [9].

This classification system assumes that when any innovation is introduced to a population of end-users, they self-segment into five categories. These adopter categories are represented by specific percentages of the population that have been observed empirically over the past half-century of study. They include the following:

- A. Innovators: The visionaries who, Rogers calculates, represent roughly 2.5% of the end-user population.

- B. Early adopters: Once the benefits, or potential benefits, of an innovation become observable, early adopters join the process. They represent 13.5% of the population.

- C. Early majorities: Majorities are always harder to convince, more sensitive to costs, potential downsides of innovations, and tend to be more risk averse. They represent 34% of the population.

- D. Late majorities: Late majorities are risk averse and generally do not like change, which makes them uncomfortable. They represent 34% of the population.

- E. Laggards: According to Rogers, laggards are holdouts, typically representing 16% of populations.

It is important to note that these generalizations adapted from Rogers, 2003 have been developed across numerous peer reviewed research publications. That said, most DOI research has been conducted on consumer product adoption among individuals [10], as opposed to innovative services such as stormwater management solutions among municipal organizations. These services and the municipal population as an adoption entity are more complex and dynamic by nature (Walker, 2008). The classification of adopter categories enables innovation advocates to select and target audiences that are most likely to be persuaded by empirical facts and data. It would also help them understand that the social landscapes surrounding end-user groups are in a constant state of flux and likely most influenced by forces and phenomena outside of the purview of the science informing the innovation decision.

Results and Discussion

Results were compared to placement on the Diffusion of Innovation (DOI) adopter curve [10]. To keep municipal agents anonymous, town names have been replaced with numbers throughout all aspects of this research. Overall distribution of affirmative responses can be seen in Figure 1 and Table 1. An affirmative response is counted toward the final score, while a negative response is not. A total of seven innovative stormwater management approaches were categorized and results were calculated based on the ratio of adoption with a 100% score indicating innovators, > 84% early adopters, >50% early majority, <50% late adopters, and <14% laggards. Because of the lower number of communities involved in this research results and conclusions more easily fit a simpler distribution where there were two categories; early and late majorities. Early majorities represent audiences more influenced by science-based information sources and late majorities represent those audiences more influenced by peer-to-peer interactions. As seen in Figure 2, the audience distribution in this study area leaned more heavily toward late majority population characteristics.

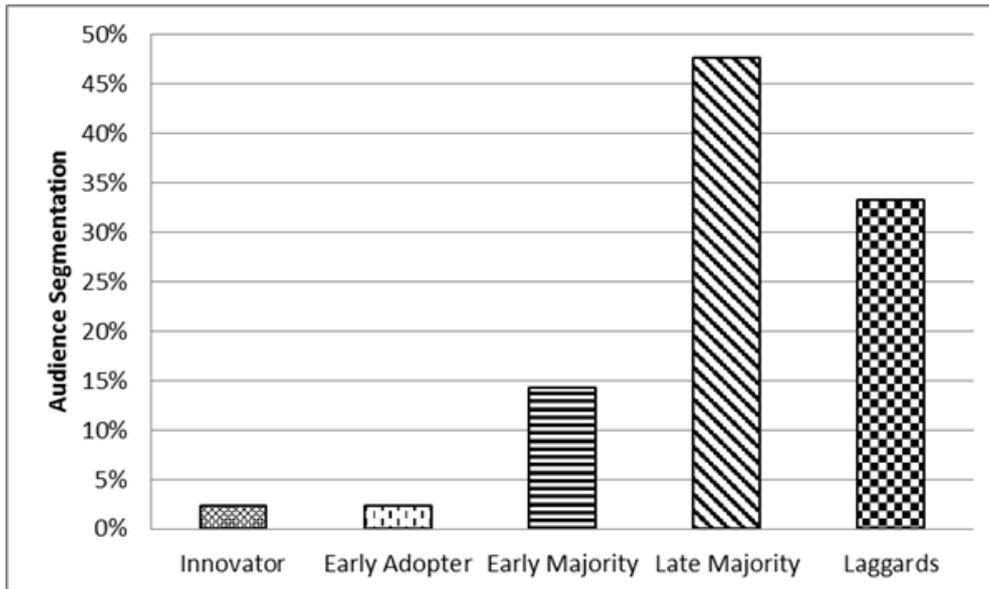


Figure 1: Ranking of N.H. Great Bay municipalities according to their water resource management score.

Table 1: Distribution of adopter categories from a sample size of 42 predicted by DOI vs. actual distributions found in the study.

Study	Ranking				
	1	1	6	20	14
	Innovators	Early Adopters	Early Majority	Late Majority	Laggards
DOI	1.10%	5.70%	14.30%	14.30%	6.70%
%	2%	2%	14%	48%	33%

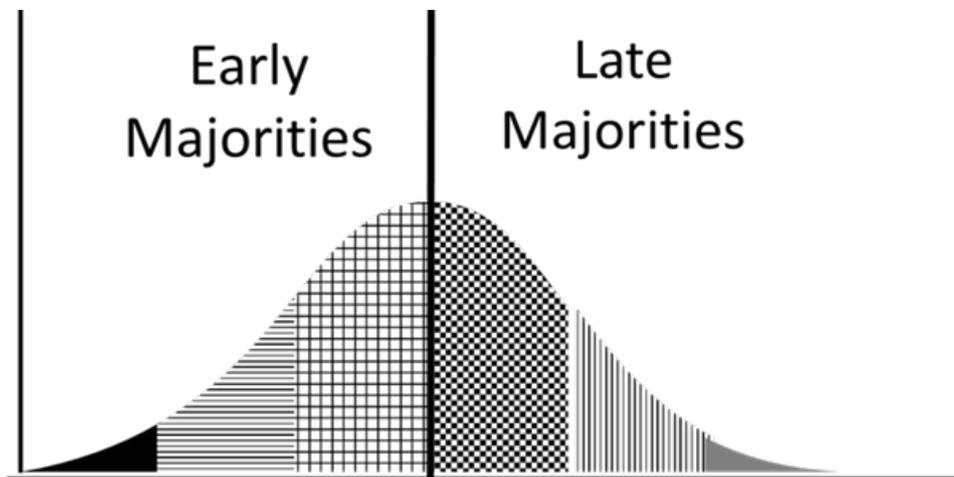


Figure 2: Theoretical distribution of audiences more influenced by science-based information sources and source providers.

Due to the complexity of municipal organizations as a unit of analysis, only two primary adoption categories were determined: early majorities and late majorities. Early majorities (50%) refer to original classifications including innovators, early adopter and early majorities, while late majorities (50%) includes the late majority and laggard classifications. This differentiation itself is a simple yet powerful outcome considering common outreach and education approaches. Early majorities are not only more amenable

to science-based solutions but they also have standing amongst their peers to advance innovation adoption more effectively. Using this classification method would enable innovation advocates to select and target audiences that are most likely to be persuaded by empirical facts and data. It would also help them understand that the social landscapes surrounding end-user groups are in a constant state of flux and likely most influenced by forces and phenomena outside of the purview of the science informing the innovation

decision. A fundamental challenge in ushering science into the public domain is to manage the boundaries between multiple disciplines, organizations, and interests. Few scientists are policy makers, and few policy makers review technical scientific literature for appropriate management solutions. The persuasive power of outreach campaigns built around simple presentation of scientific evidence is likely limited in comparison to influence exerted by peer-to-peer communication pathways that bridge the worlds of scientists and policy makers. The implication is that agents of change who want to move innovations through a population should focus their efforts on working with early majority populations that have status within relevant peer networks. Examples may include working in greater detail with a few communities that are ready to advance stormwater management solutions. Technical assistance with design strategies can propel ready to adopt communities into the stages of implementation where characteristics of the stormwater management innovations can be further refined and advanced. These leaders then become role models who can help to establish the innovation as a new norm within the peer network and to spread the innovation to others via interpersonal communications.

Conclusion

The fundamental conclusion from this relatively simple and low cost assessment is that stormwater subject matter experts may be trying to do too much in attempting to influence the entire range of end-user audiences with their innovations. Instead, focus should be on early adopter audiences and the leadership from high-ranking staff within these municipalities who have the responsibility and authority to enact change in practice. The direct outreach to and participation of respected and trusted staff addresses three fundamental problems that are often associated with municipal adoption of innovative stormwater management approaches; compatibility, complexity and trialability, or in other words, does it fit our management culture, can people understand it, and can local staff adapt the designs for greater utility? Due to the inherent flexibility of innovative stormwater management strategies, it is incumbent that municipal officials with credibility and power to experiment with designs easily adapt them to suit the needs of others in municipal leadership roles. Engagement of these audiences that have the respect and trust of staff and other administrative leadership personnel are vital to not only the continued success in adopting innovative technologies but hold

the key to complying with up-to-date management approaches in a pragmatic and economical way.

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