Transportation Sustainability and the Transition to Autonomous Vehicles

Carol Atkinson-Palombo, PhD
Associate Professor
Department of Geography

Outline

- Integrating Across Disciplines
- Defining Transportation Sustainability
- Transportation Indicators for Sustainable Places
- Need for a Holistic Systems-Based Approach

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Integrative Perspective

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GEOGRAPHY

INTERESTED IN...

Challenges in creating cities?
The concept of sustainability?

GEOG 2400 INTRODUCTION TO SUSTAINABLE CITIES

1:25-2:15 MWF, LAUREL HALL 102
PROFESSOR CAROL ATKINSON-PALOMBO, DEPARTMENT OF GEOGRAPHY

Course Description: Cities offer the potential to accommodate the world's expanding population in an efficient manner by concentrating people in places designed to use (and recycle) fewer (and more renewable) resources. This course introduces various pathways to make cities more sustainable from social, economic, and environmental perspectives. Students will be introduced to various problems experienced in many contemporary metropolitan areas such as air and water pollution, sprawl, traffic congestion, affordable housing, and inequity in general. They will then learn about solutions to some of those problems including sustainable transportation, renewable energy, recycling of waste, and green infrastructure.

For a syllabus or for more information about this course, contact Dr. Carol Atkinson-Palombo, at carol.atkinson-palombo@uconn.edu

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DEPARTMENT OF GEOGRAPHY

Relationship between Wind Turbines and Residential Property Values in Massachusetts

A Joint Report of University of Connecticut and Lawrence Berkeley National Laboratory

January 9, 2014

Carol Atkinson-Palombo
Assistant Professor, Department of Geography
University of Connecticut

Ben Hoen
Staff Research Associate
Lawrence Berkeley National Laboratory

With Support From
MASSACHUSETTS CLEAN ENERGY CENTER
BERKELEY LAB
Lawrence Berkeley National Laboratory

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Examining Human-Environment Interactions

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Suburban Sustainability

Volume 3 | Issue 1 Article 4

2015

Coupling community preferences with hydrologic evaluation of low impact development implementation in an urban watershed

Corinna M. Fleischmann
US Coast Guard Academy, corinna.m.fleischmann@uscga.edu

Carol Atkinson-Palombo
University of Connecticut, carol.atkinson-palombo@uconn.edu

Joseph T. Bushey
University of Connecticut, busheyjoseph@gmail.com

Eric D. Jackson
Connecticut Transportation Institute, University of Connecticut, erj02003@engr.uconn.edu

David W. Payne
dwpayne89@gmail.com

ELSEVIER

Atmospheric Environment

Volume 40, Issue 39, December 2006, Pages 7644–7658

Quantifying the ozone "weekend effect" at various locations in Phoenix, Arizona

Carol M. Atkinson-Palombo, James A. Miller, Robert C. Balling Jr.
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http://dx.doi.org/10.1016/j.atmosenv.2006.05.023 Get rights and content

Abstract

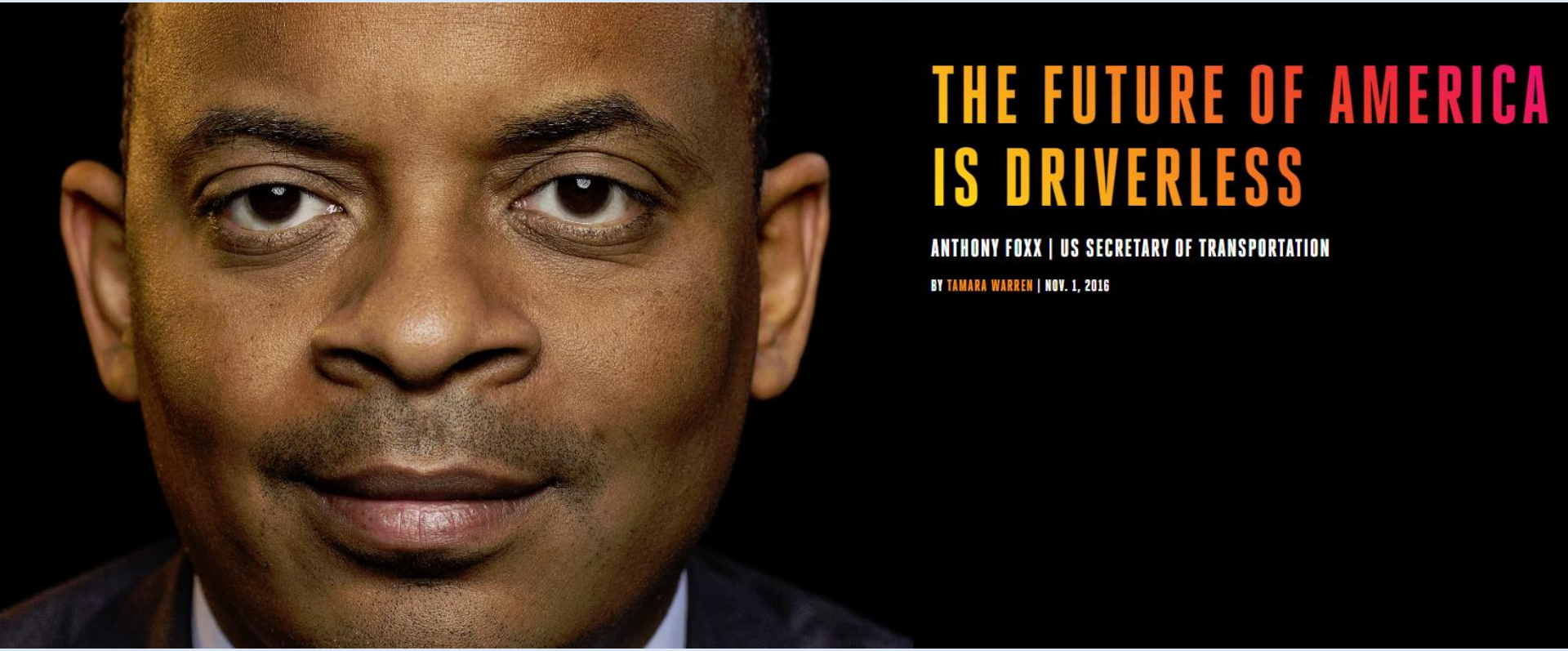
Analysis of pollution data from a network of monitors in Maricopa County, Arizona, reveals considerable variation in the magnitude of the ozone "weekend effect" depending on how and where it is measured. We used four separate methods to calculate the weekend effect, all of which showed that the phenomenon is stronger in the urban core, where ozone is produced. Spatial linear regressions show that the magnitude of the weekend effect and the goodness of fit of weekly harmonic cycles in ozone is a function of urbanization, described quantitatively using an index of traffic counts, population, and employment within a 4 km buffer zone of monitoring sites. Analysis of diurnal patterns of ozone as well as oxides of nitrogen (NO_x) at a representative site in the urban core supports the hypothesis that lower levels of NO_x on Sundays reduce the degree to which ozone is titrated, resulting in a higher minimum and hence mean for that day of the week (DOW). Fringe sites, where ozone concentrations are higher in absolute terms than in the urban core, show almost no "weekend effect," regardless of which of the four individual methods we used. Alternative quantification methods show statistically significant DOW differences in ozone levels in urban fringe locations, albeit out of phase with the weekly cycling of ozone in the urban core. Our findings suggest that multiple metrics need to be used to test for the weekend effect and that the causes of DOW differences in ozone concentrations may be location specific.

Cross-cutting Nature of Transportation

Dedicated to interdisciplinary, use-inspired research into various aspects of Sustainable Cities, particularly land use and transportation.

Self-Driving Cars Are Coming …

The Future of America is Driverless



It’s November, 2021: what does the world look like?

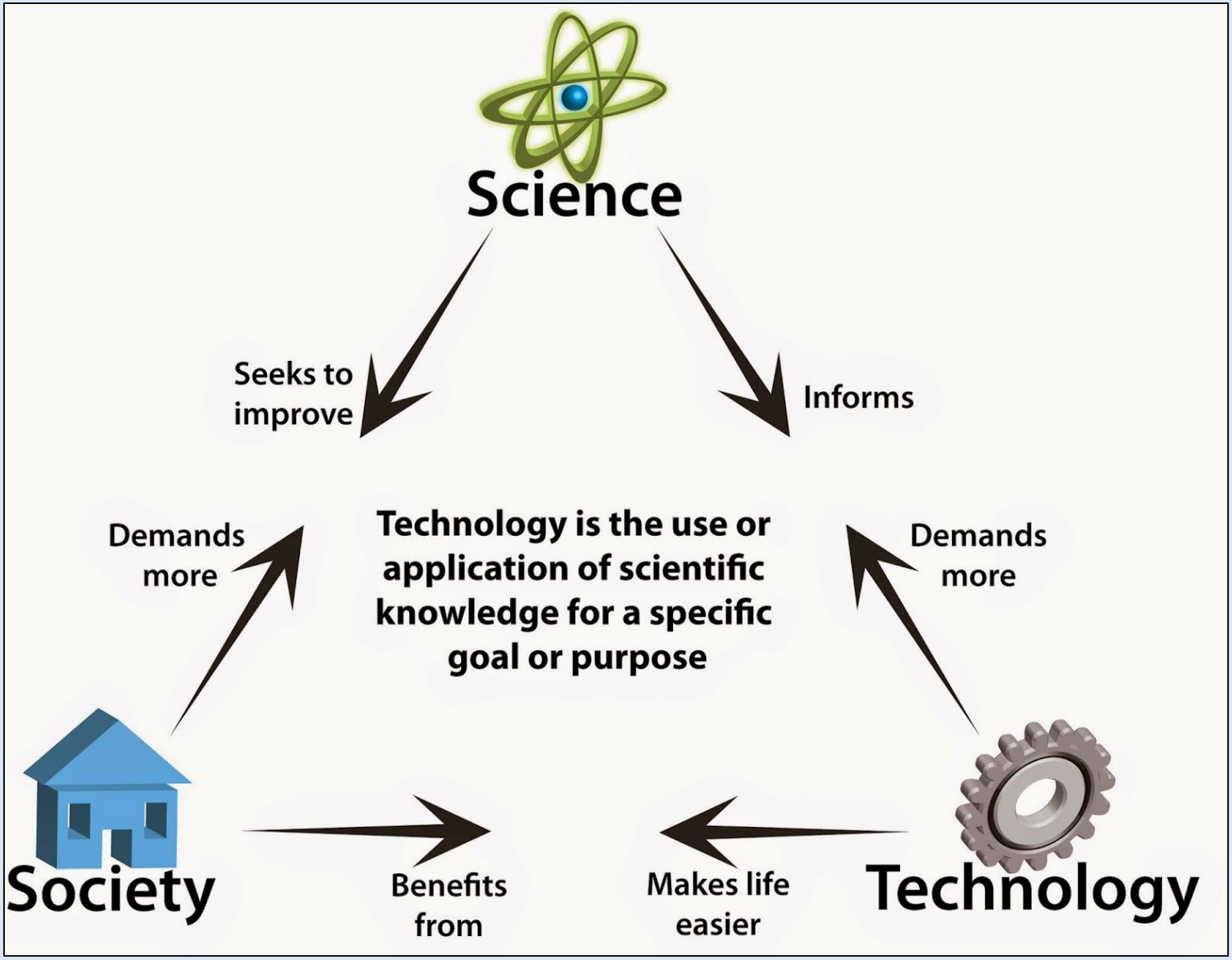
By 2021, we will see autonomous vehicles in operation across the country in ways that we [only] imagine today… Families will be able to walk out of their homes and call a vehicle, and that vehicle will take them to work or to school.

We're going to see transit systems sharing services with some of these companies. It's not just autonomy in the vehicles. You're going to see trucks running more closely together, resulting in fuel savings and positive climate impact.

A Potentially Revolutionary Technology

"This is going to revolutionize the way we travel"

Science, Technology & Society



Science, Technology & Society

ELSEVIER

Energy Policy 35 (2007) 2683–2691

ENERGY POLICY

www.elsevier.com/locate/enpol

Social acceptance of renewable energy innovation: An introduction to the concept

Rolf Wüstenhagen[a,*], Maarten Wolsink[b], Mary Jean Bürer[a]

[a]*Institute for Economy and the Environment, University of St. Gallen, Tigerbergstrasse 2, CH-9000 St. Gallen, Switzerland*
[b]*Department of Geography, Planning and International Development Studies, University of Amsterdam, Nieuwe Prinsengracht 130, NL-1018 VZ Amsterdam, The Netherlands*

Available online 26 February 2007

Abstract

This paper introduces the special issue on Social Acceptance of Renewable Energy Innovation. It is a collection of best papers presented at an international research conference held in Tramelan (Switzerland) in February 2006. While there are ambitious government targets to increase the share of renewable energy in many countries, it is increasingly recognized that social acceptance may be a constraining factor in achieving this target. This is particularly apparent in the case of wind energy, which has become a subject of contested debates in several countries largely due to its visual impact on landscapes. This paper introduces three dimensions of social acceptance, namely socio-political, community and market acceptance. Factors influencing socio-political and community acceptance are increasingly recognized as being important for understanding the apparent contradictions between general public support for renewable energy innovation and the difficult realization of specific projects. The third dimension, market acceptance, has received less attention so far and provides opportunities for further research, particularly from management scholars.

Social Acceptance Triangle

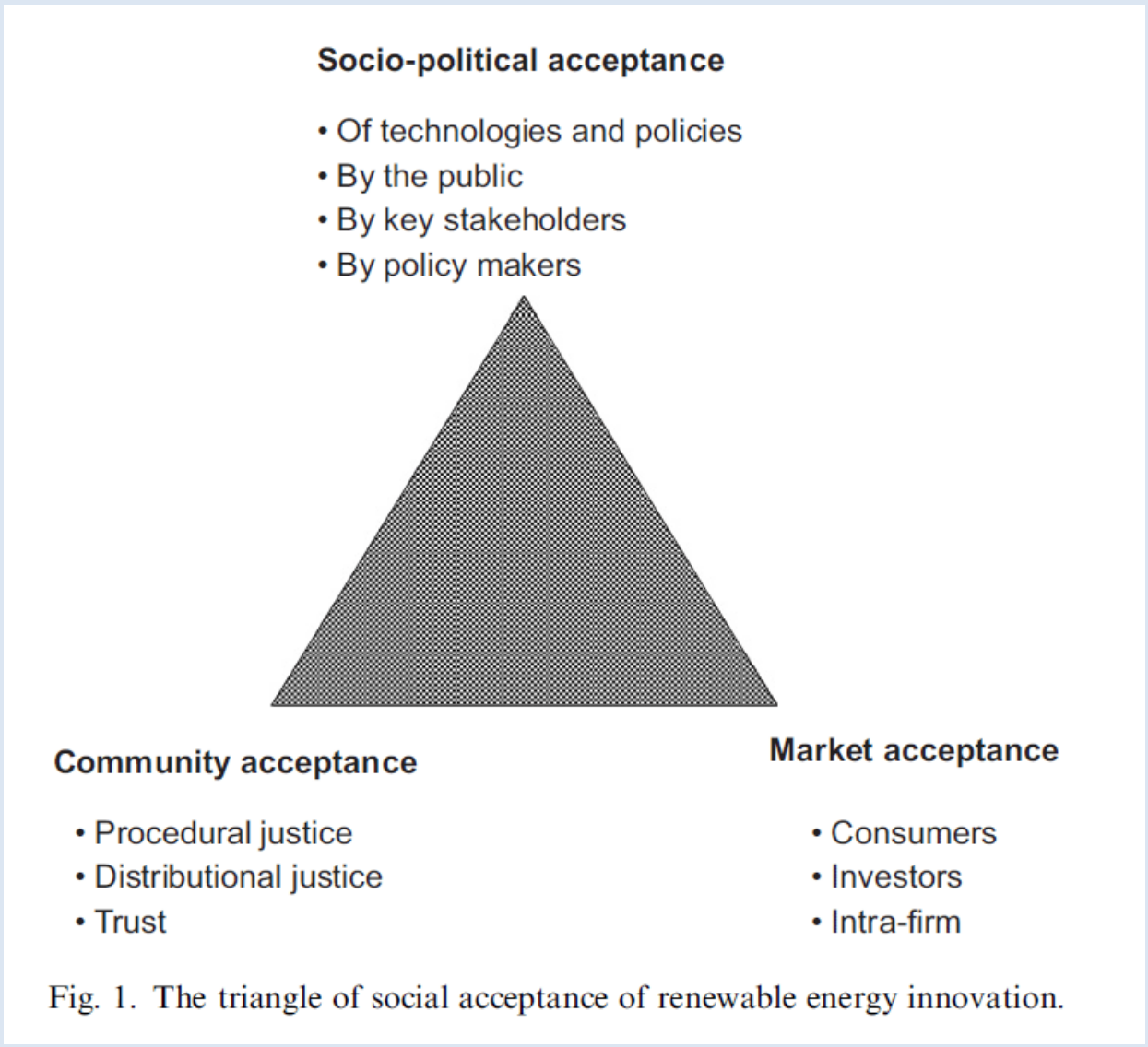


Fig. 1. The triangle of social acceptance of renewable energy innovation.

Social Acceptance Triangle

Energy Policy 107 (2017) 27–31

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

A conceptual framework for understanding the social acceptance of energy infrastructure: Insights from energy storage

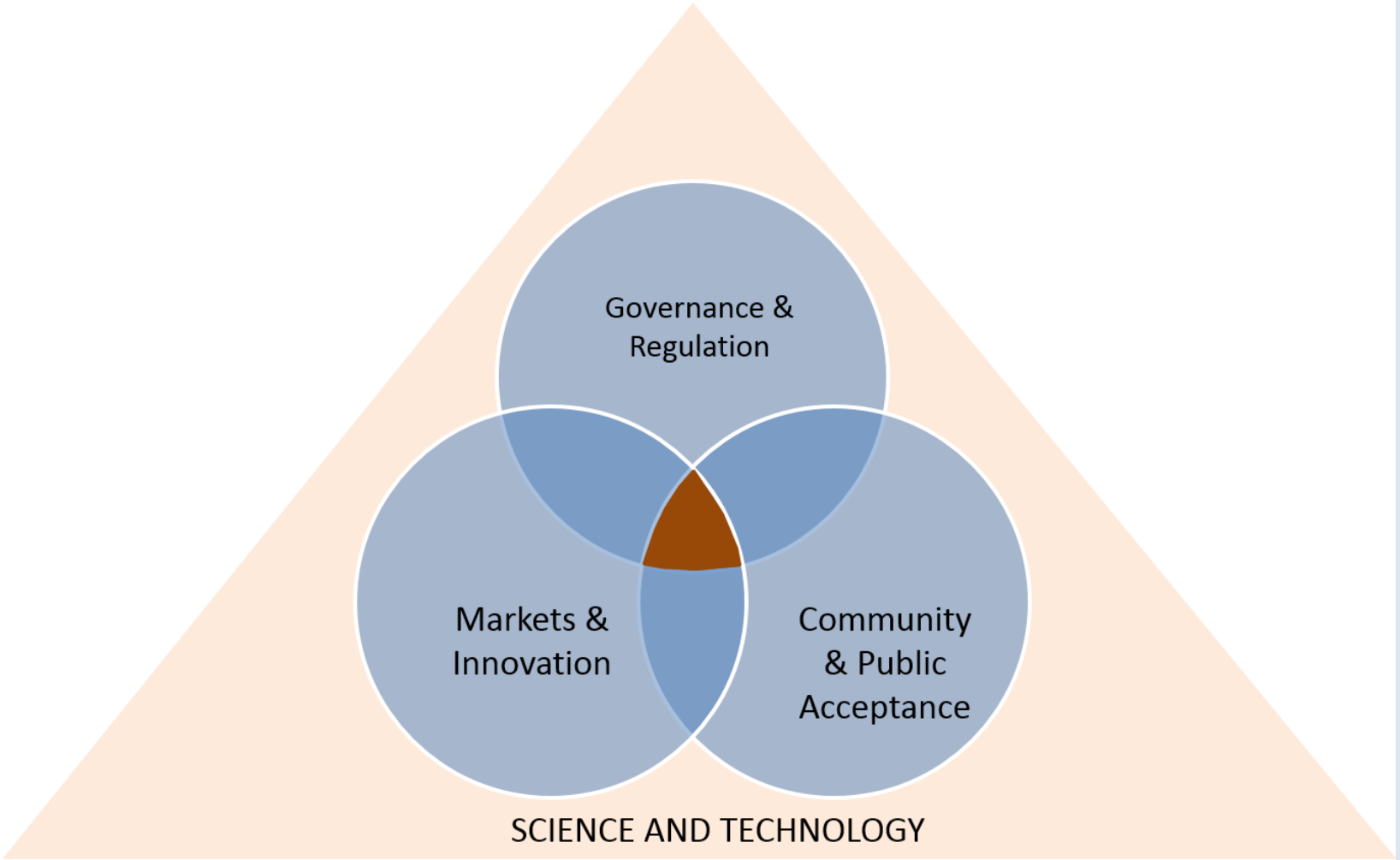
Patrick Devine-Wright[a,*], Susana Batel[b], Oystein Aas[c], Benjamin Sovacool[d], Michael Carnegie Labelle[e], Audun Ruud[c]

[a] University of Exeter, United Kingdom
[b] Instituto Universitário de Lisboa (ISCTE-IUL), Cis-IUL, Lisboa, Portugal
[c] Norwegian Institute for Nature Research, Norway
[d] University of Sussex, United Kingdom and Aarhus University, Denmark
[e] Central European University, Hungary

ARTICLE INFO

ABSTRACT

Science, Technology & Society



An Interdisciplinary Approach to Evaluate the Social Acceptance of Technology within an Integrated Socio-Technological System

Dimensions of Social Acceptance of Technology

Middle Actors

Dimension of Acceptance / Geographic Scale	Governance & Regulation	Markets & Innovation	Community & Public Acceptance
International			
National			
State			
Town			
Local			

Middle Actors

Dimensions of Social Acceptance of Technology at various Geographic Scales

Quantifying the Economic Domain of Transportation Sustainability

Jason Zheng, Carol Atkinson-Palombo, Chris McCahill, Ryan O'Hara, and Norman W. Garrick

The lens of sustainability refocuses the perception of transportation and allows a look beyond its accustomed role of providing vehicular mobility to the broader impacts of transportation on the environment, society, and the economy. As the understanding of transportation's function evolves beyond throughput and capacity, sustainability can be used as an organizing principle for transportation planning to promote livable communities. To fully understand and integrate the ideas of sustainability with transportation, the proper metrics and performance measures need to be developed and adopted. This study demonstrated how the theoretical concepts and definitions of transportation sustainability could be transformed into a practical metric for assessing the performance of the U.S. transportation system in terms of sustainability. The study focused on characterizing and measuring the economic aspect of sustainability in relation to transportation. The analysis was carried out for surface transportation at the statewide level and took into consideration the degree of urbanization of states. The final results described the relationship between urbanity, mode share, and the economic aspects of transportation sustainability. On the basis of this assessment, the best-performing states in terms of the economic aspects of transportation sustainability were more urban and had lower automobile mode shares.

Transportation plays a pivotal role in some of global society's critical issues, including greenhouse gas emissions, diminishing natural resources, energy security, and the current economic downturn. Transportation is also associated with domestic policy issues such as pollution and air quality, obesity and health, sprawl and development patterns, and social equity. To address some of these environmental and socioeconomic concerns, in 2009 the federal government formed an interagency partnership between the U.S. Department of Housing and Urban Development, the U.S. Department of Transportation, and the U.S. Environmental Protection Agency; this partnership coordinates housing, transportation, and environmental protection to promote sustainable development and livable communities. Although this partnership demonstrates an immediate response, another, more long-standing plan is NCHRP's multiyear study on long-range strategic issues facing the transportation industry (*1*). One key component of the NCHRP study is to assess how sustainability can be used as an organizing principle for transportation agencies.

J. Zheng, C. McCahill, R. O'Hara, and N. W. Garrick, Department of Civil and Environmental Engineering, University of Connecticut, 261 Glenbrook Road, Unit 2037, Storrs, CT 06269-2037. C. Atkinson-Palombo, Department of Geography, University of Connecticut, 215 Glenbrook Road, Unit 4148, Storrs, CT 06269-4148. Corresponding author: J. Zheng, jasonz87@gmail.com.

Transportation Research Record: Journal of the Transportation Research Board, No. 2242, Transportation Research Board of the National Academies, Washington, D.C., 2011, pp. 19–28.
DOI: 10.3141/2242-03

Sustainability is a broad and variously
principles can be incorporated into a framew
tic approach for transportation. However, s
sustainability with transportation requires
which ultimately means expanding the und
plex and recursive interactions between tran
ronment, society, and the economy. New fe
ongoing efforts to develop innovative metho
range of transportation impacts suggest tha
under way. Conventional transportation r
focused on vehicular mobility, resulting in
portation systems for throughput and capa
regard for other impacts (*3, 4*). New metrics, with sustainability as a theme, will assist policy makers in developing more comprehensive transportation plans that enhance environmental conservation, social livability, and economic vitality (*4, 5*).

This study reviews a metric developed for transportation sustainability, with emphasis on the details of how the economic domain of transportation sustainability was defined, characterized, and assessed. Existing metrics and definitions for transportation sustainability were used to frame the overall metric. It was decided to further develop the economic domain because the background of the economic components is not well explored in existing literature on transportation sustainability. The literature review explores pertinent studies on transportation that relate economics with sustainability. This review helped to form a set of indicators for the economic domain of transportation sustainability that were then used to assess the performance of individual states. Additional analysis was conducted to distinguish between rural and urban states to provide relevant comparisons and to assess the role of urbanity in transportation sustainability.

FRAMEWORK FOR TRANSPORTATION SUSTAINABILITY

Defining transportation sustainability is the first critical step in developing a tool to measure it (*4*). Definitions of transportation sustainability are rooted in the broader concept of sustainability, which focuses on the interaction among the environmental, social, and economic domains (*2, 5*). Additional concepts that expand the understanding of sustainability include Haughton's equity principles and the green and brown agendas (*4*). Haughton's principles consider how people's actions may affect intergenerational, intragenerational, geographical, procedural, and interspecies equity (*6*). The green agenda is concerned with long-term and indirect global issues such as resource consumption and climate change, and the brown agenda focuses on short-term and direct local issues such as clean air and water (*7*). These domains and concepts underscore the breadth

Research in Transportation Business & Management

Volume 7, July 2013, Pages 4–13

Valuing Transportation: Measuring What Matters for Sustainability

Guidelines on developing performance metrics for evaluating transportation sustainability

Jason Zheng[a], Norman W. Garrick[b], Carol Atkinson-Palombo[c], Chris McCahill[b], Wesley Marshall[d]

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http://dx.doi.org/10.1016/j.rtbm.2013.02.001

Abstract

Transportation systems have a significant impact on environmental, social, and economic sustainability. Traditional transportation performance metrics, which tend to focus on vehicle mobility and congestion, fail to assess the degree to which transportation planning leads to sustainable outcomes. Lacking appropriate metrics, transportation managers and policy-makers often do not have sufficient information to make decisions that consider sustainability as an outcome. Accordingly, this paper focuses on the process for developing such metrics in the form of a composite index. The intent of this paper is not to provide a singular, definitive index; rather, the goal is to provide guidance into the issues of selecting an appropriate index or developing their own.

Assessing the Economic Burden of Transportation

Jason Zheng, Norman Garrick, Carol Atkinson-Palombo, Chris McCahill, Ryan O'Hara

Center for Transportation and Livable Systems, University of Connecticut

Abstract

Conventional assessment of transportation primarily focuses on vehicle capacity and mobility, thus communities and transportation systems are planned around such objectives. Our research creates and tests a framework to assess transportation sustainability, used to develop the **Transportation Index for Sustainable Places**, providing a more holistic platform for planning.

Rating the States

The results suggest that regional attitudes and differences may be responsible for affecting land development and transportation patterns.

Rating the Cities

An assessment of the fifty largest urbanized areas shows that an individual city is not necessarily related to the respective state's overall performance.

Top 5	Bottom 5
New York, NY	Nashville, TN
San Francisco, CA	St Louis, MO
New Orleans, LA	Tucson, AZ
Austin, TX	Jacksonville, FL
San Jose, CA	Oklahoma City, OK

The best performing urban areas are generally the ones with less automobile use.

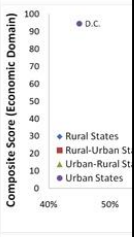
Methodology

The metric we developed is composed of twelve elements which make up the environmental, social, and economic domain of transportation sustainability. This poster concentrates on the economic impact of transportation.

Economic Domain					
Goal	Transportation is affordable for individuals	Transportation system provides efficient movement of people & goods for economic activity		Transportation finance is locally self-sufficient	Transportation system does not contribute to economic vulnerability of society
Indicator	% of household income spent on transportation	Change in GDP per VMT Growth Rate	Absolute GDP per VMT	% of transportation expenditure from federal funding	% of GDP spent on fuel

U

The scores were co
share for each stat
better. There is also
car use.



17TH ANNUAL INTERNATIONAL SUSTAINABLE DEVELOPMENT RESEARCH CONFERENCE

Moving Toward a Sustainable Future:

OPPORTUNITIES AND CHALLENGES

Beyond Mobility: Measuring Transportation in Terms of Equity, Resiliency, and Economic Efficiency

Carol Atkinson-Palombo, University of Connecticut

Team: Norman Garrick, Jason Zheng, Christopher McCahill

A Sustainable Transportation System …

…allows the basic access needs of individuals to be met safely in a manner consistent with human and ecosystem health, and with equity within and between generations.

…is affordable, efficient, offers choice in transport mode, and supports a vibrant economy.

…limits emissions, pollution, and wastes; minimizes consumption of resources and land.

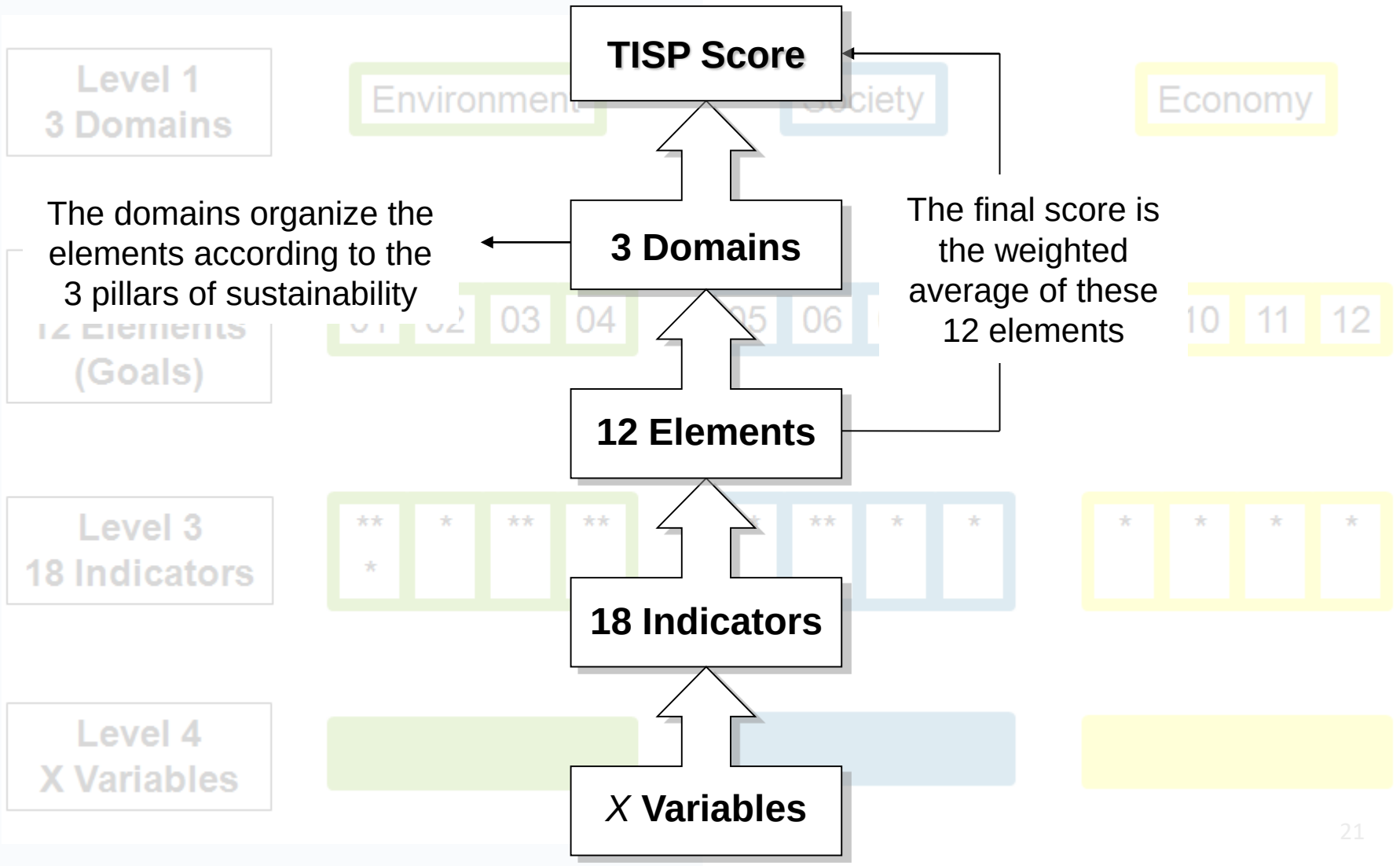
The Centre for Sustainable Transportation
Le Centre pour un transport durable

Transportation Indicator for Sustainable Places (TISP)

Not just an accounting system.

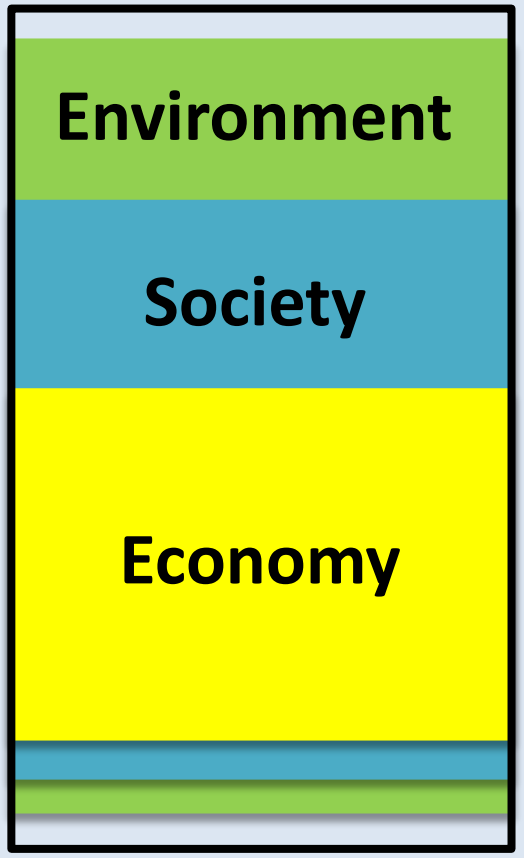
"What gets measured gets managed".

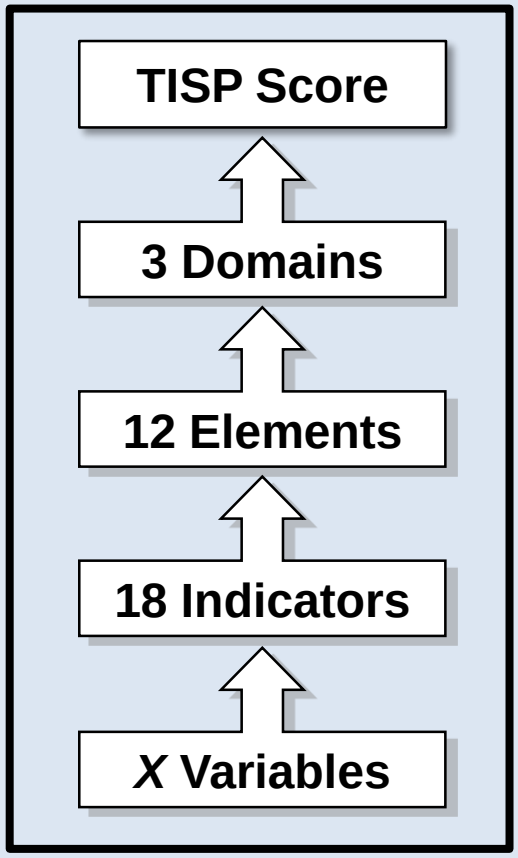
Structural Framework of the TISP



Summary

Define and develop a methodology to assess transportation sustainability





Dimensions of Social Acceptance of Technology

Middle Actors

Dimension of Acceptance / Geographic Scale	Governance & Regulation	Markets & Innovation	Community & Public Acceptance
International			
National			
State			
Town			
Local			

Middle Actors

Dimensions of Social Acceptance of Technology at various Geographic Scales

Big Questions

- How should government (at all scales) regulate emerging transportation technology?
- How will the public learn to interact with self-driving cars?
- How willing are people to give up control of their vehicle to machines?
- How will any transition to shared ownership of self-driving vehicles affect automobile ownership levels, and ultimately the auto industry?

Video Links

https://www.youtube.com/watch?v=oNyq2_92H0Y

UBER BOXES

https://www.youtube.com/watch?v=Od6EeCWytZo

SHIBUYA

https://www.youtube.com/watch?v=b0A9-oUoMug

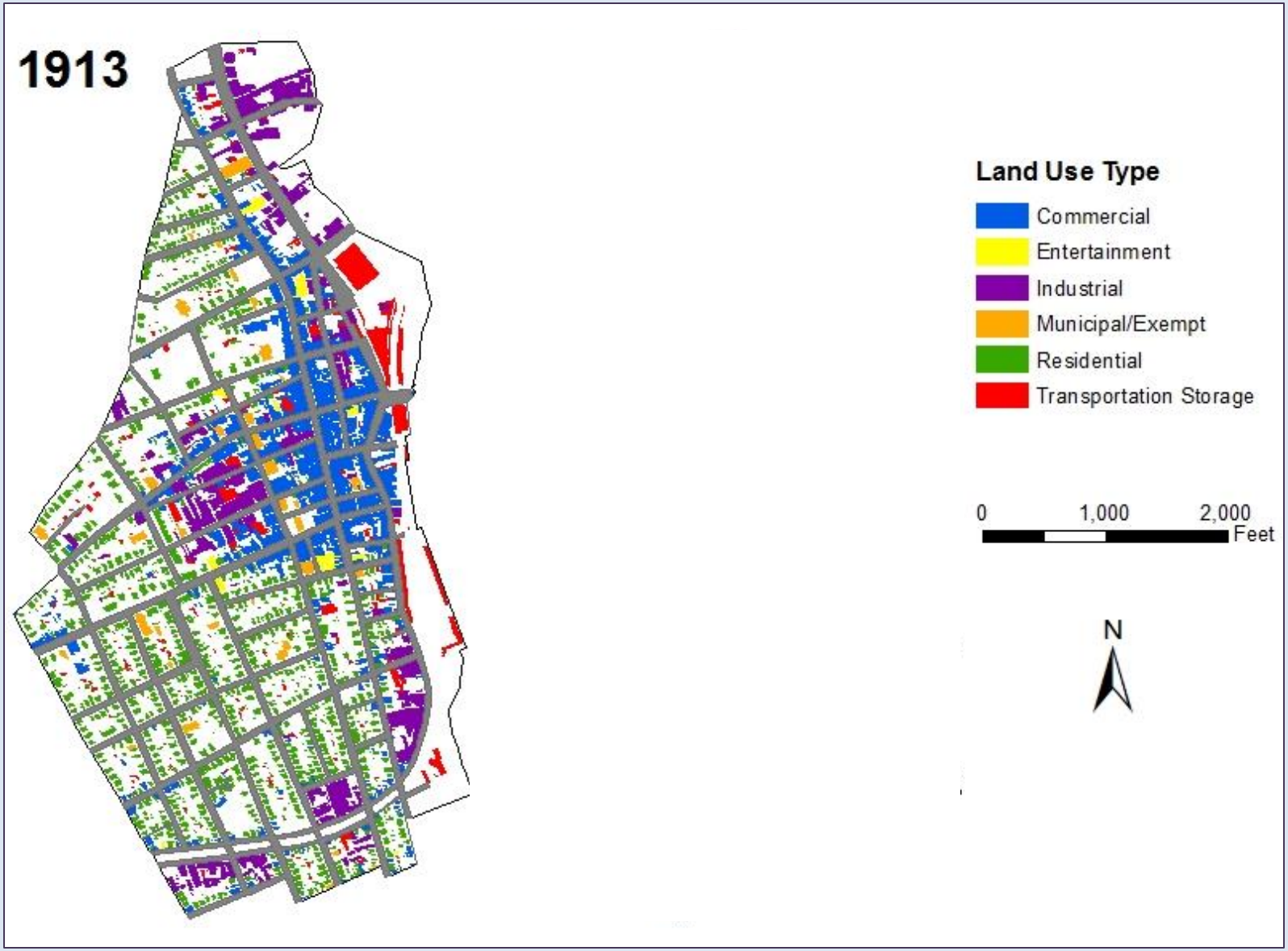
TOKYO SUBWAY

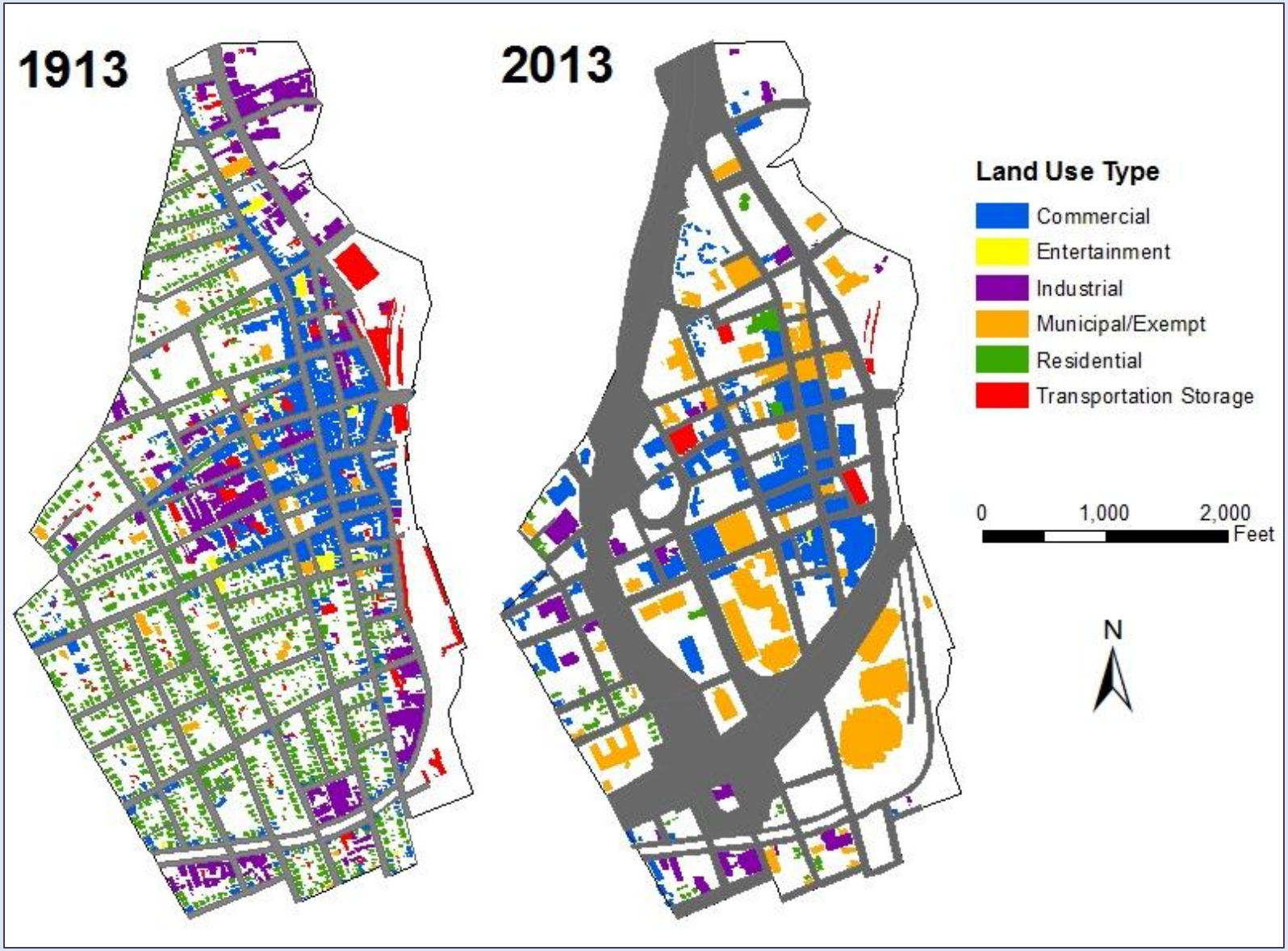
Amsterdam Car-Free Street

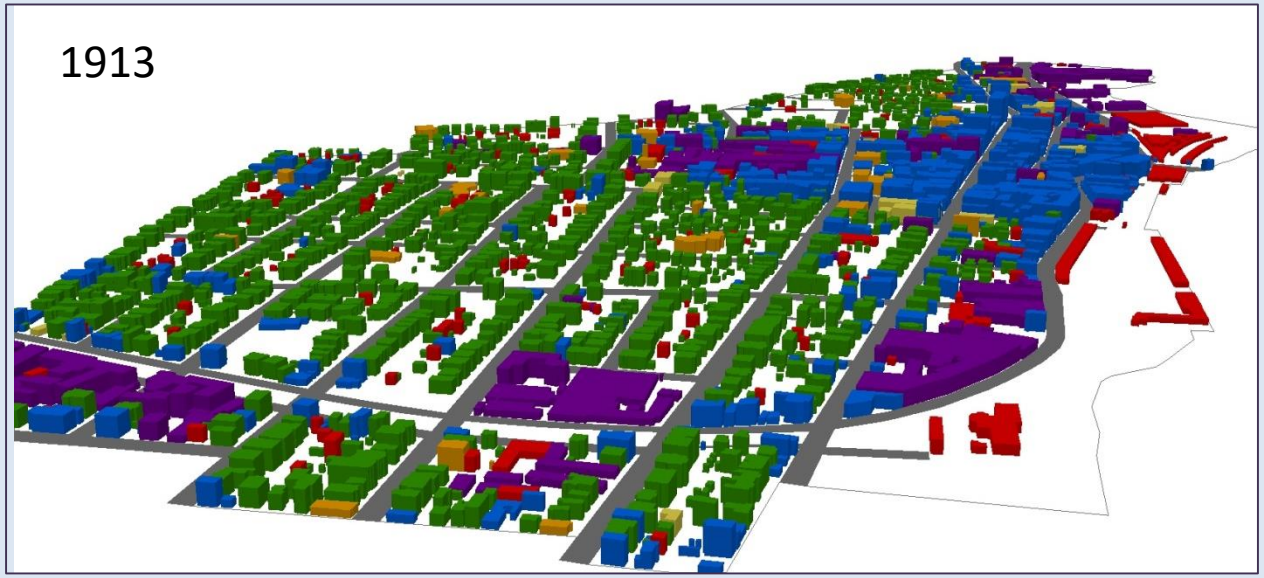
Car Free Day in Paris

Already Congested Roads

Interstate Highway System


1913
Land Use Type
Commercial
Entertainment
Industrial
Municipal/Exempt
Residential
Transportation Storage
0
1,000
2,000
Feet
N


1913
2013
Land Use Type
Commercial
Entertainment
Industrial
Municipal/Exempt
Residential
Transportation Storage
0
1,000
2,000
Feet
N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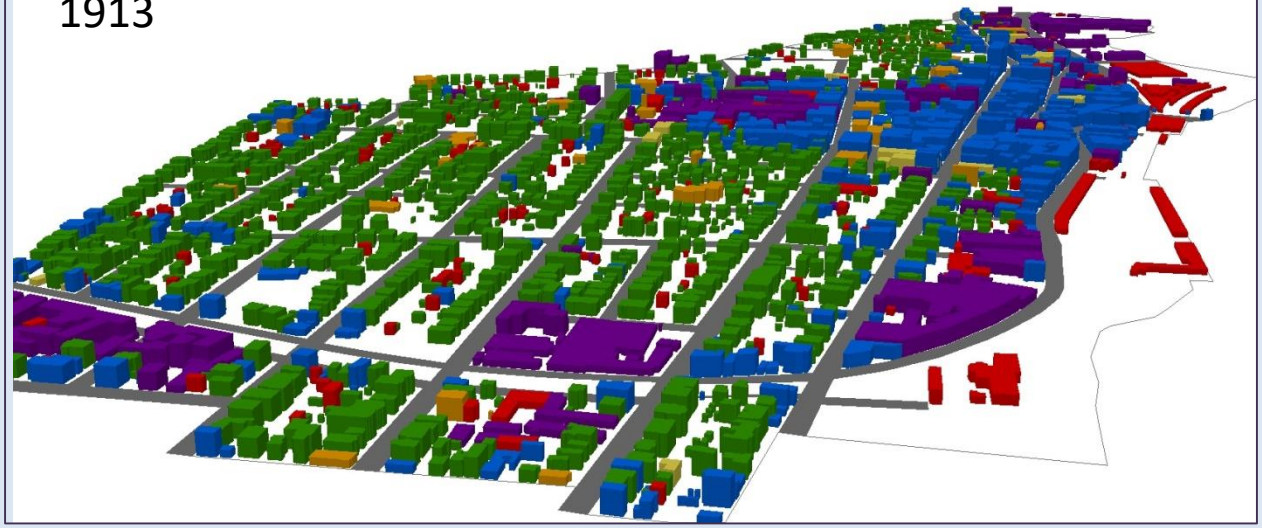
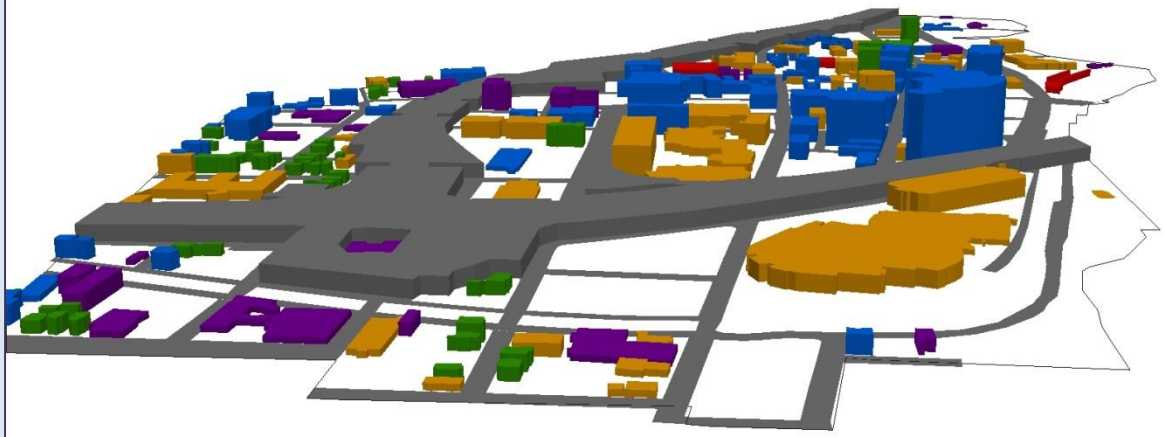


2013



This emerging technology needs to be thoughtfully implemented into society in a way that maximizes the positive impacts and minimizes any unavoidable costs.

Adoption will have its own Geography.