FINAL REPORT

The Use of Smart-Growth Scorecards/Assessment Tools to Advance Sustainable Land-Use Practices

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16. Abstract

Few studies have gauged causal linkages between shifting smart-growth agendas and the development of new tools to evaluate smart-growth outcomes. Both the implementation of smart-growth practices and efforts to measure the effectiveness of initiatives and outcomes have been influenced by a host of socioeconomic, demographic, technological, and environmental factors as well as shifting housing, travel, and communication preferences. Through a literature review, informational interviews, and survey of smart-growth scorecard users/developers, this research finds that both the concept of smart growth and the development and use of scorecards/assessment tools have co-evolved. Shifting state and federal legislation, leadership, political agendas, and funding have shaped the extent to which smart-growth practices are implemented and evaluated at the local government level. While federal and state governments have developed programs to incentivize implementation of smart growth strategies at the local government level, measuring outcomes of smart growth remains challenging. New assessment tools, scenario-planning techniques, and interactive visualization tools are being crafted to engage and educate the public on smart-growth-related topics and planning outcomes. Building local government capacity, funding support, technical assistance, and an open environment for information sharing and education is needed.

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1. Executive Summary

While many definitions exist, smart growth is a planning approach that fosters mixed-use development, a range of transportation options, pedestrian-scale development, and land-use patterns that are efficient and compact. Smart growth principles are widely accepted and receive multidisciplinary support across both the public and private sectors. Smart growth has significant environmental, economic, transportation, health, and social benefits for communities that choose to inhibit sprawl and implement more sustainable planning policies and practices.

To provide a means for communities to measure the extent to which plans and policies achieve local sustainability goals, smart growth scorecards and other assessment tools have been developed by federal, state, and local governments; metropolitan planning organizations (MPOs); regional councils of government; and advocacy groups like Smart Growth America. However, many static, paper-based, or early GIS-based analytical tools that were created and lauded as "best practices" by the federal Environmental Protection Agency (EPA) in the late 1990s and early 2000s, are now out of date and no longer used.

Few studies have gauged causal linkages between shifting smart growth agendas and the development of new tools to evaluate smart-growth outcomes. To bridge this gap, the research team comprising staff of the University of Delaware's Institute for Public Administration (IPA) and Delaware Center for Transportation (DCT) and Marshall University's Nick J. Rahall, II Appalachian Transportation Institute (RTI) conducted several tasks. A literature review explored factors that have both transformed the concept of smart growth and, concurrently, shaped smart growth evaluation methods and formats. In addition, the research team conducted phone interviews with select planning agencies and surveyed Mid-Atlantic region planning practitioners and smart growth advocates at the state, regional, and local levels on their current use of smart growth scorecards/assessment tools. The research team also studied EPA's shift from its use of the Smart Growth INDEX® (SGI), a GIS sketch tool, to its current use of the Smart Location Database (SLD). Finally, an Internet scan and audit identified current examples of qualitative, quantitative, and visual/interactive smart growth assessment tools used to advance sustainable land-use practices.

The results of this research reveal that both the concept of smart growth and the development and use of scorecards/assessment tools have co-evolved. Shifting state and federal legislation, leadership, political agendas, and funding have shaped the extent to which smart growth practices are implemented and evaluated at the local government level. Federal and state government funding have incentivized implementation of smart growth strategies at the local government level. Yet, measuring outcomes of smart growth remains challenging. If smart-growth programs are implemented, considerable resources are needed to track progress and quantify results. If key indicators of performance are identified, it may take years to achieve results. In addition, many facets of smart growth are qualitative and cannot be easily measured. Local governments—especially small municipalities with limited professional capacity or resources—may lack performance measurement systems and/or performance indicators to quantify outcomes of smart growth.

The analysis indicates that a variety of contemporary assessment tools have been developed to provide either qualitative data and/or quantify performance on key indicators of sustainability. Transportation researchers from academia, as well as the public and private sectors, have played an important role in developing models and tools for analyzing smartgrowth strategies. Because implementation of smart-growth strategies may impact travel behavior and patterns of travel, travel demand models are commonly used to assess the impact of smart growth programs. Yet, considerable expertise is required to effectively utilize newer, state-of-the-practice travel forecasting models, which place them out of reach for most local jurisdictions.

Regional government associations, councils of governments, MPOs, state departments of transportation (DOTs), state planning agencies, private engineering consultant firms, and university transportation centers are more likely to have the staffing resources, technical expertise, and funding to develop and promote the use of smart-growth assessment tools. New assessment tools are being crafted and used to better educate and engage the public through scenario planning and the development of interactive, visualization tools. Further, digital assessment tools offer a much-needed and dynamic platform with which to satisfy mandates for increased transparency, accountability, and public engagement.

2. Introduction

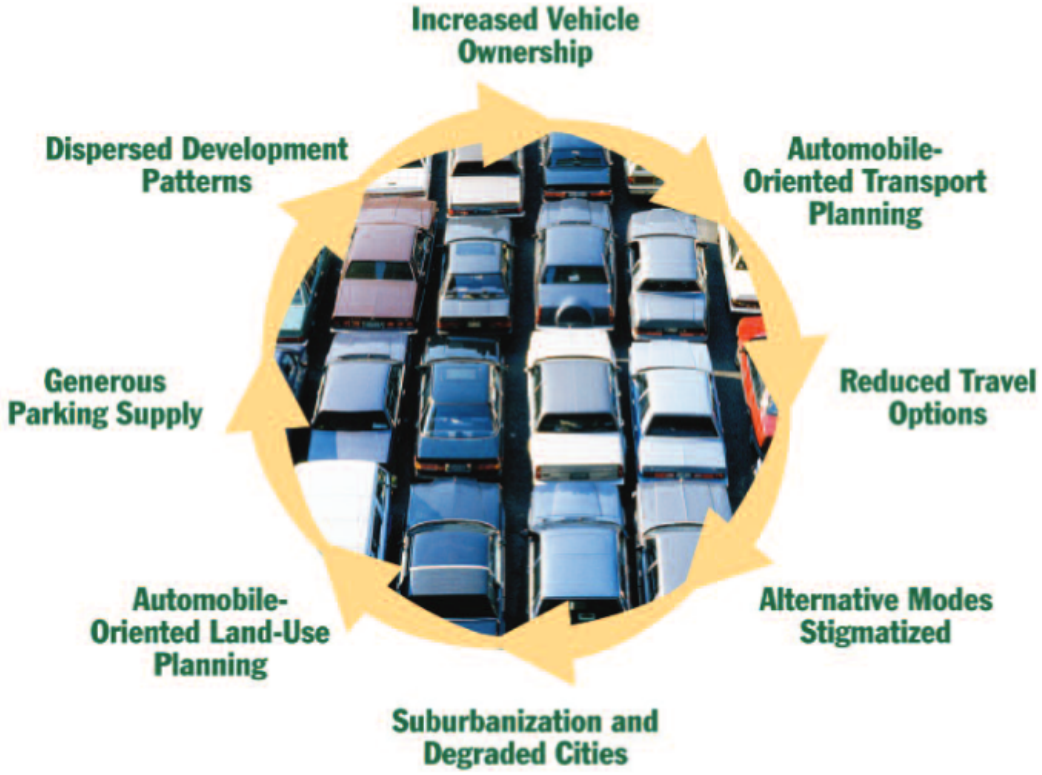
2.1 Problem Statement

Sprawling and dispersed land-use patterns have now dominated the American landscape for more than 50 years. Sprawling development leaves a troubling social, environmental, and economic legacy. Many Americans live in disconnected, "hollowed-out" suburbs where land-use patterns, the transportation system, and community design discourage walking, bicycling, and transit ridership. This means more people must own cars—a costly household expense. Socially, these uncoordinated land-use and transportation planning practices have contributed to rising rates of obesity and associated health problems, perpetuated racial and class segregation, and isolated non-driving individuals who live in car-dependent environments (Muro & Puentes, 2004).

Because our society favors travel by car, transportation-disadvantaged populations often face economic inequities and must rely on non-motorized modes and public transit, if and when available, to travel to school, work, shopping, and other destinations of daily living (Scott, 2010). This physical segregation of where people live and work, along with a preference for low-density suburban development, has created a "Cycle of Automobile Dependency" as illustrated below. Increased vehicular travel, reduced travel options, and car ownership are perpetuated by auto-oriented land-use and transportation planning that contribute to dispersed development patterns (Litman, 2010).

The overuse of cars has generated higher emissions of greenhouse gases, which have negatively impacted air quality and contributed to climate change (Wheeler, 2013). Environmental impacts of society's auto dependency have resulted in more paved surfaces, diminished open and green space, increased energy consumption, more traffic congestion, and added ecological degradation and pollution (Litman, 2010).

Figure 1: Cycle of Automobile Dependency.



Source: Victoria Transport Policy Institute, 2010

Unfortunately, the legacy of sprawl is costly. A recent study estimates that urban sprawl costs the American economy $1 trillion annually (Litman, 2015). Other studies over the last 40 years (Burchell, 2002) have affirmed that low-density, sprawling development is more costly than compact, urban development in terms of provision of infrastructure and public services, transportation, and real estate development. *Measuring Sprawl 2014* (Smart Growth America, 2014) documents that people living in compact, connected metropolitan areas have greater economic mobility, spend less on housing and transportation costs, and enjoy a higher quality of life.

2.2 Smart Growth: An Alternative Growth Management Strategy

"Smart Growth" is rooted in early initiatives to control and manage growth. Although smart growth is now socialized and considered a cornerstone of land-use planning, no simple, single definition exists. Some of the earliest advocates of the development approach simply write in

The Smart Growth Manual that smart growth is "the opposite of automobile-based suburban development" (Duany, Speck, & Lydon, 2010, xiii). In its Policy Guide on Smart Growth, the American Planning Association (APA) identifies the concept as "that which supports choice and opportunity by promoting efficient and sustainable land development, incorporates redevelopment patterns that optimize prior infrastructure investments, and consumes less land that is otherwise available for agriculture, open space, natural systems, and rural lifestyles" (APA, 2012).

The Smart Growth Network describes smart growth as "development that serves the economy, community, and the environment" (Smart Growth Network & ICMA, 2003). Another umbrella organization, Smart Growth America, a national coalition of nonprofit agencies, advocacy groups, and research organizations, defines smart growth as "a better way to build and maintain our towns and cities. Smart growth means building urban, suburban, and rural communities with housing and transportation choices near jobs, shops, and schools. This approach supports local economies and protects the environment" (Smart Growth America, n.d.). The Urban Land Institute characterizes smart growth as development that is "economically sound, environmentally friendly, and supportive of community livability" (ULI, 1999). Some scholars describe smart growth simply as limiting growth to areas that already have existing infrastructure (roads, water, and sewage) in place (Hawkins, 2011).

In the mid-1990s, the smart-growth movement gained momentum as it won support from a diverse range of interest groups, non-profit organizations, the private sector, and government entities. According to Goetz (2005, 45), smart growth "provided a framework for linking previously disparate concerns such as loss of farmland, traffic congestion, central city neighborhood decline, concentrated poverty, and even the growing problem of obesity."

As smart growth became a broadly accepted planning concept that embraced "socially and environmentally intelligent growth," the term itself became too general to offer a consistent definition (Ye, Mandpe, & Meyer, 2005). Researchers stressed the need for a consistent, clear definition to help filter and orient policy-making and other activities toward desired outcomes. While attempts at a definition lacked precision, EPA, International City/County Management

Association (ICMA), APA, and a coalition of advocates called the Smart Growth Network agreed that smart growth has ten principles (EPA, 2015):

1. Mix land uses
2. Take advantage of compact building design
3. Create a range of housing opportunities and choices
4. Create walkable neighborhoods
5. Foster distinctive, attractive communities with a strong sense of place
6. Preserve open space, farmland, natural beauty, and critical environmental areas
7. Strengthen and direct development toward existing communities
8. Provide a variety of transportation choices
9. Make development decisions predictable, fair, and cost effective
10. Encourage community and stakeholder collaboration in development decisions

2.3 Implementation of Smart Growth

Although the tenets of smart growth are widely accepted, there is no universal approach to implementing smart-growth practices (Bolen et al., 2002). Smart growth is not a one-size-fits-all policy prescription that can be uniformly adopted, implemented, or applied by a government entity, region, or community (Meck, 2002). Smart-growth reforms have been described as synergistic and cumulative (Litman, 2015). A single policy change will not affect sprawl or alter inefficient development patterns. To effect cumulative smart growth changes, a comprehensive series of integrated reforms to planning activities, policies, and fiscal practices is required.

APA (2012) advocates the integration of smart-growth principles into local government planning practices and asserts that comprehensive plans (also called land-use master plans) should serve as a foundation for smart growth. Comprehensive plans set forth a community vision for growth and development, and they also provide the ideal framework to achieve sustainable outcomes through the implementation of local government policies/regulations and other "planning action tools."

2.4 Evaluating Smart Growth Practices

Just as there is no uniform definition or implementation strategy, there is also no prescribed method to assess or measure the effectiveness of smart growth practices. Smart Growth America was an early leader in quantifying the extent and effects of sprawl. In the 2002 *Measuring Sprawl and Its Impact* report, development patterns in major metropolitan areas and their counties were evaluated on four factors: density, land-use mix, street connectivity, and activity centering. The groundbreaking study affirmed that sprawl is a real, measurable phenomenon and policy recommendations were provided to achieve smart growth (Ewing, Pendall, & Chen, 2002). Smart Growth America's subsequent report, *Measuring Sprawl 20*14, updated the earlier research and analyzed development patterns to determine which communities are more compact and connected and which are more sprawling (Ewing & Hamidi, 2014).

A Lincoln Institute of Land Policy report, *Evaluating Smart Growth: State and Policy Outcomes,* notes that while smart growth policies have been implemented since the early 1970s, various growth management approaches "have received little systematic evaluation" (Ingram & Hong, 2009, 4). The study examined the effectiveness of various state policies in achieving common smart-growth objectives in four states with established programs and in states with an absence of programs. It concluded that while there is not one preferred smart-growth approach, results could be achieved if states clearly articulate policy goals, institute a variety of regulatory controls, and provide market incentives (Ingram & Hong, 2009). The study recommends developing and evaluating smart-growth programs based on more clearly defined performance indicators and attainment measures (Ingram & Hong, 2009).

Most literature on smart growth focuses on tools and policies used to implement smart growth, rather than tools designed to evaluate the outcomes of smart growth policies and practice. —Bengston, Fletcher, and Nelson, 2003

2.5 Focus and Purpose of Study

To address this research gap, under the auspices of Mid-Atlantic Transportation Sustainability University Transportation Center (MATS-UTC), researchers from the Institute for Public Administration (IPA) and Delaware Center for Transportation (DCT) at the University of

Delaware, and Marshall University's Nick J. Rahall, II Appalachian Transportation Institute (RTI) studied the use of smart-growth assessment tools that advance sustainable land-use planning practices.

Originally, the purpose of the study was to evaluate smart-growth scorecards and assessment tools that support sustainable plans, policies, and practices at the local government level. A traditional literature review was proposed to study smart-growth performance measures and performance measurement frameworks/tools to assess outcomes. A goal was to identify "best practice" smart-growth scorecard/assessment tools in terms of (1) assessment processes, (2) criteria used to evaluate community sustainability, and (3) the extent to which scorecards are applicable to urban, suburban, or rural communities. Building on outcomes of this research, a subsequent study was proposed to develop an assessment/scorecard framework that could be used to gauge sustainable land-use and smart-growth practices in Delaware or other Mid-Atlantic states.

2.6 Research Questions and Methods

The research team initiated the study by conducting a traditional literature review while also conducting an online scan of smart-growth assessment tools. The online scan identified several municipal-level and project-specific scorecards developed by state and local governments, which were identified and listed as "best practice" tools on EPA's website (EPA, n.d.). Yet, an online search of the actual tools revealed that most "best practice" smart-growth scorecards listed and described on the EPA website are outdated or no longer in use (EPA, n.d.1).

This observation shifted the focus of the research and approach to address the following questions:

1. How has the concept of smart growth evolved and what factors have influenced the evolution of smart growth?
2. Have performance measures and/or assessment tools co-evolved with the changing interpretation of smart growth?
3. To what extent are smart-growth scorecards/assessment tools currently being used; are there common formats?

4. What types of organizations developed or are currently using smart-growth scorecards/assessment tools—particularly in the Mid-Atlantic region?
5. Do assessment tools bolster support for smart-growth principles and sustainable land-use and transportation practices?
6. Do contemporary assessment tools reflect demands for greater public accountability and community engagement?

To answer these questions, the University of Delaware-Marshall University (UD-MU) research team refined the study approach and methods to include:

- **Informational Interviews** with three entities involved in regional planning that have a sophisticated digital presence and extensive experience developing online measures of sustainability, interactive mapping tools, and assessment tools.
- **A Survey** to understand the prevalence, usage, and content of smart-growth scorecards and assessment tools in the Mid-Atlantic region.
- **An Expanded Literature Review** to explore (1) factors (e.g., financial, economic, social, political, technological) contributing to the evolution of smart growth, (2) how changing aspects of smart growth have influenced the use and development of assessment tools, and (3) EPA's shift in its use of GIS–based analytic tools.
- **A Targeted Internet Scan** to identify organizations and contemporary tools and methods being used to assess smart growth and advance sustainable land-use practices.

3. New Framework for Growth and Development

3.1 Legacy of Sprawl

Before the era of suburbanization, American towns were generally pedestrian-friendly, compact, and composed of thriving urban centers that were connected to local neighborhoods and other daily living destinations. Downtowns represented the heart of community where people gathered and interacted in civic places or outdoor spaces—the so-called public realm. Towns were built on a human scale that gave primacy to pedestrians rather than cars. Communities were typically bordered by, and distinctly separate from, countryside and farmland. People could easily walk from their homes to local shops, jobs, schools, gathering spots, and other amenities of daily living (Scott, 2010).

However, sprawling land-use patterns began to emerge in the late 1800s and early 1900s. Railroads that brought goods and laborers to large, urban employment areas provided a means for more prosperous workers to commute back home to small towns, clustered around train stations. By the early 20th century, electric mass transit (trolleys and streetcars) systems were operating in most major U.S. cities. While this inexpensive public transportation made it possible for workers to obtain refuge from poor urban living and working conditions, it also contributed to transportation-driven suburban development and urban sprawl (Feagin & Parker, 2002). Outward urban growth, away from the downtown core, followed the expansion of new streetcar lines. By the mid-twentieth century, high operating costs, labor issues, and a so-called conspiracy among the motor vehicle, tire, oil, and petroleum industries resulted in the demise and replacement of electric mass transit systems with buses (Henricks, 2010). Bus mass transit also made it possible and cost effective for workers to live farther from the core urban employment areas.

Walkable urbanism declined further with the advent of post-World War II suburbia. The end of World War II, coupled with cheaper automotive technology and growing

affluence, brought the expansion of the American population and suburban lifestyles. Government transportation policies, investment, and regulations positioned the automobile as the new dominant mode of transportation. The Federal-Aid Highway Act of 1956 created the national Interstate Highway System, making auto travel convenient and fast (Wiengroff, 1996). Government investment in the U.S. transportation system influenced changes in the spatial distribution of the population in U.S. metropolitan areas between 1950 and 1990 (Baum-Snow, 2006). The construction of superhighways spurred flight to new, sprawling suburban bedroom communities. Increasingly, the growing population avoided downtown and favored driving to new strip-mall shopping centers and mega-malls outside of town that provided ample parking, fewer crowds, and consumerism. Federal highway funding also provided an opportunity for urban planners and urban renewal proponents in the 1950s and 1960s to clear slums that replaced or divided poor neighborhoods with roadways (Weingroff, 2000; Rose & Mohl, 2012).

The appeal of suburban home ownership was also heightened by national housing policies. During the 1940s, the Federal Housing Administration (FHA) and the Veterans Administration (VA)—via the Servicemen's Readjustment Act of 1944 (i.e., GI Bill)—made home loans and mortgages more affordable, offered government-insured loans with low down payment requirements, and standard fixed-rate mortgage terms (Chambers, Garriga, & Schlagenhauf, 2013). This enabled more civilians and World War II veterans to be qualified to purchase and finance homes, particularly in suburban developments with housing designed to accommodate the postwar baby boom. Moreover, FHA was guaranteeing whites-only mortgages; 98 percent of FHA loan guarantees went to whites, thus catalyzing the segregation between suburban and urban places.

New street layouts emerged as automobiles became the preferred mode of travel and suburbia prevailed as the American dream. Traditional connected street grids and road networks were discouraged as the Institute of Transportation Engineers published standards that encouraged "curvilinear patterns and discontinuities" (Southworth & Ben-Joseph, 2003). Further, the FHA promoted restrictive housing regulations and criticized

the conventional grid street layouts in favor of cul-de-sacs to control through traffic in residential subdivisions (Alba, 2003).

In addition, state and federal financing of new water and sewage systems encouraged more suburban sprawl instead of infill development that could make use of existing infrastructure. With the passage of the 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and stricter environmental regulations, redevelopment of abandoned or underutilized urban areas became more expensive and difficult than new development on pristine land (U.S. Department of Housing and Urban Development [HUD] & EPA, 1997). Local governments adopted single-use zoning ordinances that in theory were intended to protect the health, safety, and welfare of residents. However, increased auto dependency and inefficient land-use patterns became unintended consequences of single-use zoning (also known as Euclidean zoning). Auto-centric land-use patterns were reinforced by transportation network capacity building that for decades focused on roadways, resulting in more low-density, car-oriented communities (Wheeler, 2013; Duany, Plater-Zyberk, & Speck, 2010). By the mid-1990s, the "overspent American" (Schor, 1998) had driven consumer demand for "supersized" meals, cars, and homes (aka "McMansions") on larger lots in remote areas that were not pedestrian, bicycle, or transit friendly.

3.2 Emergence of Smart Growth

Smart growth emerged as a cohesive land-use planning framework and growing movement in the 1990s, but its roots can be traced to concerns over suburban sprawl and environmental conservation that began in the 1960s. Responding to growing concern over water pollution, open space and farmland development, and poor air quality, President Richard Nixon's administration established EPA in 1970 as an independent agency responsible for enforcing national environmental policy (Lewis, 1985).

On a global scale, heads of state, policy makers, and scientists were questioning whether economic development would degrade the natural environment to the extent that future generations would lack clean water, open space, usable farmland, and clean air. In 1983,

the United Nations established the World Commission on Environment and Development, later to be known as the Brundtland Commission. In 1987, the Brundtland Commission issued its report, *Our Common Future,* which coined the term "sustainable development" and its definition: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Health Organization, 2015).

The Brundtland Commission report provided an international audience with a much-needed perspective on the intersection of environmental degradation, economic development, and social justice (World Health Organization, 2015). The report prompted world leaders to begin developing policy agendas in their own countries for sustainable development; however, general consensus and broad support for a more environmentally healthy planet requires significant political will, economic adaptations in industry and agriculture, and cultural and societal change. These factors have made progress in sustainable development relatively slow.

In the United States, the sustainable development framework prompted early advocates of smart growth to reimagine community form and function. Urban planners and architects from the New Urbanism movement such as Peter Calthorpe, Robert Davis, Andres Duany, and Elizabeth Plater-Zyberk argued against indiscriminate auto-centric sprawl and urged the use of planning techniques to design, control, and shape the design of communities into compact, high-density, mixed-use, and walkable spaces that respect natural features and environments.

3.3 Benefits of Smart Growth

Multiple studies show that smart-growth development produces significant direct and indirect cost savings on public infrastructure spending. Litman (2012) analyzed several studies on smart-growth costs and cost savings. He reports that smart-growth development that is dense and located within existing municipal service boundaries can provide a direct cost savings of $5,000 to $75,000 per unit in public infrastructure (roads and utilities) spending, compared with the same infrastructure built outside of

an established urban boundary. Other studies report that some states could reduce their highway construction expenses anywhere from 12 to 26 percent (Muro & Puentes, 2004).[1]

Smart growth also provides financial benefits for individual households, primarily in the form of transportation cost savings. Residents of higher-density communities, with access to multiple modes of transportation, rely much less on automobiles than residents of lower-density communities. Because residents of higher-density communities typically own fewer or no vehicles, they can save several thousand dollars each year on vehicle payments, fuel, parking expenses, auto maintenance, and auto insurance premiums (Litman, 2012). Further, research shows that when homeowners have access to affordable transportation and are less auto-dependent, household economic resilience is strengthened and the risk of mortgage foreclosure is reduced (Henry & Goldstein, 2010). Some researchers draw a firm link between sprawl and the financial crisis of 2008, stating that "millions of American homebuyers used unsustainable financial means to buy far-out homes in artificially cheap, 'drive 'til you qualify' suburbs" (Congress for New Urbanism, 2010).

Smart growth fosters active-transportation options and greater opportunities for physical activity through targeted investment in multimodal transportation, pedestrian-oriented design, and sustainable land-use patterns. The *Active Living Research Report* (Sallis, JF, et al., 2015) cites the benefits of activity-friendly environments on the physical health, mental health, social inclusion, safety/injury prevention, environmental sustainability, and economic vitality of communities.

3.4 Implementation Challenges

Implementation of smart-growth policy and practices has faced challenges of fiscal restraints, competing interests, political pressures, and negative perceptions. As noted by

[1] Specific density classifications vary by jurisdiction but are measured in dwelling units per acre. Cost savings vary widely according to development density; studies referenced here show significant cost savings even with moving from 1 dwelling unit per acre to 4.5 dwelling units per acre. As referenced by Muro and Puentes, most economic analysts agree that lowering development density increases public spending on development.

Edwards and Haines (2007, 52), smart growth has been a communal buzzword, but policies to institute smart-growth goals often have no teeth: "the inclusion of broad goal statements accompanied by weak or nonexistent policies suggests that communities may simply be paying lip service to smart growth because the law requires them to do so."

Although smart growth can provide clear environmental, economic, health, and social benefits, implementation of smart-growth practices often faces huge political and civic hurdles. Whether through policies or funding incentives, or a combination of both, it is often difficult for multiple layers of government to achieve a collective and coordinated response to public policy issues. "Home rule" authority of local governments may pose a barrier to statewide smart-growth programs and growth management regulation (Downs, 2005). Because states have delegated land-use control to local governments, state-level growth management policies are often viewed as an intrusion on local decision-making and authority. Obstacles to implementing smart-growth strategies also arise when a community's land-use decisions (e.g., official maps, zoning ordinances, and subdivision regulations) conflict with its comprehensive plan (Edward & Haines, 2007). Among adjacent jurisdictions, conflicting visions for land use and development can also thwart implementation of smart-growth goals.

Moreover, communities with economic hardships face competing pressures to make land use and development decisions to achieve immediate, albeit often short-term, economic gains. These shortsighted actions may not align with smart-growth/sustainability ideals that may take years to cultivate. Adversaries also have blamed smart-growth legislation for restrictive or exclusionary zoning, which they believe limits entry into local housing markets. Vested interests, anti-smart-growth views, and not in my backyard (NIMBY) sentiments have also served as roadblocks to smart-growth implementation. Opponents argue that smart growth infringes on rights of individual property owners, results in higher-density development that reduces property values, and drives up the cost of affordable housing and development (Downs, 2005).

4. Factors Influencing "Eras" of Smart Growth

Research suggests that both federal- and state-level policies, funding, and incentives have influenced the adoption of smart growth and growth management practices at the local government level (Bhatt, Peppard, & Potts, n.d.). A 2002 study by the Lyndon B. Johnson School of Public Affairs at the University of Texas at Austin provides compelling evidence that "federal transportation policies assert a powerful force on state and local planning efforts" (Zinn, 2004, 10). The report, based on a survey of states and other literature, describes state-level smart-growth policy approaches adopted from 1990 until 2001 (the time of the survey). It notes that most states have delegated responsibility for land-use planning to local governments. However, federal policy and programs provide a powerful influence on the ability of state and local governments to manage growth and preserve open space, generally under the moniker of "Smart Growth" (Zinn, 2004, 2).

Federal policy has increasingly emphasized the need for inter-jurisdictional coordination of land-use planning and transportation planning. In the 1920s, under Herbert Hoover's leadership—first as Secretary of Commerce and later as President—passage of model legislation on zoning and city planning motivated states to engage in land-use planning. In the 1960s, President Lyndon Johnson's administration recommended that state agencies be created to coordinate planning at the local level (Nolon, n.d.). The American Association of State Highway and Transportation Officials (AASHTO) stresses that developing a collective vision, integrating planning processes, and providing incentives—such as federal-aid funding for transportation planning or improvements—can be instrumental to coordinate efforts that further smart-growth ideals (AASHTO, n.d.).

This trickle-down effect of federal funding to states and local governments serves as a mechanism to incentivize plans, policies, and programs to manage growth and development. Several distinct eras of smart growth have been documented. The eras have been shaped by public policies, funding incentives, and socioeconomic, sociopolitical,

and demographic forces (DeGrove, 2005; Ingram & Hong, 2009). Three waves of growth management policy have been identified, labeled, and defined based on policy issues that influenced smart-growth implementation (Ingram & Hong, 2009; Chapin, 2012).

4.1 Era of Growth Controls (~1950–1975)

From approximately 1950–1975, the first era of smart growth, called the "Era of Growth Controls," was defined by concerns with sprawling land-use patterns, loss of open space, and environmental degradation (Ingram & Hong, 2009; Chapin, 2012). President Lyndon Johnson appointed the National Commission on Urban Problems (Douglas Commission) in 1968 and advanced the notion of urban growth boundaries (UGBs) as a measure to curb sprawl (Zinn, 2004). In response, state-appointed task forces studied the issues and/or considered legislation to regulate land use through top-down planning. Measures to control growth, including mandated urban growth boundaries (UGBs), were among the solutions (Staley & Mildner, G., 1999).

Lexington, Kentucky, was the first jurisdiction to establish UGBs in 1958 (Nelson & Duncan, 1995). By 1999, more than 100 cities and counties and three states—Oregon, Tennessee, and Washington—had approved mandates for UGBs. In addition to Oregon, two states—Hawaii and Vermont—were the first to adopt comprehensive statewide land-use reforms and growth management laws.

4.2 Era of Growth Management (~1975–2000)

Studies in the 1990s began to provide strong empirical evidence that dispersed or sprawling development patterns are costly and unsustainable. The heightened interest in aligning local land-use decisions with federal and state government plans and policies further ignited the smart-growth movement. Called the "Era of Growth Management," defining issues of the second era (roughly 1975–2000) were concerned with natural resource and environmental protection, growth and land-use management, need to control the provision and costs of infrastructure, and the need to coordinate land-use management at the state level (Ingram & Hong, 2009; Chapin, 2012).

4.2.1 Advocacy and the Rise of the Smart-Growth Movement

During this era, widespread advocacy led to the rise of the smart-growth movement and institutionalization of the concept. The 1000 Friends of Oregon, an advocacy group formed in 1975, established the National Growth Management Leadership Project in 1990. Later renamed the Growth Management Leadership Alliance, this group formed a leadership network and captured broad-based public support to implement smart-growth policies and actions nationwide (Rodwin & Sanyal, 1999). The Natural Resources Defense Council teamed with the Surface Transportation Policy Partnership (STPP) on a smart-growth initiative in 1997. Their efforts produced a toolkit for policy makers, three reports on adverse impacts of sprawl, and a series of guidebooks that promoted planning and policies to implement to achieve principles of smart growth (e.g., compact development patterns, a mix of land uses, and transit-oriented development; Burchell et al., 2000). Work by STPP provided a foundation of support for the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, which provided infrastructure funding for non-motorized transportation modes and transportation funding for projects with environmental benefits.

The smart-growth movement began to flourish in the 1990s under the banner of growth management. The American Planning Association (APA) initiated a seven-year Growing Smarter project in 1994 to lead reform of the nation's planning statutes by providing new planning approaches and tools to manage growth and change. By the mid-1990s, disparate organizations and professions with common interests came together to urge reform of local land-use controls to combat inefficient land-use patterns. Advocates proposed an alternate land-use-planning framework that became the core principles of smart growth. Land-use planning practices were advanced that foster mixed-use development, a range of housing and transportation options, pedestrian-scale development, and more compact land-use patterns (Goetz, 2005). The American Institute of Architects (AIA) began its Center for Livable Communities in 1998 to help communities with their growth strategies. In addition, the U.S. Department of Housing and Urban Development (HUD) began to assume a stronger leadership role in working

with government and private-industry groups to develop contemporary model planning and zoning enabling legislation for use by state and local governments (APA, 1998).

4.2.2 Strong Funding Support for Smart Growth

Passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 established a foundation for smart growth within federal transportation policy. Both ISTEA and the follow-up Transportation Equity Act for the 21st Century (TEA-21) enacted in 1998, tied funding for transportation projects to environmental sustainability, efficient land use, and non-motorized travel modes. These transportation bills included Congestion Mitigation and Air Quality Improvement (CMAQ) funds as a flexible funding source to state and local governments for transportation projects and programs that relieved traffic congestion and improved air quality. Transportation Enhancements Activities incentivized programs that expanded surface transportation choices, improved mass transit, and created bicycle and pedestrian facilities. ISTEA and TEA-21 provided incentives for states to integrate land-use and transportation planning, an enhanced role for MPOs in regional transportation planning, greater opportunities for public involvement, and a rationale to integrate land-use and transportation planning (Zinn, 2002).

EPA's active role in developing policies, regulations, and grants to manage growth, protect the environment, protect natural resources, and revitalize brownfields provided impetus for anti-sprawl measures. In 1995, EPA's Office of Smart Growth began to fund organizations that offered technical assistance to communities under its Smart Growth Program. The following year, EPA and other private, public-sector, and nonprofit organizations established the Smart Growth Network to deliver a range of planning and policymaking resources to assist regional and municipal governments with redevelopment projects, comprehensive plans, and policy adoption (Smart Growth Network & ICMA, 2006). The Smart Growth Network began to conduct research, publish information and resources, and advance smart-growth principles. The Network facilitated the first New Partners for Smart Growth conference in 1999 to provide a forum for discussing multidisciplinary strategies to achieve environmentally sensitive growth and development.

The William Jefferson "Bill" Clinton administration proved to be a strong ally for smart growth by making resources available to assist communities conserve open spaces, protect the environment, and make communities more livable. In 1999, the Clinton administration set forth its Livability Agenda: Building Livable Communities for the 21st Century. As part of the Livability Agenda, the FY 2000 federal budget provided funding to provide "communities with new tools and resources to preserve green space, ease traffic congestion, and pursue regional 'smart growth' strategies" (The White House, 1999). The FY 2000 federal budget provided $700 million in new tax credits for state and local bonds to build more livable communities under the "Better America Bonds" program. It was designed to leverage $10 billion of community investments under existing federal brownfields and community revitalization programs. An additional $6.1 billion was pledged in community funding for investments in surface transportation alternatives and another $1.6 billion to support state and local government efforts to reduce air pollution and ease traffic congestion.

Under the Clinton administration, a new Regional Connections program promised $150 million in matching funding to support regional planning to help communities develop comprehensive plans, improve public participation in planning, and share regional planning data (Gore, 1999). Clinton's Lands Legacy Initiative of 1999 supported the preservation of open spaces, areas of natural beauty, and critical environmental resources. In FY 2001, the initiative boosted Land and Water Conservation Fund funding support for states and local government to $150 million and provided $50 million in competitive grants for smart-growth planning (U.S. Department of the Interior, 2000).

In addition to federal government funding support, foundations also provided grants for smart-growth initiatives. The Funders' Network for Smart Growth and Livable Communities was formed in 1999 as a coalition of 30 interested funders, which included several high-profile foundations. With its core mission to "inspire, strengthen, and expand philanthropic leadership and funders' abilities to support organizations working to improve communities through better development decisions and growth policies," the Funders' Network incentivized communities to "initiate and facilitate coordinated actions

to tackle the root causes of sprawl and promote sustainable, socially equitable, and economically sound land-use decisions" (Carlson, 2009).

4.2.3 State Adoption of Growth Management Laws

Federal policies, advocacy, and availability of public and private funding fueled the smart growth movement. As the movement gained momentum, states were incentivized by funding and amplified public support to adopt smart-growth policies and actions (Rodwin & Sanyal, 2000). Although different in each state, smart-growth legislation during this era was designed to manage, rather than control growth. Legislation generally consisted of the five Cs: comprehensive plans, consistency (of plans and regulations), concurrency (i.e., providing adequate infrastructure capacity to meet proposed development needs), coordination, and cooperation (Richardson, 2002). State legislation served to structure land-use governance and develop policy frameworks to support smart-growth principles and mirror federal-level "livability" initiatives. Legislation recognized and respected that a local government's planning structure and process serve as the foundation for smart growth. A local government comprehensive plan communicates a community's goals and objectives, provides a blueprint for future land-use and physical development, and serves as the legal basis to implement land-use regulations and codes. Therefore, many state-level initiatives were designed to elevate the importance of the local government comprehensive plan, strengthen the coordination of land-use planning between state and local governments, and align the spending of state infrastructure dollars with comprehensive plans for local growth and development.

Florida, Connecticut, New Hampshire, Rhode Island, Maine, Georgia, Washington, Maryland, and Delaware were among the first states to adopt statewide growth management laws during this era. Legislation instituted by these states established statewide land-use planning systems and/or state departments (planning or smart growth) that required local governments to adopt comprehensive plans, enact ordinances that were consistent with the comprehensive plan, and complement statewide planning goals to manage growth (Purcell, 1997).

Maryland and Delaware used an incentives-based approach to manage growth, rather than to control growth by strict regulation (Glendening, 2001). The foundation for smart growth in the State of Maryland was initiated in 1992 with the passage of the Economic Growth, Resource Protection, and Planning Act (Maryland Department of Planning, n.d.). It articulated Maryland's growth policy through eight visions centered on concentrating development in suitable areas, protecting sensitive areas, and establishing funding mechanisms to achieve the visions. The act also required local jurisdictions to address these same visions in their comprehensive plans. Then-Governor Parris Glendening initiated a smart-growth movement among states beginning 1997. He described the need for a smarter, more sustainable alternative to sprawling development during his first gubernatorial term and popularized the phrase smart growth." In 1997, Maryland's Smart Growth and Neighborhood Conservation Initiative was enacted as the nation's first statewide, incentive-based program to reduce the impact of urban sprawl. The legislation included a series of bills, including Maryland's Priority Funding Areas Act, which established priority-funding areas for new growth. These areas included existing communities and neighborhoods targeted for revitalization, planned growth areas, and heritage areas. The Rural Legacy Program was also established in 1997 and enabled Maryland to direct state funds to preserve open space and farmland (Glendening, 2001).

During this era of growth management, Delaware Governor Thomas Carper championed the ideals of managed growth (without calling it smart growth). The Cabinet Committee on State Planning Issues and the Office of State Planning Coordination (OSPC) were established under Carper's administration (1993–2001). *Strategies for State Policies and Spending* was adopted in 1999 and crafted to direct state investment to designated growth areas. The policy strengthened the coordination of state and local government land-use planning under the Land Use Planning Act (LUPA), later called the Preliminary Land Use Strategies (PLUS) process. The PLUS process provides for state agency review of major land-use change proposals prior to submission to local government (Delaware Code, Chapter 92 of Title 29). *State Strategies* and the PLUS process have continued under the administrations of both Governor Ruth Ann Minner (2001–2009) and Governor Jack Markell (2009–2016).

4.3 Era of Smart Growth (~2000–2007)

Chapin (2012) identifies the third phase as the Era of Smart Growth, which he believes occurred roughly between 2000 and 2012. He cites place-making and urban economic development as defining issues of this smart-growth phase (Chapin, 2012). However, there is evidence that a convergence of trends, roughly around 2007, signaled a new era of smart growth.

4.3.1 Broad-Based Support and Technical Assistance for Smart Growth

As states began to adopt smart-growth reforms, a variety of proponents and coalitions began to provide technical assistance to support implementation of smart-growth practices, which helped spread the concept of smart growth across all sectors. Efforts by inter-jurisdictional and multidisciplinary groups to collaborate, conduct outreach, and engage generated strong public support. Government agencies, professional associations, and advocacy groups published technical assistance resources to help policy makers implement the ten principles of smart growth. APA and HUD crafted a *Growing Smarter Legislative Guidebook* for state and local governments in 2000. It was designed to provide alternatives for states to initiate planning statute reforms and provide practical tools to minimize sprawl, protect natural resources, promote affordable housing, and direct growth to areas prepared for development (Meck, 2002).

In 2002, the American Planning Association (APA) published its Policy Guide on Smart Growth to support the "coordination of plans, policies, and services across jurisdictions and levels of government to help support and reinforce smart-growth approaches that fit local, regional, and statewide contexts" (APA, 2002). The guide advocates, "proactive planning encourages regional cooperation, collaborative citizen participation in public life, diverse neighborhoods, the equitable distribution of resources, and shared fiscal responsibility" (APA, 2002). Also in 2002, the Natural Resources Defense Council and the Surface Transportation Policy Project for Smart Growth produced a toolkit to advance smart-growth practices of compact, mixed-use, and transit-oriented development (Knapp, 2006).

The Smart Growth Network, International City/County Management Association (ICMA), and the EPA produced several publications on smart-growth basics. Almost 90,000 copies of their policy workbook, *Getting to Smart Growth: 100 Policies for Implementation* were downloaded or distributed in hard copy between its publication in January 2002 and September 2003 (EPA, 2014). This led to a subsequent publication of *Getting to Smart Growth II: 100 More Policies for Implementation* in October 2003. Examples of planning strategies, policies, and regulatory tools to support smart growth (Litman, 2015; Delaware Valley Regional Planning Commission, 2007) include, but are not limited to:

- Cluster development
- Innovative zoning codes [e.g., incentive zoning, overlay zoning, transit-oriented development (TOD) zoning, traditional neighborhood development (TND) zoning, mixed-used zoning]
- Performance-based and flexible regulations (e.g., form-based codes) that foster compact, mixed-use and infill development near transit, jobs, shops, schools, and other destinations of daily living
- Interjurisdictional and/or regional service agreements
- Remediation and adaptive reuse of brownfields/greyfields, underutilized sites, and abandoned/vacant buildings
- Plans, policies, and practices that provide a range of housing, mobility, and multimodal transportation options (e.g., complete streets)
- Land-use management tools (e.g., transfer of development rights, conservation easements, installment purchase agreements, land trusts)
- Adoption of codes that support sustainable historic preservation and encourage rehabilitation of existing structures
- Regulatory flexibility, financial incentives, expedited approval and permitting processes within priority investment/growth areas
- Public-private partnerships and adoption of alternative transportation financing strategies (e.g., corporations, transportation improvement districts, transportation revitalization districts, transportation development districts, tax increment financing, impact fees to provide fair share mitigation of transportation impacts)

The swell of outreach and education was effective in generating a demand for smart-growth programs and funding. According to the Smart Growth Network, the November 2000 elections included 553 growth-related state and local ballot measures, with voters approving 78.2 percent of open-space initiatives and 74.7 percent of infrastructure measures (Smart Growth Network & ICMA, 2003).

The 2003 formation of Smart Growth America, a coalition of national, state, regional, and local organizations, heightened advocacy for smart-growth policies and funding support (Smart Growth America, n.d.,1). Smart Growth America urged federal and state governments to assume a stronger leadership role to support smart-growth practices at the local government level. The organization strongly advocated for funding and technical assistance to help communities plan for efficient land use and coordinate transportation, housing, and environmental needs. Smart Growth America supported the publication of *Policies that Work: A Governor's Guide to Growth and Development,* and worked with governors and their cabinets to institute smart-growth policy frameworks and agendas at the state government level (Governors' Institute on Community Design, 2009).

Community development corporations (CDCs) emerged as strong promoters for smart growth. In 2000, the Joint Center for Housing Studies of Harvard University issued a report that provides a rationale for CDCs to be involved in the smart-growth movement. It called for CDCs to promote regional land-use planning, development around existing infrastructure, mixed-use and mixed-income development, and (re)investment/ revitalization efforts in older-city and inner-suburban neighborhoods (Karlinsky, 2000).

Public health agencies, health advocacy groups, and health promotion professionals also became strong advocates in the partnership to create healthy, livable communities and address built environment barriers to healthy lifestyles through urban planning. Public health journal articles, including "Smart Growth: A Prescription for Livable Cities" (Geller, 2003), urged the public health field to strongly advocated that the indicators of smart growth be defined and evaluated to achieve health benefits. The Robert Wood Johnson Foundation (RWJF), Centers for Disease Control and Prevention (CDC),

American Public Health Association (APHA), and public health organizations began to provide leadership, funding, resources, and tools to include health professionals in the planning process for healthy communities. RWJF's Active Living Leadership initiative helped state and local leaders understand the connections among community design, physical activity, and health by working with the National Governors Association (NGA) and offering grants to design "active living" communities (RWJF, 2001).

Non-profit organizations, advocacy groups, the private sector, regional planning agencies, state agencies, non-governmental organizations, and citizens also provided critical support for the smart-growth movement (DVRPC, 2007). The Urban Land Institute (ULI), National Association of REALTORS®, National Association of Home Builders, and other interest groups began conducting research to capitalize on the marketability of smart growth. Studies by these organizations have documented the rising market demand for walkable, compact development that exemplifies smart-growth approaches. These and other private-sector groups have forged partnerships, cultivated support, and sponsored educational symposiums to build collaborative bridges and a business case for smart-growth development practices.

4.3.2 Shifting Influence of Federal Programs

Networking, leadership, dissemination of knowledge, public engagement, and outcomes/products of funding all contributed to the phenomenon of the smart growth during this era. Yet, federal support for smart-growth initiatives clearly shifted. Instead of continuing previous levels of federal funding support for smart-growth programs/initiatives, a new emphasis was placed on providing technical assistance, flexibility in use of funding, integrating land-use and transportation planning, mandates for greater planning coordination, and performance measurement.

One report calls the George W. Bush administration's FY 2002 budget "a disappointing missed opportunity to promote smart growth activities in America" (Warren, 2001). The Bush administration reduced the federal government's leadership role in smart growth, cut funding to land conservation programs, and failed to continue the previous

administration's Better America Bonds program that supported local government initiatives to preserve open space, redevelop brownfields, and protect water quality (Warren, 2001). Yet, the Bush administration continued to support EPA's Smart Growth Program by targeting technical assistance to communities for smart growth, establishing the National Award for Smart Growth Achievement, and providing support and grants to existing programs that incorporate smart-growth principles, such as brownfields redevelopment (Whitman, 2002).

The passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU) in 2005 continued support for transportation initiatives to improve safety, reduce traffic congestion, increase intermodal connectivity, protect the environment, and build multimodal travel alternatives. It provided a more flexible funding framework of the federal surface transportation bill and required the statewide transportation planning process to consider "projects and strategies that will protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and state and local planned growth and development patterns" [49 USC 5303(g)(3) and 23 USC 134(g)(3)]. This enabled states to have greater discretion in the use of funds, allowing for a range of investments that would better integrate land use and transportation, support multimodal transportation improvements, and advance smart-growth principles.

With a SAFETEA-LU mandate to work more collaboratively, states and MPOs began to use the greater adaptability of federal funding to support smart-growth projects. Funded projects included smart-growth-oriented initiatives to foster growth and economic development, enhance mobility options, implement transportation demand management strategies, design multimodal transportation systems, and better connect land use and transportation. Provisions of SAFETEA-LU complemented President Bush's September 18, 2002 Executive Order 13274—Environmental Stewardship and Transportation Infrastructure Project Reviews—to evaluate performance of transportation projects.

SAFETEA-LU also placed a greater emphasis on applying performance measures in transportation planning, programming, and budgeting. As a result, the Federal Highway Administration (FHWA) advanced innovative, non-traditional methods of performance measurement methods involving data collection, management, and analysis (Shepherd, 2008). In addition, there became a greater recognition in the need for advanced use of technology in land-use and transportation planning (e.g., GIS mapping, scenario planning, and visualization techniques), developing meaningful performance measures, and communicating performance measure outcomes by transportation professionals (Polzin et al., 2008).

4.3.3 State Adoption of Smart-Growth Initiatives

APA conducted a comprehensive survey of planning reform and smart-growth activity in the states between 1999 and 2001. In addition to the one-quarter of the states that were implementing moderate to substantial statewide comprehensive planning reforms, the survey revealed that:

- Nearly one-third of the states were actively pursuing their first major statewide smart-growth planning reforms, including Arkansas, Colorado, Connecticut, Idaho, Illinois, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Mexico, North Carolina, and South Carolina; and
- About one-fifth of the states were pursuing additional statewide amendments to augment local or regional planning requirements or already adopted reforms including, Arizona, California, Hawaii, Maine, Nevada, New Hampshire, New York, Texas, Utah, and Virginia (APA, 2002).

States began to align their programs and policy platforms with federal initiatives and funding. For example, Delaware Governor Ruth Ann Minner (2000–2009) established a "Livable Delaware Agenda." It reflected the Clinton administration's Livability Agenda that integrated policies focusing on economic development, infrastructure, transportation, land-use, environmental, and quality-of-life issues. Livable Delaware provided legislation that tied state spending and investment to designated growth areas, reinforced the importance of local government comprehensive plans, and provided funding for local governments to prepare state-certified comprehensive plans. Delaware's OSPC

incentivized planning by offering matching grants to local governments to develop comprehensive plans, update zoning codes, land-use ordinances, and official maps to implement comprehensive plans.

During this era, states issued policies, executive orders, guiding principles, directives, and provided incentives (i.e., technical assistance and/or funding) to implement smart-growth practices. Incentives proved to be a substantive feature of state smart-growth policy doctrines. As of 2002, Maryland, Delaware, Georgia, New Jersey, New York, Pennsylvania, and Wisconsin had incentivized smart growth by offering financial and/or technical assistance to prepare comprehensive plans (APA, 2002). State governments either obtained or offered funding to provide local government technical assistance, funding inducements, and/or incentives designed to (Williams, 2006; Deakin, 2004):

- Mandate the adoption of local government comprehensive plans
- Support and create incentives for infill development and redevelopment
- Stimulate (re)development opportunities
- Incentivize development in designated growth areas
- Optimize or leverage prior infrastructure investments
- Encourage mixed-use development and a range of housing choices
- Promote development densities sufficient to warrant public transit
- Manage or restrict development in, or near, environmentally sensitive areas
- Ensure adequate infrastructure through public facilities mandates or concurrency requirements
- Foster transit-supportive or transit-oriented development (TOD)
- Advance policies and practices that provide multimodal transportation options, transportation systems designed for people of all ages and abilities and environments that are pedestrian-, bicycle-, and transit-friendly
- Consider alternative funding strategies to finance transportation improvements, infrastructure, and facilities
- Balance economic development with conservation
- Provide state agency oversight and emphasize interagency coordination
- Enhance partnerships and regional collaboration

5. Efforts to Assess and Measure Smart-Growth Outcomes

5.1 Emphasis on Government Performance Management

Priority focuses of the smart-growth movement included building support and advancing the need for smart growth. Establishing performance measures to systematically track progress and outcomes, however, seemed to be a postscript (Bengston, Fletcher, & Nelson, 2003). This began to change in the late 1980s with the rise of the New Public Management, which reflects the fundamental notion that governments should be publicly accountable to their citizens. This approach rejects traditional performance measures that focus on efficiency, resources used, or "inputs." Instead, performance measures are used to evaluate outcomes or the achievement of performance goals (Pfiffner, 2004). The Clinton administration's push to "reinvent government" drove home the need for transparency and accountability and is consistent with the New Public Management philosophy. Training and technical assistance were provided to help all levels of government manage for results, develop benchmarks for performance measurement, and report on service efforts and accomplishments (GASB, 2003). Moreover, eligibility for federal funding and other incentives for smart growth became increasingly tied to performance measurement and reporting.

> *Performance management in the public sector is an ongoing, systematic approach to improving results through evidence-based decision-making, continuous organizational learning, and a focus on accountability for performance. Performance management is integrated into all aspects of an organization's management and policy-making processes, transforming an organization's practices so it is focused on achieving improved results for the public. —National Performance Management Advisory Commission, 2010*

During the 2000s, government entities were challenged by an increasing lack of public trust and greater demands for public accountability. The Pew Center on the States initiated its Government Performance Project in 1996 to improve state government management. The 12-year project, which ended in 2010, focused on the need to strengthen state government policy and performance to improve public service. A series of "grading the states reports," issued from 2005 to 2008, provided annual ratings for

each state in strategic planning, performance budgeting, performance management, performance auditing, and e-government (Joyce, 2009). By the late 2000s, most states were implementing performance management measures, analyzing performance data, communicating performance findings and trends, and leveraging partnerships to improve outcomes.

In addition, the National Performance Management Advisory Commission developed a conceptual context for public-sector performance management. Formed in February 2008 as a joint initiative of 11 leading public-interest associations, the commission worked with government officials and public-sector leaders to develop *A Performance Management Framework for State and Local Government: From Measurement and Reporting to Management and Improving* (GFOA, 2010). Other organizations, such as the National League of Cities, urged local jurisdictions to meet contemporary challenges by adopting performance measures and strengthening local democracy through transparency and civic engagement (National League of Cities, 2014).

5.2 Early Modeling and Geospatial Technology Tools

As more states, regional agencies, and local governments initiated smart-growth programs, demand grew for information on the outcomes of smart growth. Federal agencies, state DOTs, and MPOs relied on established transportation performance assessment methods—such as transportation forecasting and scenario planning—to evaluate transportation-related impacts of smart-growth initiatives. Other performance measurement approaches were adapted to assess smart-growth outcomes. These included establishing baseline conditions as a starting point to measure progress, conducting performance monitoring, and applying project performance assessments (EPA, 2011).

5.2.1 Transportation Forecasting Models

Following the establishment in 1956 of the U.S. highway system and its rapid expansion, increases of federal highway spending required the regional modeling of travel behavior. When federal legislation was passed in 1962 for urban transportation planning, transportation forecasting models became standardized by the federal agency that is now

FHWA (FHWA, n.d.). Transportation forecasting models support decision-making by using current data to predict changes in travel patterns in response to changes in regional development, demographics, land use, economic conditions, and travel behavior. Trip-based models use four-step approach to predict (1) trip generation, (2) trip distribution, (3) mode choice, and (4) route assignment. MPOs and state DOTs use trip-based transportation forecasting models extensively to predict changes or growth in regional demand for travel (Deakin, 2004).

Shortcomings associated with trip-based transportation modeling are well documented. Transportation Research Board (TRB) Special Report 288 states that "weaknesses of current practice can be categorized as follows: (a) inherent weaknesses of the models, (b) errors introduced by modeling practice, (c) lack or questionable reliability of data, and (d) biases arising from the institutional climate in which the models are used" (TRB, 2007 67). It recommended that MPOs and other transportation agencies that travel demand models begin to transition to more advanced model forms to respond effectively to new policy and planning requirements (TRB, 2007). Trip-generation guides, developed by the National Cooperative Highway Research Program (NCHRP) and Institute of Transportation Engineers (ITE), instituted transferable parameters that paved the way for more simplified development and application of these tools in local government settings (NCHRP, 1998).

In cooperation with the Federal Transit Administration (FTA) and EPA, FHWA established a Travel Model Improvement Program (TMIP) in 1994 to address trip-based model shortcomings and respond to changes in transportation policy, transportation technology, and travel behavior (FHWA, 2003, 1). Considerable research has been devoted to address issues with trip-based transportation forecasting models, improve methodologies, and foster new approaches to transportation forecasting. The need for new state-of-the-art modeling practices, such as activity-based modeling, continues to be advanced by TMIP. The activity-based approach recognizes the complex interactions in activity and travel behavior and the need to address emerging issues such as alternative transportation financing, environmental sustainability, non-motorized travel, mixed land

use, and freight movement (FHWA, 2013). Despite the documented benefits of activity-based models, there are challenges associated with practical application of the technology. Most activity-based models are complex, require custom-built software that is costly to purchase and maintain, and a high level of staff expertise. The 2007 NCHRP Special Report 288 stated that the average development cost, at that time, ranged between $1,000,000 and $1,400,000 dollars per model—depending upon the size and population of the area (TRB, 2007). While there are nearly 20,000 municipal governments in the United States, the majority (over 90%) have populations under 25,000 (NLC, 2011). Therefore, development and use of activity-based models are out of reach of many small jurisdictions that seek to engage citizens in local land-use decision-making.

5.2.2 Scenario Planning

Integrating land-use and transportation planning to achieve smart growth requires the ability to estimate potential benefits and impacts of various choices or scenarios. Spreadsheet-based or GIS-based sketch planning have been developed and are used to produce general order-of-magnitude estimates of transportation and land-use demand and impacts. Sketch planning tools were developed as an alternative to complex travel demand models for forecasting future travel demand. The tools are generally easier to implement, more flexible in adapting to diverse projects, less costly than sophisticated software packages used to conduct in-depth engineering analysis, and can be used for scenario planning.

FHWA defines scenario planning as "a process that can help transportation professionals to prepare for what lies ahead. It provides a framework for developing a shared vision for the future by analyzing various forces (e.g., health, transportation, livability, economic, environmental, land use), that affect communities" (FHWA, 2011, 1). Scenario planning/sketch planning uses a variety of tools and techniques to engage stakeholders in assessing trends in land use, transportation, demographic, environmental, and other factors to consider the pros and cons of alternative future scenarios. Scenario planning has been used to advance smart growth, New Urbanism, neo-traditional planning, and sustainability strategies using a variety of GIS-based visualization tools.

The nonprofit smart-growth advocacy group, 1000 Friends of Oregon, used scenario planning extensively in 1990s as an alternative to transportation modeling to consider how various land-use patterns and other factors could impact travel behavior (FHWA, 2011). Beginning in the early 2000s, more local, regional, and state agencies, MPOs, and DOTs began to deploy the use of scenario/sketch planning tools because they are less expensive, easier to use that traditional transportation demand models, and provide meaningful public engagement in the planning process.

5.2.3 EPA's GIS-Based Tools

EPA has been involved in the creation of scenario/sketch planning tools and models to assess and measure land-use change and transportation efficiency. EPA pioneered the use of GIS sketch modeling to advance smart-growth practices at the local level and developed the Smart Growth INDEX® (SGI) in 1998. This GIS-based software tool was used to compare alternative land-use and transportation scenarios and evaluate their outcomes using community and environmental outcome indicators. SGI allowed "users to benchmark existing environmental and community conditions, compare the impacts of multiple development and transportation scenarios, and monitor changes over time" (EPA, 2003, 1). Over 35 pilot communities used the tool in the early 2000s to simulate alternative land-use and transportation scenarios and evaluate their outcomes using indicators of environmental performance.

As part of this research effort, the research team from Rahall Transportation Institute (RTI) at Marshall University studied EPA's shift in using the Smart Growth INDEX® (SGI), a GIS sketch tool, to its recent use of a Smart Location Database (SLD), a resource that can be used to analyze location efficiency and the built environment. RTI's study is summarized in Appendix A. The RTI team notes that while SGI was a useful analytic tool to quantitatively demonstrate the environmental, transportation, and quality-of-life benefits of smart-growth scenarios, it had several limitations. SGI was (1) not well suited to evaluate the performance of smart-growth practices in rural areas, (2) complex and not user-friendly for planners or staff members that lack extensive modeling experience, (3) overlooked non-motorized travel as a factor in location-efficient transportation and land

use, (4) not designed to foster communication and interaction between land-use decision-makers and transportation planners, and (5) not easily conveyed via online platforms to engage stakeholders in alternative scenario planning (Outwater, Smith, Walters, Cervero, Kockelman, & Kuzmyak, 2014). SGI has been replaced by new tools, such as EPA's Smart Location Database that provides a methodology, interactive map, and open-source data for measuring location efficiency and the built environment (Ramsey & Bell, 2014). Other advanced scenario planning, visualization tools, and activity-based transportation modeling formats are also being advanced by various entities such as FHWA, the American Association of State Highway and Transportation Officials (AASHTO), and the Lincoln Institute of Land Policy.

5.3 Early Scorecards and Assessment Tools

Performance management and assessment tools represent a good-faith effort on the part of public administrators to create public value in the form of better policies, services, and programs as the cornerstone of community livability (GFOA, 2010). However, performance measurement tools require a significant degree of applicability. Studies show that report cards and other assessment tools should meet six general criteria to enhance accountability of an organization and effectively measure performance (Gormley & Weimer, cited in Coe, 2003):

- Validity – measures relevant aspects of performance
- Comprehensiveness – multidimensional, measures all important indicators
- Comprehensibility – easy to understand
- Relevance – both for stakeholders and users
- Reasonableness – in terms of effort and costs
- Functionality – impactful for a targeted organization

Rutgers University's Reid Ewing, Cornell University's Rolf Pendall, and Smart Growth America's Don Chen were early pioneers in defining, measuring, and evaluating metropolitan sprawl and its impact. After three years of extensive research, the team created an Index of Metropolitan Sprawl, which measured and analyzed four factors—residential density; neighborhood mix of homes, jobs, and services; strength of activity

centers and downtowns; and accessibility of the street network. Based on the calculations, rankings were generated of the 83 most and least sprawling metropolitan areas in the United States (Ewing, Pendall, & Chen, 2002). The goal was to help policy makers envision the impact of sprawl to target growth management strategies more effectively. Outcomes of the study, and the use of the Sprawl Index, revealed that sprawl is a reality that could be measured as documented in Smart Growth America's 2002 publication, *Measuring Sprawl and Its Impact* and subsequent *Measuring Sprawl 2014.*

A 2004 report for NCHRP provided an inventory of state-level smart-growth initiatives and evaluation activities as the smart-growth movement was building momentum (Deakin, 2004). The report found that most evaluation activities at that time were primarily qualitative, focusing on a description and analysis of policies implemented at the local level to achieve state-level policy directives or mandates for smart growth. The report noted that if quantitative methods were used, they primarily evaluated the effectiveness of urban growth boundaries or urban spatial patterns, used outcome-based measures (e.g., congestion, environmental quality, vehicle miles traveled, human behavior, economic trends), or output-based measures (e.g., vehicle speeds, traffic volume) (Deakin, 2004).

In the late 1990s and early 2000s, smart-growth scorecards and assessment tools began to be developed—at the national, state, regional, and local levels—to help entities gauge the extent to which implemented policies or programs achieved smart-growth principles (or the local interpretation of those principles). Scorecards can be either conceptual models or practical tools. EPA defines scorecards as "basic assessment tools" that systematically track, measure, or gauge progress toward achieving smart-growth goals or objectives and help communities (EPA, n.d.,1):

- Determine how the current regulatory environment, including communities' comprehensive plans and/or zoning ordinances, influences growth and development patterns;
- View their current development patterns through a smart-growth lens;

- Determine whether development projects meets their smart-growth criteria for features such as compactness, walkability, and bikeability; and
- Decide whether their desired development type can be built using current codes and policies.

Smart-growth scorecards and other assessment tools have been developed by federal, state, and local governments; MPOs; regional councils of government; and advocacy groups like Smart Growth America. These tools have been used to help transportation and planning professionals, public practitioners, community leaders, decision-makers, "citizen planners," government officials, and other stakeholders determine the extent to which a community is wisely planning and managing both the challenges of, and opportunities for, sustainable growth and (re)development.

5.4 "Best Practice" Scorecards

EPA's Smart Growth Scorecard web page identifies three types of smart-growth scorecards that may be adopted or adapted to fit the needs of individual communities. While not specifically endorsed by EPA, "best practice" scorecards address topics such as density, mix and balance of uses, location, the variety and quality of multimodal transportation options, housing affordability, community character, connectivity/accessibility, and economic development impact. The three categories of scorecards geared for use at the local level, which are cited by EPA and described below, include municipal-level scorecards, project-specific scorecards, and component scorecards.

5.4.1 Municipal-Level Scorecards

Cities and towns develop and use these instruments to assess the impact of a community's current regulatory environment (e.g., comprehensive plan and land-use ordinances) on desired growth and development patterns. Generally, these scorecards evaluate the extent to which adopted land-use growth practices or reforms are consistent with principles of smart growth.

The Vermont and Colorado Smart Growth Scorecards were developed as voluntary, community self-assessment tools. These scorecards were designed for use by local government officials, planning commission members, or community leaders to help a community assess how well it was managing growth and whether plans or regulations needed to be augmented to reinforce smart-growth principles (EPA, 2000). Other smart-growth scorecards/assessment tools were developed by states (such as Massachusetts) to determine local government eligibility for, or distribution of, state capital improvement project funding based on their engagement in smart-growth activities (Massachusetts, 2006). These types of scorecards generated numerical ratings that were used to award incentives, discretionary grants, loans, and/or technical assistance to communities.

5.4.2 Project-Specific Scorecards

This type of scorecard may be used to evaluate and/or rate the virtues, impacts, or extent to which a current or proposed development project meets a community's criteria for smart growth. As noted by practitioners (Fleissig & Jacobsen, 2002), scorecards for development projects can be an effective tool that work in tandem with local planning tools (e.g., comprehensive plan, vision statement, or land-use map) to measure how well development projects meet smart-growth or local sustainability objectives. Scorecards that employ a point-calculation system can establish a benchmark to make project sponsors and developers eligible for incentives (Fleissig & Jacobsen, 2002). Scorecards can be used in tandem with a development review process to gauge whether a project can qualify for special incentives (e.g., expedited reviews, fee waivers, tax rebates, code requirement waivers) if the project proposal meets or exceeds smart-growth benchmarks. Scorecards also can have great utility as a "policy bridge," providing more extensive planning supports and additional development guidelines for local governments that do not possess the resources to replace outdated codes or update a comprehensive plan.

Maryland's Smart Growth Scorecard and the New Jersey Future Development Scorecard were designed to help citizens and local officials evaluate the smart-growth attributes of development proposals (EPA, 2002). In addition to enabling communities to weigh the pros and cons of proposed developments, outcomes of such evaluations reinforced the

need for additional measures such as improving zoning or updating comprehensive plans to encourage smart growth (New Jersey Future, n.d.).

5.4.3 Component Scorecards

Component scorecards have been used to assess specific characteristics of smart growth, such as walkability, bikeability, or transit friendliness. The EPA website provides hyperlinks to two checklists developed by the National Highway Traffic Safety Administration, the Pedestrian and Bicycle Information Center, and the U.S. Department of Transportation. The Walkability and Bikeability Checklists are designed for use by citizens to rate the walkability or bikeability of their neighborhoods and take action for improvements (EPA, n.d.).

5.5 Reality Check

The research team conducted an online search of the best practice scorecards listed on EPA's Smart Growth Scorecard web page. The web search of the actual tools revealed that most of the "best practice" smart-growth scorecards listed and described on the EPA Smart Growth web page are outdated or no longer in use (EPA, n.d.).

To understand why many of the best practice smart-growth scorecards are now obsolete, the UD-MU research team refined its research approach to include several additional tasks. These included: (1) conducting phone interviews with select regional planning entities that have a strong digital presence and extensive experience advancing smart-growth practices, engaging the public, and measuring progress toward smart growth and sustainability, (2) developing and administering an online survey to understand the prevalence, usage, and content of smart-growth scorecards and assessment tools in the Mid-Atlantic region, (3) expanding the literature review to examine advances in performance measurement, factors contributing to the evolution of smart growth, how these factors have influenced the use and development of assessment tools, and EPA's shift in use of GIS-based analytic tools, and (4) identifying organizations that have developed contemporary smart-growth scorecards/assessment tools.

6. Informational Interviews

Because many of the best practice smart-growth scorecards listed on EPA's website are no longer in use or obsolete, the research team conducted a preliminary Internet scan to identify entities currently using smart-growth scorecards/assessment tools in the Mid-Atlantic region. Interviews were initially conducted with staff members from New England's Sustainable Knowledge Corridor and Delaware Valley Regional Planning Commission (DVRPC), two regional planning organizations that have an innovative and sophisticated digital presence. Subsequently, an interview was conducted with a staff member with the Michigan State University (MSU) Land Policy Institute. While the Land Policy Institute is not located within the Mid-Atlantic region, the purpose of the interview was to understand why the Smart Growth Readiness Assessment Tool was replaced with a Placemaking Assessment Tool in 2015.

6.1 New England's Sustainable Knowledge Corridor

New England's Sustainable Knowledge Corridor is an alliance of three regional planning organizations in central Connecticut and western Massachusetts—the Central Connecticut Regional Planning Agency, the Pioneer Valley Planning Commission (PVPC), and the Capitol Region Council of Governments (CRCOG). Building on a decade of regional economic cooperation, the agencies applied for and obtained a three-year $4.2 million grant in 2011 from the U.S. Department of Housing and Urban Development's Sustainable Communities Regional Planning (SCRP) Grant Program. The three agencies partnered with nearly 40 regional, state, and city agencies and nonprofit organizations to advance sustainable initiatives and focus on linking housing, employment, and education to good-quality transportation.

A phone interview was conducted with PVPC planner Molly Goren-Watts on October 7, 2014. Goren-Watts stated that the website and planning tools were developed as part of the grant and HUD's focus on addressing issues of regional significance, using data to set and monitor progress toward performance goals, and engaging diverse stakeholders in meaningful decision-making on strategies to generate more jobs and regional economic

activity. PVPC is renown as a leader in measuring performance outcomes and providing data analysis to help a broader audience understand regional trends in a more easily digestible manner through text, charts, graphs, and GIS maps.

In 2012 an interactive online dashboard of sustainability data indicators was developed to track the Sustainable Knowledge Corridor region's performance (i.e., monitor performance) toward achieving sustainability goals. The sustainability indicators were modeled after HUD's six livability principles (rather than smart-growth principles) were designed to be visually appealing and user-friendly to engage a broad cross section of the region's population in developing a pathway toward sustainability. Interactive features allowed online users to:

- Easily understand large amounts of data that indicate the region's progress toward sustainability via the use of presentation technologies
- Change the graphs and compare various indicators
- Explore "fusion charts" within dashboards
- Manipulate "bubble charts" that provide local data on each indicator for towns within the corridor
- Use the highly customizable "Rank Your Priorities" online tool focused on transit-oriented development that was developed separately by another vendor.

In 2015 the online "dashboards" were replaced by a series Sustainable Knowledge Corridor videos. Although the website is being maintained, the end of the three-year HUD grant has paved the way for new grant-funded initiatives. For example, PVPC has developed a Pioneer Valley Sustainability Toolkit with grants from HUD's Sustainable Communities Initiative (in partnership with CRCOG), EPA's Targeted Watersheds Grant Program, and a Massachusetts Department of Transportation's Unified Planning Work Program grant. The Toolkit is designed to help communities develop strategies, take action, and assess performance on environmental protection, food security, climate change, clean energy, green energy, and smart growth.

Figure 2: New England's Sustainable Knowledge Corridor's Sustainability Indicators

6.2 Delaware Valley Regional Planning Commission (DVRPC)

Created in 1965 under a compact between Pennsylvania and New Jersey, DVRPC serves as the MPO that plans for the growth and development for the nine-county Greater Philadelphia region within both states. DVRPC's website has a range of interactive, visually appealing tools with the right "bells and whistles" that are ideally suited to a digital platform. A phone interview was conducted with DVRPC planners Karin Morris and Mike Boyer on October 9, 2014, to obtain more information on DVRPC's database that tracks smart-growth development within the region and online Smart Growth Tools maps.

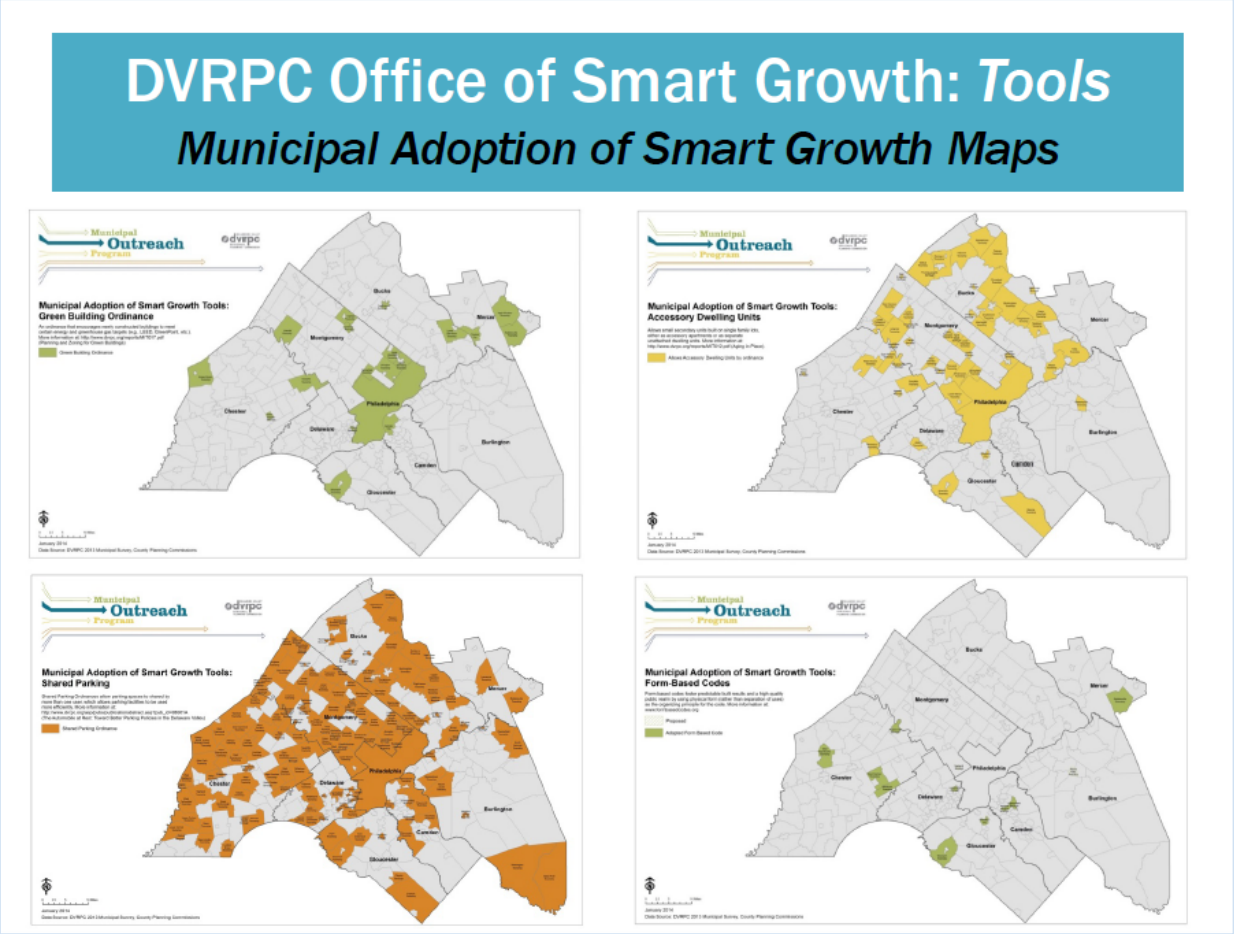
DVRPC's Smart Growth Project Database is an interactive online mapping application that tracks proposed, in-progress, and completed smart-growth development projects in the Greater Philadelphia region. Maps display locations of three types of regional Smart Growth projects—developments near transit, traditional neighborhood development, and conservation subdivisions.

DVRPC's website also displays a series of Smart Growth Tools maps. Morris and Boyer state that these maps represent outcomes of smart-growth initiatives, as reported by local governments in the Greater Philadelphia area. In 2013 DVRPC conducted a Municipal Outreach Survey, which generated 62 responses from 55 municipalities. One question focused on the professional planning capacity of municipalities in the Greater Philadelphia area. A significant number of respondents affirmed that most planning work is not performed by professional planning staff, but by volunteers such as planning commission members. A response to a question about municipalities' progress toward implementing smart-growth principles revealed that the greatest challenge was lack of financial resources. Another question asked whether planning and growth were "completely based on smart-growth principles," or whether other tools were being used to make progress toward smart growth. Survey outcomes revealed that municipalities were using a wide variety of tools (e.g., plans, policies, standards, official maps) to implement smart growth in their municipalities (DVRPC, 2013).

Based on the survey responses and follow-up with nine county planning commissions/departments within the planning region, DVRPC developed a series of Smart Growth Tools maps. The maps show outcomes of smart growth by pinpointing locations of municipalities that have adopted smart-growth ordinances (i.e., accessory dwelling units, alternative energy, form-based codes, green building, parking/shared parking, transit-oriented development, and complete streets), plans (i.e., multi-municipal plans and transit village designations), or official maps. Morris and Boyer were pleased with the various interactive mapping and survey tools being used to assess progress toward smart growth. However, they expressed concerns about data analytics—specifically qualifications of respondents (e.g., volunteers/planning

commission members versus staff) who had completed the surveys on behalf of municipal staff within the planning region.

Figure 3: DVPRC Smart Growth Tools Maps (DVRPC, 2014)



6.3 Michigan State University (MSU) Land Policy Institute

In 2009 the Michigan State University (MSU) Land Policy Institute, MSU Planning & Zoning Center, and MSU Extension's Citizen Planner Program, developed a proprietary, online Smart Growth Readiness Assessment Tool (SGRAT). The online scorecard and related tools enabled Michigan communities to a conduct self-assessments and rate preparedness to undertake development using smart-growth principles. The tool provided communities with baseline scores that could be used to measure future progress in the implementation of smart-growth practices.

SGRAT was replaced with an online Placemaking Assessment Tool in 2015. A phone interview was conducted with Mary Beth Graebert, Associate Director for Programs and Operations with the MSU Land Policy Institute, on July 23, 2015, to learn more about the move from smart growth toward placemaking in Michigan. Graebert stated that placemaking is relevant to smart growth, but viewed with a different lens. Placemaking is tied to the policy platform Michigan Governor Rick Snyder outlined in his 2011 special message to the Michigan Legislature. Snyder's Economic Vitality Incentive Program (EVIP) provided the impetus for municipalities to institute government reforms, foster intergovernmental cooperation, and advance placemaking "best practice" strategies (Snyder, 2011). Michigan's "MIplace" initiative was developed to offer toolkits, education/training, state technical assistance, local project action plans, and guidance on measuring progress and outcomes of placemaking strategies (MIplace, n.d.).

MSU's Land Policy Institute created a placemaking curriculum to train public and private sector stakeholders. Concurrently, its online Placemaking Assessment Tool (PAT) was launched in 2015. The tool helps communities gain awareness of factors that contribute to vital places and how plans and ordinances can set the stage for effective placemaking, attract and retain talent, and spur economic development. Placemaking is tied to the state-mandated local land-use planning process. The Land Policy Institute advises that a placemaking assessment be undertaken during the five-year update to a municipality's master (land use) plan (MSU Land Policy Institute, 2015). Placemaking incentives have been institutionalized within Governor Snyder's administration. Michigan municipalities that institute placemaking strategies may receive priority consideration for funding under Michigan Economic Development Corporation's Community Development incentives program (MEDC, 2015).

6.4 Discussion

Development of online smart-growth assessment tools by these entities was driven by needs/desires to (1) provide visually appealing, user-friendly, and interactive data to citizens, (2) involve and engage the public in the planning process, (3) provide performance outcomes or measures and/or (4) publicly disseminate, via the web,

outcomes of smart-growth/sustainable land-use practices. Additional motivation for the development and use of assessment tools by these three entities also seems to be driven by the need to:

- Fulfill federal or state mandates for performance measurement
- Demonstrate progress toward goals of grant-funded programs
- Provide public accountability for use of funding
- Develop a mechanism to incentivize and target funding to municipalities

7. Survey of Smart-Growth Scorecard Users/Developers

To fully understand the prevalence, usage, and content of smart-growth scorecards and assessment tools in the Mid-Atlantic region, the research team developed and electronically distributed an online survey. SurveyMonkey® was used to compose, collect, and aggregate the survey responses. Survey recipients were identified through an Internet search, and the research team used a MailChimp® mass email to solicit responses from those individuals.

7.1 Question Development

Survey questions targeted three main areas: scorecard development, scorecard use, and knowledge of scorecards (see Appendix B for a full copy of the survey). For scorecard development, the research team requested information on (1) how many organizations created their own scorecards, (2) when they were created, (3) the substantive content contained in those instruments and whether or not they reflected the EPA's definition of smart growth, (4) their format (paper, electronic, etc.), (5) the motivation for developing a scorecard, and (6) the targeted user. For scorecard use, questions focused on which scorecard, if any, groups are using—as well as alternative techniques used—to measure and track smart growth (such as GIS analysis). For knowledge of scorecards, respondents were asked to identify a scorecard they considered to be an exemplary model and offer additional insights that might deepen the research team's understanding of scorecard use and development.

Initial research questions were drafted and input into the online survey software offered by SurveyMonkey®. The research team conducted several rounds of collaborative editing to arrive at a satisfactory set of questions. Before distribution, the research team requested a trial run by five close contacts within the planning profession who are knowledgeable on smart-growth practices. The contacts tested the survey and offered several suggestions for improving the quality and focus of the questions. This feedback was incorporated into the wording and ordering of the questions to arrive at a final survey instrument for distribution to recipients.

7.2 Selection of Recipients

Potential survey respondents were identified through a systematic process. It was determined that the survey must target individuals who might use and/or create smart-growth scorecards, namely urban planning professionals. Members of the research team conducted an extensive Internet search for the following types of organizations in the Mid-Atlantic region that employ planners: MPOs, regional planning commissions, state DOTs, state planning departments, local government (municipal and county) planning departments, and smart-growth advocacy organizations. For each organization that was identified during this initial search, a contact person and their publicly accessible email address was recorded. This process yielded 250 individuals with email addresses. Collectively, these email addresses became the master distribution list for the survey. The MailChimp® automated messaging service was used to compose a solicitation email (see Appendix C for a copy of the solicitation email).

A draft of the MailChimp® solicitation email, a copy of the SurveyMonkey® survey, and a completed project protocol form requesting exemption was submitted to the University of Delaware's Institutional Review Board (IRB). Exemption was granted on March 4, 2015.

7.3 Distribution and Solicitation

On March 18, 2015, the research team sent a MailChimp® mass email to all recipients asking them to complete the online survey or, if they were unable to do so, to forward the solicitation to someone in their organization who could. On March 26, a reminder email was sent to the same individuals. Two more solicitation emails were sent to the email list on April 1 and April 7. The total number of individuals receiving the solicitation is unknown since some people may have forwarded the email to others within or even beyond their organizations. However, at a minimum, the composite MailChimp® list contained 250 unique email addresses. At the end of these four MailChimp® solicitations, a total of 52 individuals had navigated to the SurveyMonkey® instrument and responded to at least one question. This gives a response rate of 20.8 percent. Unfortunately, 16 of

the 52 responses were either incomplete or a duplicate from within the same organization, leaving a total of 36 usable responses, or an effective response rate of 14.4 percent.

To boost the response rate, the research team elected to send direct, personal emails to contacts who had not responded in the initial rounds. In the direct emails, contacts were also asked to forward the email and the link to the survey to individuals they felt would have useful and valuable knowledge of smart-growth practices. After these direct emails were sent in the middle of April, a final total of 71 responses were received (inclusive of the 52 responses from the MailChimp® solicitations). Of these 71 responses, 47 were deemed useable. Based on the original 250 individuals who received the MailChimp® solicitation, this gives an effective response rate of 19 percent, although the real figure is likely to be slightly lower due to some respondents advertising and passing the survey on to others.

7.4 Summary of Responses

Responses tended to come primarily from the local and county governments (22) and MPOs (13). The survey results demonstrate that few organizations have developed their own smart-growth scorecards or assessment tools. Of the 47 usable responses, ten noted that they created a technique for measuring achievement toward smart-growth practices.[2] Both hard-copy and downloadable scorecards are the preferred format, and the most popular audiences are public administrators and planners. The majority of scorecards were designed to assess smart-growth progress in all types communities—rural, suburban, and urban.

[2] The ten organizations are Genesee County Planning Department, New Jersey Future, Fredericksburg Area Metropolitan Planning Organization, Delaware Valley Smart Growth Alliance, Wilmington Area Planning Council, Poughkeepsie-Dutchess County Transportation Council, New Jersey Office for Planning Advocacy, New York State Department of Transportation, Delaware Valley Regional Planning Commission, and Duffield Associates, Inc.

Figure 4: Graphic illustrates that 10 of the 47 respondents have developed a smart-growth scorecard/assessment tool

In terms of substantive content and their alignment with the EPA's smart-growth principles, all ten scorecards were reported to include *mixed land uses, walkable neighborhoods, and directing development toward existing communities*. The principles of *fair and predictable decision-making* and *stakeholder engagement* were only reflected in four of ten scorecards. Several scorecard developers included elements of sustainable planning that go beyond the EPA's ten smart-growth principles, for instance transit-oriented development, green building codes, sustainable site practices to reduce heat island effects, stormwater management practices such as impervious paving and energy and water conservation measures.

Although ten survey respondents have developed their own smart-growth scorecards or assessment tools, many jurisdictions use a technique or combination of techniques to evaluate the implementation of smart growth in their locales. Geospatial analysis is employed by 15 organizations. Performance indicators, adoption of municipal ordinances that promote smart growth, qualitative-oriented metrics, and civic engagement processes such as focus groups are also common.

Figure 5: Graphic illustrates that respondents use a wide variety of approaches to evaluate the implementation of smart-growth strategies

7.5 Discussion

Given the low number of respondents who developed their own smart-growth scorecard or assessment tool, it would not be wise to extrapolate and draw larger conclusions about the general substance and functionality of smart-growth scorecards. Nevertheless, some meaningful information and knowledge can be gleaned from the survey. First, the majority of local- and county-level planning organizations in the Mid-Atlantic region are not creating customized methods of assessing or tracking progress on smart growth. However, this does not suggest that they are failing to monitor, evaluate, and achieve smart-growth in their jurisdictions, only that they have not invested (likely scarce) resources to tailor an assessment technique to their local context. Larger organizations such as MPOs, which typically have larger pools of resources, are more likely to develop smart-growth scorecards or assessment tools. MPOs have a long-standing federal mandate to carry out a regional transportation-planning program that is performance-oriented. Therefore, MPOs presumably have greater technical capacity, professional staff,

funding, and technology to track and monitor the implementation of regional smart-growth outcomes. In this way, MPOs have an important role to play in working cooperatively with state DOTs and planning agencies and local governments to share performance-based data with partners to support local smart-growth policies and land-use decisions. This will be more important since recent iterations of the federal surface transportation authorization (i.e., Moving Ahead for Progress in the 21st Century Act [MAP-21], and Fixing America's Surface Transportation Act, [FAST Act]) have placed a greater emphasis on public engagement and the performance management system of MPOs.

The frequency at which the EPA's ten smart-growth principles are included in scorecards or assessment tools can be viewed as a function of the principle. The principles that can be objectively measured, quantified, or empirically verified (mixed land uses, compact design, walkable neighborhoods, directing development toward existing communities, multiple transportation choices) are all more prominent than those with normative or highly subjective dimensions (creating a sense of place, predictable and fair decision-making, and stakeholder engagement). The survey results indicate that despite smart-growth principles that incorporate subjective elements such as community placemaking, the objectively verifiable principles are prioritized in scorecard development. This understanding was not lost on one survey respondent who noted that their organization's scorecard included all ten of the EPA's principles except *predictable and fair decision-making* and *stakeholder engagement* because while those "two items are important, we didn't have any way to track them."

Although most planning organizations have not developed a smart-growth scorecard or assessment tool, many use tracking methods such as GIS analysis to evaluate smart-growth performance. This indicates that local jurisdictions either have the technology and/or the capacity to plan for and assess spatial development patterns, and can obtain useful information on indicators such as compact design, mixed-use development, and walkability. Yet while GIS-based analysis is useful for measuring the quantifiable principles of smart growth, it does not help municipalities determine if they have achieved the more abstract elements, such as sense of place or predictable and fair

decision-making. Therefore, it is essential that planners and administrators complement GIS-based smart-growth assessment with additional qualitative evaluations such as community surveys, data visualization strategies, digital interface platforms, and online public engagement tools (e.g., websites, social media, GIS Story Maps, virtual town hall meetings, e-newsletters) as well as in-person engagement methods. Combining quantitative data with qualitative input, using both "high-tech" and "high-touch" methods, can comprehensively determine not just the spatial organization of a municipality, but the extent to which its residents co-create their community through informed participation.

The final question, "Do you have any additional information that can enhance our understanding of why smart-growth scorecards/assessment tools are or are not being used in the Mid-Atlantic region?" elicited a variety of interesting responses. Respondents indicated that smart-growth scorecards/assessment tools are not being used due to:

- Administration changes, staffing reductions, lack of staff capacity
- Overuse of the terms "smart growth" and "sprawl" to the point that they fuel sentiments of NIMBY and CAVE people (citizens against virtually everything)
- New focus on policy priorities such as sustainability and resiliency
- Need for scorecards to be tied to funding or development decisions rather than education and guidance
- "Political baggage" associated with tools and lack of political will to keep up with the "next faddish process" to guide volunteer planning commissions
- Financial constraints
- Weak state mandates for local government planning
- Need to focus on economic stability and resilience rather than growth management

8. Factors Influencing the Evolution of Smart Growth

Outcomes of the research team's initial literature review chronicled what has been described as the "eras of smart growth" (Chapin, 2012). Within each of these eras, the smart growth movement built momentum through advocacy and innovative initiatives to transform government policies and programs. The informational interviews and survey responses provided additional evidence that while the principles of smart growth remain intact, the concept has and still continues to evolve. Based on this evidence, the literature review was expanded to assess contemporary factors that have contributed to the evolving concept of smart growth and aspects that are influencing the use and development of new innovative assessment tools.

8.1 New Era of Sustainable Growth and Complete Communities (~2007–Present)

While the core principles of smart growth have remained consistent throughout the various the eras of smart growth, the notion of smart growth and implementation strategies continues to be fluid and evolve. Chapin (2012) identifies the current and emergent phase of smart growth as the Era of Sustainable Growth. He states that this new era began around 2012 and defining issues include concerns about climate change and energy demand and supply (Chapin, 2012). A convergence of social, economic, political, environmental, demographic, and technology changes and trends, however, seems to have shaped a distinct, new era of smart growth that emerged around 2007. A more descriptive term for this new phase of smart growth may be the Era of Sustainable Growth and Complete Communities, which describes an integrated approach to transportation planning, land use planning, and community design. According to University of Arizona urban planning professor Gary Pivo, the objective of complete communities is, "to use less land and reduce the separation of land uses in order to achieve a variety of values including open space protection, community vitality, affordable housing, air quality, transit use, and more walkable places" (Pivo, 2005).

Smart growth has proved to be both a transformative concept as well as a movement. Both the concept of smart growth and the implementation of smart-growth practices are not one-size-fits-all approaches. A community's planning structure; state legislation/planning framework; and state- and federal-level policy landscapes, regulatory frameworks, programmatic funding, and local incentives exert considerable influence on the implementation of smart-growth practices. In addition, both the implementation of smart-growth practices and efforts to measure the effectiveness of initiatives and outcomes have been shaped by a convergence of trends/factors such as (Deakin, 2004; Litman, 2015a; Dutzik et al., 2014):

- Economic downturn, Great Recession, and slow economic recovery
- Emerging demographic trends, including the "Millennial Effect" (e.g., changing lifestyle, housing, and travel preferences)
- Rise of the digital age, including advancements in the use of interactive technology, communication technologies, and social media
- Emergence of the shared economy (including bikesharing, ride-sourcing services (e.g., Uber and Lyft), and technology-enabled transportation services)
- Public participation mandates and heightened interest in collaborative planning processes
- Volatility of fuel prices
- Geographic location and availability and/or access to multimodal transportation options
- Shifts in the federal and state policy frameworks, agendas, funding priorities, and grant programs that have resulted in inconsistent funding or technical support to local governments
- Increasing globalism and impact on physical, social, political, and economic environments
- Increased demand for government transparency, accountability, and greater public engagement and outreach
- Evolving public policy issues (i.e., community revitalization, placemaking, climate change, sustainability, and resiliency) and integration of these issues into transportation and land-use planning

- Market acceptance for smart growth and uneven levels of public support (both advocacy and opposition)
- Technologic innovations that have advanced the development of new analytical tools and application of new performance measures

8.2 Reframing Smart Growth

In recent years, smart growth has been rebranded, reinterpreted, redefined, and renamed to encompass new movements, ideological views, and issues. In its 2003 *Ten-Year Retrospective*, The Funders' Network for Smart Growth and Livable Communities discussed the need to reframe the discussion of "smart growth" to address its negative undertones and appeal to a broader audience (Carlson, 2009). A *City Lab* article (Benfield, 2013), suggests that while the ten principles of smart growth stress important values, its practical implementation has focused more on development and transportation than equity and conservation. An article by *Atlantic Cities* suggests that the term "smart growth" has lost its allure and was among the "Urbanist Buzzwords to Rethink in 2014" (*Atlantic Cities* staff, 2013). New axioms now include terms such as livability, healthy communities, smart mobility, sustainability, resiliency, new urbanism, WalkUps, complete streets, complete communities, and transportation demand management (e.g., transit-oriented development, walkable activity centers, livability and sustainability initiatives, and integrated corridor management initiatives).

For example, the complete streets movement was launched by the National Complete Streets Coalition in 2004 and is now championed by Smart Growth America. Research sponsored by Smart Growth America and the Urban Land Institute (ULI), on the pent-up market demand for walkable urban places, has popularized the term "WalkUps" (Leinberger & Lynch, 2014). In Delaware, the term "complete communities" has been coined to describe a planning framework that consists of five elements—complete streets, efficient land use, healthy and livable, active and inclusive, and sustainable and resilient. It is designed to build capacity of Delaware communities to go beyond comprehensive planning to create "attractive, inclusive, efficient, healthy, and resilient places" (Scott et al., 2013).

8.3 Impact of the Great Recession

The Great Recession (2007–2009) and slow recovery created a complex mix of public policy challenges for states and local governments that seems to have altered the concept of smart growth. Slow and uneven economic recovery, coupled with federal discretionary spending cuts, has created ongoing fiscal pressures. State and local governments dealt with budget shortfalls by instituting operating efficiencies, spending cuts, withdrawals from reserves, revenue increases, and reliance on federal stimulus dollars. Some policy makers, whose constituents associated slower economic growth with growth management programs, have responded by rejecting the premise of smart or managed growth. The State of Florida, for example, repealed its 30-year-old growth management law that required local governments to prepare and adopt comprehensive plans that designated areas primed for growth and development (Cox, 2011). Like Florida, other state legislatures have viewed the Great Recession as an opportunity to "reset" the course for economic prosperity, where cities would again become the drivers of economic activity and growth (Florida, 2011). Other state and local policy makers have refocused on the need to reinvest in and reinvigorate core urban areas.

The accelerating pace of globalism has increased competition among states, regions, and communities for economic development opportunities. Rather than focus on strict growth management policies, state and local governments in the aftermath of the recession have begun to respond to new global economic realities, market preferences, and demographic shifts. Urban Land Institute (ULI) Minnesota has developed a (Re)Development Ready Guide for local governments to establish policies and practices that "attract private investment, grow jobs, support a full range of housing choices, and build tax base [resiliency]" (ULI Minnesota, 2014).

8.4 Focus on Sustainability

The Great Recession heightened an interest in the interplay among human, social, environmental, and economic sustainability. Maryland has altered its smart-growth-planning framework to include a strong focus on sustainable growth. Established by the Maryland General Assembly in 2010, the Sustainable Growth Commission has established

programs to support infill, redevelopment, and revitalization (Maryland Department of Planning, 2014). The Commission's Concentrating Growth Workgroup has been working with the National Center for Smart Growth Research & Education at the University of Maryland to develop a suite of sustainable growth objectives, indicators, and measurements. In spring 2015, sustainable objectives and indicators—broken down by statewide by region—were categorized by (1) development, (2) agriculture and environmental resources, (3) socioeconomic equality, (4) sustainable transportation/land use, and (5) economic development (Knapp, L., 2015). As of September 2015, the "Sustainable Growth and Conservation Indicators – Status Check & Measuring Progress" project was undergoing review by the Maryland Department of Planning.

8.5 The "Millennial Effect"

The Great Recession also reinforced real estate and development trends that favor smart growth. Two demographic groups—the Baby Boomers (born between 1946 and 1964) and the Millennial generation (born between 1982 and 2000)—are driving demand for "homes in central cities and closer-in suburbs where one can walk to stores and mass transit," or WalkUps—walkable urban real estate (Doherty & Leinberger, 2010). Research provides evidence that Millennials and Boomers want community investments targeted to address barriers to healthy living, provide new transportation options, and create attractive, walkable communities (APA, 2014; Lachman & Brett, 2015).

According to a June 2015 press release by the U.S. Census Bureau, Millennials number 83.1 million, represent more than one-quarter of the nation's population, and have surpassed the 75.4 million Baby Boomers (U.S. Census Bureau, 2015). Millennials will also make up 75 percent of the workforce by 2025. Nielsen, a consumer behavioral measurement company, reported in 2014 that almost two-thirds of Millennials prefer cities over suburbs, favor efficient public transportation over cars, and value corporate social responsibility over companies with no corporate conscience. Millennials use social networking, mobile devices, and smart technology to be part of a connected culture. This generation's living, transportation, consumer, social media, and communications

preferences are driving demands for more interactive and human-centered approaches to urban design, revitalization, and economic development.

8.6 Place-Based Economic Development

The Project for Public Spaces (PPS), a nonprofit organization, has worked since 1975 to build stronger communities by designing attractive, pedestrian-oriented public spaces with a mix of uses. A recent emphasis is working with communities to reimage streets as public spaces. Instead of engineering transportation improvements to foster mobility, PPS and its partners advocate that transportation facilities and networks be designed to improve the public realm and create a unique sense of place (PPS, n.d.).

Place-based governance, or placemaking, has come to the forefront as both a tenant of smart growth and an economic development in recent years. Placemaking has been embraced by the public, private, nonprofit sectors as a way to strategically shape the physical, economic, and social character of a community. Michigan Governor Rick Snyder has made placemaking, or MIplace, the state's key economic development policy platform; it "requires strategic investment and development in mixed-use corridors and urban centers" (Steuteville, 2014). Local governments that work cooperatively with the state to improve public infrastructure, develop accountability and transparency measures, and consolidate services are eligible for economic vitality incentives (Steuteville, 2014). Integral to the MIplace initiative is the support for investments that provide measurable results and a process that was established to evaluate the performance of economic development and placemaking activities (Snyder, 2011).

> *"Neighborhoods, cities, and regions are awakening to the importance of 'place' in economic development. They are planning for a future that recognizes the critical importance of quality of life to attracting talent, entrepreneurship, and encouraging local businesses. Competing for success in a global marketplace means creating places where workers, entrepreneurs, and businesses want to locate, invest, and expand. This work has been described as 'a sense of place' or 'place-based economic development' or simply 'placemaking.'" —Governor Snyder's Special Message to the Michigan State Legislature, March 2011*

8.7 Changing Federal Policy Landscape

This contemporary wave of smart growth has been heavily influenced by the changing federal policy landscape and more intense competition for available funding geared to support economic recovery, community livability, and sustainability initiatives. Several federal funding programs, such the reauthorization of the federal surface transportation program, reflected the new federal emphasis on outcome-based performance measurement. The Obama administration also reinforced the need for transparency and accountability in the allocation and use of federal funds. All levels of government were urged to coordinate policies and investments, improve performance management to increase efficiency, and publicly report on performance outcomes.

8.7.1 American Recovery and Reinvestment Act

In 2009, the Obama administration introduced the American Recovery and Reinvestment Act of 2009 (ARRA) to provide discretionary (competitive) and flexible funding opportunities to preserve or create jobs, speed economic recovery, invest in transportation infrastructure to provide long-term economic benefits, and assist those most affected by the recession (Recovery.gov). Signed into law on February 17, 2009, the Act elevated the need for transparency and accountability in both the obligation and reporting of the use of federal funds. With respect to surface transportation and infrastructure funding, the ARRA award process heightened the need for state DOTs to work cooperatively with MPOs, local governments, other transportation partners, and the public. ARRA provided states and MPOs with $26.6 billion in surface transportation funding to link investments in transportation systems with job creation, which supported smart-growth strategies (Smart Growth America, 2011).

The Transportation Investment Generating Economic Recovery (TIGER) competitive grant program was also created within ARRA in 2009. It provided a "highly visible example of incorporating livability criteria, including factors such as fuel and travel time savings, carbon emission reductions and economic and public health benefits, into the grant decision-making process" (National Housing Conference, n.d.). This

source of funding signaled a focus away from highways and toward livable communities and streets.

USDOT's discretionary and competitive TIGER grant program has continued to fund state and local government transportation and transit projects. Since its inception in 2009, more than $4.1 billion for six rounds of TIGER has funded multimodal, multijurisdictional transportation projects; $500 million has been made available for transportation projects in 2015 (USDOT, 2015b).

8.7.2 Partnership of Sustainable Communities

Livable communities, comprehensive planning, and sustainable development became a nationwide mantra with the appointment of Ray LaHood as Secretary of Transportation in 2008. On June 16, 2009, HUD, USDOT, and EPA joined together to form the Partnership for Sustainable Communities.

Partnership for Sustainable Communities grants, programs, and technical assistance became available to communities to implement six livability principles. These principles incorporated smart-growth attributes under the moniker of "sustainability" (FHWA, 2013):

- Provide more transportation choices
- Promote equitable, affordable housing
- Enhance economic competitiveness
- Support existing communities
- Coordinate and leverage federal policies and investment
- Value communities and neighborhoods

Partnership initiatives incentivized communities to plan for and implement regulations that foster mixed-use development, affordable housing, and transit-oriented development. In response, many states rebranded their smart-growth programs to "livability" or "sustainability" initiatives to better compete for federal funding opportunities. New state policy initiatives incorporated livability principles—in addition to, or in place of smart-growth principles—into programs that foster complete streets, pedestrian and bicycle

safety, transit-supportive communities, location efficiency, and affordable housing (National Conference of State Legislatures, 2011). Funding under this program was curtailed in FY 2012.

In 2011, the Partnership for Sustainable Communities joined forces with the U.S. Department of Agriculture (USDA) to produce *Supporting Sustainable Rural Communities*, which recognizes the distinct policy and planning needs of rural jurisdictions with regard to sustainability, comprehensive planning, land preservation, housing, and keeping small towns viable. The Partnership also fueled the growing interest in the use of technology, tools, and indicators to help communities assess, plan, design, and evaluate their progress toward achieving sustainable communities. Technical assistance and grants were offered to conduct scenario planning and develop measures to inform planning processes. Tools developed and/or promoted by HUD, USDOT, and EPA promoted open access to scenario planning, visualization, interactive mapping, and digital tools designed to better inform and facilitate citizen engagement in planning decisions (FHWA, n.d.).

8.7.3 Surface Transportation Authorization Bills

Moving Ahead for Progress in the 21st Century (MAP-21) – Enacted in 2012, this surface transportation authorization bill had several key provisions that supported smart-growth-type projects. It retained the ability to "flex" highway program funds for communities seeking to provide transportation choices, improve neighborhood accessibility, and foster transit-oriented development (Kline, 2012). In addition, MAP-21 placed a new federal emphasis on performance measurement. The law requires state DOTs, MPOs, and transit agencies to report on progress made toward performance targets. It required those agencies to incorporate performance measures into their broader planning processes. As a result, state DOTs and MPOs have assumed a greater role in developing performance measures, or indicators, to achieve national transportation performance goals—including environmental sustainability (Zietsman & Ramani, 2011). Efforts have focused on collecting, developing, using, and sharing data and tools; developing and applying performance measures;

advancing modeling and forecasting techniques; and improving the use of interactive and visual tools to promote engagement in decision-making.

Fixing America's Surface Transportation (FAST) Act – Signed into law by President Obama on December 4, 2015, this five-year authorization fully funds surface transportation programs through September 2020. It is the first law enacted in over ten years that provides long-term funding certainty for surface transportation. According to a USDOT summary, the FAST Act includes provisions designed to "improve transportation options, redevelop communities, and expand employment opportunities" (Office of Policy and Governmental Affairs, 2016). Notably, the FAST Act supports principles of smart growth. The legislation expands local transportation project design flexibility and control, makes transit-oriented development (TOD) near transit hubs eligible for funding under highway and rail credit programs, and supports efforts to increase connectivity by improving bicycle and pedestrian networks.

The five-year, $225.2 billion program will increase annual federal highway investment by about 15 percent—from $40.3 billion in FY 2015 to $46.4 billion by FY 2020. Yet, industry analysts predict that despite this level of highway investment growth, it may not be sufficient to fix the projected deficit in the Highway Trust Fund (HTF). A comprehensive analysis by American Road & Transportation Builders Association (ARTBA) states that "without a permanent increase in current trust fund excise taxes or enactment of a new revenue source, the HTF will exhaust the fund provided under the FAST Act by 2020" (ARTBA, 2016). Unless Congress allocates additional funds, the gap between incoming HTF revenues and surface transportation investment levels will continue to widen—and leave states without sufficient funding to complete highway projects (ARTBA, 2016). Moreover, the Act provides no new provisions to measure the performance of transportation investments, nor improve the transparency and accountability for selection of public agency transportation projects (Transportation for America, 2016).

8.8 Improvements in Transportation System Modeling

In 2011, EPA's Office of Sustainable Communities developed a Smart Location Mapping resource to fulfill the need to better understand the effect of land use/urban form on transportation outcomes. To explore location efficiency, EPA made available two new data products via its website: the Smart Location Database (SLD) and the Access to Jobs and Workers via Transit Tool. Use of these tools is designed to enable analyses of neighborhood conditions, evaluation of potential development locations, scenario planning/travel demand modeling, and comparisons of urban form among metropolitan areas. The resources are designed for use by a variety of stakeholders including local governments, MPOs, regional planning commissions, and private developers or real estate professionals.

In 2013, the Smart Growth Area Planning (SmartGAP) tool was launched as part of a second Strategic Highway Research Program (SHRP2) project titled "The Effect of Smart Growth Policies on Travel Demand" to evaluate the impact of various smart-growth policies. It was designed to provide transportation and land-use planners with limited technical experience with "improved tools and methods to more accurately and comprehensively integrate transportation investment decision-making with land development and growth management" (i.e., smart-growth strategies) (Transportation Research Board, 2016, 1). Building upon existing research, the project produced the SmartGAP software tool to help transportation and land-use planners communicate to decision-makers how smart-growth strategies will influence travel demand, the environment, the economy, and local communities. Planners can use the SmartGAP tool to test various scenarios for land use, population growth, and transportation strategies and then evaluate their effects on several significant performance measures. The tool also can be used to evaluate regionally significant changes in the built environment, travel demand, transportation supply, and policies. The tool was piloted with Maryland Department of Transportation (MDOT), Atlanta Regional Commission (ARC), the Thurston Regional Planning Council (TRPC) in Olympia, Washington, and Portland Metro, Oregon.

FHWA and FTA have emphasized "next generation" scenario planning as a means to achieve stakeholder engagement, visualize the trade-offs between land-use and transportation choices, inform decision-making, and a provide a framework for performance measures. Scenario planning aims "to capture a broader range of issues and challenges than previously considered in transportation and land-use scenario creation and analysis" (FHWA, 2010). Scenario planning is advocated as a tool for communities to explore broader risks and potential transportation impacts associated with:

- New demographic shifts, such as aging populations
- Technological developments, such as alternative fuels
- Fuel prices, including peak oil production
- Climate change and associated policies
- Economic shifts

9. Contemporary Smart Growth Assessment Tools

A targeted Internet scan was conducted by the UD IPA research team. It focused on searching websites of select entities that (1) responded to the survey of Mid-Atlantic land-use and transportation planning practitioners and smart-growth advocates reported to have experience assessing smart growth, (2) previously developed "best practice" smart-growth scorecards that were listed on EPA's or Safe States Alliance's websites, and (3) were identified through the literature review as innovators or leaders in developing new assessment tools. In addition, a Google search was conducted of various configurations of relevant terms (e.g., smart-growth scorecards/assessment tool, measures, performance evaluation, benchmarks, indicators, metrics). A matrix (see Appendix D for the Contemporary Assessment Tools to Gauge Smart Growth) was prepared to summarize outcomes of the targeted Internet scan and categorize the types of assessment tools that are currently being utilized within the Mid-Atlantic region and throughout the United States.

A key issue for community sustainability is the relationships among land-use, transportation, and environmental planning. Conventionally, transportation planning has been conducted at a state or regional level, while land-use planning and decision-making have been made at the local level. The evaluation of smart-growth scorecards being used at the state and local levels will identify examples of "best practices" in terms of both the assessment tools and criteria being used to evaluate sustainable policies and practices. In addition, identifying aspects of and criteria for "best practice" smart-growth scorecards can provide a framework for local jurisdictions that seek to develop their own assessment tools. The benefit of this approach is that the scorecard is a simple, efficient, and easy-to-use broad assessment tool that allows communities to collaboratively assess whether they have the right tools in place to handle projected smart growth and future development. This approach encourages a collaborative dialogue and active engagement among local citizens and community stakeholders who wish to provide input on public policy decisions that may lead to smart-growth practices.

Both the concept of smart growth, and contemporary assessment tools designed to evaluate outcomes of smart-growth practices, continue to co-evolve. Contemporary tools reflect changing policy agendas, opportunities for funding incentives, shifting dimensions of smart growth, rebranding of the concept, advancements in technology, and new trends and movements (e.g., placemaking and integration of sustainability/climate change into land-use and transportation planning). Assessment tools may be geared for use by citizens, elected or appointed public officials, academics, or professionals in various disciplines (e.g., planning, public policy, engineering). The matrix of Contemporary Assessment Tools to Gauge Smart Growth (see Appendix D) lists qualitative, quantitative, and visualization tools that represent many of the current indexes that were developed within the last decade and are currently being used to assess smart growth.

9.1 Qualitative

Qualitative assessment tools were developed to help communities gauge the extent to which adopted plans, policies, and regulations achieve smart-growth principles. Types of qualitative assessment tools include checklists and audits.

9.1.1 Checklists

These user-friendly tools list or describe ideal smart-growth characteristics or practices as determined by a state, region, community, or advocacy group. Checklists can be used to assess whether or not current regulatory and management practices in a community align with the widely accepted ten principles of smart growth, a local/regional interpretation of the concept, or government policy directives or mandates. Users simply check off what practices are currently underway to identify planning/policy gaps and needed actions to address deficiencies.

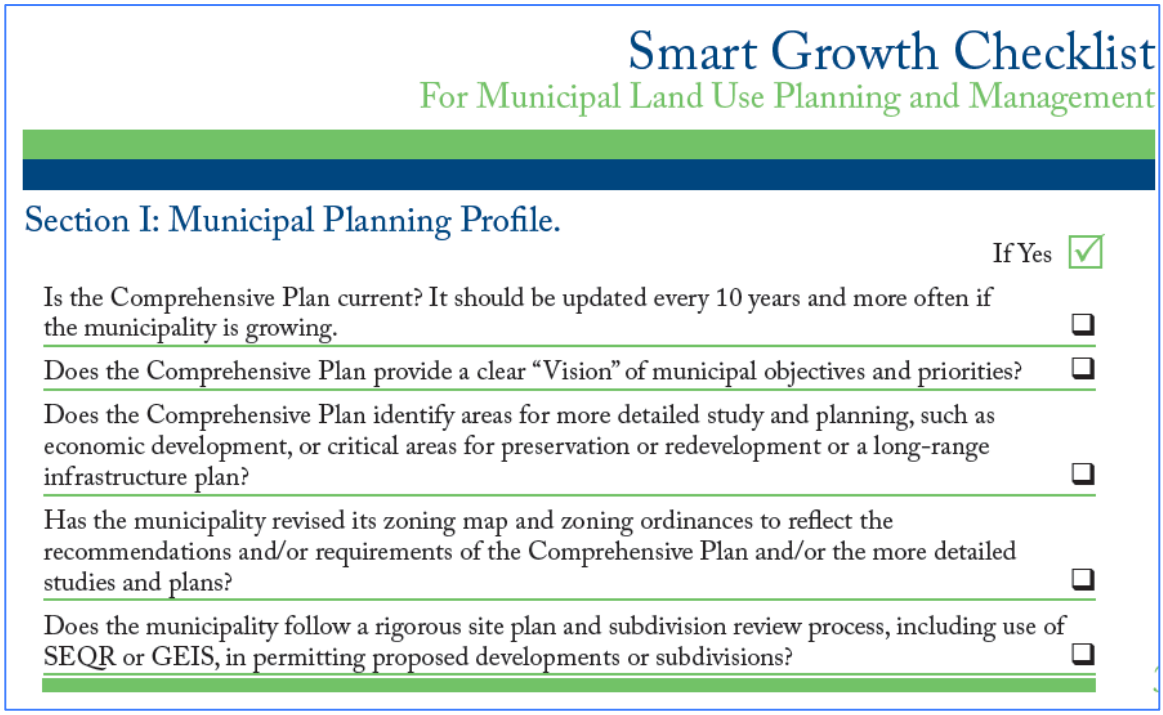
In the 2000s, the State of New York attempted to adopt smart-growth legislation several times. The push to compete for federal funding economic stimulus funding for "shovel-ready" projects under the American Recovery and Reinvestment Act of 2009 (ARRA), however, intensified the need to establish a strong smart-growth policy agenda for the state. New York State's Smart Growth Public Infrastructure Policy Act (SGPIPA) was enacted in

August 2010 and became effective the following month as an amendment to Environmental Conservation Law. The Act is intended to minimize the high costs of infrastructure investment associated with sprawl development. It requires state infrastructure agencies, authorities, and public corporations to ensure that proposed public infrastructure projects undergo a smart-growth consistency evaluation and review before approving investments (Empire State Future, 2012). In essence, SGPIPA incentivizes smart-growth planning by local governments that seek infrastructure-funding assistance. State agencies that fund infrastructure projects through grants, loans, or assistance programs will give a local government a higher ranking and priority status for proposed infrastructure projects that meet relevant smart-growth public infrastructure criteria.

The New York State Department of Transportation (NYSDOT) has integrated SGPIPA requirements (i.e., consistency evaluation) into its existing federally required transportation project development process. NYSDOT's Smart Growth Screening Tool provides guidance to those reviewing transportation project funding proposals. The screening tool is used to evaluate projects to determine whether or not they are consistent with smart-growth criteria, if the project provides a "sustainable solution" given its context, and if the project should advance to an MPO's transportation improvement plan (TIP) process (NYSDOT, 2013).

NYSDOT also provides online resources and tools to help educate communities about smart growth and the need to integrate transportation and land-use planning. NYSDOT's Proposal Development Project Checklist is designed to ensure that smart growth is considered in new projects funded or supported by the state. NYSDOT's Smart Growth Checklist for Municipal Land Use Planning is designed to help municipalities evaluate whether or not current land-use planning and management practices align with the state's guiding principles of smart growth (NYSDOT, n.d.)

Figure 6: Smart Growth Checklist (NYSDOT, 2010)



Smart Growth Checklist

For Municipal Land Use Planning and Management

Section I: Municipal Planning Profile.

	If Yes ☑
Is the Comprehensive Plan current? It should be updated every 10 years and more often if the municipality is growing.	❑
Does the Comprehensive Plan provide a clear "Vision" of municipal objectives and priorities?	❑
Does the Comprehensive Plan identify areas for more detailed study and planning, such as economic development, or critical areas for preservation or redevelopment or a long-range infrastructure plan?	❑
Has the municipality revised its zoning map and zoning ordinances to reflect the recommendations and/or requirements of the Comprehensive Plan and/or the more detailed studies and plans?	❑
Does the municipality follow a rigorous site plan and subdivision review process, including use of SEQR or GEIS, in permitting proposed developments or subdivisions?	❑

9.1.2 Audits

Smart-growth audits enable a community to review and assess how well existing land-use codes and regulations meet local smart-growth goals. Audits provide a scan of the regulatory framework and are used to identify areas for improvement. A basic audit may entail conducting a review of a jurisdiction's comprehensive plan, zoning code, parking regulations, strategy or incentives to attract infill/(re)development, community design guidelines, and other policies or documents that guide development to areas intended for growth.

Smart Growth America has crafted an online downloadable Smart Growth Implementation Toolkit that provides a set of tools designed to help communities implement smarter growth and sustainable development strategies. The Smart Growth Policy Audit allows communities to simply check off how well they are achieving each of the ten principles of smart growth. The Smart Growth Code and Zoning Audit enables

communities to simply identify (Y or N) whether the regulatory landscape supports or blocks smart growth (Smart Growth America, 2007).

Figure 7: Smart Growth Implementation Toolkit: 2. Policy Audit (Smart Growth America, 2007)

Smart Growth Principle #1 **PROVIDE A VARIETY OF TRANSPORTATION CHOICES**	Excellent	Needs Improvement	Poor	Not Addressed
1. Provide transportation choices to densely populated areas as well as major employment centers.				
2. Link land use and transportation choices at the local and regional levels.				
3. Address jobs and housing balance in the General Plan.				
4. Locate new development, especially public facilities, in areas supported by a balanced transportation network.				
5. Require roadway design standards that protect pedestrians and support transit and non-automotive modes.				
6. Encourage transit-oriented (TOD) and transit friendly developments.				
7. Grant density bonuses in transit or mixed -use districts.				
8. Offer TOD-promoting incentives such as down payment assistance, reduced transit passes, and location efficient mortgages.				
9. Encourage public transit use by integrating multimodal use and connectivity (Park and Ride lots, transit centers, etc.).				
10. Plan or maintain high-occupancy vehicle (HOV) lanes.				
11. Encourage the formation of vanpools and carpools.				

Michigan State University's School of Planning, Design & Construction developed two sustainable audit self-assessment tools in 2014 with primary funding from a HUD Sustainable Communities Regional Planning Grant. The "basic" self-assessment tool is a compilation of 19 indicators of sustainability and the "advanced" self-assessment tool is a compilation of 32 indicators of sustainability. Both assessment tools enable communities to evaluate the extent to which they achieve the five identified sustainability categories of livability, governance, environment, community, and economy (MSUSASC, 2014).

9.2 Quantitative

Several types of analytic tools have been designed to quantitatively predict or evaluate the outcomes of implemented smart-growth initiatives—particularly from an

environmental or transportation perspective. An array of quantitative measures exists that has been influenced by federal and state policy agendas, prospective funding, greater access to data, refinements in performance indicators, and improved technology.

9.2.1 Scorecards

As previously described, these tools assign values or numerical ratings to desired smart-growth attributes. Scorecard ratings are used to rate a community's performance of community plans, policies, and practices that have been adopted to manage growth. Many scorecards developed in the last decade still reflect smart-growth principles but may be influenced by federal- or state-level policy agendas and funding opportunities. For example, the Arizona Smart Growth Scorecard (2009) reflects the state's Growing Smarter planning statutes, the Growing Smarter Guiding Principles, and smart-growth techniques. It is promoted as a voluntary, self-assessment tool that enables communities to evaluate their planning efforts. In reality, the scorecard provides a basis for the state to award and distribute discretionary grants, loans, incentives, and technical assistance to communities (Arizona Department of Commerce, 2009). The San Joaquin Council of Governments' (SJCOG) Regional Smart Growth/Transit-Oriented Development Plan includes a smart-growth scorecard. It provide a basis for evaluating smart growth-related projects proposed for funding under SJCOG's Smart Growth Incentive Program (SGIP) such as pedestrian, bicycle, and transit infrastructure; improved access to transit; streetscaping; and traffic-calming measures (SJCOG, 2012).

Many scorecards mirror the rebranding the concept of smart growth as sustainability. Colorado's Department of Local Affairs, in collaboration with its partners, developed the state's Community Sustainability Guide in 2010. It uses a rating score to assess sustainable community character and quality-of-life attributes that include a focus on land use, transportation, public health, and safety. This self-assessment tool has replaced a 2003 scorecard, listed as a "best practice" on EPA's website, which was prepared by a nonprofit entity and foundation (State of Colorado, 2010). In Minnesota, community leaders developed a Twin Cities Equitable Development Scorecard in 2014. Because this initiative was funded, in part, with a HUD Sustainable Communities Regional Planning

grant, it closely aligns with HUD-DOT-EPA's Sustainable Communities Livability Principles (Corridors of Opportunities, 2014).

Contemporary scorecards also reflect the growing trend toward sustainability-oriented planning and performance measurement. The California Department of Transportation (Caltrans), in partnership with other state agencies, crafted a *Smart Mobility 2010: A Call to Action for the New Decade*. The framework was developed in response to state mandates to reduce greenhouse gases (GHG) from transportation and enhance the three pillars of sustainability—environment, economy, and equity. The framework outlines strategies and methodologies for integrating Smart Mobility principles, concepts, and performance measures into sustainable and multimodal transportation planning practices (Caltrans, 2010).

9.2.2 Sustainability Indicators and Assessment Tools

Community Indicators Consortium (CIC) is a nonprofit organization working to improve the use of indicators for better planning, decision-making and communities' quality of life. According to a report by CIC, there has been a growing interest in linking community indicators and government performance measures in the last decade (CIC, 2007). Another organization, the National Neighborhood Indicators Partnership (NNIP) was created in 1995 to further the development and use of neighborhood-level information systems in community building and policymaking.

Nationwide, several cities have been involved in data collection, benchmarking, indicator analysis, and tracking of sustainability outcomes. "Best practice" cities use data-driven decision-making, cutting-edge technology, democratized data on community access websites, and innovative neighborhood engagement techniques. Washington state law (RCW 36.70A) requires local jurisdictions to guide future growth plans by developing comprehensive plans and development regulations. The Seattle Sustainable Neighborhoods Assessment Project (SNNAP) used a data-driven approach to develop a methodology to measure quality of life, sustainability, and growth of Seattle's neighborhood-based urban villages. The analytic tools consisted of 22 Urban

Sustainability Indicators organized into four outcome groups—resource use and conservation, healthy communities, open space and development, shared prosperity and opportunity (Seattle.gov, 2014). In addition, the San Francisco Indicator Project and City of San Antonio Neighborhood Sustainability Assessment Index used a series of neighbor-level sustainability indicators and performance measurement targets to quantify the level of sustainability in various neighborhoods (Steinbrueck, 2014).

9.2.3 Scenario-Planning and Activity-Based Transportation Planning Modeling Tools

Transportation performance measures forecast, evaluate, and monitor the degree to which a transportation system accomplishes adopted public goals and integrates transportation and land-use planning. USDOT's FHWA issued a *Scenario Planning Guidebook* in 2011 to encourage scenario planning by transportation agencies, state DOTs, MPOs, and rural planning organizations (RPOs) (FHWA, 2011).

> *"A primary goal of scenario planning is to engage the general public, the business community, resource agencies, and elected officials on a broad scale; to gain a thorough understanding of community values, growth trends, and tradeoffs; and to incorporate participants' values and feedback into future plans." – FHWA, Environmental Review Toolkit*

Scenario-planning and activity-based transportation modeling tools are designed to address issues with the standard trip-based transportation forecasting models and represent an emerging practice in transportation planning. The Transportation Research Board published *Activity-Based Travel Demand Models: A Primer* (Castiglione, Bradley, & Gleibe, 2015). It explains that activity-based models are similar, but provide improvements over traditional auto-oriented, trip-based models. These models link travel behavior choices, such as departure time or route, with congested network conditions and land-use models to better reflect real-world circumstances. They also can reflect travel behavior such as transportation modes (e.g., walking and biking) and demographic or other data that may impact travel choices (e.g., age, gender, or other socioeconomic data). By using these models, planners can more directly test the effects for various alternatives on congestion.

EPA has continued to refine tools and models used to measure land-use change and transportation efficiency since it released the Smart Growth INDEX® (SGI) in 1998. In 2010, a report described the outcomes of an EPA-funded meta-analysis (Ewing & Cervero, 2010) that summarized the research that attempted to quantify the potential effects of land-use decisions (e.g., compact and mixed-use development, transit-oriented development, walkable neighborhoods) on the built environment. The study identified the lack of freely available, nationally consistent data products and tools that planners can use to compare the location efficiency of various places and reliably summarize neighborhood-scale built-environment conditions (Ewing & Cervero, 2010).

As a result of the study, EPA developed two data products in 2011 to explore location efficiency—the Smart Location Database and the Access to Jobs and Workers via Transit Tool (EPA, 2011). These tools can be used to conduct analyses of neighborhood conditions, evaluate potential development locations, conduct scenario planning/travel demand modeling, and compare urban form among metropolitan areas. The Smart Location Database includes more than 90 attributes summarizing characteristics such as housing density, diversity of land use, neighborhood design, destination accessibility, transit service, employment, and demographics for every Census block group in the United States (Ramsey & Bell, 2014). An analysis of EPA's former Smart Growth INDEX® (SGI**)** and current Smart Location Mapping tools is provided in Appendix A.

While many transportation agencies and MPOs are testing the new activity-based models, the actual application has been limited. These models require considerable training and resources to implement, maintain, and update. To bridge this gap, the second Strategic Highway Research Program (SHRP2) of the American Association of State Highway and Transportation Officials (AASHTO) sponsored the development of a user-friendly Smart Growth Area Planning (SmartGAP) software tool. Tested and launched in 2013, the free and open-sourced tool was designed to evaluate the impact of smart-growth policies on regional travel demand and estimate smart growth's effect on both peak and non-peak travel. The SmartGAP tool is designed for use by transportation and land-use planners with no modeling experience to assess the impact of smart-growth strategies/policies on sprawl, energy reduction, active travel, and

emissions. It allows the use of either national or local data to measure the travel demand impacts of smart-growth policies (Outwater, et al., 2014).

Since its 2013 release, SmartGAP has been renamed the Rapid Policy Assessment Tool (RPAT) and endorsed by AASHTO. RPAT is not a detailed transportation and land-use simulation model, but rather sketch-planning tool designed to assess various policies. Under SHRP2, improved tools and methods for more accurately and comprehensively integrating investment decision-making with land-use strategies are being advanced in several ways. For example, SHRP2 hosts a website (https://planningtools.transportation.org/) with a TravelWorks Resource Page that promotes RPAT as a transportation modeling tool available as a free and "open source" code. The website offers a RPAT user guide, online forum of users, and "best practice" examples of agencies using the applied technology.

The San Francisco County Transportation Authority (SFCTA) is the sub-regional transportation planning and programming agency for San Francisco County. It administers voter-approved taxes and fees that benefit the transportation system and funding for transportation projects that directly benefit air quality. In 2001, SFCTA launched San Francisco Chained Activity Modeling Process (SF-CHAMP), the first activity-based model in the United States. It was initially implemented for San Francisco County, but a subsequent phase made it applicable to all nine Bay-Area counties. This activity-based travel demand model is used to predict yearly patterns of travel for all persons within the region. SF-CHAMP is *tour*-based not *trip*-based and is more sensitive than traditional auto-oriented, trip-based models. Unlike a trip, which is a single movement from origin to destination, a tour is a chain of trips made by an individual that begins and ends at home without any intermediate stops at home (SFCTA, n.d.). The model considers various conditions that influence travelers' choices and can be used to predict trip-generation rates based on changes to land use, socioeconomic conditions, and the transportation system in the Bay Area (Cambridge Systematics, 2011).

SF-CHAMP is being used to quantify the benefits of transportation system investments and help stakeholders understand the implications of various transportation projects, plans, and policies. The state-of-the-art model continues to be refined and used for all types of applications such as transportation planning, feasibility studies, environmental analysis, fleet planning, travel demand management, travel demand management (Sall et al., 2014). SFCTA has also developed CycleTracks, a smartphone app for iPhone and Android that obtains cycling data from users. Information on bicycle route choice mode is collected and incorporated into the SF-CHAMP modeling and forecasting tool. The CycleTracks app has been adapted for use by other regional councils, MPOs, and transportation agencies to better understand the needs of bicyclists to more effectively prioritize bicycle infrastructure investments (Hood et al., 2011).

The Delaware Department of Transportation (DelDOT) and State Smart Transportation Initiative (SSTI) at the University of Wisconsin–Madison have also collaborated to develop and test a Land Use and Transportation Scenario Analysis and Microsimulation (LUTSAM) model. LUTSAM seeks to address inherent challenges of using activity-based or tour-based travel demand models. The model is designed to accurately evaluate various land-use and transportation scenarios, provide a platform to test land-use planning and multimodal transportation investments (e.g., pedestrian and bicycle infrastructure), promote interaction between planners and engineers, and foster public engagement through the use of realistic, 3-D visualization software (Thompson-Graves et al., 2013).

9.3 Web-Based, Interactive Visualization Tools

While scenario-planning and activity-based transportation modeling tools continue to be refined, they remain complex and resource intensive for many local jurisdictions. However, local governments are increasingly using data analytics, civic engagement technology, and online digital tools/platforms to both inform decision-making and show performance metrics. As a result, web-based, interactive visualization tools and digital strategies are helping local governments become more transparent, efficient, collaborative, and productive (Goldsmith & McClellan, 2013). High-tech approaches are being used to provide information and foster public engagement through websites,

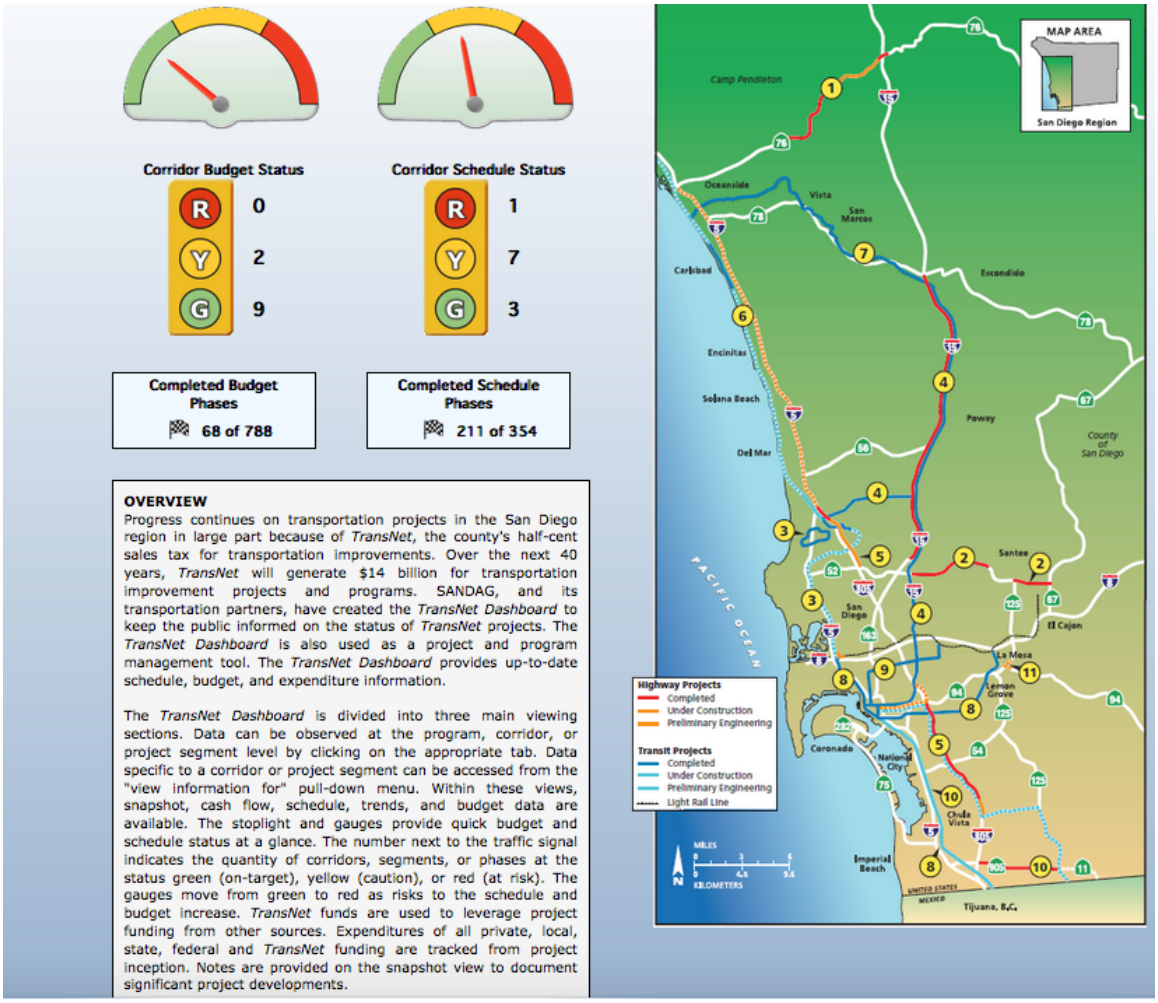
electronic networks, social media, and new technology. The most effective strategies integrate high-touch (in-person) and high-tech approaches to sustain long-term engagement, involve diverse stakeholders, and incorporate a wide range of activities and techniques. While digital public engagement tools are not a panacea, they are strategies being used by governments to build trust, engage stakeholders, and visually show planning outcomes.

9.3.1 Monitoring Approaches

Monitoring techniques are used to assess changes over time to (1) local planning policies and regulations, (2) development patterns, (3) transportation conditions, and (4) travel behavior (Deakin, 2004). As discussed in Section 5 (Informational Interviews), the Delaware Valley Regional Planning Commission (DVRPC) and New England's Sustainable Knowledge Corridor have each developed "dashboards" that provide metrics to track progress toward smart growth and sustainability initiatives. In addition to monitoring progress toward achieving smart growth and sustainability goals, these interactive dashboards can be viewed online and used to inform and engage stakeholders in meaningful dialogue on planning for a sustainable future.

The San Diego Association of Governments (SANDAG) has been a leader in public accountability and in developing visual tools to showcase performance indicators and the use of public tax dollars. In 2006, SANDAG launched its online *TransNet Dashboard.* The interactive visualization tool conveys how *TransNet*, the half-cent sales tax, is being spent for local transportation projects to reduce traffic congestion, improve transit, and improve the quality of life in the San Diego area (SANDAG, 2008).

Figure 8: TransNet Dashboard (SANDAG, 2015)



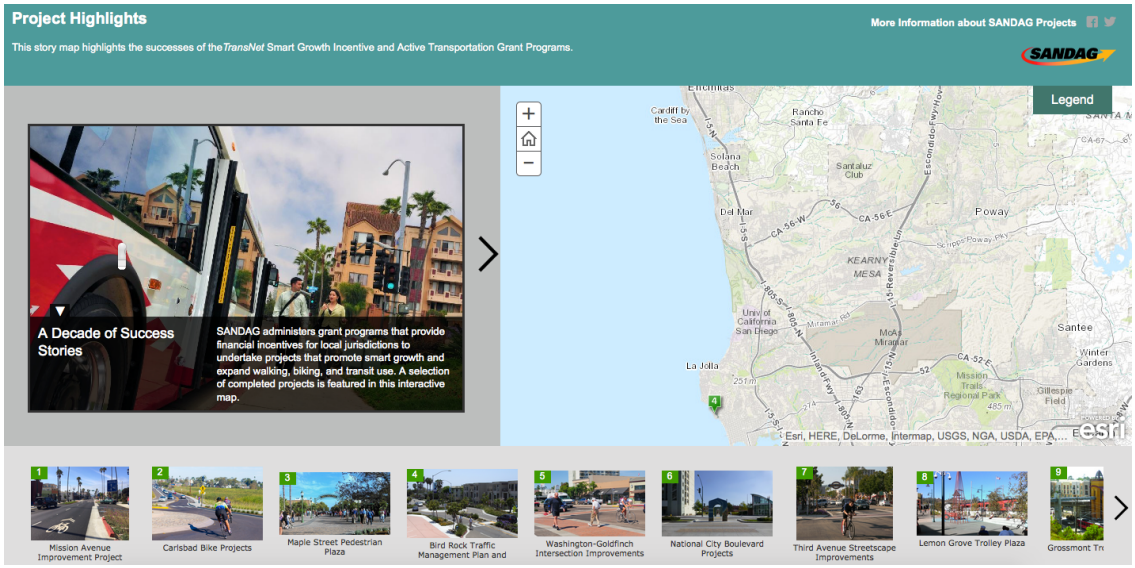
9.3.2 Smart Growth GIS Story Maps

Story Maps use Geographic Information System (GIS) tools to combine geospatial data with photos, video, audio, and text to visualize a theme or sequential events. Story Maps are designed for nontechnical audiences with access to the Internet; users do not need experience with GIS software to read or use Story Maps. Story Maps serve as a great tool for public engagement because they can be shared easily via social media or embedded within a website.

ArcGIS was used to develop interactive smart growth GIS Story Maps for SANDAG and the Fresno Council of Governments in California (Fresno COG). SANDAG has an extensive interactive mapping service that helps users visualize the relationships among

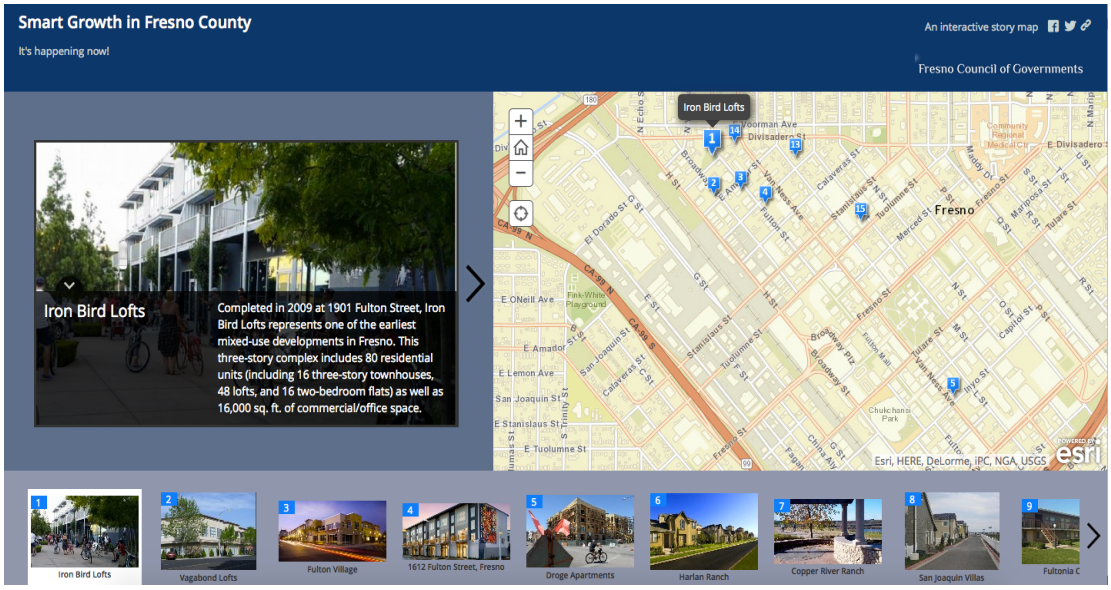
existing and planned land uses and transportation. SANDAG's smart growth GIS Story Map highlights the successes of its *TransNet* Smart Growth Incentive and Active Transportation Grant Programs (SANDAG, n.d.).

Figure 9: SANDAG's GIS Story Map of TransNet Smart Growth Incentives and Active Transportation Grant Programs (SANDAG, n.d).



A Smart Growth GIS Story Map, prepared by Fresno COG, showcases mixed-use development as part of the region's smart-growth strategy (Fresno COG, n.d.).

Figure 10: Fresno Council of Government's Smart Growth GIS Story Map (Fresno COG, n.d.)



9.3.3 Smart Growth Visualization Tools

Urban Advantage, Inc. (urban-advantage.com) uses digital photo editing technology to show how smart-growth approaches can transform the built environment. MPOs, councils of government, and local jurisdictions have enlisted Urban Advantage, Inc. to prepare conceptual simulations to help citizens envision possible built-environment changes through the application of smart-growth principles. The simulations can be viewed online or in a public meeting to generate additional ideas and discussion about smart-growth opportunities.

Figure 11: Conceptual visualizations produced by Urban Advantage for SANDAG

9.3.4 Use of Geo-Design Principles

PlaceWorks, Inc., a private urban planning and design firm in California, has partnered with Esri to develop "GreenScore," or tools that measure and evaluate the built environment. GreenScore uses geo-design principles to create new interactive tools that enable both planners and citizens to visualize and assess the natural and social outcomes of proposed development. GreenScore provides a qualitative and quantitative assessment of socioeconomic and environmental factors that help illustrate how the built environment affects sustainability. One of the key strengths of the methodology is the diversity of topics it assesses—such as walkability, vehicle miles traveled, air pollutant emissions, housing density and affordability, and natural resource preservation. These tools can be used with a desktop or laptop computer or any handheld electronic devices, (e.g., smartphone or tablet) to provide online and mobile public engagement opportunities. The analytic software allows users to produce visually appealing renditions

to create and test land-use alternatives against a predefined set of indicators and get immediate feedback on potential performance.

Figure 12: Diversity of Focus Areas of GreenScore's Sustainability Assessment

10. Conclusion

To measure the effectiveness of smart growth, there must be a general consensus on a community's vision and goals for future growth and development. Ideally, smart-growth performance metrics and assessment tools must align with goal-specific requirements (Ingram et al., 2009). In addition, some principles of smart growth are inherently difficult to measure. For example, there is no specific performance metric to evaluate the desire to "foster distinctive, attractive communities with a strong sense of place." Moreover, there are limitations of data and methodology to measure smart growth. Because state, regional, and local institutional practices to implement smart growth vary, there are no consistent performance metrics or tools.

Inherently, assessing smart growth outcomes has been difficult for several reasons. First, implementing smart growth takes time and requires long-term support and commitment of all levels of government (Ingram & Hong, 2009). Second, goals of smart-growth programs need to be clearly stated. Performance benchmarks/indicators need to be established, articulated, reasonable, and attainable. Third, because there is not one universal approach to implement smart-growth strategies, developing model smart-growth assessment tools and performance measures, which can be uniformly applied, is problematic. Finally, the concept of smart growth continues to evolve. Changing political agendas, public policy issues, funding, incentives, and federal and state policy frameworks programs may impact long-term smart-growth planning processes and the ability to measure outcomes.

10.1 Explanation of Research Findings

Both the implementation of smart-growth practices and efforts to measure the effectiveness of initiatives and outcomes have been influenced by a host of socioeconomic, demographic, technological, and environmental factors as well as shifting housing, travel, and communication preferences. Suggestions gleaned from the literature review, informational interviews, and survey of smart-growth scorecard users/developers follow.

10.1.1 The federal and state policy landscape can provide a foundation for and incentivize smart growth.

The roots of the smart growth movement can be traced to concerns over suburban sprawl, environmental issues, and the need to control growth and development. While there is general consensus on the ten principles of smart growth, various factors have shifted the motivation, goals, and implementation of smart-growth policies and practices during the "eras of smart growth." During various phases, smart-growth policy and practices have faced challenges of fiscal restraints, competing interests, political pressures, and shifting consumer and market preferences.

While the federal government policy landscape continues to change, it has provided a firm foundation for smart growth. Federal government technical assistance, public policies, funding programs, and grants have helped to incentivize smart-growth practices at the state, regional, and local government levels. Research shows:

- Availability funding, resources, and technical assistance can strengthen local planning capacity.
- State-enabling legislation, policies, executive orders, guiding principles, directives, and incentives (e.g., funding or technical assistance) foster support for smart-growth practices at the local government level.
- Inter-governmental and inter-agency cooperation/communication are needed for broad-based policy support.
- State level gubernatorial, legislative, and agency support are critical to instituting smart-growth practices at the local level.
- Flexibility and context sensitivity in policymaking are required.
- Successful implementation of smart-growth policies and practices requires strong stakeholder commitment, collaborative public engagement, and coordination across jurisdictions and levels of government.
- Public interest has heightened the interplay among human, social, environmental, and economic sustainability and development trends that favor smart growth.

10.1.2 The study of smart-growth assessment tools has been overshadowed by research on implementation strategies.

Most literature on smart growth has focused on tools and policies to implement smart growth, rather than tools designed to evaluate the outcomes of smart-growth policies and practices (Bengston et al., 2003). Just as there is no uniform definition or implementation strategy for smart growth, there is no prescribed method to measure the effectiveness of smart-growth practices. The body of evidence suggests that:

- Various growth management approaches have received "little systematic evaluation" (Ingram & Hong).
- Sprawl is a real, measurable phenomenon (Ewing et al., 2002; Ewing & Hamidi, 2014).
- Performance measures to systematically track smart-growth progress and outcomes have seemed to be a postscript to smart-growth implementation (Bengston et al., 2003).

10.1.3 Both the concept of smart growth and the development and use of scorecards/assessment tools have co-evolved.

Few studies have gauged causal linkages between shifting smart-growth agendas and the development of new tools to evaluate smart-growth outcomes. This study finds that four distinct eras of smart growth have been identified and transformed by shifting policies, funding incentives, and socioeconomic, sociopolitical, and demographic forces. In the last two decades, the integration of performance management has been advanced into all aspects of an organization's management and policy-making processes (National Performance Management Advisory Commission, 2010). The body of evidence suggests:

- An increasing lack of public trust and demands for greater public accountability.
- Professional associations and advocacy organizations fostered the development of a government-oriented performance management framework.
- Federal government mandates for transparency and accountability reinforced the need for performance measures and metrics at all levels of government.
- Eligibility for federal funding and other incentives for smart growth became increasingly tied to performance measurement and reporting in the early 2000s.

- States aligned smart-growth programs and policy platforms with federal initiatives to qualify for funding and grants.
- As more smart-growth programs were funded and initiated, demand grew for metrics on the outcomes of smart growth.
- Accepted and tested performance measurement approaches, including transportation forecasting and scenario planning, were adapted to assess smart-growth outcomes.
- Several federal funding programs, such as the reauthorization of federal surface transportation funding (beginning with SAFETEA-LU), reflected the new federal emphasis on outcome-based performance measurement.
- Federal programs and the reauthorization of surface transportation funding (beginning with MAP-21) required state DOTs, MPOs, and transit agencies to work more collaboratively and report on progress made toward performance targets.

10.1.4 Measuring smart growth remains a challenge.

Many "best practice" state- and local-level smart-growth scorecards and assessment tools, listed and described on EPA's website, are now obsolete. This study, informational interviews, and survey revealed that new assessment tools reflect federal funding/grant program and requirements for greater transparency, accountability, and performance measurement. Contemporary assessment tools were developed to provide either qualitative data or quantify performance on key indicators of sustainability. Yet, measuring outcomes of smart growth remains challenging.

While the survey of smart-growth scorecard users/developers did not generate statistically significant results, it provided a snapshot of current use of smart-growth assessment tools. It revealed:

- Many local governments have not created customized methods to assess or track progress on smart growth.
- Jurisdictions struggle to measure qualitative aspects of smart growth.
- Organizations use a combination of approaches to evaluate the implementation of smart-growth strategies. Performance indicators, adoption of municipal

ordinances, qualitative-oriented metrics, geospatial analysis, and civic engagement processes such as focus groups are common.

- Smart-growth scorecards/assessment tools may not be used due to lack of capacity, faddish or overuse of the term "smart growth," new policy directions, need for scorecards to be tied to funding/development decisions, "political baggage" associated with tools, fiscal constraints, weak state planning mandates, and/or a new focus on economic resiliency and stability rather than growth management.
- Larger organizations, such as MPOs, have larger pools of resources, professional and technical expertise, and long-standing federal mandates to carry out a transportation-planning program that is performance-oriented; these organizations are more likely to track smart-growth outcomes.
- Although local planning departments/organizations may have not have developed a smart-growth scorecard or assessment tool, many use tracking methods such as GIS analysis to evaluate smart-growth performance.
- Quantitative assessments should be augmented with additional qualitative evaluations to comprehensively determine the success of smart-growth outcomes.

10.1.5 Contemporary smart-growth assessment tools incorporate advanced methodologies and reflect technological advancements and the rise of online digital tools/platforms.

Federal agencies and transportation researchers have played an important role in developing models and tools for analyzing smart growth. Despite well-documented shortcomings, transportation forecasting models became standardized, adapted, and extensively used to predict changes or growth in regional demand for travel.

EPA and AASHTO's Strategic Highway Research Programs (SHRP and SHRP2) have advanced "improved tools and methods to more accurately and comprehensively integrate transportation investment decision-making with land development and growth management" (TRB, 2016, 1). FHWA and FTA have emphasized "next generation" scenario planning as a means to achieve stakeholder engagement, data visualization, informed decision-making, and a framework to develop performance measures.

Advanced methodologies have been developed to address trip-based transportation model shortcomings and respond to changes in transportation policy, technology, and consumer/travel behavior. In addition, newer activity-based transportation modeling and scenario-planning techniques continue to be advanced to engage stakeholders and assess smart-growth outcomes. However, the literature indicates that sophisticated scenario-planning and assessment tools remain out of reach of many local jurisdictions. Transportation modeling for land-use planning is often a function of regional association of governments, state DOTs, and/or MPOs rather than local jurisdictions. Newer activity-based transportation planning models have added more sensitivity to smart-growth strategies, but are expensive and resource-intensive. Considerable technical expertise, staffing resources, and funding are needed for local governments to utilize newer, state-of-the-practice scenario planning, visualization tools, and travel-forecasting models.

A new generation of assessment tools includes both qualitative examples (e.g., checklists, audits, dashboards, charts) and quantitative tools (e.g., scorecards, sustainability indicators, scenario planning, and activity-based transportation-planning tools). New assessment tools, scenario-planning techniques, and interactive visualization tools are being crafted to engage and educate the public on smart-growth-related topics and planning outcomes. This research revealed that:

- Use of clear and concise data visualization is essential to appeal to a wide audience.
- The nature of public engagement is changing. Web-based, interactive visualization tools show promise to integrate high-tech approaches with "high-touch" participatory processes.
- Online digital formats offer a much-needed and dynamic platform with which to satisfy mandates for increased transparency, accountability, and public engagement.
- Creating opportunities to connect and engage stakeholders through online engagement tools, data visualization techniques, and digital interface platforms can augment dissemination of smart-growth outcomes.

10.2 Recommendations to Optimize Use of Contemporary Assessment Tools

Many local governments lack capacity and resources to use advanced activity-based transportation modeling and/or develop contemporary assessment tools. There is greater recognition of the need to build local government capacity and fostering an open environment for information sharing and education. *Opening Access to Scenario Planning Tools*, a 2012 report by the Lincoln Institute of Land Policy, states that while complexity and cost remain barriers, there are opportunities to optimize the use of scenarios and scenario-planning tools. It recommends establishing better data standards, providing for education and technical training, creating a model scenario-planning process, and improving interoperability between platforms through the use of open-source software-development practices (Holoway et al., 2012).

10.2.1 Create and Cultivate Communities of Technology Users

Creating and cultivating communities of technology users that share data, information, and best practices can be effective strategies to optimize the use of contemporary assessment tools. Under the banner of the Open Planning Tools Group (OPTG), the Lincoln Institute hosts a website (www.openplanningtoolsgroup.org/), online clearinghouse, and annual symposium to harness the use of scenario-planning technology and grow a community of users.

Esri, an international supplier of GIS software, web-GIS, and geo-database management applications, has developed several strategies to nurture and build technical expertise of GIS users. An Esri Community has been established to promote collaboration, exchange ideas, and suggestions among GIS users. Esri's ArcGIS Online is a web application that fosters sharing and searching of geographic information as well as content published by Esri, ArcGIS users, and other data providers. Users can create and join groups, and provide access to items shared publicly or within groups. Esri's ArcGIS Open Data allows organizations to use the ArcGIS platform to provide the public with open access to data (Esri, n.d.). Virtual information can be shared via the online GeoNet community. Esri's annual international conference also fosters in-person sharing of user experiences

through technical workshops, plenary sessions, and networking opportunities. Esri also offers online resources for the use of its applications, such as GIS Story Maps. Users who create an ArcGIS Online account can access GIS Story Map resources including examples showcased within its gallery, a series of apps to build a story map, resources to learn the fundamentals of storytelling with maps, and access to a community of users. For Delaware's community of GIS users, the state government created FirstMap Open Data (http://opendata.firstmap.delaware.gov/). The website provides the ability to search, filter, and download Delaware's publicly available spatial data in a variety of formats.

10.2.2 Foster Performance-Based Approaches to Plan for and Evaluate Smart Growth

The Delaware Valley Regional Planning Commission (DVRPC), the Greater Philadelphia area's MPO, recognizes that scenario planning is more than a framework for developing a shared vision for the future. DVRPC uses scenario planning as one aspect of its performance-based approach to multimodal transportation planning. DVRPC's 2014 white paper, *The Future of Scenario Planning,* notes that "scenario planning is most effective if it is part of a broader management program that contains performance measures and strategy implementation" (DVRPC, 2014, 2). DVRPC uses regional indicators to monitor, evaluate implementation, and track performance of its long-range transportation plan goals. As the next generation of scenario-planning tools is being developed, DVRPC suggests "simplifying, gaining acceptance, improving data access, and [facilitating] interoperability between analytical tools" (DVRPC, 2014, 7).

10.2.3 Provide Smart-Growth Incentives and Technical Assistance

State and federal legislation, leadership, political agendas, and funding have shaped the extent to which smart-growth practices are implemented and evaluated at the local government level. Federal and state governments need to continue to incentivize local smart-growth planning, policy adoption, implementation, and evaluation processes through competitive funding processes. Additionally, performance-driven federal and state funding programs are needed that require performance tracking and reporting.

Regional associations of governments, councils of governments, MPOs, state DOTs, state planning agencies, private engineering consultant firms, and university transportation centers (UTCs) have the staffing resources, technical expertise, and funding to develop and promote the use of tools to evaluate smart-growth outcomes. These entities can collaborate to build local government capacity to develop smart-growth plans/policies, implementation strategies, performance-evaluation methods, and visualization tools to engage stakeholders. Moreover, these entities have the resources and capacity to disseminate outcomes of research, highlight best practices, develop shared database(s), and train local officials and the next generation of planners and engineers in state-of-the-art practices.

The Innovative MPO guidebook suggests that MPOs play a key role in building local government capacity to achieve regional transportation and land-use goals. The guidebook states that MPOs should provide technical assistance and collaborate with local communities (Transportation for America, 2014). Because MPOs are federally mandated to work in collaboration with state DOTs, planning agencies, and local governments to coordinate transportation and land-use planning, they are ideally suited to facilitate local government education, outreach, technical assistance, data analysis, and stakeholder engagement. In addition to encouraging the adoption of local policies and supporting smart-growth objectives, MPOs are well equipped to assist with developing implementation strategies and performance measures for evaluation processes and sharing performance-based data.

10.2.4 Support Development of Digital, Interactive, and Visually Appealing Tools

Planning for smart growth requires extensive public and stakeholder outreach and engagement to successfully implement and evaluate policy. This can be achieved by forming collaborative partnerships with diverse stakeholders, building consensus on shared community values, identifying local champions, and cultivating strong leadership.

Complex scenario-planning and activity-based transportation modeling tools continue to be refined and advanced to gauge outcomes of smart-growth-type planning, projects, and

programs. While GIS-based and analytic assessment tools can measure the quantifiable principles of smart growth, they do not measure more abstract or participatory elements (e.g., public engagement). The UD-MU research team recommends that:

- Planners and decision-makers should complement sophisticated assessment tools with qualitative evaluations (e.g., checklists, audits, surveys).
- More web-based, interactive instruments should be created and piloted to further democratize policy- and decision-making (e.g., GIS Story Maps, monitoring techniques, dashboards, sustainability indicators, visualization tools).
- New tools should complement GIS-based and analytic tools by tracking the more subjective aspects of smart growth (e.g., public engagement and place-making).
- Geospatial analysis of land use should be combined with the more participatory dimensions of smart growth to provide a more balanced approach to achieving sustainable communities.
- Both visually appealing high-tech and high-touch public engagement processes should be utilized to illustrate various scenarios at public workshop settings, virtual workshops, online platforms, and via social media.
- An open environment for information sharing, education, and transfer of knowledge should be promoted via access to advanced technology, a community of users, and open data.

11. Appendices

Appendix A – Assessment of EPA Digital Tools to Measure Land-Use Change and Transportation Efficiency

Appendix B – Smart-Growth Scorecard/Assessment Tool Survey

Appendix C – Survey Solicitation Email

Appendix D – Matrix: Contemporary Assessment Tools to Gauge Smart Growth

Appendix E – Literature Review Matrix

Appendix F – References

Appendix A – Assessment of EPA Digital Tools to Measure Land-Use Change and Transportation Efficiency

The Environmental Protection Agency (EPA) has been involved in the creation of tools and models used to measure land-use change and transportation efficiency. This section examines the need for the creation of these tools, the technology behind the tools, and the creation of indicators to measure output. Specifically, the Smart Growth INDEX® (SGI) and Smart Location Mapping, both developed by EPA, are examined in this section.

Background

Transportation networks developed in the United States since the end of WWII have opened access to the countryside causing linear branch development (Bhatta, 2010). Roadways are often cited as a major contributor to sprawl and its impacts. New roads, increased capacity, and additional access help to decrease driving times while promoting lower-density development. Increased automobile dependency and more vehicle miles traveled (VMT) are indicators of sprawl (Southerland, 2004). Communities struggle to balance the demands of growth with the desire to preserve the natural environment. To find this balance, planners need to ask the right questions about the benefits and detriments of growth and have tools in place to answer these questions. Computer models are one tool used in the process to evaluate how social and physical variables affect land-use change (LUC). LUC models are one part of a comprehensive planning approach to predict potential outcomes of policy decisions on land-use patterns (EPA, 2000). Models are estimation techniques that rely on data and mathematical equations to simulate conditions in the real world. Traditionally, transportation and urban economic models formed the foundation of many LUC models.

Two federal Congressional acts, passed in the early 1990s, steer the direction of policy decisions about LUC in the United States. In 1990, Congress passed the Clean Air Act Amendments (EPA, 2013) mandating metropolitan areas to look at the relationships between transportation and air quality. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 (RITA, 2015) required transportation planners to consider likely

effects of transportation policy decisions on land use and development and how to match transportation plans with provisions of land-use development plans (EPA, 2000). These two Congressional actions resulted in linking transportation planning and land-use development plans (comprehensive plan) with air quality, energy conservation, and transportation access. These two acts provide the motivation for EPA's involvement in smart growth policy development and implementation.

Geographic information system (GIS) software is designed to capture, manage, analyze, and display all types of geographic information. Data in GIS are geo-referenced to the coordinates of a particular projection, which allows precise placement of features on the earth's surface while preserving the spatial relationship among features. These geo-referenced sets of data are commonly called "layers." Layers can be overlaid and linked to tables of additional data about features on the map. This data allow for analysis of spatial patterns at multiple levels of scale. Trends and interactions can be analyzed and visualized to foster better decision-making (EPA, 2000).

Community design is based primarily on GIS data. Many local governments now have data layers that contain information on tax records, LUC, zoning, floodplains, etc. The use of GIS to identify dimensions of sprawl and calculate normalized measures of sprawl rankings is an ongoing process. Early attempts used quantifiable characteristics—such as density, land use mix, and street connectivity—to measure sprawl (Knaap, Song, & Nedovic-Budic, 2007).

"D" Variables

Early quantifiable characteristics of the built environment were often named with words beginning with D. These influences came to be called "D" variables. Density, diversity, and design were the original D variables identified by Cervero and Kockelman (1997). Destination accessibility and distance to transit (Ewing & Cervero, 2001) followed later as the fourth and fifth D variables. Demand management, present in some studies as a sixth D, includes parking supply and cost.

Demographics are the seventh D. Demographics are not part of the built environment, yet have an influence in travel studies.

Literature (Ewing & Cervero, 2010) has identified the usefulness of D variables to measure land use and the urban form. The D variables include:

- Density – Measured as the variable of interest per unit of area. Density variables summarize population, housing, or employment within a block group.
- Diversity – Refers to the relative mix of land uses in each block group based on housing unit counts and job counts by employment sector.
- Design – Includes street network characteristics within the area. Street networks vary from dense interconnected urban grids to sparse suburban streets with low connectivity (EPA, 2015).
- Distance to Transit – Measures transit availability, proximity, frequency, and density of transit services measured as an average of the shortest street routes from residences and workplaces in an area to the closest bus or train stop (EPA, 2015).
- Destination Accessibility – Measures ease of access to trip attractions. Attractions can simply be a location like a central business district or the number of jobs in a certain travel time.

The D variables are not perfect measures. Some dimensions overlap but, D variables are still useful for providing order-of-magnitude insights (Ewing & Cervero, 2010).

The most common travel outcomes modeled are trip frequency, trip length, mode choice, VMT and Vehicle Trips (VT). Using 14 travel studies that included socio-demographic controls, we previously synthesized the literature on the elasticities of VMT and VT with respect to density, diversity, design, and destination accessibility (Ewing & Cervero, 2001). EPA incorporated these summary measures into its SGI model. The SGI model measures density as residents plus jobs per square mile; diversity as the ratio of jobs to residents divided by the regional average of that ratio; and design as street network density, sidewalk coverage, and route directness (road distance divided by direct distance). Two of these three measures relate to street network design.

Quantitative Measures

Meta-analyses have both advantages and disadvantages from individual primary studies (Ewing & Cervero, 2010). The main advantage is that all available research on the topic is aggregated, allowing patterns to be found. Aggregated study sample results can generalize more than those of primary studies. Disadvantages of combining study results for meta-analysis include corrupting the results of strong studies with the results of weaker studies. The differences among the primary individual studies in technique, variables, and sampling units can result in comparing "apples and oranges."

A common measure of effect size is needed to combine and compare results from various studies. The common metric used in the meta-analysis (Ewing & Cervero, 2010) is the elasticity of some outcome with respect to one of the D variables. Elasticity is the ratio of the percentage change in one variable associated with the percentage change in another variable. The associations of these variables are measured as a unitless value that can be used for comparison of effect size. For outcomes measured as continuous variables, an elasticity can be interpreted as the percent change in the outcome variable when a specified independent variable increases by 1 percent. For outcomes measured as categorical variables, elasticity can be interpreted as the percent change in the probability of choosing that alternative when the specified independent variable increases by 1 percent. Elasticities can be applied in sketch planning to model estimates of transit use relative to a base scenario or in post-processing travel forecasts to reflect the influence of "D" variables (Ewing & Cervero, 2010).

Sketch Planning

The goal of sketch planning is to provide a comprehensive forecasting model based on the interrelated pros and cons of potential future land use for better decision-making. Sketch planning methods have been used in economic studies since the 1960s. Its consistent application to urban and regional planning began around 2000. The recent popularity of sketch planning is due in part to advances in computer and data management technologies along with the increased availability of GIS and digital spatial

data (Holway, Gabbe, Hebbert, Lally, Matthews, & Quay, 2012). Sketch planning tools produce general order-of-magnitude estimates of travel demand and transit operations in response to changes in the built environment. Sketch planning tools perform analytical functions using simplified analytical techniques and highly aggregated data. Sketch planning is typically the simplest and least costly of analysis techniques, but can be limited in scope and analytical robustness (U.S. Department of Transportation, 2015).

The two types of sketch planning in use today are normative and exploratory. Normative sketch planning attempts to reflect the values of a region by determining opinions about various possible visions of the future. A common set of future goals, based on the identified values, can be determined by comparing the pros and cons of several scenarios. This type of sketch planning is most often applied to major policy decisions that could have a large impact on the future of the community. A scenario is created for each policy approach—usually ranging from the least aggressive (do nothing) to most aggressive actions—relative to a baseline. Exploratory sketch planning predicts how future conditions may affect established policies and goals. These results are used to create contingency plans for a range of future conditions. Assessment of how each scenario affects the community can be used to identify and plan for potential opportunities or threats (Holway, Gabbe, Hebbert, Lally, Matthews, & Quay, 2012).

EPA has been involved in the development of use of sketch planning tools for use in smart growth and transit studies since 1998. The first model developed by EPA, in partnership with Criterion Planners, is the Smart Growth INDEX®. EPA no longer supports this tool and now uses a set of two data products collectively named Smart Location Mapping.

Smart Growth INDEX®

Realizing the need for an analytical tool to measure smart growth, in 1998 EPA developed the Smart Growth INDEX® (SGI), a GIS sketch tool for comparing alternative land-use and transportation scenarios and evaluating their outcomes using community and environmental outcome indicators. An underlying assumption of SGI is that

population and employment growth are directly related to accessibility to transportation and infrastructure services (EPA, 2000). SGI was intended to help stakeholders and decision-makers create plans by identifying important issues while analyzing alternatives and setting goals. Through evaluating proposed plans against goals of the community, SGI facilitated decision-making, measure progress over time, and evaluate outcomes.

SGI was aimed at helping communities evaluate, prioritize, and implement regional growth management plans, land-use and transportation plans, neighborhood plans, land development proposals, and environmental impact reports and allowed the users to review special projects including but not limited to brownfield redevelopment. Using GIS data, SGI can prepare and evaluate a baseline scenario used to compare against alternative scenarios that factors in as many as 56 indicators. The indicators can range from land consumption to housing and employment density. In addition, SGI measures factors such as pollution emissions or proximity to transit. While SGI is able to address effects of transportation infrastructure, city or county master plans, and environmental qualities, it is unable to provide effects of fiscal policies and fiscal conditions or offer insight into school quality and crime—all of which are important facets of land use, development, and growth (EPA, 2000).

Tailored by EPA's smart growth principles, SGI operated in two modes: the forecast mode and the snapshot mode. The forecast mode used demographic and economic indicators such as population and employment projections of a given area to estimate a community's land-use plan, environmental constraint areas, infrastructure service areas, development incentive areas, and transportation system capabilities over a period of years. Forecast outputs are summarized in Table 1.

Table 1: Forecast Analysis Outputs (EPA, 2000)

- Growth Compactness
- Employment Density
- Incentive Area
- Housing-Transit Proximity
- Jobs/Housed Workers Balance
- Mode Split
- Air Pollution
- Residential Energy Consumed
- Residential Population
- Land-Use Mix
- Housing Density
- Employment-Transit Proximity
- Vehicle Miles and Hours Traveled
- Auto Travel Cost
- Climate Change
- Water Consumed

The snapshot mode estimates the impacts of known alternative development plans and can provide insight to impacts by adjusting land-use designations, mixes of housing and job types, or transportation system characteristics at a given point in time. Snapshot outputs are summarized in Table 2 below.

Table 2: Snapshot Analysis Outputs (EPA, 2000)

- Population Density
- Residential Density
- Housing Proximity to Transit
- Employment Density
- Street Connectivity
- Criteria Air Pollutant Emissions
- Housing Proximity to Recreation
- Pedestrian Orientation
- Vehicle Miles Traveled
- Street Network Density
- Residential Water Consumption
- Land-Use Mix
- Diversity of Housing Type
- Jobs/Housed Workers Balance
- Employment Proximity to Transit
- Energy Consumption
- Park Space Availability
- Open Space
- Pedestrian Route Directness
- Vehicle Trips
- Auto Travel Costs
- Greenhouse Gas Emissions

In 2000, EPA selected 20 communities from 17 states for a beta test aimed at testing, evaluating, and providing feedback on SGI while participating in the planning process for future development of these 20 communities. SGI pilot focused on locating strong prospects for improved environmental, economic, and community outcomes and a high potential of environmental benefits through smart growth. Through this program, EPA hoped to address problems such as traffic congestion and air pollution, fostering and maintaining a sense of place and minimization of infrastructure such as water, sewer, and roads while adding important facets of a livable community.

The pilot programs were spread over six categories: (1) transit authority, (2) non-governmental organizations, (3) counties, (4) cities, (5) state agencies, and (6) metropolitan planning organizations (MPOs)/councils of governmental entities. These 20 agencies focused on comprehensive planning, transit-oriented development, urban revitalization, and corridor planning. These pilot communities were able to use SGI to analyze actions specific to their communities and estimate the impact of these actions. In Baltimore, planning officials estimated that smart growth development would reduce daily VMT per capita as well as annual per capita emissions of harmful gases. In Boston, SGI was used to evaluate the impacts of job and housing growth on the traffic congestion. The addition of jobs and housing showed slight incremental effects on the indicators selected to measure congestion, but the addition of many developments would have a larger impact on the city.

Based on users' experience with SGI, advances in ArcGIS technology, and evidence-based research, EPA continued to refine its analytical resources and tools for public use. It focused on the need to provide user-friendly resources and interactive maps, in various formats, to dynamically and quickly display information.

Smart Location Mapping

In 2011, EPA's Office of Sustainable Communities developed a Smart Location Mapping resource to fulfill the need to better understand the effect of land use/urban form on transportation outcomes. To explore location efficiency, EPA made available two new data products via its website: the Smart Location Database (SLD) and the Access to Jobs and Workers via Transit Tool. Use of these tools is designed to enable analyses of neighborhood conditions, evaluation of potential development locations, scenario planning/travel demand modeling, and comparisons of urban form among metropolitan areas. The resources are designed for use by a variety of stakeholders including local governments, metropolitan planning organizations (MPOs), regional planning commissions, and private developers or real estate professionals.

The resource was developed as the result of an EPA-funded meta-analysis (Ewing & Cervero, 2010) of research literature on the urban form and transportation with the purpose of drawing generalizable conclusions for land planning and urban design. The goal was to

quantify effect sizes, update earlier work, include additional outcome measures, and address the methodological issue of self-selection. The SLD tool aggregates data from a number of sources (Table 3) and calculates the D variables used as independent variables for this research (EPA, 2015). These data sources were picked because they are maintained at consistent periods of time that allows for longitudinal studies on the dataset.

Table 3: Smart Location Database Data Sources (Ramsey & Bell, 2014)

Source	Data
Block Ground Boundaries	• 2010 U.S. Census TIGER (Topologically Integrated Geographic Encoding and Referencing)/Line shapefiles • Basic geographic dataset to which all SLD variables are appended • 2010 Block group centers of population used in geo-processing routines developed for spatially derived variables • The U.S. Census provides tables relating county and county equivalent areas to core based statistical areas and combined statistical areas
2010 U.S. Census	• Basic population, demographic, and housing data for Census Block Groups (CBGs)
ACS	• Additional socioeconomic and demographic variables from the 2006–2010 American Community Survey (ACS) Five-Year Estimates
Longitudinal Employer-Household Dynamics (LEHD)	• Summary of employment at the census-block level
InfoUSA	• Employment variables for Massachusetts
NAVTEQ	• NAVSTREETS for developing spatially derived variables such as intersection density and automobile accessibility metrics • Nationwide street network dataset rich with information
PAD-US	• Protected Areas Database (PAD-US) used to identify land area protected from development
TOD Database	• Inventory of existing, planned, and proposed fixed-guideway transit station location • Includes heavy rail, light rail, commuter rail, streetcars, bus rapid transit, and cable cars
GTFS	• General Transit Feed Specifications (GTFS) to share transit schedules and associated geographic information in a common format • GTFS files contain stop locations, stop times, routes and trips, and other attributes of the transit network

The Smart Location Database (EPA, 2015) is a nationwide geographic data resource that measures location efficiency. It uses more than 90 attributes summarizing characteristics of the built environment. Using Census block data, the Smart Location Database uses variables across categories including density, diversity of land, urban design, transit service, destination accessibility by transit, destination accessibility by car, demographics, and employment (Table 4).

Table 4: Smart Location Database Variables (D Variables) (EPA, 2015)

Category	Variables
Density	• Gross resident density (housing units per acre) on unprotected land • Gross population density (people per acre) on unprotected land • Gross employment density (jobs per acre) on unprotected land
Diversity of Land Use	• Jobs per housing unit • Employment entropy (employment diversity) • Employment and housing entropy
Urban Design	• Street intersections per square mile • High-speed road network density
Transit Service	• Aggregate transit service frequency, afternoon peak period • Transit service density, afternoon peak period • Distance to nearest transit stop
Destination Accessibility by Transit	• Jobs within a 45-minute transit commute • Working-age population with a 45-minute transit commute
Destination Accessibility by Car	• Jobs with a 45-minute drive • Working-age population within a 45-minute drive
Demographics	• Percentage of households with no car, 1 car, or 2 or more cars • Percentage of workers that are low, medium, or high wage (by home and work locations)
Employment	• Employment totals broken down by 5-tier classification scheme • Employment totals broken down by 8-tier classification scheme

The Access to Jobs and Workers Via Transit Tool (EPA, 2015) is a geospatial data resource and mapping tool available on the Internet that compares the accessibility of neighborhoods via public transit. This tool summarizes the accessibility to jobs as well as accessibility by workers, households, and population. A drawback to the Transit Tool is the fact that mapping is limited to metropolitan regions served by transit agencies and shares their data appropriately. Variables included in the Transit Tool include an accessibility index, population access by transit/percentage of population with access by

transit, jobs accessible by transit/percentage of regional jobs accessible by transit, workers with access by transit/percentage of workers with access by transit, low-wage workers with access by transit/percentage of low-wage workers in region with access to transit, and low- to medium-wage workers with access to transit/percentage of all low- to medium-wage workers in region with access to transit (Table 5).

Table 5: Access to Jobs and Workers Via Transit Tool Variables (EPA, 2015)

Map Layer Name	**Description**
Accessibility Index	An index of the relative accessibility of a block group compared to other block groups in the same metropolitan region, as measured by travel time to working-age population via transit
Population with Access to Transit	Total population able to access the block group within a 45-minute transit and walking commute
Percentage of Population with Access by Transit	Total population able to access the block group within a 45-minute transit and walking commute as a percentage of total regional population
Jobs Accessible by Transit	Total jobs reachable within a 45-minute transit and walking commute
Percentage of Regional Jobs Accessible by Transit	Total jobs reachable within a 45-minute transit and walking commute as a percentage of total regional jobs
Workers with Access by Transit	Employed population able to access the block group within a 45-minute transit commute from their home location
Percentage of Workers with Access by Transit	Employed population able to access the block group within a 45-minute transit commute from their home location as a percentage of total regional employed population
Low-Wage Workers with Access by Transit	Workers earning $1,250 or less per month who can reach the block group within a 45-minute transit commute from their home location
Percentage of All Low-Wage Workers in Region with Access by Transit	Low-wage workers who can reach the block group within a 45-minute transit commute from their home location as a percentage of all low-wage workers in region
Low-Medium Wage Workers with Access by Transit	Workers earning $3,333 or less per month who can reach the block group within a 45-minute transit commute from their home location
Percentage of All Low-Medium Wage Workers in Region with Access by Transit	Low-medium wage workers who can reach the block group within a 45-minute transit commute from their home location as a percentage of all low-medium wage workers in region

Smart Location Mapping can be used to compare existing neighborhood conditions by viewing regional benchmarks for neighborhoods in the same metropolitan region. The SLD is also being used to develop indicators of location efficiency in addition to scenario planning and travel-demand modeling. Planners are able to use indicators from the data as a baseline scenario for planning, sketch planning, and travel-demand studies. These datasets can be used to compare metropolitan regions based on urban form characteristics as well as estimation of surface growth based on land-use development scenarios (EPA, 2015). These new tools are able to measure standardized measurements over time to compare communities or to monitor a community's change over time.

EPA lists several suggested uses for the SLM data tool on its website (EPA, 2015):

- **Assessing and Comparing Neighborhood Conditions**
  Users can browse either dataset using an interactive map to assess and compare conditions across different neighborhoods and communities. Access to Jobs and Workers Via Transit includes regional benchmarks to compare the performance of a neighborhood to the highest and average performing neighborhoods in the same metropolitan region.
- **Developing Indicators of Location Efficiency**
  EPA is using the SLD to develop simple indicators of location efficiency.
- **Scenario Planning and Travel-Demand Modeling**
  Planners can use indicators from these datasets as baseline information for scenario planning, sketch planning, and travel-demand studies when more detailed or consistent local data are unavailable. Analysts can also use elasticities to adjust outputs of travel or activity models that are otherwise insensitive to variation in the built environment.
- **Conducting Nationwide Research Studies and Developing Tools**
  EPA is conducting a nationwide modeling study to predict commuting travel based on characteristics measured in the SLD. This study and others like it assist in creating online tools to help more communities analyze the potential outcomes of proposed land-use development.

- **Comparing Urban Form among Metropolitan Regions**
  Researchers can use these datasets in nationwide studies that compare metropolitan regions based on urban form characteristics.
- **Modeling Impervious Surface Growth**
  The Impervious Surface Growth Model (EPA, 2013) was created from the SLD and NLCD to estimate new impervious surface growth associated with land-use development scenarios.

Comparison of SGI and SLM

EPA was involved in the development of both SGI and SLD tools. EPA's interest in transportation planning and smart growth policies stem from an obligation to protect the environment. EPA offered these two tools to interested parties at no cost. The SLD is available as a free web service or data can be downloaded for use in a GIS. SGI is no longer supported by EPA. The primary objective behind both SGI and SLD are the same. Both these tools use available data to evaluate community and environmental impacts of land use and transportation (EPA, 2015). The output of both tools includes indicators. These indicators are created through analysis of research in transportation and land-use studies.

SGI is a stand-alone GIS application that operates without standard GIS platforms like ArcGIS. However, SGI requires shapefiles created with ESRI GIS as inputs to the database. The database stores shapefiles for any geographic area the user wishes to sketch. The geographic scope of analysis can range from multi-county regions down to single neighborhoods, and users can choose from 56 indicators to evaluate sketches (EPA, 2015). Data requirements for sketches are determined by the number of indicators. Users can add data for all indicators to the database, or data can be added on an as-needed basis depending on the indicator selection (Criterion Planners/Engineers Inc., 2002). In SGI the geography and indicator requirements are established by the user and can vary from sketch to sketch. The task of collecting and properly formatting the data falls on the user.

Unlike SGI, SLD uses data that are collected, aggregated, or created by government agencies and private companies. SLD is available as an interactive web tool or data can be downloaded for use in a GIS. Data are available for the entire country or any area within using the EPA Clip N Ship tool. The data include more than 90 indicators associated with the built environment and location efficiency based on extensive research. EPA plans to add to the available data in future years to allow for longitudinal comparisons of areas. Both SGI and SLD are capable of creating sketches at various geographic scopes and have a number of indicators that can be evaluated depending on the needs of the analysis. Both data products are suitable for analysis at multiple levels of government ranging from local to national.

The basic unit of analysis is one difference between SGI and SLD. SGI uses parcel-level data, while SLD uses Census Block Groups (CBGs). The larger scale of parcel data allows for more detailed data products, showing forecasts for individual parcels. One problem with parcel-level data is that the local government is responsible for producing and maintaining this data. SLD uses CBGs as the basic unit of analysis, which is smaller scale than parcel data. There are benefits to using CBGs. As mentioned earlier, these include the comparable population sizes of CBGs and the consistent data upkeep by the U.S. Census Bureau. The ability of SGI to compare alternative land-use scenarios at the parcel level is lost in the move to CBG-level data.

The availability of a national, standardized data set to measure location efficiency is a valuable tool. The utility of the SLD will increase as EPA adds data for additional years. The ability to track changes in the indicators over time will be an additional analysis tool available to users of SLD. EPA collects and aggregates the data needed for the SLD; the user can easily access the tool when needed. Certainly, time series studies can be done using SGI. The main difference is that the SGI user is responsible for collecting and formatting all the data needed for the analysis.

Appendix B – Smart Growth Scorecard/Assessment Tool Survey

I. Informed Consent

Dear Colleague:

A research team from the University of Delaware and Marshall University is conducting research on behalf of the Mid-Atlantic Transportation Sustainability University Transportation Center (MATS UTC). The study involves identifying and analyzing "best practice" Smart Growth scorecards and assessment tools that have been developed and are being used in the Mid-Atlantic region (New York, New Jersey, Pennsylvania, Delaware, Maryland, Washington, D.C., Virginia, and West Virginia).

As part of the research, the MATS UTC research team is conducting an online survey to determine the nature of Smart Growth scorecards or assessment tools development and the extent to which they are currently being used in the Mid-Atlantic region. You are being invited to participate in the survey because of your professional expertise and/or association with an organization dedicated to building sustainable places and vibrant communities.

The survey should take less than 15 minutes of your time. Your participation in this study is completely voluntary, poses minimal risks, and you can withdraw at any time. You are free to skip any question that you choose. Please be assured that all responses will remain confidential. Information you provide will be used only for research purposes and only on an aggregate level—no personally identifiable information will be collected.

If you would like more information about this survey or this research project, please contact Marcia Scott, Policy Scientist at University of Delaware's Institute for Public Administration at msscott@udel.edu or 302-831-0581.

***1. Please select "yes" if you have read and understand this informed consent statement, are at least 18 years old, and agree to take the survey. Please print a copy of this page for your records. If you elect to not participate in the survey, select "no" and the survey will end.**

- ○ Yes
- ○ No

II. Introduction

Please provide a small bit of information about your organization.

2. The organization(s) you represent is:

- ☐ State government planning agency
- ☐ State Department of Transportation (DOT)
- ☐ Metropolitan planning organization (MPO)
- ☐ Non-governmental organization or institution (NGO)
- ☐ Regional planning commission or agency
- ☐ Local government (city or county)
- ☐ Professional association
- ☐ Advocacy group
- ☐ Other (please specify)

3. Please provide the name of the organization(s) you represent.

4. Please provide the website URL for your organization(s).

III. Development of Smart Growth Scorecards/Assessment Tool

While definitions of Smart Growth vary, the term generally describes a range of planning and economic development strategies designed to manage growth, reduce traffic congestion, contain sprawl, and preserve open space. The Smart Growth Network, a joint activity of the U.S. Environmental Protection Agency (EPA) and several non-profit and government agencies, identifies ten widely accepted principles of Smart Growth. This survey seeks information on your use, or knowledge, of Smart Growth scorecards or assessment tools in the Mid-Atlantic region. The EPA defines Smart Growth scorecards as basic assessment tools that allow communities to rate and analyze the policies and regulations that determine their development patterns.

5. Has your organization developed a Smart Growth scorecard/assessment tool?

- ○ Yes
- ○ No (you can skip to next section by clicking "Next" below.

6. In what year was it developed?

7. Please check any of the following ten EPA Smart Growth principles that are used as benchmarks on the scorecard/assessment tool.

- ☐ Mix land uses
- ☐ Take advantage of compact design
- ☐ Create a range of housing opportunities and choices
- ☐ Create walkable neighborhoods
- ☐ Foster distinctive, attractive communities with strong sense of place
- ☐ Preserve open space, farmland, natural beauty, and critical environmental areas
- ☐ Strengthen and direct development towards existing communities
- ☐ Provide a variety of transportation choices
- ☐ Make development decisions predictable, fair, and cost effective
- ☐ Encourage community and stakeholder collaboration in development decisions
- ☐ Other (please specify)

8. Please list other benchmarks of Smart Growth, which were included on your scorecard/assessment tool, but are not listed as part of EPA's ten principles of Smart Growth.

9. If the scorecard/assessment tool was developed to reflect a state, regional, or local legislative or policy directive to address growth management and (re)development pressures, please provide the name/number of the policy or executive order.

10. What metrics, if any, does your organization track on the use of the scorecard/assessment tool?

11. Is the scorecard/assessment tool currently being used?

- ○ Yes
- ○ No (please explain why)

12. What is the format of the scorecard/assessment tool? Check all that apply.

- ☐ Hard copy
- ☐ Online, downloadable PDF
- ☐ Digital, interactive
- ☐ Map-based tool (e.g., GIS)
- ☐ Other (please specify)

13. If the scorecard/assessment tool is available online, please provide a URL.

14. Who are the targeted user groups(s) for the scorecard/assessment tool? Check all that apply:

- ☐ Policy makers (e.g., elected officials)
- ☐ Administrators and/or professional staff
- ☐ Citizen planners (e.g., non-elected, volunteers such as planning commission members)
- ☐ General public/community members

☐ Advocacy groups

☐ Other (please specify)

15. Select the reasons why your organization developed a Smart Growth scorecard/assessment tool. Check all that apply.

☐ Foster public involvement in Smart Growth, community planning, and decision making

☐ Enhance general knowledge among elected officials and public administrators about Smart Growth planning strategies

☐ Provide incentives based on how well the local project/entity has achieved a state, regional, or local policy directive

☐ Serve as a prerequisite to apply for federal and state grants or loans

☐ Provide criteria or indicators to guide and evaluate growth management and development strategies

☐ Measure the effectiveness of implementation of Smart Growth policies and practices

☐ Present or analyze geospatial information

☐ Ensure that land use and transportation decisions are complementary

☐ Evaluate a community's development practices compared to generally accepted Smart Growth principles

☐ Rate and analyze policies and regulations that determine growth and development patterns

☐ Track policies, codes, and regulations that have been adopted and support Smart Growth

☐ Other (please specify)

16. Is your scorecard/assessment tool geared toward (check all that apply)

- ☐ All communities
- ☐ Rural communities
- ☐ Suburban communities
- ☐ Urban communities
- ☐ Other (please specify)

17. If the scorecard/assessment tool has evolved from its original purpose or format, please explain how and why.

IV. Use of Smart Growth Scorecards/Assessment Tools

18. Do you use a Smart Growth self-assessment instrument developed by another organization or agency?

- ○ No
- ○ Yes (please provide name of organization/agency)

19. Does your organization use other approaches to evaluate the implementation of Smart Growth strategies (check all that apply)?

- ☐ Performance indicators and benchmarks
- ☐ Smart Growth checklist
- ☐ Monitoring tools to track the adoption of Smart Growth policies (e.g., ordinances and regulations)

☐ Social media

☐ Surveys

☐ Audits of adopted plans, policies, and practices that facilitate Smart Growth

☐ Geospatial analysis/mapping and data analysis

☐ Processes (e.g., civic engagement, focus groups)

☐ Other (please specify)

V. Knowledge of Other Organizations using Smart Growth Scorecards/Assessment Tools in the Mid-Atlantic

20. Are you aware of other organizations that have developed Smart Growth scorecards/assessment tools in the Mid-Atlantic region?

○ No

○ Yes (please provide the name of the organization, a URL, and any other relevant information)

21. Is there a Smart Growth scorecard/assessment tool that you consider to be a model or "best practice"?

◉ No

Yes (please provide the name of the organization, a URL, and any other relevant information)

22. Do you have any additional information that can enhance our understanding of why Smart Growth scorecards/assessment tools are, or are not, being used in the Mid-Atlantic region?

No

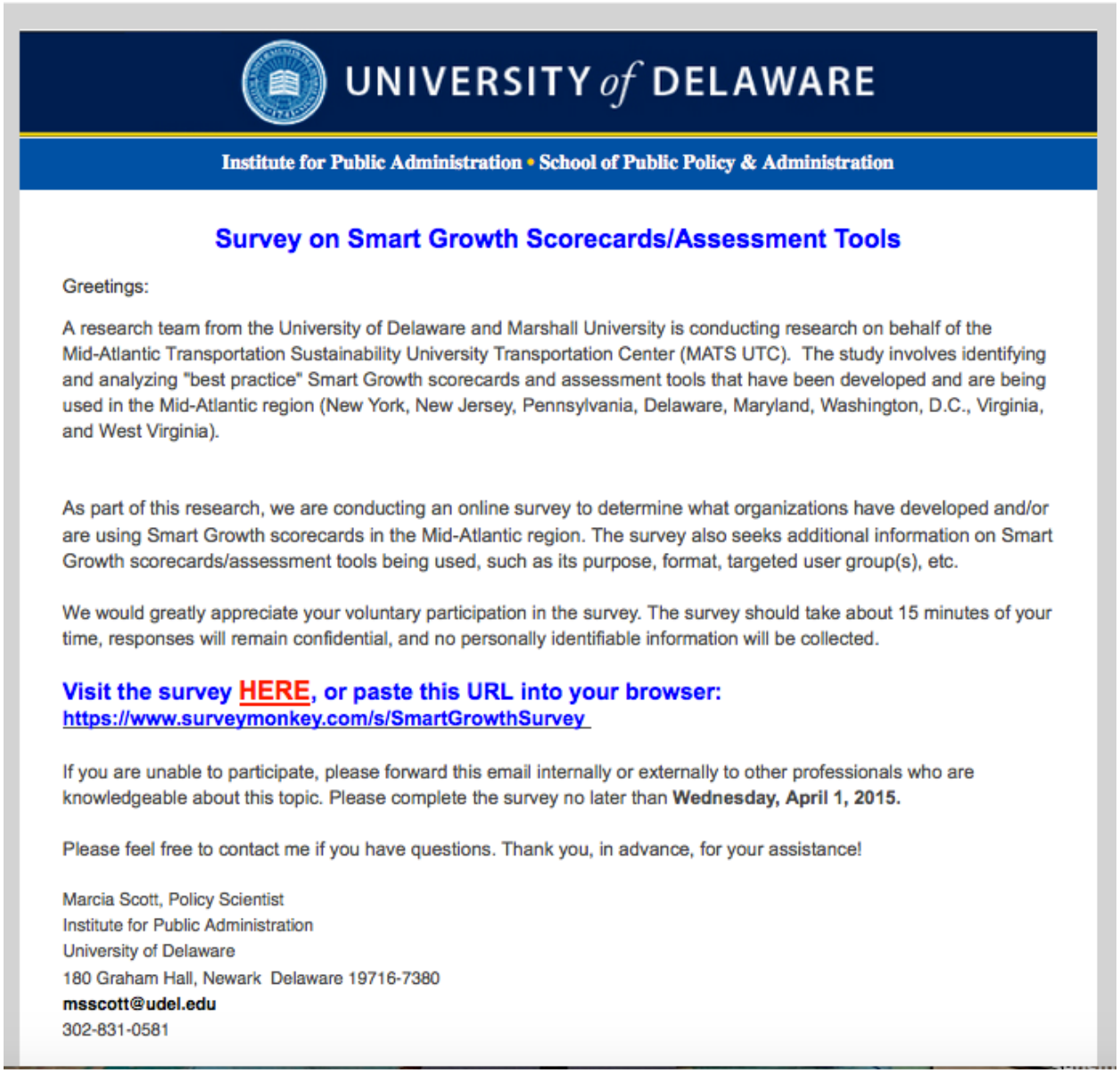
Yes (please specify)

VI. Thank you!

Thank you for taking the time to respond to this survey! We sincerely appreciate your participation.

- The University of Delaware and Marshall University team

Appendix C – Survey Solicitation Email



UNIVERSITY of DELAWARE

Institute for Public Administration • School of Public Policy & Administration

Survey on Smart Growth Scorecards/Assessment Tools

Greetings:

A research team from the University of Delaware and Marshall University is conducting research on behalf of the Mid-Atlantic Transportation Sustainability University Transportation Center (MATS UTC). The study involves identifying and analyzing "best practice" Smart Growth scorecards and assessment tools that have been developed and are being used in the Mid-Atlantic region (New York, New Jersey, Pennsylvania, Delaware, Maryland, Washington, D.C., Virginia, and West Virginia).

As part of this research, we are conducting an online survey to determine what organizations have developed and/or are using Smart Growth scorecards in the Mid-Atlantic region. The survey also seeks additional information on Smart Growth scorecards/assessment tools being used, such as its purpose, format, targeted user group(s), etc.

We would greatly appreciate your voluntary participation in the survey. The survey should take about 15 minutes of your time, responses will remain confidential, and no personally identifiable information will be collected.

Visit the survey HERE, or paste this URL into your browser:
https://www.surveymonkey.com/s/SmartGrowthSurvey

If you are unable to participate, please forward this email internally or externally to other professionals who are knowledgeable about this topic. Please complete the survey no later than **Wednesday, April 1, 2015.**

Please feel free to contact me if you have questions. Thank you, in advance, for your assistance!

Marcia Scott, Policy Scientist
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302-831-0581

Appendix D – Matrix: Contemporary Assessment Tools to Gauge Smart Growth

CONTEMPORARY ASSESSMENT TOOLS TO GAUGE SMART GROWTH				
Tool Name (URL)	**Entity (Type)**	**Year Developed**	**Intended User**	**Description/Key Points**
Qualitative Tools				
Checklists				
New York Checklists for Smart Growth (1) Checklist for Proposed Development Projects (www.dot.ny.gov/programs/smart-planning/repository/SGCheck_Development_Print.pdf) **(2) Checklist for Municipal Land Use Planning and Management** (www.dot.ny.gov/programs/smart-planning/repository/SGCheck_Municipal_PRINT.pdf)	New York State Department of Transportation (DOT)	2010	Municipalities	New York State enacted the Smart Growth Public Infrastructure Policy Act (SGPIPA) in September of 2010. The Act's intent is to minimize the "unnecessary cost of sprawl development." 1) **Proposal Development Project Checklist** is designed to ensure that Smart Growth is considered in new projects funded or supported by the state. 2) **Municipal Land Use Planning Checklist** is designed to help municipalities evaluate whether or not current land use planning and management practices align with the state's guiding principles of smart growth.
Placemaking Assessment Tool (http://landpolicy.msu.edu/uploads/files/Resources/Tools/MIplace_Partnership_Initiative/PlacemakingAssessmentTool_LPI_updated_041515.pdf)	Michigan University Land Policy Institute and Michigan State Housing Development Authority (academic)	2015	Planners, Elected Officials, Neighborhood Associations, Civic Groups, Consultants	The Placemaking Assessment Tool (PAT) is designed to help communities decide which of four different types of placemaking will help them transform their downtown, or key places, into better-quality places that people enjoy. **A short PAT is designed to help stakeholders** understand what activities contribute to vital places and how community organizations and community plans and ordinances can set the stage for effective placemaking. **A more extensive Strategic PAT is designed to** improve the ability of a community to attract and retain talent and other economic development purposes.

CONTEMPORARY ASSESSMENT TOOLS TO GAUGE SMART GROWTH				
Tool Name (URL)	**Entity (Type)**	**Year Developed**	**Intended User**	**Description/Key Points**
Audit				
Smart Growth Implementation Toolkit (www.smartgrowthamerica.org/leadership-institute/implementation-tools)	Smart Growth America (advocacy organization)	2007	Local Governments	A set of tools was created to help communities implement smarter growth and sustainable development strategies. These tools include: (1) **Smart Growth Policy Audit** – Allows communities to simply check off how well they are achieving each of the ten smart growth principles (www.smartgrowthamerica.org/documents/policyaudit.pdf) (2) **Smart Growth Code and Zoning Audit** – Enables communities to simply identify (Y or N) whether the regulatory landscape supports or blocks smart growth. (www.smartgrowthamerica.org/documents/zoningaudit.pdf) (3) **Smart Growth Project Scorecard** – Designed to help communities evaluate the extent to which a proposed development project matches a vision for smart growth. (www.smartgrowthamerica.org/documents/scorecard.pdf)
Quantitative Assessment Tools				
Scorecards				
***Designing for Smart Growth, Creating Great Places in the San Diego Region*, Ch. 10: Scorecard** (www.sandag.org/uploads/projectid/projectid_344_9168.pdf)	San Diego Association of Governments (MPO)	2009	Local Jurisdictions, Community Organizations	Designed to determine whether or not a proposed development or streetscape project incorporates design issues that are addressed in *Designing for Smart Growth.* Includes a set of 14 questions about land use, proximity to transit, accessibility, design, and aesthetics. Scorecard may be tailored for use by local jurisdictions to reflect development priorities.
Arizona Smart Growth Scorecard (http://azdot.gov/docs/default-source/planning/smart-growth-scorecard-application.pdf?sfvrsn=4)	Arizona Department of Commerce, Office of Smart Growth (state government)	2009	Local Governments	Voluntary, incentive-based, self-assessment tool that local jurisdictions can use to evaluate the effectiveness of their planning and development efforts. The Governor's Growth Cabinet designed the scorecard to: (1) Provide a tool for local communities to evaluate themselves (2) Assist state agencies in providing land-use planning technical assistance (3) Provide criteria for state agencies to use in distributing discretionary funds

CONTEMPORARY ASSESSMENT TOOLS TO GAUGE SMART GROWTH				
Tool Name (URL)	**Entity (Type)**	**Year Developed**	**Intended User**	**Description/Key Points**
Colorado Community Sustainability Guide: A Self-Assessment Tool for Local Governments (www.colorado.gov/cs/Satellite?c=Document_C&childpagename=DOLAMain%2FDocument_C%2FCBONAddLinkView&cid=1251594822897&pagename=CBONWrapper)	State of Colorado (state government)	2010	Local Governments	Now used instead of 2003 Colorado Smart Growth Scorecard. The self-assessment tool is designed for local governments to "guide an informed" dialogue that will result in sustainable development practices. Recommends that dialogue/assessment will be followed by objectives-based action plan, measurement, and reporting. Provides 12 evaluation criteria for communities to assess the need to improve community sustainability and quality-of-life criteria. Uses a 0–3 rating score.
Regional Smart Growth/Transit-Oriented Development Plan (www.dot.ca.gov/hq/tpp/offices/ocp/dist10/fy09-10/SJCOGFinalPlan.pdf)	San Joaquin Council of Governments (COG)	2012	Local Governments	Designed to provide a means for evaluating smart-growth-related projects proposed for funding under SJCOG's Smart Growth Incentive Program (SGIP). Scorecard focuses on the transportation infrastructure and planning projects that can be funded through the SGIP program. The scorecard evaluates projects in three key ways: (1) Smart Growth Characteristics (2) Financial Efficiency (3) Project Readiness and Matching Funds
Twin Cities Equitable Development Scorecard (www.corridorsofopportunity.org/sites/default/files/PRO-RECE-Toolbox-Lib-CESCEquitDevtPrinciplesOct2014-FINAL.pdf)	Community leaders in Twin Cities, MN (government association)	2014	Planners and Community Members	Scorecard is designed for use by communities as a flexible guide to score the extent to which a proposed development project achieves a community's desired vision and "equitable" community engagement, land-use, housing, economic development, and transportation practices. The scorecard aligns with HUD-DOT-EPA Sustainable Communities Livability Principles.

CONTEMPORARY ASSESSMENT TOOLS TO GAUGE SMART GROWTH				
Tool Name (URL)	**Entity (Type)**	**Year Developed**	**Intended User**	**Description/Key Points**
Sustainable Audit Tools (www.midmichigansustainability.org/)	Michigan State University, School of Planning, Design & Construction (academic)	2014	Communities	Funded primarily through a HUD Sustainable Communities Regional Planning Grant, two assessment tools were developed that enable communities to evaluate the extent to which they achieve the five sustainability categories of Livability, Governance, Environment, Community, and Economy: 1. **Basic Self-Assessment Tool** – Provides 19 indicators of sustainability, divided into the five sustainability categories of each indicator and has associated Yes/No metric questions to provide a basic measure of community progress toward sustainability 2. **Advanced Self-Assessment Tool –** Provides 32 indicators, and associated metrics, divided into the five categories of sustainability
Sustainability Indicators				
The San Francisco Indicator Project (www.sfindicatorproject.org/)	San Francisco Department of Public Health, City and County of San Francisco (local governments)	2007	Planners, Community Groups, Academicians, and Journalists	The neighborhood-level data system measures how the city performs in eight dimensions of a healthy, equitable community—environment, transportation, community, public realm, education, housing, economy, and health. Each dimension contains multiple objectives, and each objective is measured by one or more indicators. The goal of this project is to support collaboration, planning, decision-making, and advocacy for social and physical environments that meet the needs of all citizens.

Appendix E – Literature Review Matrix

Literature Review Matrix for MATS UTC Research Project on Smart Growth Assessment Tools

Date	Author(s)	Publisher	Title	Summary/Comments
Federal Agencies, Committees, and Partnerships				
August 2014	Outwater M, Smith C, Walter J, et al.	Second Strategic Highway Research Program (SHRP2), Transportation Research Board	Effect of Smart Growth Policies on Travel Demand	Report outlines tools and methods transportation planners can use to perform scenario planning to determine impact of smart growth policies on travel demand. Specifically, the report focuses on SmartGAP, an open-source software tool that allows planners to test smart growth's effects on peak and nonpeak travel, sprawl, energy reduction and carbon footprints. SmartGAP was tested by three planning agencies that provided feedback on the software and its user's guide (Outwater, et al., 2014).
Fall 2011	Partnership for Sustainable Communities (HUD, DOT, EPA) and USDA	US EPA	Supporting Sustainable Rural Communities	Multi-agency report to promote interagency initiatives that encourage sustainable rural communities. Support for rural communities is guided by the six livability principles adopted by HUD, DOT, EPA and USDA. These principles align fairly well with the ten smart growth principles mentioned in other reports/literature (EPA, 2011).
November 2009	Kevin Nelson (principal author)	US EPA	Essential Smart Growth Fixes for Urban and Suburban Zoning Codes	A guide that local governments can use to modify or replace existing development/building codes and ordinances so that cities can create "complete neighborhoods" that encourage sustainable housing, more transportation options, and preserve open space. Identifies common code barriers to smart growth and ways to improve or change codes (Nelson, 2009).

Date	Author(s)	Publisher	Title	Summary/Comments
January 2006	Development, Community, and Environment Division	US EPA	Parking Spaces/Community Places: Finding the Balance through Smart Growth Solutions	Presents multiple approaches to balancing parking needs with other sustainability goals, i.e., walkability, open space, improving transit options, community character, more affordable housing (EPA, 2006a).
November 2006	Office of Policy, Economics, and Innovation	US EPA	National Award for Smart Growth Achievement	Looks at parking as a component of smart growth and land use and highlights some alternative parking strategies that have been used in urban areas to improve urban space and urban design, protect land, and provide other social benefits (EPA, 2006b).
June 2012	Office of Sustainable Housing and Communities	US HUD	Guidance on Performance Measurement and Flagship Sustainability Indicator Fact Sheets	Memo that focuses on performance measures, "Flagship Sustainability Indicators," and provides guidance for communities on how to track community-based goals in these areas (HUD, 2012).
2010	US EPA; FEMA; City of Cedar Rapids, Iowa; Rebuild Iowa Office; Iowa Department of Economic Development	US EPA	City of Cedar Rapids Smart Growth Code and Zoning Audit (Embracing the River: Smart Growth Strategies for Assisting in Cedar Rapids' Recovery, Appendix, p. 52)	EPA expert team analyzes the scorecard produced by the City of Cedar Rapids to determine its effectiveness and whether it is realizing its full potential. The team determines the scorecard could be altered to reach desired outcomes in regard to project development (EPA, 2010).
State Agencies, Committees, and Partnerships				
April 2010	DVRPC	Delaware Valley Regional Planning Commission	Implementing Connections: A Guide for Municipalities	Offers a concise description of major planning tools and policies available to localities to implement Connections, the DVRPC's regional plan for sustainability. The plan has four key organizing principles: Managing Growth and Protecting Resources, Creating Livable Communities, Building an Energy-Efficient Economy, and Modernizing the Transportation System (DVRPC, 2010).

Date	Author(s)	Publisher	Title	Summary/Comments
2013	Maryland Department of Planning	Maryland Department of Planning	Smart, Green, and Growing Planning Guide	Guide that presents context for land-use planning in Maryland, with background on planning law, summaries of key planning enhancements, overview of Maryland's comprehensive plan for sustainability, information on key land-use planning tools (e.g., ordinances),and a glossary of planning terms (Maryland Department of Planning, 2013).
September 2012	Concentrating Growth Workgroup Report	Maryland Sustainable Growth Commission	Sustainable Maryland 2.0: Financing Smart Growth	Outlines the four goals for revitalizing Maryland's existing/historic neighborhoods: Goal 1: Attract and sustain private investment in revitalization areas and projects; Goal 2: Preserve the authentic "sense of place" and historic character of Maryland communities; Goal 3: Advance green and sustainable development practices in tandem with revital-ization investment; Goal 4: Connect Maryland families to economic opportunity in improving communities. Identifies sources of funding to realize those goals. Includes a "Status Check" on overall statewide progress on key goals and initiatives (Berlage, 2013).
March 2001	New Jersey State Planning Commission	State of New Jersey	New Jersey State Development and Redevelopment Plan Executive Summary	Provides detailed overview of New Jersey's state land-use and development plan, including plan structure, planning goals and strategies for creating livable communities and preserving the natural environment, infrastructure needs, and important indicators and targets (New Jersey State Planning Commission, 2001).

Date	Author(s)	Publisher	Title	Summary/Comments
Nonprofit Coalitions, Research Institutions, and Advocacy Organizations				
October 2003	Hersh R. (coordinator)	New Jersey Future	Smart Growth: The Basics – Smart Growth Recommendations from New Jersey Future	Offers very basic introduction to smart growth and recommendations for achieving adoption of smart growth principles in New Jersey (Hersh, 2003).
August 2012, updated Spring 2013	Seskin & McCann	Smart Growth America and National Complete Streets Coalition	Complete Streets Local Policy Workbook	Policy-development workbook for updating and designing policy and creating policy language to enact complete streets initiatives: better walking and biking, more choice for traveling, connected, integrated networks of streets (Seskin & McCann, 2013).
January 2002	Smart Growth Network	Smart Growth Network	Getting to Smart Growth: 100 Policies for Implementation	Fourth primer in a series. Offers policy suggestions that can help local policymakers put the ten smart growth principles (mixed land uses, compact building design, range of housing choices, walkable neighborhoods, distinctive communities with a strong sense of place, preservation of open space, direct development toward existing communities, transportation choices, predictable, fair and cost effective decisions, and community collaboration) into practice. Suggestions range from zoning changes to incentives ideas to changing building design codes to community stakeholder engagement strategies (Smart Growth Network, 2002).
2003	Smart Growth Network	Smart Growth Network	Getting to Smart Growth II: 100 More Policies for Implementation	This edition offers 100 different policy suggestions that can help local policymakers put the ten smart growth principles (mixed land uses, compact building design, range of housing choices, walkable neighborhoods, distinctive communities with a strong sense of place, preservation of open space, direct development toward existing communities, transportation choices, predictable, fair, and cost

Date	Author(s)	Publisher	Title	Summary/Comments
				effective decisions, and community collaboration) into practice. Suggestions range from zoning changes to incentives ideas to changing building design codes to community stakeholder engagement strategies (Smart Growth Network, 2003).
December 2012	Litman T	Victoria Transport Policy Institute	Understanding Smart Growth Savings: What We Know About Public Infrastructure and Service Cost Savings, and How They Are Misrepresented by Critics	Report reviews estimated savings from smart growth and critiques claims that savings due to smart growth are not substantial (Litman, 2012).
June 2014	Litman T	Victoria Transport Policy Institute	Evaluating Criticism of Smart Growth	Report addresses criticisms of smart growth and provides data and analysis to counter specific authors' inaccuracies and false claims about smart growth (Litman, 2014).
January 2002	Fleissig W and Jacobsen V	Congress for New Urbanism and US EPA	Smart Scorecard for Development Projects	Smart growth scorecards can be used as a method to immediately assess development projects' impacts on sustainability goals and can foster effective communication between community and developer when long-term planning and zoning work has not been completed. This report details how to build a scorecard and what measurements can be used to gauge how well projects meet local smart growth goals (Fleissig & Jacobsen, 2002).
March 2010	Martin SO	*Planning* (APA magazine)	Maryland's Second Generation of Smart Growth: Would have, could have, should have: What happened to this bright idea	Documents the shortcomings of the State of Maryland's attempts to incorporate smart growth into land use and development and discusses the "reboot" of smart growth through new plans and legislation enacted in the past ten years (Martin, 2010).

Date	Author(s)	Publisher	Title	Summary/Comments
Academic Research Publications				
2015	Egilmez G, Gumus S, Kucukvar M	*Cities*	"Environmental sustainability benchmarking of the U.S. and Canada metropoles: An expert judgment-based multi-criteria decision making approach"	Paper looks at sustainability performance measurement scores for 27 U.S. and Canadian metropolitan areas. Provides background on sustainability indicators and benchmarking (Egilmez, Gumus, & Kucukvar, 2015).
2010	Bhatta B	Springer Science & Business Media	Analysis of Urban Growth and Sprawl from Remote Sensing Data. In Advances in Geographic Information Science, Shivanand Balram and Suzana Dragicevic, eds.	The book focuses on methods and models for analyzing urban growth and sprawl. The book reviews studies to examine how methods and models worked successfully in their analysis (Bhatta, 2010).
2003	Coe CK	*Public Performance and Management Review*	"A report card on report cards"	Article discusses validity of report cards as a tool for public administration accountability and best practices for issuing report cards (Coe, 2003).
2009	Jepson Jr	Nova Science Publishers, Inc.	"Planning and Sustainability" in Urban Planning in the 21st Century	Paper explores the specific requirements for the role of the planner and planning processes/ methods as they relate to the somewhat-ambiguous idea of sustainable planning; looks at the problematic relationship between planning and sustainability and attempts to define what a sustainable community is, as well as how "sustainable community character" is built (Jepson Jr, 2009).
2007	Edwards MM and Haines A	*Journal of Planning Education and Research*	Evaluating Smart Growth: Implications for Small Communities	Authors developed a framework to examine how well local governments in Wisconsin were incorporating smart-growth principles in their local planning efforts. They looked at policies and evaluated them as being action-oriented vs. non-action-oriented. Authors evaluated 30 local comprehensive plans and concluded that local communities were only partially adopting a smart

Date	Author(s)	Publisher	Title	Summary/Comments
				growth agenda. Also, larger municipalities and cities were incorporating smart-growth principles in their plans much more than small towns and rural communities, leading to a discussion of applicability of smart growth to small-town planning (Edwards & Haines, 2007).
2011	Hawkins CV	*Policy Studies Journal*	Smart Growth Policy Choice: A Resource Dependency and Local Governance Explanation	Article questions what is behind local governments' decision to adopt smart growth policies. Author draws on interest group theory of local policy and resource dependency theory to explain smart growth policies adopted by local governments in Massachusetts. Examinedhow localities use and are scored in the Commonwealth Capital Scorecard, Massachusetts's version of a smart growth scorecard. Higher scores improve eligibility for funding for specific programs that promote smart growth. Looks at how resource dependency may provide a strong motivation for communities to participate in intergovernmental incentive-based planning program (Hawkins, 2011).
2013	Hawkins CV	*Urban Studies*	Competing Interests and the Political Market for Smart Growth Policy	Looks at the political landscape of five local governments in Massachusetts to analyze influence of pro-growth and smart growth interest groups in local decision-making. Concludes that both real estate and environmental groups influence policy decisions and stresses a collaborative model of decision making so that a larger share of benefits is distributed to more local constituencies (Hawkins C., 2014).
2002	Salkin PE	*Valparaiso University Law Review*	Smart Growth and Sustainable Development: Threads of a National Land Use Policy	Article focuses on federal agencies' policy and regulations that have furthered a land-use and smart growth agenda. Is a fairly good history and inventory of some federal policy acts that have

Date	Author(s)	Publisher	Title	Summary/Comments
				influenced and are influencing land use at the local level. Author asserts that these programs and regulations have amounted to a de facto national land-use policy (Salkin, 2002).
2006	McElfish Jr, J. M.	*Widener Law Journal*	New Paths in Existing Law: Opportunities for Pennsylvania to Avoid Sprawl	Legal analysis of laws and regulations in Pennsylvania that are impacting development and land-use patterns in the state. Author looks at governance, planning, infrastructure, and investment in the state (McElfish Jr, 2006).
2010	Mayer HJ, Danis CM, Greenberg MR	*Local Environment: International Journal of Justice and Sustainability*	Smart Growth in a Small Urban Setting: The Challenges of Building an Acceptable Solution	Article evaluates redevelopment plans of five older suburbs in New Jersey, using GIS models to help jurisdictions understand their land-use decisions and impacts on the community. Authors assert that GIS tools and discussion with local regional and state stakeholders "provide a framework for building a 'bottom-up' regional planning model." Raises some issues expressed by local citizens that may generate resistance to smart growth policies and plans (Mayer, Danis, & Greenberg, 2002).
2007	Knaap G-J, Song Y, Nedovic-Budic Z	*Local Environment: The International Journal of Justice and Sustainability*	Measuring Patterns of Urban Development: New Intelligence for the War on Sprawl	Authors look at urban development patterns through analysis of a number of measures of sprawl for neighborhoods in five urban areas. They conclude that sprawl indexes may not be useful for large metropolitan areas because development patterns vary widely within and across study areas, over time. Many smart growth principles measured in the research have produced mixed results in terms of mitigating sprawl (Knaap, Song, & Nedovic-Budic, 2007).

Date	Author(s)	Publisher	Title	Summary/Comments
2002	Williams DW	*Administrative Theory and Praxis*	Before Performance Measurement	Traces the origins of performance measurement and the use of scorecards and data collection for monitoring productivity, resource allocation, and governmental performance (Williams, 2002).
Smart Growth Scorecards				
2010	Koontz J	Partnership for Smarter Growth	Smart Growth Checklist (Richmond, Virginia)	20 questions; B&W, no graphics, no point or scoring system.
n/a	n/a	New Jersey Future	Smart Growth Scorecard–Proposed Developments	7-Section (seven broad criteria for sustainability) scorecard with point/scoring system.
n/a	n/a	New Jersey Future	Smart Growth Scorecard–Municipal Review	7-Section (seven broad criteria for sustainability) scorecard with point/scoring system.
2001	n/a	Arizona Office of Smart Growth, Department of Commerce	Arizona Smart Growth Scorecard: A Tool for Community Self-Assessment	6-Section scorecard for communities, color graphics, large brochure format, point/scoring system.
2003	Colorado Center for Healthy Communities and the Orton Family Foundation	Healthy Mountain Communities, Orton Family Foundation, and Vermont Forum on Sprawl	Colorado Smart Growth Scorecard: A Community Self-Assessment Tool	10-section questionnaire with simple point system, color, a lot of graphics, large brochure format.
n/a	n/a	Cape Cod Business Roundtable	Cape Cod Growth Management Audit	B&W, 45-question audit, no graphics, no points/scoring.
2005		EcoCity Cleveland	Smart Growth Community Scorecard	47-question score sheet, with point system, no graphics, B&W.
February 2001	n/a	City of Austin Transportation, Planning, and Design Department	Smart Growth Criteria Matrix	3-Section (how and where of development, quality of life, tax base) criteria matrix, point/scoring system, no graphics.
	San Diego Association of Governments	San Diego Association of Governments	Smart Growth Scorecard	14-Section scorecard for specific projects, easy scoring system, well designed, easy to read.
2010	US EPA; FEMA;	City of Cedar	Smart Growth Code and	7-Section scorecard (infrastructure/service

Date	Author(s)	Publisher	Title	Summary/Comments
	City of Cedar Rapids, Iowa; Rebuild Iowa Office; Iowa Department of Economic Development	Rapids	Zoning Audit (Appendix, p. 45)	proximity, protection of land, housing options, mix of uses, transportation options, character and design, bonus criteria).

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