Journal of Transport Geography 26 (2013) 51–64

Contents lists available at SciVerse ScienceDirect

Journal of Transport Geography

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

Developing context-sensitive livability indicators for transportation planning: a measurement framework

Harvey J. Miller [a,*], Frank Witlox [b], Calvin P. Tribby [a]

[a] Department of Geography, University of Utah, Salt Lake City, UT, USA
[b] Department of Geography, Ghent University, Ghent, Belgium

ARTICLE INFO

Keywords:
Livability
Sustainability
Indicators
Multicriteria analysis
Spatial analysis
Geodesign

ABSTRACT

New emphases on livability and sustainability are creating demands for measuring and applying these concepts in transportation policy and planning. However, livability and sustainability are complex, multidimensional concepts that require careful measurement if they are to be applied meaningfully in plan evaluation and benchmarking. This paper provides a framework for constructing and applying quantitative livability and sustainability indicators. In addition to critically reviewing principles of constructing indicators describing a multidimensional concept such as livability or sustainability, we also discuss methods for capturing local context, a critical feature for transportation planning. Specifically, we review methods for incorporating diverse stakeholder perspectives into indicator construction and spatial analytic tools for geographic entities and relationships. We also discuss spatial decision support systems and the Geodesign concept for organizing these tools and technologies as well as integrating livability indicators into the overall planning process.

1. Introduction

The last two decades have witnessed a surge of interest in enhancing the livability of communities, and a growing commitment by governments to provide the framework, tools and data to plan and build livable communities. Although European governments have been proactive with respect to livability and sustainability plans (see, e.g., EU, 2010), until recently, efforts in the United States have been mostly citizen-organized in response to local and regional issues (Deakin, 2002; NRC, 2002). This changed substantially in 2009 when the US Environmental Protection Agency (EPA), the Department of Housing and Urban Development (HUD) and the Department of Transportation (DOT) formed a partnership to coordinate federal housing, transportation, and other infrastructure investments with the goal of creating more livable and sustainable communities. The Partnership for Sustainable Communities intends to identify policy and investment strategies that encourage safe, reliable and economical transportation choices, promote equitable and affordable housing, enhance economic competitiveness, support community revitalization and promote healthy, safe and walkable neighborhoods in rural, urban or suburban settings.

A key research need identified in the Partnership for Sustainable Communities is the development of livability measures and tools. The agreement calls for efforts to research, evaluate and recommend analytical measures that reflect the livability of communities, neighborhoods, and metropolitan areas. The intent is to use indices to benchmark existing conditions, measure progress and improve accountability in integrated planning efforts to enhance community livability. HUD, DOT, and EPA also intend to develop incentives to encourage communities to implement, use, and publicize the indices (USDOT, 2009).

Livability indices are not new: quality of life, and sustainability measures and rankings include scientifically-based policy measures such as the ecological footprint (Wackernagel and Rees, 1996) and the human development index (UNDP, 1990) and measures of inequality such as the Gini coefficient (Garner, 1993; Yitzhaki, 1979). However, new policy initiatives imply a greater emphasis on indicators to guide planning and investment decisions. These indices should be carefully constructed given these functional requirements. In particular, livability and sustainability indicators should be *internally consistent* or coherent with respect to measurement assumptions, *transparent* in the sense that they are easily understood and interpreted, and *externally valid* with respect to capturing all relevant aspects of the concepts.

This paper provides a measurement framework for developing and applying livability indices in transportation planning. With respect to internal consistency and transparency, we critically review the indicator construction process, focusing the discussion on issues

* Corresponding author. Address: 260 S. Central Campus Dr., Room 270, Salt Lake City, UT 84112-9155, USA. Tel.: +1 801 585 3972; fax: +1 801 581 8219.
E-mail address: harvey.miller@geog.utah.edu (H.J. Miller).

0966-6923/$ - see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jtrangeo.2012.08.007

relevant to transportation planning. With respect to external validity, we discuss *multicriteria analysis* (MCA): a set of techniques for eliciting preference structures in multiattribute decision-making (Jankowski, 1995; Nijkamp et al., 1990). We also discuss techniques that allow indicators to capture the local context more fully. These include techniques that explicitly maintain stakeholder perspectives, and spatial analytic tools that can model spatial entities and relationships at varying levels of aggregation. We also discuss spatial decision support systems and the emerging concept of *Geodesign* as a framework for organizing these tools and technologies as well as integrating livability indicators into the broader planning process.

Although we discuss conceptualizations of livability, we do not intend to provide definitions of livability beyond identifying features that are relevant for the indicator construction process. We also do not intend to suggest what livability data should or should not be collected. In fact, it is often a good idea to collect data beyond the requirements for indicator construction: these can be used for "drilling-down" to derive additional detail or auxiliary information.

The next section of this paper provides background on defining livability, livability and transportation planning, indicators in policy and planning, and indicators for multidimensional concepts. After this background, the following section addresses issues associated with developing internally consistent and transparent indicators. Specifically, Section 3 provides a critical review of how to construct a *composite* index that summarizes a multidimensional concept such as livability, paying special attention to issues that are relevant to transportation. Section 4 discusses methods for developing externally valid indicators through capturing local context. These methods include the *multiactor multicriteria analysis* (MAMCA), spatial analytical tools, spatial decision support systems and the Geodesign process for organizing tools and technologies as well as incorporating livability indicators into the broader planning process. Section 5 concludes the paper with summary comments and directions for further research and application.

Although this paper focuses on livability measurement, we draw heavily from the literature on sustainability indicator construction since this latter problem is well-studied and has a mature body of theory and methodology with an admirable degree of rigor. Since sustainability and livability are closely related (arguably, the only difference is time scale; Litman, 2010), lessons learned over four decades of sustainability measurement and accounting can provide valuable insights to the problem of livability indicator construction (as well as combined livability/sustainability indicators). Consequently, we use the term "livability" generically, although we use the term "sustainability" for references to that specific concept.

2. Background

2.1. Defining (urban) livability

A scan of the literature and the web suggests few precise and consistent definitions of urban livability. Many authors and commentators point to ideal city types as examples of livable communities. These ideal communities are typically moderately dense, diverse, walkable, safe, affordable, accessible and well-served by public transit systems; in other words, the qualities usually associated with New Urbanist and smart growth principals (Banister, 2008). For example, the Partnership for Sustainable Communities defines six principals of livability (USDOT, 2009):

- *Provide more transportation choices*. Develop safe, reliable and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions and promote public health.
- *Promote equitable, affordable housing*. Expand location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities to increase mobility and lower the combined cost of housing and transportation.
- *Enhance economic competitiveness*. Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers as well as expanded business access to markets.
- *Support existing communities*. Target federal funding toward existing communities – through such strategies as transit-oriented, mixed-use development and land recycling – to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.
- *Coordinate policies and leverage investment*. Align federal policies and funding to remove barriers to collaboration, leverage funding and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.
- *Value communities and neighborhoods*. Enhance the unique characteristics of all communities by investing in healthy, safe and walkable neighborhoods – rural, urban or suburban.

These principals are not a conceptualization of livability: rather, they are objectives that underlie a deeper but unstated definition that spans economic, social and environmental dimensions. This reflects a widely accepted consensus about the dimensions of sustainability and livability that was first and most famously articulated by the well-known Brundtland Report on sustainable development (Brundtland, 1987; Litman, 2007; NRC, 2002).

While livability and sustainability have general principles, the set of attributes that comprise a livable and/or sustainable community can vary from place to place and over time. Livability in particular has a strong local component due to the particular mix of attributes that emerge as people sort themselves among communities based on preference (and ability-to-pay), the importance of local trends in perceived quality of life, the local nature of politics, the varying availability of policy and planning prescriptions, and the need to ground these measures in local opinion for credibility (Myers, 1987). Similarly, sustainability problems such as overconsumption and environmental degradation are not simply technical but have strong social and political components. Solutions to livability and sustainability problems occur within complex human and physical systems where local context can have dramatic effects on the outcomes (Prugh et al., 2000). The local component of livability does not mean that there are no general principles underlying livability indicators: rather, it suggests the relative importance of livability attributes can vary from place to place.

2.2. Livability and transportation planning

As a primary shaper of urban form and travel behavior, transportation systems have a key role to play in the development of livable and sustainable communities. Livability in transportation is about using the quality, location, and type of transportation facilities and services available to help achieve broader community goals such as access to good jobs, affordable housing, quality schools, and safe streets (USDOT, 2010).

Although livability and sustainability have received heightened attention in recent years, livability in transportation is not new: community groups, developers and residents have long advocated for initiatives that promote accessibility, affordability, safety, smart growth and New Urbanism, with varying degrees of support from federal, state, and local agencies and planning organizations