

Triangle Trends Report: Tracking Disruption



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Researched and written for the
Triangle J Council of Governments

by

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INTRODUCTION

The 21st century is a time of accelerating change that is disrupting local communities and the lives of community members. Consider the impacts of the COVID-19 pandemic: who in autumn 2019 anticipated that, a few months later, communities would have to shift to remote operations literally overnight, weather an instant economic crisis, support mass testing and vaccinations, help businesses and residents disproportionately impacted by the pandemic, and more?

The pandemic played out against a backdrop of long-term trends such as climate change, technological disruption, shifting demographics, and increasing socioeconomic inequality. As 2021 drew to a close, *The Economist* asserted that “it is time to face the world’s predictable unpredictability. The pattern for the rest of the 2020s is not the familiar routine of the pre-covid years, but the turmoil and bewilderment of the pandemic era. The new normal is already here.”

The human tendency is to return to the “old normal” by reacting to the crisis of the moment rather than anticipating and preparing for what the future may bring. The profound effects of the COVID-19 pandemic on local governments and the lives and livelihoods of their constituents highlight the need for a more flexible, strategic, and proactive approach that accounts

for the disruptive impacts of change. The question is: how can we operationalize this approach in the work of local governments?

This report is intended as a resource that communities in the Triangle J region can individually and collectively use to begin answering the above question. It builds on Anticipating Change, TJCOG’s October 2021 Regional Summit, by offering a framework for incorporating **strategic foresight** — the ability to anticipate what will likely happen or be needed in the future — into planning, operations, and decision-making. The framework is organized around the concept of **drivers of change**, which are macro issues and trends that are impacting local communities or will impact them in the future. Drivers of change are organized into four broad, interconnected categories: social, technological, economic, and environmental. For each of these four categories, four current or future drivers of change have been selected that are particularly relevant or of interest to the Triangle J region (Figure 1).

As is evident from Figure 1, the drivers of change are in varying stages of development and degree of impact on local communities. Some are well-established and have deep historical roots (for example, housing need and equity, diversity, and inclusion). Others have

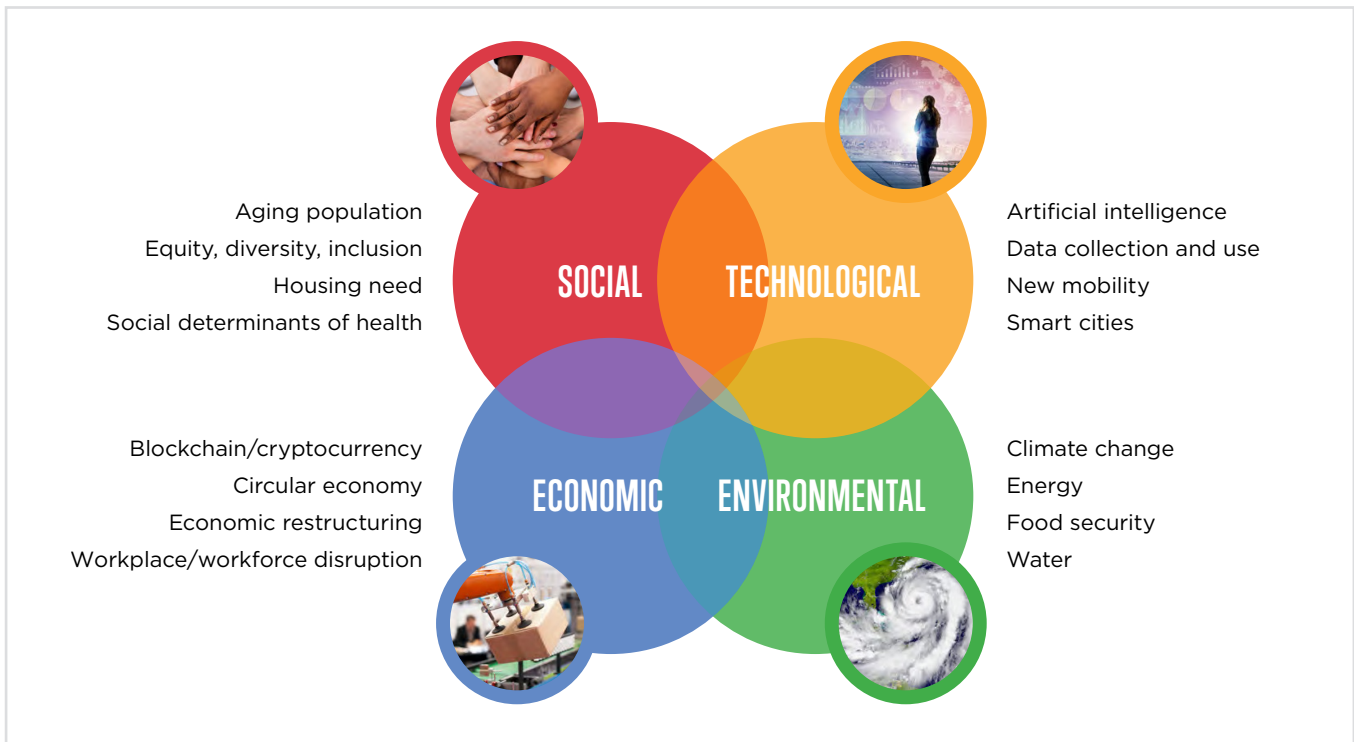


Figure 1. Drivers of Change

risen to the forefront more recently (for example, climate change and economic restructuring tied to the “digitization of everything”). Still others (primarily technological) are emergent, with their full impacts to be felt in the future (for example, artificial intelligence, blockchain/cryptocurrency, and smart cities). The basic premise is that communities need to address drivers of change in a proactive, integrated manner (rather than the piecemeal, reactive way that is the norm) if they are to successfully prepare for change.

The main part of this report contains briefs for the 16 drivers of change shown in Figure 1. Each brief begins with an overview of the driver of change and its societal implications. It then identifies other drivers to which it relates; outlines considerations for the Triangle J region and potential responses at the community and regional levels; and concludes with some key statistics and references. The potential responses are organized into short, mid, and long-term timeframes

corresponding to the “Cone of Uncertainty” strategic planning model (see Figure 2 below). They are offered not as definitive recommendations, but rather as initial ideas to stimulate discussion and further development of overall directions, strategies, and actions to address the driver’s impacts (ideally in coordination with related drivers).

Web links are provided to references cited in each brief, as well as to selected resources of interest (for example, noteworthy plans, initiatives, or websites that address the driver of change covered by the brief). Appendix A contains additional links to general resources related to drivers of change.

The drivers of change covered by this report are, of course, not exhaustive. Examples of others that could be added to the list include immigration (social), autonomous vehicles (technological), ethical consumption (economic), and resource depletion (environmental).

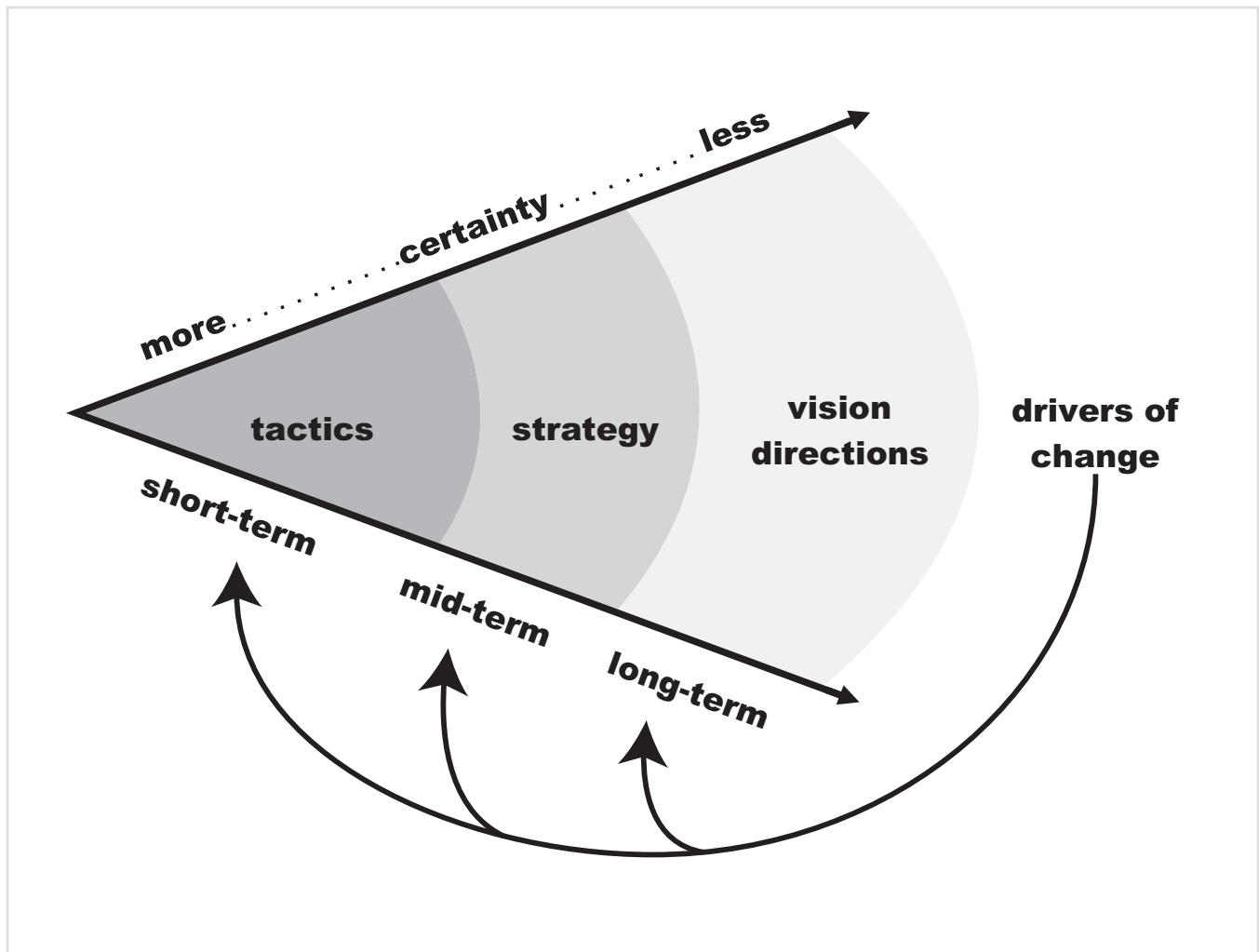


Figure 2. Cone of Uncertainty Strategic Planning Model
 (Source: Rouse and Piro 2022, p. 211)

The format allows for supplemental briefs to be added over time as new issues and priorities identified by local jurisdictions and TJCOG arise.

Cone of Uncertainty Strategic Planning Model

The dizzying pace of technological advancement, acute shocks like the Great Recession of 2008 and the COVID-19 pandemic, and the intensifying impacts of climate change illustrate the uncertainty inherent in dealing with change. The Cone of Uncertainty is a strategic planning model and tool that can be used to help a community or organization prepare for change in an increasingly unpredictable environment.¹ As shown in Figure 2, this tool integrates short, mid, and long-term thinking to deal with increasing uncertainty. In the short term (the timeframe of the annual budget and work program, when conditions are most certain), the focus is on **tactics** — concrete actions and activities that advance community and organizational goals. As uncertainty increases in the mid term (say 2-5 years), the focus shifts to broader **strategies** to achieve the goals. Looking further into the future (5+ years, when conditions are least certain), the focus is on longer term strategic directions to achieve a desired **future vision**.

A couple of key points should be kept in mind when applying this model. The first is to think through the timeframes both simultaneously and sequentially – in other words, all together (a form of systems thinking) as well as one after another (conventional linear thinking). For example, short-term tactical interventions and mid-term strategy development should account for

the potential long-term impacts of drivers of change such as climate change or artificial intelligence. The second is to prepare for and have a plan in place to deal with the possibility of acute shocks like the pandemic. Vulnerability/risk assessments and “what if” scenarios for identified risks can be used to develop the plan.

The potential responses shown on the briefs generally follow the Cone of Uncertainty strategic planning model. As a rule, the short-term responses are discrete actions that can be undertaken to begin addressing the driver of change. Mid-term responses typically involve developing and implementing strategies to overcome challenges and capitalize on opportunities associated with the driver. Long-term responses seek to bring about broader systems change consistent with a vision, goals, or long-range target. Monitoring of the potential implications and impacts of different drivers of change should be done on an ongoing basis; it is particularly important in the long-term timeframe to anticipate what may be coming over the horizon.

1. This model is adapted from Amy Webb, “How to Do Strategic Planning Like a Futurist,” *Harvard Business Review*, July 2019
2. The share of the region’s population below the federal poverty level increased from 11.8% in 2012 to 13.5% in 2018, 1.7% higher than for the United States as a whole. (Source: *Strength in Numbers: 2021-2026 Comprehensive Economic Development Strategy*, TJCOG 2020)
3. Source: *Triangle Regional Resilience Assessment: Technical Report for the Triangle Regional Resilience Partnership*, Rogers et al. 2018

CROSSCUTTING THEMES: EQUITY AND RESILIENCE

While there are many points of interconnection between different drivers of change, two key themes — equity and resilience — recur throughout the 16 briefs contained in this report. Equity (defined as reducing or eliminating outcome disparities between different groups) is a primary concern in a relatively prosperous region with increasing socioeconomic inequality.² Resilience (defined by the Triangle Regional Resilience Partnership as the capacity to prevent, withstand, respond to, and recover from a disruption) is similarly growing in importance as the region experiences increasing climate change impacts and other stressors such as population growth, aging infrastructure, and increased demand for resources and services.³

The importance of equity and resilience to the region’s future is illustrated by *Strength in Numbers 2021-2025: A Regional Plan for Economic Resilience and Prosperity*, the Comprehensive Economic Development Strategy (CEDS) developed by TJCOG. “Foster Economic Inclusion” is the overarching theme that unifies the plan’s five goals, each of which outlines “equity-driven strategies and actions.” The strategies for Goal #5 (Economic Resilience) are to “proactively plan for natural disasters and economic shocks, address aging infrastructure, invest in rural communities, and intentionally rebuild from COVID.” This report can be used as a supplemental tool to integrate the CEDS action items into the work of the Triangle J Council of Governments’ Economic Development District (EDD). The “Potential Responses” listed throughout the report can also be used as metrics to measure progress towards successful implementation.



Driver of Change: Aging Population

Overview

The increasing number of older adults as a share of total population is a global phenomenon. According to the United Nations, by 2050 1 in 6 people in the world will be over the age of 65, up from 1 in 11 in 2019. This trend is most pronounced in developed countries like the United States. The U.S. Census estimates that, by 2030, 1 in 5 Americans will be 65 or older; by 2034, older adults will outnumber children under 18 for the first time in U.S. history. Older adults comprise diverse population groups with differing abilities and needs, from the relatively healthy and self-sufficient “young old” (ages 65-74) to members of older age groups who may require special care. These include persons living with Alzheimer’s disease, the majority of whom are 75 years and older.

Implications

An aging population has profound implications for communities, such as the need to adapt housing, transportation, community facilities, and other components of physical and social infrastructure to serve the needs of older adults. Economic implications include, among others, increasing healthcare costs and a higher dependency ratio (retirees and children as a percentage of the working age population). At the same time, older adults have a wealth of life experience and resources and make positive contributions to society. “Aging in community” is the idea that supportive neighborhoods and networks, along with alternative living arrangements such as intergenerational housing, can enable older adults to lead healthy, engaged, and fulfilling lives while benefiting all community members.

Related Drivers

The social determinants of health and equity, diversity & inclusion are the most directly related. However, the needs of and impacts on an aging population are relevant to multiple drivers. For example, older adults are particularly vulnerable to climate change impacts (e.g., increasing temperatures).



[Bridge Meadows intergenerational Community](#), Portland, Oregon

Considerations for Triangle J Region

An aging population poses challenges and opportunities for Triangle J communities. The primary challenge is to create the physical and social infrastructure (such as community design, facilities, and services) that all people require as they age. The opportunity is to integrate older adults into community life in ways that improve quality of life for all community members. Needs and capacity to address the challenge vary from community to community. While the largest numeric increase in the 65 and older population is projected to occur in the region’s population centers, rural counties and smaller communities with less capacity are projected to have the highest proportion of older adults in the future. The City of Durham and Durham, Orange, and Wake Counties are members of AARP’s [Network of Age-Friendly Communities](#), which is devoted to fostering places where people of all ages can live healthy and active lives. TJCOG’s Area Agency on Aging has prepared an Area Plan for Aging Services while Durham City and County and Orange County have developed Master Aging Plans. Local and regional initiatives can build on these existing efforts to create a Triangle J region that is age friendly for all.

Driver of Change: Aging Population



Social

POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Conduct “audits” of barriers and opportunities to creating age-friendly communities Develop age-friendly community plans (with the support of AARP, Area Agency on Aging, and NC Division of Aging and Adult Services) Initiate pilot projects (e.g., intergenerational programming, dementia-capable communities, infrastructure improvements to support healthy lifestyles) 	<ul style="list-style-type: none"> Revise community plans, ordinances, and standards (e.g., to promote universal design) Develop and implement strategies to enable older adults to age in place (e.g., age-friendly housing designs, walkable street networks, multimodal transportation options, supportive community facilities and services) Share best practices across the region 	<ul style="list-style-type: none"> Plan for the long-term adaptation of physical and social infrastructure to achieve the vision of age-friendly communities Shift to a paradigm of health promotion with older adults actively participating in community life Monitor implications of other drivers of change for the health and well-being of older adults and their service providers

Key Stats

- The North Carolina Division of Aging and Adult Services projects that North Carolina’s 65 and older population will increase from 1.7 million in 2020 to 2.7 million in 2040, a growth of 52%. The state’s 85 and older population is projected to increase 116% (from 193,000 to 417,000) during the same period. By 2040 the state’s population will include more people 65 years and older than 17 years and younger (North Carolina Department of Health and Human Services 2022).
- The Triangle J region’s 65 and older population is projected to nearly double (from 291,000 to 571,000) between 2020 and 2040. The region’s 85 and older population is projected to triple (from 30,000 to 90,000) during this time period (North Carolina Department of Health and Human Services 2022).
- Chatham and Moore Counties have the highest current and projected percentages of older adults. The NC Division of Aging and Adult Services projects that 35% of Chatham County’s population will be 65 and older and 8% will be 85 years and older in 2040. The projections for Moore County are 30% and 6%, respectively (North Carolina Department of Health and Human Services 2022).
- The costs to the U.S. economy associated with persons living with dementia are estimated at \$355 billion and could rise as high as \$1.1 trillion by 2050 (Alzheimer’s Association 2021). Research demonstrates that exercise reduces the risk of age-related decline and dementia (Alty, Farrow, and Lawler 2020).

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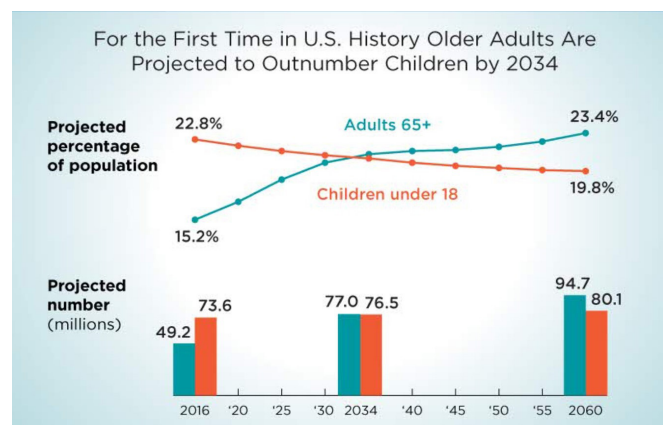
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(Source: Vespa 2019)



Driver of Change: Equity, Diversity, and Inclusion

Overview

The racial and ethnic composition of the United States is becoming increasingly diverse, with changes so significant that Kenan-Flagler Business School Distinguished Professor James Johnson Jr. has termed them “disruptive demographics”.¹ By 2042, the U.S. Census projects that the U.S. population as a whole will be majority minority. At the same time, there is a growing wealth gap between different populations, resulting in part from longstanding racism. To reduce poverty and help ensure liberty and justice for all, many communities, businesses, and institutions are working to increase equity, diversity, and inclusion (EDI) to more fully engage historically underrepresented populations, involve them in decision-making, and create greater access to economic opportunity.

Implications

EDI provides an important way to tap the talents and participation of all members of a community to increase its collective prosperity and resilience. In addition, studies have shown that communities and workplaces that are more diverse and welcoming are often more desirable and have a competitive advantage in attracting the worker talent that drives innovation and business success in the New Economy.² This challenge has only become more pressing as a result of labor shortages stemming from the Great Resignation. At the same time, places that struggle to advance EDI risk increasing the vulnerability and dependency of a growing segment of the community, with added costs and detrimental impacts for all.

Related Drivers

This driver is related to other social drivers (aging population, immigration, and social determinants of health). In addition, it links with vulnerability to climate change, automation, and artificial intelligence, and the ability to access services and amenities such as autonomous vehicles, new mobility, and smart cities.

Equity: Reducing or eliminating outcome disparities between different groups.

Diversity: Ensuring the presence of people with different races, ethnicities, sexual orientation, geographic origin, physical capabilities, and other characteristics.

Inclusion: Making people of all racial, ethnic, and other backgrounds feel welcome, valued, and included in activities and decisions.

Considerations for Triangle J Region

The Triangle depends on its knowledge-based economy for jobs and prosperity. Support for EDI is key to maintaining the region’s edge in attracting and retaining the talent that fuels this success. As a result, local governments, businesses, and individuals need to continue to advance EDI to tap the skills of all members of the community. The [Government Alliance on Race & Equity \(GARE\)](#) provides a national resource for government agencies on this topic. The [N.C. Center for Nonprofits](#) has identified a number of [state resources](#) for addressing equity. The Triangle has a dynamic constellation of organizations working on social justice issues. Businesses can help address the income gap by providing a living wage and exploring employee ownership through organizations such as the [N.C. Employee Ownership Center](#). Individuals can help address the income gap by supporting organizations such as the [The Center for Community Self-Help](#) and the [N.C. Justice Center](#) that are working to provide access to economic opportunity and eliminate poverty. Other social justice organizations in the region can be identified through the [United Way of the Greater Triangle](#), [EarthShare North Carolina](#), and the [Triangle Community Foundation](#).

Driver of Change: Equity, Diversity, and Inclusion



Social

POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Join organizations such as Government Alliance on Race & Equity (GARE) Hire Chief Diversity Officer or create Equity & Inclusion Dept. Create community EDI stakeholder team Prepare organizational and community EDI assessments Track regional equity data on TJCOG Equity Dashboard 	<ul style="list-style-type: none"> Draft organizational and community EDI action plans Promote “equity in all policies” Develop “community connections” strategy to engage underrepresented populations Enhance TJCOG Equity Dashboard to track organizational, community progress Review public resource distribution (capital investments, services, etc.) through equity lens 	<ul style="list-style-type: none"> Reconsider public resource distribution based on equity analysis Develop a minority leadership development initiative Support employee engagement and employee ownership initiatives (private sector firms)

Key Stats

- The U.S. Census projects that starting in 2020, white non-Hispanic children will be less than 50% of the total child population in the U.S. (U.S. Census).
- By 2042, the U.S. population as a whole will be majority minority (U.S. Census).
- The average Black and Hispanic households in the U.S. earn about half as much as the average white household, and own 15 to 20 percent as much wealth. (U.S. Federal Reserve, FEDS Notes, 10/22/21)
- From April 1, 2020 to July 1, 2021, North Carolina had more deaths than births for the first time, meaning that the state’s population growth resulted from net immigration (Carolina Demographics 2022).
- 88% of project professionals surveyed believe that diversity increases the value of a project team, and only 33% of professionals think their organization has culturally diverse leadership (Project Management Institute 2020).
- Offering gender-based programming and having a culturally diverse leadership team are associated with high organizational performance (PMI 2020).

“This is equity: just and fair inclusion into a society in which all can participate, prosper, and reach their full potential. Unlocking the promise of the nation by unleashing the promise in us all.”

—PolicyLink, The Equity Manifesto (2018)

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Driver of Change: Housing Need

Overview

Quality affordable housing is a basic human need that has become out of reach for a significant portion of the nation's population. Three main factors contribute to what is often referred to as the national housing crisis: affordability, availability, and accessibility. Escalating prices are making housing unaffordable for a broad range of incomes, from low and moderate to middle and upper middle, particularly in hot real estate markets. Regarding availability, there is a mismatch between demand and supply of different housing types in the right locations to meet the needs of a changing population. Finally, housing needs to be accessible, which means 1) convenient access to jobs, transportation, and community facilities and services, and 2) housing designs that enable independent living by seniors and persons with disabilities.

Implications

The effects of the housing crisis are felt across the socioeconomic spectrum, but particularly by low-income populations and people of color, who are least able to afford rising housing costs. Potential impacts include gentrification, displacement, and increased homelessness. Economic impacts include reduced household spending on goods and services and a shortage of workers for local businesses as people relocate to more affordable locations remote from job centers. Alternatives to conventional single-family housing are needed as the population ages, becomes more diverse, and family structures change. Technological innovations such as modular housing and 3-D printing hold the promise to significantly increase efficiency and reduce costs compared to conventional construction methods.

Related Drivers

Equity, diversity, and inclusion and the social determinants of health (housing is essential to health and well-being) are particularly relevant. Other related drivers include aging population, climate change (housing is a major contributor to greenhouse gas emissions), energy (a significant housing cost), and workplace/workforce disruption, among others.



Willard Street Apartments, Durham
Source: [DHIC](#)

Considerations for Triangle J Region

Based on pre-pandemic data, median home values and rents in the Triangle are generally affordable to median income households using accepted affordability ratios (home values no more than three times annual income and rental costs no more than 30% of monthly income) (Morristown 2019). By definition, however, half of households earn less than the median, many of which — renters in particular — struggle to pay their housing costs (see table showing cost-burdened households on next page). Higher priced housing units and higher earning households are concentrated in the region's core (Raleigh-Durham-Chapel Hill). Conversely, lower-priced units and lower-earning households are distributed around the periphery of the region, meaning that lower-wage workers may find it difficult to access job centers. Because new housing production is geared towards homeowners at the upper end of the market, the need for affordable rental units and alternative housing types is increasing. In the aftermath of the pandemic, housing prices are escalating nationwide and relatively affordable, less dense regions like the Triangle have become more attractive.

Driver of Change: Housing Need



Social

POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> • Conduct county and municipal housing need analyses • Document housing best practices in the Triangle region • Identify attractive examples of alternative housing types to build acceptance of affordable housing • Establish a Regional Housing Coalition to coordinate efforts to meet housing needs 	<ul style="list-style-type: none"> • Develop a regional housing plan to address housing needs at the regional scale • Implement universal design standards to make homes more accessible • Establish a housing best practices toolbox to help local jurisdictions meet housing needs • Establish a Regional Housing Fund to leverage resources to meet housing needs 	<ul style="list-style-type: none"> • Incorporate goals such as energy efficiency, net zero emissions, compact/mixed-use land use patterns, and multimodal transportation into housing policy and investment • Monitor national housing trends, technological and market innovations, and their implications for housing needs in the Triangle region

Key Stats

- In April 2022, the national median listing price of homes for sale was \$425,000, up 14.2% from April 2021 and 32.4% from April 2020. In March, the national median rent was \$1,807, up 17% from March 2021 (National Association of Realtors 2022).
- In March 2022, Raleigh-Durham ranked as the sixth hottest of 300 metropolitan markets in the country. The median home listing price was \$425,000 (same as the national median) and the median rent was \$1,591 (National Association of Realtors 2022).
- 28% of North Carolina households, including 43% of renters and 20% of homeowners, are considered cost burdened. Figures for the Triangle region are comparable, with the highest percentage of cost-burdened rental households in Orange (48%) and Durham (46%) Counties (North Carolina Housing Coalition 2021).

County	Median Household Income	Cost-Burdened Households (Total)	Cost-Burdened Renters / Homeowners
Chatham	\$86,400	6,743 (23%)	2,594 (38%) / 4,149 (19%)
Durham	\$86,400	39,754 (32%)	26,619 (46%) / 13,135 (19%)
Johnston	\$95,700	18,070 (26%)	8,230 (44%) / 9,840 (20%)
Lee	\$61,000	6,246 (29%)	3,046 (42%) / 3,200 (22%)
Moore	\$76,500	9,732 (24%)	3,523 (36%) / 6,209 (21%)
Orange	\$86,400	15,817 (30%)	9,553 (48%) / 6,264 (19%)
Wake	\$95,700	102,338 (26%)	60,134 (42%) / 42,204 (17%)
Total		198,700 (27%)	113,699 (43%) / 85,001 (18%)

Source: North Carolina Housing Coalition (2021). Cost-burdened defined as spending more than 30% of household income on housing costs. Note: These data do not include transportation costs, which often follow housing as the next largest cost center in the typical household budget.

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Driver of Change: Social Determinants of Health

Overview

Despite spending far more per capita on health care than any other nation in the world, the United States is less healthy than many other countries; according to one survey, the U.S. health index score ranked 69th in the world in 2021 (Statista Research Department 2021). Contributing factors to the poor state of the nation's health include the prevalence of chronic conditions and diseases such as obesity and diabetes; physical inactivity and poor diet; lack of access to healthcare; and health disparities related to race and income, all of which are interrelated. Collectively, these factors are shaped by the social determinants of health, which are the conditions in which people are born, grow, live, work and age (Artiga and Hinton 2018).

Implications

The COVID-19 pandemic revealed the poor health of the U.S. population in general (a CDC study found that one-half of all patients hospitalized with COVID were obese) and major disparities between different racial, ethnic, and socioeconomic groups. Significantly improving the nation's health will require changing the current paradigm — in which all but a small proportion of healthcare spending goes towards treating people after they become sick — to one that emphasizes health promotion, disease prevention, and assuring conditions in which **all** people can be healthy (the mission of the public health profession).

Related Drivers

Because the social determinants of health are a cross-cutting concept, they are influenced by virtually all other drivers of change. Equity, diversity and inclusion are particularly important given the stark disparities in health outcomes tied to race, income, and where people live. Other relevant drivers include food security, housing, aging population, and workplace/workforce disruption.

Considerations for Triangle J Region

Based on the Robert Wood Johnson Foundation's County Health Rankings, the Triangle is healthier than



Social Determinants of Health
(Source: [Centers for Disease Control and Prevention](#))

other North Carolina regions as measured by health outcomes, health behaviors such as smoking, obesity, and physical inactivity, and other social and economic factors (RWJF 2021). There are, however, significant disparities between different segments of the region's population and between urban and rural areas; individual rankings among North Carolina's 100 counties range from #1 for Wake County to #66 for Lee County. In accordance with state guidance for the accreditation of local health departments, all seven counties in the Triangle have developed Community Health Assessments that identify health conditions, needs, and priorities. In addition, Wake County completed the [Live Well Wake Community Health Improvement Plan 2020-2023](#) in 2020. The Community Health Assessments identify a range of health priorities to address. Priorities identified by a majority of the counties include access to healthcare, mental health or substance abuse, and obesity. Moving forward, cross-sectoral collaboration will be required to remove barriers and create conditions that enable people to live the healthiest lives possible. This will involve implementing policies, programs, investments, and other actions to address the social determinants of health.

Driver of Change: Social Determinants of Health



Social

POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> • Prepare Community Health Improvement Plans to address priorities identified in Community Health Assessments • Form cross-sectoral partnerships to address health inequities and the root causes of poor health • Establish a “Healthy Region” working group to share ideas and coordinate efforts to improve health 	<ul style="list-style-type: none"> • Implement strategies to address priorities identified in the Community Health Assessments/ Community Health Improvement Plans (access to health care, mental health, obesity, etc.) • Identify a set of common indicators to track progress in improving health within the region 	<ul style="list-style-type: none"> • Pursue coordinated regional and local actions to shape the social determinants of health to promote health and wellness (e.g., economic opportunity, walkable environments, green infrastructure, etc.) • Monitor implications of other social, technological, economic, environmental drivers of change for the social determinants of health

Key Stats

- The Centers for Disease Control and Prevention (CDC) estimates that 90% of the \$3.8 trillion spent every year on health care in the United States is for people with chronic and mental health conditions. Obesity affects 19% of children and 42% of adults, costing the U.S. healthcare system \$147 billion/year (CDC n.d.).
- According to America’s Health Rankings, North Carolina ranked 38th among states in health behaviors and 32nd in health outcomes in 2021 (United Health Foundation 2022).

County	Health Ranking (out of 100 NC Counties)	Priorities Identified in Community Health Assessments
Chatham	10	access to comprehensive health services, obesity, poverty
Durham	7	affordable housing, access to healthcare and insurance, poverty, mental health, obesity, diabetes, and food access
Johnston	17	access to health services, mental health/substance abuse, heart disease & stroke, respiratory diseases, transportation
Lee	66	tobacco use, substance abuse, obesity, teen pregnancy
Moore	16	obesity, behavioral health
Orange	2	access to care, health behaviors, health equity
Wake	1	transportation, employment, access to care, mental health/substance use, housing and homelessness

Source: RWJF (2021), County Community Health Assessments

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Driver of Change: Artificial Intelligence

Overview

Artificial Intelligence (AI) is the development and use of computer algorithms to simulate tasks commonly associated with human intelligence, such as reasoning and learning from past experience. Using machine learning and data analytics, AI systems have the ability to learn and adapt based on data patterns without following explicit instructions. While beating humans in chess helped put AI on the map, close approximations of human intelligence have been elusive. AI's greatest impact to date has been in analyzing large datasets quickly and cheaply to perform functions such as pattern recognition and automation.

Implications

The emergence of AI has a broad range of implications for society, supporting advanced data analysis functions and increased productivity in virtually every field. AI is helping organizations recognize patterns and predict future outcomes, and also support new capabilities such as autonomous vehicles and robotics. In addition, it can improve the effectiveness of public service provision. For example, the Cincinnati Fire Department is using data analytics to help determine whether to treat medical emergency calls on site or transport patients to a hospital based on the type of call, location, and weather. AI can also help governments with digitization of infrastructure, public input analysis, and customer service improvements. At the same time, AI is heightening concerns about cybersecurity, privacy, and discrimination through algorithmic bias. It provides great potential for spurring economic growth, and also threatens jobs such as analysts and factory workers. With the Great Resignation, it can also enable employers to backfill vacancies with technology.

Related Drivers

This driver is related both to other technological drivers (data collection & use, autonomous vehicles, new mobility, smart cities), and to economic drivers (e-commerce, remote work, the sharing economy). In addition, it holds potential to help address equity, diversity, and inclusion, an aging population, climate change, and energy and water usage.

AN AI LEXICON

Algorithm: A set of specific steps to perform a well-specified task, with data inputs used to generate outputs.

Algorithmic bias: Systematic and repeatable errors in a computer system that create unfair outcomes, typically privileging one group of users over others.

Deep learning: Deep learning is a subset of machine learning that includes a neural network with three or more layers that attempt to simulate the behavior of the human brain, allowing it to “learn” from large datasets.

Digital twin: A digital representation of the built environment or system. A “smart city digital twin” can be updated with real-time data and analytics on interactions between humans, infrastructure, and technology to create a live digital representation of a city.

Machine learning: Algorithms based on applied statistical models that can learn without following explicit instructions.

(Sources: Wasserman and Flaxman 2022; IBM Cloud Education)

Considerations for Triangle J Region

The Brookings Institution has identified the Raleigh-Cary metropolitan statistical area (MSA) as one of 13 metro areas that are “early adopters” of AI technology, and the Durham-Chapel Hill MSA as one of 21 “federal research and contracting centers” for AI ([Muro and Liu 2021](#)) based on factors such as federal contracts and research & development funding. Brookings also lists the Durham-Chapel Hill MSA in the top fifteen metro areas for jobs threatened by this technology ([Muro, Whiton, and Maxim 2019](#)). With its plethora of data scientists, software engineers, and other professionals, the region has an opportunity to support the continued development of this industry cluster. At the same time, organizations have the chance to pilot and use the technologies to increase productivity. Efforts to use AI

Driver of Change: Artificial Intelligence



Technological

POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Promote standardization of local government processes and data, for example through TJCOG Regional Data Sharing Group, to facilitate cross-jurisdictional collaboration and AI applications Create Triangle government-business-academia AI users group to share best practices on AI applications, cybersecurity, and privacy 	<ul style="list-style-type: none"> Work with vendors to conduct demos to vet new AI applications Select promising applications for pilot initiatives Scale up successful pilots to the community and regional level Coordinate actions with those for Data Collection and Use 	<ul style="list-style-type: none"> Track growth of AI business sector Host annual forum on latest AI applications in collaboration with academic, business, and institutional partners Host regional awards program to recognize innovative local govt. use of technology Coordinate with partners to promote AI applications that advance social goods and minimize negative impacts

can be advanced by promoting standardized data and open data, for example through efforts like the [TJCOG Regional Data Sharing Group](#), and through making new AI applications open source to help other agencies use them. Attention should also be paid to workers in industries vulnerable to AI, and helping them as needed with re-training.

Key Stats

- Federal research and development expenditures on AI at U.S. colleges and universities grew by 45% in the past decade, but still accounted for only 5% of total R&D expenditures at U.S. institutions of higher learning, suggesting this sector is both fast-growing and also early in its development ([Muro and Liu 2021](#)).
- Global GDP could be up to 14% higher in 2030 as a result of AI — the equivalent of an additional \$15.7 trillion — making it the biggest commercial opportunity in today's fast changing economy ([PriceWaterhouseCoopers 2017](#)).

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ENABLING AI APPLICATIONS

To facilitate the use of AI in planning and local government applications, the Planning Institute of Australia (PIA) recommends the following principles:

- 1. Machine readable digital content:** Collect and publish data in a digital format that is easily read by machines.
- 2. Standardization:** Develop standards for processes and data to facilitate cross-jurisdictional collaboration.
- 3. Open data:** Make all non-sensitive public data available as open data, while developing standards and processes for protecting private information.
- 4. Open rules:** Publicly share computer code for automated or assisted public decision-making processes.
- 5. Open-source code:** When public funding is used in the development of new digital tools, the tools should be provided as open source to enable reuse across different agencies.

(Source: Wasserman and Flaxman 2022)



Driver of Change: Data Collection and Use

Overview

Increasingly, our society runs on data. It is available in digital form in unprecedented quantities for an ever-broadening range of uses. Whether gathered by people, cell phones, sensors, or satellites, data can help us do many things, such as track human health using a heart monitor, or manage traffic patterns through an advanced traffic signal system. To be helpful, data must be converted into actionable information. To do this, it must be collected, processed, stored, and analyzed, often with the help of information and communication technologies (ICT) that provide the necessary digital infrastructure of sensors, hardware, and software. The internet can facilitate this process. Data analytics software can help data scientists and others then interpret what is gathered to inform decision-making.

Implications

Data can improve service efficiency and facilitate new capabilities like e-commerce, remote work, computer visualization, artificial intelligence, autonomous vehicles, and smart cities. It also supports the creation of an internet of things (IoT) composed of devices that talk to each other to provide real-time monitoring and adjustment, such as precision farming. It can generate new insights and build our understanding to help us solve a myriad of problems. At the same time, lack of data access can limit its beneficial use. In response, there is a widespread movement calling for open data, especially from government sources. In addition, data collection and analysis can perpetuate bias and facilitate discrimination. As a result, monitoring and daylighting the assumptions we use to collect, process, and analyze data is an essential function. Our growing data needs are also spawning new land uses such as data centers comprised of racks of servers stored in giant warehouses that drive the internet and cloud computing. The quality of our information depends on data maintenance and data quality. The increasing availability of data is also creating new challenges such as data privacy and security. As a result, at the same time that we develop our digital infrastructure to facilitate efficient data collection and use, we also need to draft policies and procedures to help us manage its downsides.

STEPS TO TURNING DATA INTO A TOOL FOR DECISION-MAKING

1. Data collection
2. Data management
3. Data analysis
4. Data interpretation
5. Data-driven decision-making

(Adapted from Desouza and Smith 2016)

Related Drivers

This driver is related both to other technological drivers (artificial intelligence, autonomous vehicles, new mobility, smart cities), and also to e-commerce, remote work, and the sharing economy. In addition, it holds potential to help address equity, diversity, and inclusion, an aging population, climate change, and energy and water usage.

Considerations for Triangle J Region

The Triangle is poised to continue its leadership in data collection and analysis with its strong institutions of higher learning that support more than a dozen academic programs for computer science and data analytics, providing a rich flow of worker talent. In turn, a wide variety of businesses, agencies, and organizations are tapping this talent to provide valuable data services, such as Cisco and Red Hat for access to computing power, IBM and SAS for data analytics, the National Institutes of Health and the U.S. Environmental Protection Agency for government services, and the Research Triangle Institute (RTI) and its Center for Data Science for a wide variety of research. The region is also a hotbed for tech start-ups, ranking as the 2nd fastest growing tech hub in the US in 2018. These assets provide the region with strong opportunities to support continued tech business development. It can also utilize technology to improve local services. One way is by building on the [Regional Data Sharing Group](#) that TJCOG, local governments, and their partners have formed to coordinate the collection of data on flooding, greenway and parks usage, and other applications to improve monitoring, coordination, and management of systems and services that extend across jurisdictional lines.

Driver of Change: Data Collection and Use



Technological

POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> • Draft/update local government technology plans, potentially in coordination with smart city strategic plans, to develop data policies, procedures, and apps • Continue to support the “start-up ecosystem” through subsidizing co-working space, incubators, and networking events • Ensure local governments have up-to-date data privacy and protection policies + procedures 	<ul style="list-style-type: none"> • Invest in developing and coordinating new data platforms and apps, for example through TJCOG Regional Data Sharing Group • Host pitch events to help local governments vet new data technologies such as the Propellor sensor on inhalers to learn more about what triggers asthma attacks • Select promising technologies for pilot initiatives • Scale up successful pilots to the community and regional level 	<ul style="list-style-type: none"> • Track regional performance in data job creation and business development • Host annual forum on the latest in data science in collaboration with academic, business, and institutional partners • Host regional awards program to recognize innovative local govt. use of technology

Key Stats

- 85% of U.S. households have a broadband internet subscription (U.S. Census, 2016-2020).
- In 2021, 30% of U.S. consumers used wearables such as smartwatches and fitness trackers (DeAngelis and Gomez 2022).
- Each autonomous vehicle is expected to produce 25 gigabytes of data per hour, as much as 12 complete high-definition movies (Wheeler 2019).
- The Triangle tech sector includes nearly 4,000 businesses and 60,000 workers, and makes a \$14.6 billion contribution to the gross regional product (Research Triangle Regional Partnership 2020).

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A DATA LEXICON

Data: Facts or items of information.

Big data: Extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations.

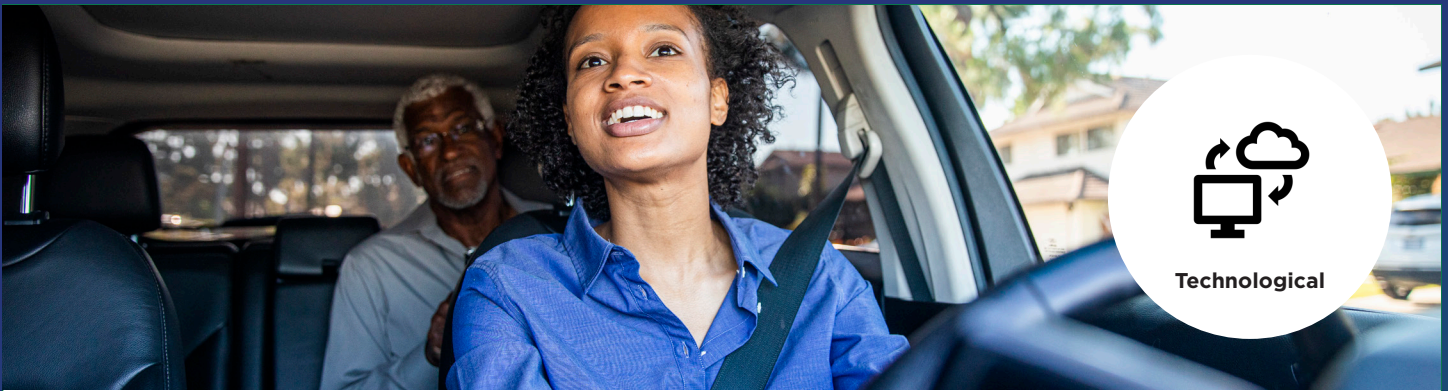
Data mining: The practice of analyzing large databases to generate new information.

Data-driven decision making: The process of making decisions based on actual data rather than intuition or observation alone.

Digitalization: The conversion of processes or roles from an analog form to a digital form, including business operations and social interactions. Examples include using digital technologies such as email or chat instead of regular mail or the telephone.

Digitization: The conversion of information from an analog form to a digital form such as by scanning a hand-written note into an electronic text file.

(Sources: Oxford English Dictionary; [Northeastern University](#); Hurtado, Hitchings, and Rouse 2021)



Driver of Change: New Mobility

Overview

New mobility refers to public and private transportation services, mostly available on-demand, made possible by mobile technology and real-time location data. Examples include ride hailing and car sharing; bikes, e-scooters, and other micromobility options; and fixed and flexible route transit services. A related concept, Mobility-as-a-Service (Maas) is the integration of different travel options into a single mobility app. New mobility is an emerging concept that has been largely confined to cities and metropolitan regions, driven by private companies such as Uber and Lyft. While public-private partnerships (e.g., between transit agencies and ride-hailing companies) to provide new mobility services are increasing, there are few examples of truly integrated services in the U.S.

Implications

New mobility services are disrupting established transportation systems and practices. On the positive side, they can reduce car dependency by providing more mobility options for travelers. Potential benefits include less congestion, improved air quality, “first-and last-mile” connectivity to transit stops, and greater mobility for people who lack access to private automobiles. Potential negative impacts include lower transit ridership (leading to a reduction in service for transit-dependent populations), fewer walking trips, and safety concerns associated with increased use of scooters and bicycles. Management of limited curb space (e.g., to support rider pick-up and drop-off) is a further concern for municipalities. Autonomous vehicles are a related technology that has the potential to transform travel behavior and mobility systems in the future.

Related Drivers

Other technological drivers (artificial intelligence, autonomous vehicles, and smart cities) are the most directly related. However, new mobility impacts have implications for other drivers, such as climate change, an aging population, and equity, inclusion, and diversity.



[Citrix Cycle Bikeshare, Raleigh](#)

Considerations for Triangle J Region

New mobility services in the Triangle J region include ride-hailing companies; several dockless E-scooter and bikeshare programs; RTP Connect (a pilot involving GoTriangle Transit, Research Triangle Park, Uber, and Lyft); and Morrisville’s Smart Shuttle. Area transit providers have collaborated with major employers to offer GoPass, a free or subsidized pass that can be used on all transit routes in the regions. As services increase, new mobility will create opportunities and challenges for the region. In developed areas, opportunities include reducing traffic congestion and supporting more walkable, bikeable communities. While services are limited in rural areas, long-term opportunities could include mobility hubs that integrate different travel options. A key challenge is to address barriers to access by underserved populations (e.g., low-income, elderly, and persons with disabilities). Connect 2050, the long-range transportation plan prepared by the Triangle’s two metropolitan planning organizations (MPOs), encourages 1) demand-responsive microtransit services in areas where land use density and bus ridership are low and 2) micromobility services in activity centers such as business districts and universities (Capital Area and Durham-Chapel Hill-Carrboro MPOs 2021).



POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> • Incorporate new mobility services into local and regional transportation and land use plans, as appropriate • Create public-private partnerships to connect different mobility options • Initiate pilot projects (e.g., mobility hubs and microtransit) to test benefits and impacts of new mobility services 	<ul style="list-style-type: none"> • Scale up pilot projects and partnerships • Ensure equitable access to new mobility options for underserved populations • Monitor new mobility trends and their implications for the Triangle J region • Develop policies, regulations, standards, and fiscal strategies to maximize benefits and minimize costs/impacts 	<ul style="list-style-type: none"> • Integrate mobility options through a regional Mobility-as-a-Service app • Explore opportunities to increase accessibility for rural residents by integrating new mobility services into rural transportation systems • Monitor deployment of autonomous vehicle technology and its implications for transportation and land use in the Triangle J region

Key Stats

- In the US, bikeshare programs have existed at scale since 2008. Shared e-scooters launched in late 2017 and quickly grew to nearly half of total shared micromobility trips (Urbanism Next Center 2020).
- In 2019 there were 136 million trips taken on bike and scooter share systems. They averaged 11-12 minutes in duration and 1-1.5 miles in length (NACTO 2020).
- About 25% of the entire US population uses ride-hailing services at least once a month. Uber (69%) and Lyft (30%) have 99% of the US market (Stasha 2022).
- Uber and Lyft are responsible for 14% of Vehicle Miles Traveled (VMT) in some states. They averaged a combined 500 million US VMT per month in 2016 (Stasha 2022).

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WHAT IS A MOBILITY HUB?

A mobility hub is a place that brings together different mobility services, such as transit, ride share, bike share, and other ways people can get to where they want to go without using a private vehicle. They reduce automobile traffic by making transit, shared-use mobility, and walking safe, attractive, and convenient. Features include sheltering, real-time information, safe connections, and supportive infrastructure that help people transfer from one mobility mode to another (Crozier and Nisenson 2022).



Mobility Hub, Hamburg, Germany
(Source: FHWA)



Driver of Change: Smart Cities

Overview

From online public engagement to smart parking apps to advanced water metering infrastructure, digital technologies and data analytics are changing the nature of social connection and service delivery. The American Planning Association defines a “smart city” as a place that “equitably integrates technology, community, and nature to enhance its livability, sustainability, and resilience, while fostering innovation, collaboration, and co-creation” (Hurtado et al. 2021). Achieving this vision requires building a smart city “ecosystem” that includes network infrastructure such as high-speed internet to facilitate the flow of data, digital processes such as software applications to analyze the data, and plans and policies to guide data use.

Implications

As smart city technologies grow in availability, governments and other users must sort through the dazzling array of shiny objects to find the jewels that will deliver real value for their communities. In addition, they have an opportunity to align investments in smart cities with community goals, and use digital technologies to help create more equitable communities. As a result, growing attention is being given to digital equity and providing access for all community members to high-speed internet and to the skills and devices needed to use it. Moving more government and consumer functions online has been particularly important during the pandemic to increase public safety, ensure access, and improve convenience. Service providers that have been successful in doing this have been able to increase organizational resilience and reduce service interruption. Building the capability to use smart cities technologies effectively and align them with community goals are key undertakings in the years ahead.

Related Drivers

This driver is related both to other technological drivers (artificial intelligence, autonomous vehicles, and new mobility), and to economic drivers (e-commerce, remote work, and the sharing economy). In addition,

it holds potential to help address equity, diversity, and inclusion, an aging population, climate change, and energy and water usage.

Considerations for Triangle J Region

Smart city technologies can help local governments and communities in the Triangle do more with less, broaden community engagement, and improve service delivery. Major institutional partners such as area universities and businesses hold the potential to share the costs of building a dynamic smart cities ecosystem. Demonstrating value, identifying funding sources, and building cross-sector collaboration will be key priorities for advancing smart cities development. Numerous and varied partners hold the potential for creating a rich learning network of organizations that can pilot smart city tools and applications for testing, refinement, and use. Appropriate scaling of technologies will be key to serving small towns as well as larger communities.

SMART CITY “DOMAINS”

Technology professionals often describe three domains of smart cities.

- “Gov tech” uses digital technologies to improve government services;
- “Civic tech” uses them to facilitate public access and participation; and
- “Urban tech” uses them to improve infrastructure and the built environment.

Local governments can help build a smart cities “ecosystem” by adopting “dig once” policies to get fiber optic cables installed, development standards to require high-speed internet connections, and digital equity programs to make sure everyone benefits.

(Source: Hurtado, Hitchings, and Rouse 2021)

Driver of Change: Smart Cities



Technological

POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Inventory existing smart cities (SC) initiatives in the Triangle Create a regional smart cities learning network Identify smart cities funding Encourage the development of local smart cities pilot projects Expand access to broadband using NC broadband planning tools 	<ul style="list-style-type: none"> Draft local SC strategic plans Draft regional SC strategic plan Develop digital inclusion plan using NC template Develop regional “pitch + pilot” program for SC technologies Support smart cities partnerships Scale up successful smart cities pilot projects to community level 	<ul style="list-style-type: none"> Implement local smart cities strategic plans Hold annual Triangle smart cities showcase to feature projects Conduct local and regional SC needs assessments to track progress

Key Stats

- One study found that communities just starting to pursue smart cities projects were making a Return on Investment of 2.6%, while smart cities leaders were achieving an ROI of 5.6% ([ESI ThoughtLab 2019](#)).
- The Orange Water and Sewer District’s (OWASA) “[Agua Vista](#)” advanced metering infrastructure (AMI) system alerted customers to about 10,000 water leaks in 2019, and was projected to have an ROI of 4.8% (Tiger 2020; Don Schlenger and Associates 2016).
- The U.S. smart cities market was valued at \$271 billion in 2021 and is expected to grow at a compound annual growth rate (CAGR) of 21.6% from 2022 to 2030 ([Grand View Research 2022](#)).
- Smart buildings with integrated systems can save 30-50% of energy over a building that is otherwise inefficient ([American Council for an Energy-Efficient Economy](#)).

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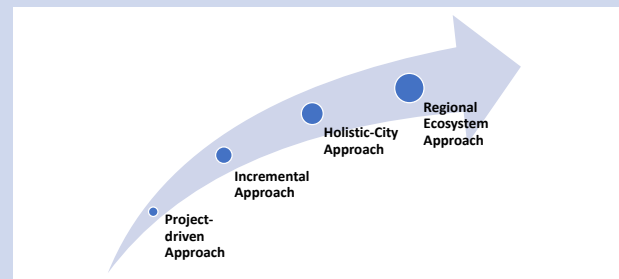
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LOCAL APPROACHES TO SMART CITIES

Local governments often take one of four approaches to using smart cities technologies:

- A **“Project-driven” approach** that utilizes a smart cities application to help solve a particular community problem or improve a community service;
- An **“Incremental” approach** that uses a smart cities pilot project to solve an immediate problem and to begin developing a larger smart cities capability;
- A **“Holistic-city” approach** that establishes a smart cities vision based on community goals, describes an integrated action plan, and works systematically to implement it; or
- A **“Regional Ecosystem” approach** that links and augments local smart city programs to build a regional smart cities support framework.

Together, these approaches outline a Smart Cities continuum that a community can move along over time.

(Source: Adapted from Hurtado, Hitchings, and Rouse 2021)



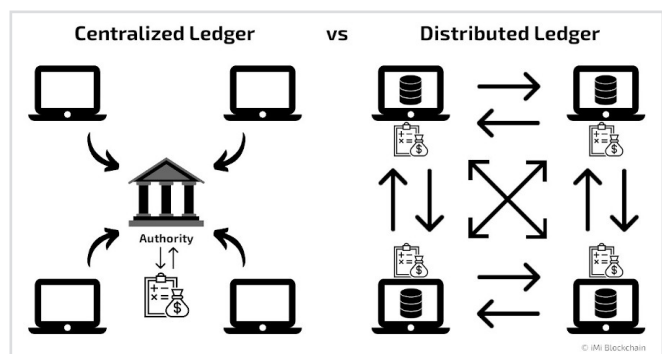
Driver of Change: Blockchain/Cryptocurrency

Overview

A blockchain is a digital, internet-based ledger for recording transactions. Each record or “block” adds to the cumulative list of transactions or “chain”. Because it is shared, decentralized, and cryptographically protected, a blockchain is broadly accessible, independently verifiable, and resistant to tampering. These features have enabled this technology to be used to develop digital cryptocurrency such as Bitcoin and Ether that don’t require centralized intermediaries like banks and governments. Some cryptocurrencies require complicated verification, and individuals or firms compete to provide this service using special computer hardware in return for digital coins (so-called cryptocurrency “mining”). Blockchain technology is also being used to provide a variety of other services such as records storage, smart contracts development, supply chain management, data protection, voting, and business process automation.

Implications

Blockchain technology can help reduce transaction costs by removing the need for intermediaries such as banks, accountants, and auditors to verify contracts or transfers of goods, services, and digital currency. It can also provide a secure and transparent location for sharing data. In addition, a blockchain can support the programming of smart contracts that automatically execute when the terms of the contract are met, for example to transfer digital currency between parties. Use of blockchain technology is in its early stages of development. As a result, conducting adequate due diligence is important before committing to a particular blockchain solution. Organizations such as the Government Blockchain Association (GBA) are helping potential users assess promising applications (see GBA’s new [Blockchain Maturity Model \(BMM\) Requirements](#)), and offering access to a government business blockchain platform as a common environment for developing and deploying [government blockchain applications](#). Cryptocurrency mining often takes place in warehouses similar to server farms that use large amounts of energy and generate substantial electronic waste, as well as creating considerable noise from



Centralized vs. Decentralized Ledger
(Source: [iMiBlockchain](#))

the HVAC equipment needed to cool computer hardware. For these reasons, some communities are developing special land use regulations for data centers and crypto mining to help manage the negative impacts.

Related Drivers

This driver is related both to technological drivers (artificial intelligence, data collection and use, and smart cities), and other economic drivers (e-commerce, remote work, and the sharing economy). In addition, it has implications for climate change, and energy and water usage.

Considerations for Triangle J Region

The Triangle has a strong infrastructure of universities and businesses working on blockchain technologies, making it an important source of worker talent and business development in this sector. Duke University offers a Blockchain Applications Certificate. North Carolina State University has a Blockchain Lab. The University of North Carolina at Chapel Hill is part of a \$50 million blockchain research project. In turn, Triangle business such as IBM, SAS, Imaginovation, and Kaleido, are developing blockchain applications. In addition, the state is experiencing significant cryptocurrency mining activity, so this will be a trend to watch as both an economic development opportunity and a land use to manage.

POTENTIAL RESPONSES

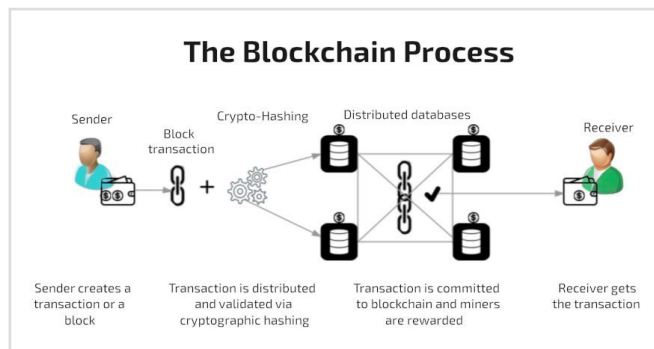
Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Coordinate with NC Blockchain Initiative on directory of Triangle universities and businesses with blockchain programs Explore govt. blockchain uses, for example as part of TJCOG Regional Data Sharing Group or AI users group (see AI brief) Conduct survey of local govts to evaluate community issues to date with crypto mining 	<ul style="list-style-type: none"> Engage Government Blockchain Association and similar orgs. on resources to evaluate potential govt. blockchain solutions Include blockchain apps in vendor demos (see AI brief) Track govt. pilot initiatives Develop guidance and case studies on managing crypto mining Track impact of cryptocurrency on local govt. finance 	<ul style="list-style-type: none"> Track growth of blockchain and crypto mining as part of AI business sector Track impact of blockchain development on local govt. services Include blockchain in annual technology showcase Include blockchain in regional awards program for innovative local govt. use of technology Partner with local governments and vendors to develop blockchain education program

Key Stats

- The cryptocurrency market has grown from \$96 billion in July 2017 to \$868 billion in July 2022 ([Coin-MarketCap](#)).
- Trade documentation alone can cost as much as 20% of the physical cost of transporting the more than \$4 trillion worth of goods shipped globally each year. By reducing supply chain barriers, global trade could increase by nearly 15 percent ([World Economic Forum](#)).
- Bitcoin cryptocurrency mining uses more energy per year than the entire country of Belgium ([Cambridge University Bitcoin Electricity Consumption Index](#), 2019).

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Blockchain Process Explained
(Source: [iMiBlockchain](#))



Driver of Change: Circular Economy

Overview

The circular economy works to move from linear flows to circular flows of raw materials and finished products, extending the productive life of finished goods, reusing and recycling their components, and reducing or eliminating waste. Renewable materials such as food byproducts can be used as food, fertilizer, or fuel. Finished products like electronics can be repaired, reused, and recycled. With thoughtful design, manufacturing processes can be structured to maximize the use of waste as feedstocks, and design finished products for modularity and disassembly to facilitate reuse. In so doing, companies and communities can move from a “take-make-use-waste” approach to a regenerative and restorative model of resource use that keeps materials working at their highest value.¹

Implications

The circular economy provides important opportunities to reduce the environmental impacts of manufacturing, capture lost value, and generate new revenue streams. In the process, it can also create new jobs and help reduce our carbon footprint.

Related Drivers

This driver is related to other economic and environmental drivers including remote work, e-commerce, energy and water usage, and climate change. In addition, it can benefit from technological drivers such as artificial intelligence, big data, and smart cities, and holds potential to help address equity, diversity, and inclusion.

Considerations for Triangle J Region

Developing a circular economy takes cross-sectoral collaboration. The Triangle has an opportunity to leverage its academic institutions to assist industry and government in making this transformation. Examples nationwide range from low tech collection of used textiles for reuse to robots that rapidly sort recyclables using artificial intelligence. Non-profit organizations and local governments can promote environmentally responsible procurement policies. Consumers can patronize busi-



Linear Economy vs. Circular Economy
(Source: [Metro Vancouver](#))



Potential Triangle Pilot Project: Reusing/Recycling More Construction and Demolition Debris
(Photo: Ben Hitchings)

nesses that advance the circular economy. Corporations can share data, and integrate these principles into their mission statements and their operations. A regional opportunity identified by Circular Triangle would be to work with the construction industry and local government to reduce the construction and demolition debris going to landfill.

1. Ellen MacArthur Foundation. *Delivering the Circular Economy: A Toolkit for Policymakers* (2015).

Driver of Change: Circular Economy



Economic

POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Partner with local orgs such as Circular Triangle to build awareness of circular economy (CE) principles and practices Document Triangle CE examples Promote use of NC Dept. of Env. Quality materials matching site (www.ncwastetrader.org) Promote use of consumer CE assistance sites like the Freecycle Network (www.freecycle.org) Identify CE tracking metrics 	<ul style="list-style-type: none"> Convene business advisory group to provide input on how to develop CE in region and state Conduct regional or state study to identify sectors that have high potential to participate in CE Promote local government procurement policies favoring companies that engage in CE Develop regional CE recognition program Integrate CE with existing plans 	<ul style="list-style-type: none"> Develop regional CE accounting system Set regional targets for participation in CE and value of materials maintained, and track progress toward net zero waste Hold annual showcase of regional and state CE businesses Explore development of state CE labeling and promotion system like "Got To Be NC" for ag sector

Key Stats

- 45% of greenhouse gases are a direct result of the way we make and use products and food, and can be significantly reduced through applying the principles and techniques of a circular economy (Source: Ellen MacArthur Foundation).
- The circular economy presents \$4.5 trillion opportunity by 2030 globally (Source: Accenture Strategy, 2020).
- Lifespan of a plastic bag: up to 1,000 years; average time a bag is used: 12 minutes (Source: *The Circular Shift*, Closed Loop Partners)
- 66% of consumers would pay more for products from more socially responsible companies, and 83% of consumers factor in brands' values when considering a purchase (Adweek, 2018)
- If all plastics landfilled in Charlotte were recycled instead, it would save 936,329 barrels of oil per year while creating more than 1,300 jobs and \$35 million in revenue (Source: Circular Charlotte, 2018).

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TAKING ACTION

The Ellen MacArthur Foundation identifies six action areas for communities and businesses that want to move toward a circular economy:

- Regenerate:** Shift to renewable energy, restore ecosystems, and return recovered biological resources to the biosphere.
- Share:** Share assets such as cars, rooms, and appliances, and repair and reuse items.
- Optimize:** Increase efficiency and performance, remove waste in production, use automation and big data to help make this happen.
- Loop:** Remanufacture products, recycle materials, and compost waste.
- Virtualize:** Dematerialize directly (e.g. books, CDs) and indirectly (e.g. online shopping) by going digital.
- Exchange:** Apply new technologies (e.g. 3D printing) and choose new products and services (e.g. bikeshare).

(Ellen MacArthur Foundation 2015)



Driver of Change: Economic Restructuring

Overview

In a broad sense, economic restructuring refers to the shift from an economy based on manufacturing to one based on services – the predominant macroeconomic trend in the U.S. over the last several decades. Rapid advances in digital technology in recent years, compounded by the disruptive effects of the COVID-19 pandemic, are spurring a new wave of restructuring tied to the “digitization of everything.” Key interconnected trends include e-commerce, the gig economy, and the subscription economy.

Implications

Digital restructuring of the economy is impacting communities, businesses, workers, and consumers.¹ Accelerated by the pandemic, conventional bricks-and-mortar retail is being superseded by omni-channel (physical and virtual) business models, guideshops (stores where customers experience products before buying them), and other forms of experiential retail. E-commerce has changed the movement of freight and goods; effects include demand for warehouses and fulfillment centers near customers, increased neighborhood traffic, and drone deliveries. The gig economy is enabling 1) businesses to access talent while reducing costs and 2) workers to create flexible, location-independent work arrangements. Equity concerns include, among others, the lack of job security, benefits, and employment rights for lower-paid gig workers and the “digital divide” for people lacking access to affordable broadband.

Related Drivers

Technological drivers (artificial intelligence, data collection and use, new mobility, and smart cities) are particularly relevant because economic restructuring is being driven by digital technology. Other related drivers include workplace/workforce disruption and equity, diversity, and inclusion.

DEFINITIONS

- **E-commerce** is the buying and selling of goods and services via the internet. Its three main types are business-to-business, business-to-consumer, and consumer-to-consumer (also referred to as the sharing economy).
- The **gig economy** uses digital platforms to connect freelance workers with customers in order to provide short-term services.
- In the **subscription economy**, customers pay periodic fees to gain access to desired products and services using digital platforms. Content streaming services (e.g., Netflix) are an example.

Considerations for Triangle J Region

The ability to live and work from anywhere that digital technology enables makes the Triangle’s assets (relative affordability, availability of jobs, quality of life, etc.) even more attractive for young professionals, retirees, and others seeking alternatives to major metropolitan areas. At the same time, there are stark disparities in incomes and access to broadband infrastructure – the underpinning of the digital economy – both within the more urbanized counties (Durham, Orange, and Wake) and between urbanized and rural counties. As in other regions across the U.S., Triangle communities need to rethink and adapt land use and transportation systems developed in the 20th century for the 21st century economy. Needs include finding new uses for obsolete retail and office space; creating distinctive places that attract people to live, work, visit and shop; accommodating changing land use types and movement patterns driven by e-commerce; and providing convenient, affordable mobility choices in a dispersed region with limited mass transit service.

1. Implications for traditional employer-employee relationships are addressed in the Workplace/Workplace Disruption brief.

Driver of Change: Economic Restructuring



Economic

POTENTIAL RESPONSES

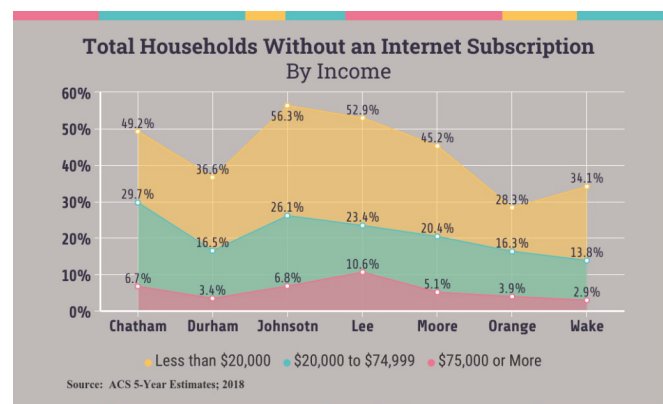
Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Conduct assessments of high-speed internet service coverage in business and residential areas Partner with the NCDIT Division of Broadband and Digital Equity and internet providers to address coverage gaps and make affordable service available to low-income households Target training and support programs to empower disadvantaged residents to participate in the digital economy 	<ul style="list-style-type: none"> Prepare county and regional digital equity plans Revise land use and transportation plans to account for the impacts of e-commerce Implement strategies to repurpose obsolete retail and office space for productive new uses Establish a regional clearinghouse providing resources and information for freelance workers 	<ul style="list-style-type: none"> Position the Triangle for success in the digital economy through universal broadband access, digital literacy and skills training, and creation of attractive, accessible places to live and work Monitor trends in the digital economy and adapt economic resiliency, land use, and other plans to address them Adapt movement systems to accommodate new forms of commerce, such as drone delivery and urban air mobility

Key Stats

- According to McKinsey & Company, the COVID-19 pandemic spurred the equivalent of 10 years of growth in e-commerce sales in just three months. Since the onset of the pandemic, consumer intent to purchase goods online has increased 40-60% compared to pre-pandemic levels; forecasts suggest that e-commerce could account for nearly half of all retail revenues by 2024 (Bai et al. 2021).
- After a surge in store closures in 2020 related to the pandemic, retailers reported a net increase in store openings in 2021. Nevertheless, UBS projects that 40,000-50,000 stores will close in the U.S. over the next five years (Thomas 2022).
- In 2021, independent freelancers represented 36% of the U.S. workforce and generated \$1.3 trillion in annual earnings. Moreover, 56% of non-freelance workers said they are likely to freelance in the future. Freelancers are increasingly high-skilled, with motivating factors including the ability to work remotely, flexibility to balance work and personal needs, and overall career and life satisfaction (Ozimek 2021)

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(Source: Triangle J Council of Governments 2020)



Driver of Change: Workplace/Workforce Disruption

Overview

Several interrelated trends are disrupting the traditional workplace and workforce, creating uncertainty for employers, workers, and communities. Short-term trends spurred by the pandemic include the shift to remote work and labor shortages across industries and professions (often referred to as the Great Resignation). Sectors particularly impacted by the Great Resignation include professional and business services, durable goods manufacturing, and state and local government (Liu 2021). Automation, the substitution of human labor with work performed by machines, is a long-term trend that has been accentuated by labor shortages during the pandemic, particularly in service industries.

Implications

For employers, implications include a need to rethink workplace models and office space needs; difficulty attracting workers in current economic conditions; and the need for a pipeline of workers entering the workforce who are prepared for jobs in the 21st century economy. Depending on position and skill level, employees have more flexibility to choose where they live and work and what they want from their jobs. Implications for communities include, among others, impacts on downtown/office markets, supporting service businesses, tax revenues, and levels of service provision. Local governments may have difficulty maintaining quality public services if they are unable to recruit and retain talented workers to replace skilled employees who retire or leave for other opportunities. Longer term, a significant number of jobs could be susceptible to displacement by automation.

Related Drivers

This driver is closely related to economic restructuring, which addresses digital economy trends (e.g., e-commerce) that are impacting the workplace and workforce. Other relevant drivers include technological drivers that are changing the workplace and required workforce skills, an aging population (a factor in the Great Resignation), and equity, diversity, and inclusion. The latter is particularly relevant given increasing economic disparity in the Triangle J Region (TJCOG 2020).

Considerations for Triangle J Region

Anchored by universities and Research Triangle Park, the Triangle J region has a high proportion of workers in the professional, scientific, and technical and educational services sectors. Health care, social assistance, and retail trade are other leading sectors (Deloitte et al. 2019). The predominance of well-paid positions creates a competitive job market in which local governments struggle to retain and attract workers. At the same time, there is an increasing divide between these positions and jobs in lower-paying sectors. To better compete for workers, public sector employers should institute more flexible practices that align with the needs and expectations of diverse segments of the workforce (including generational differences). Key community and regional needs include: 1) improving amenities, services, and infrastructure for remote workers; 2) addressing economic disparity by providing all community members with secure, living-wage job opportunities; and 3) preparing the workforce to succeed in the 21st century economy.

GENERATIONAL DIFFERENCES

Different generations reacted differently to the disruption caused by the pandemic and its aftermath. Baby Boomers (born 1945-1964) are least affected financially by the pandemic, which accelerated a readiness to retire. Gen X (1965-1980) are the most financially stressed generation. Millennials (1981-1996) are most focused on work/life balance, feel “burned out” by the pandemic, and struggle with work productivity. Gen Z (1997-2012), the most ethnically and socially diverse generation, fear being left behind by remote work (prefer in-person) and seek employers **who care about core values, purpose, and transparency**.

Source: Click Boarding (2021)

Driver of Change: Workplace/Workforce Disruption



Economic

POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Establish a local governmental working group to address workplace/workforce disruption Revise workplace models and job descriptions to better attract and retain workers Initiate public/private/institutional partnerships, programs, and investments to address changing workplace and workforce needs 	<ul style="list-style-type: none"> Partner with schools, universities, community colleges, and businesses to prepare/upskill/reskill workers Develop amenities and infrastructure to increase local and regional competitiveness in the job market Consider establishing a TJCOG workplace/workforce resource hub to support local governments 	<ul style="list-style-type: none"> Using the five goals* from TJCOG's <i>Strength in Numbers</i> as a framework, develop and implement partnerships, programs, and investments to adapt to changing workplace/workforce needs Monitor the workplace/workforce implications of drivers of change, such as automation, for the region

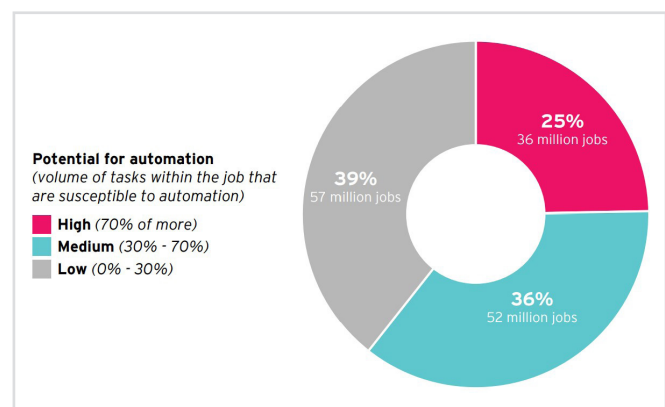
*The goals are business retention, expansion & innovation, robust infrastructure, workforce development, connected & vibrant places, and economic resiliency, all centering on the theme **Foster Economic Inclusion**.

Key Stats

- A January 2022 Pew Research Center survey found that 59 percent of U.S. workers whose jobs can mainly be done from home, constituting about a quarter of the total workforce, are doing so all or most of the time. 78 percent of these workers say they'd like to continue to work from home after the pandemic is over (Parker et al. 2022).
- An August 2021 Bankrate survey found that 55 percent of the U.S. workforce was likely to look for a new job in the next 12 months (Foster 2021).
- A Brookings Institution study found that 61 percent of U.S. jobs would face high or medium exposure, and 39 percent would face low exposure to automation by 2030 (Muro et al. 2019). Jobs paying lower wages and requiring lower education levels will experience the greatest impacts. Particularly vulnerable occupations include office administration, production, transportation, and food preparation.
- The study also found that Raleigh and Durham-Chapel Hill ranked #365 and #375, respectively out of 381 U.S. metropolitan areas in terms of vulnerability to job automation (Muro et al. 2019).

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(Source: Muro, Maxim, and Whito 2019)



Driver of Change: Climate Change

Overview

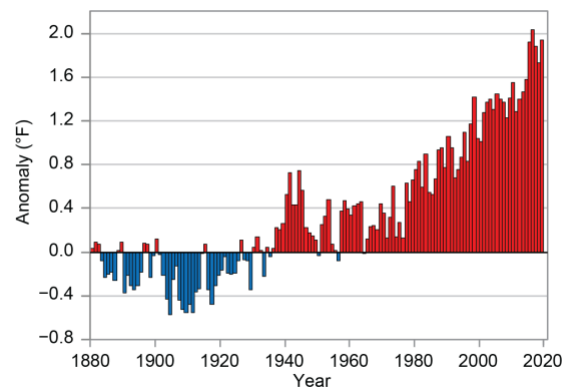
It's no secret. The planet is getting warmer. And this change is bringing a myriad of challenges for our communities. Increases in carbon dioxide, water vapor, methane, and nitrous oxide from the burning of fossil fuels and other human activities are driving this change, creating a greenhouse effect above the earth that prevents heat from escaping into the atmosphere. The result is that global temperatures are now almost 2°F warmer than they were in 1895. The years from 2015-2021 are the seven warmest years on record (WMO 2021). And as the planet warms, the climate is changing.

Implications

The implications of this change are numerous. Sea levels are rising. Weather is becoming more violent and unpredictable, with more powerful storms, shifts in rainfall, more flooding, hotter summers, and more drought, leading to more wildfires. These changes are causing increasing human fatalities, infrastructure damage, property destruction, food shortages, and ecosystem changes. The most socially vulnerable human populations are often the greatest at risk from these forces, and growing numbers of people are being displaced by extreme weather events. Climate scientists warn that time is running out to limit global warming to 2.0°C (2.7°F) and prevent large-scale and irreversible negative impacts. Major emissions reductions will be needed across all sectors to cause global greenhouse gas discharges to peak before 2025 and be reduced by about 43% by 2030 (IPCC 2022). Some strategies focus on mitigating climate change to reduce the extent of its occurrence, for example through climate-positive development that reduces carbon emissions, while other techniques focus on adaptation to reduce the harmful effects on our communities, for example through climate-resilient development. Both approaches will be needed in the years ahead, and can make our communities healthier, more equitable, and more resilient in the process.

Related Drivers

This driver is related to other environmental drivers, including energy and water usage and food security. In



Observed Changes in Global Annual Temperature
(Source: [N.C. Institute for Climate Studies](#))

addition, it has a major impact on equity, diversity, and inclusion, economic restructuring, and social determinants of health, and may be able to be mitigated in part through the use of artificial intelligence, big data, smart cities, new mobility, and the circular economy.

Considerations for Triangle J Region

The 2018 *Triangle Regional Resilience Assessment* found that the region is experiencing an increasing number of rain storms, causing more frequent local flooding, as well as increasing temperatures, and increasing frequency and duration of droughts. When combined with rapid population growth and development, these forces are endangering more people and property in the region. In particular, the Assessment notes the risk that flooding will cause many properties to be temporarily inaccessible to emergency vehicles. In addition, flooding will accelerate soil erosion, degrading surface water supplies. At the same time, changes in the amount and intensity of rainfall will negatively impact the quality and quantity of regional water supplies. In addition, extreme heat can compromise human health, particularly for socially vulnerable populations. To address these challenges, the region will need substantial, coordinated action to do its part to reduce its carbon footprint and make its communities more resilient.



POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Implement recommendations of Triangle Regional Resilience Assessment Develop local Climate Action and Resilience Plans Create local and regional Climate Action Teams to support and track implementation Create regional Climate Justice Task Force Set local, regional greenhouse gas reduction targets 	<ul style="list-style-type: none"> Integrate Climate Action recommendations into local hazard mitigation plans, comprehensive plans, other plans Coordinate with state and federal partners to implement climate-positive and climate-resilient development strategies and share innovative best practices Implement measures in this report for energy, water, food security, and circular economy Track progress toward reducing greenhouse gas emissions Track climate impacts and assistance to socially vulnerable populations 	<ul style="list-style-type: none"> Continue systematic reduction of local and regional carbon footprint to achieve net zero carbon emissions Establish the Triangle as a leader in developing and implementing climate resilient solutions Collaborate with regional educational institutions, employers to build workforce skilled in climate solutions

Key Stats

- From 2016-2021, North Carolina experienced 34 weather-related disasters that cost a total of \$20-50 billion (NOAA 2022). By far the most damaging were tropical cyclones such as hurricanes.
- Sea level rose almost 8 inches at Wilmington from 1935-2018, and almost 7 inches at Duck from 1978-2018 (N.C. Institute for Climate Studies 2020).
- After adjusting for inflation, the U.S. experienced more than twice the number of billion-dollar disasters during the 2010s than the 2000s decade: 119 versus 59 (NOAA 2020).
- From 2016-2021, the United States experienced 177 weather-related disaster events that displaced 1.5 million people on average each year (IDMC 2022).

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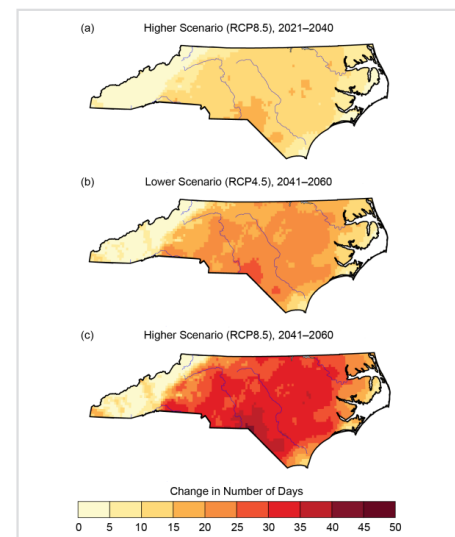
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Projected Changes in the Average Number of Very Hot Days (≥ 95° F)
(Source: [N.C. Institute for Climate Studies](#))



Driver of Change: Energy

Overview

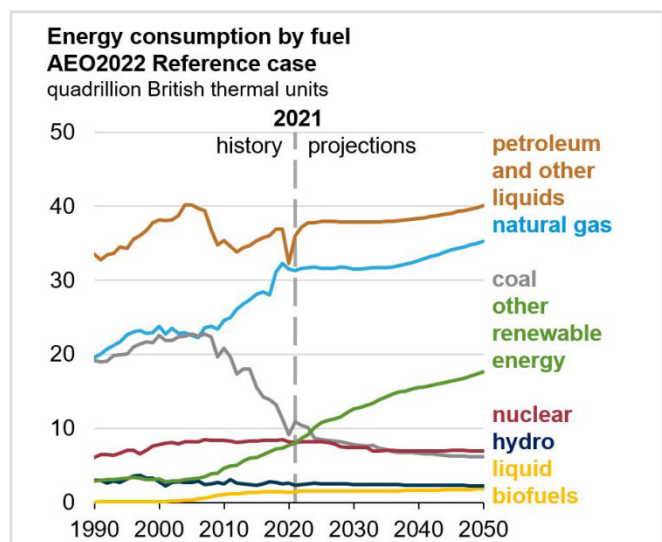
The recent escalation in oil and natural gas prices highlights the need to transition from fossil fuels to clean, renewable sources of energy — for economic, national security, and social equity as well as environmental reasons. Renewable energy use has increased rapidly over the last decade as it has become cost-competitive with other energy sources; solar power grew 23-fold and wind power nearly three-fold between 2011 and 2020 (Nick et al. 2021). Other clean energy technologies include electric vehicles, battery storage, geothermal, hydrogen, and energy efficiency. Despite the rapid growth in renewable usage, it is projected that petroleum and natural gas will remain the predominant energy sources in the U.S. through 2050 based on current trends (U.S. Energy Information Administration 2022).

Implications

Dramatically reduced fossil fuel consumption, electrification, and a shift to renewable energy sources are necessary to limit global warming to 1.5o C (2.7o F) below pre-industrial levels, a commonly cited target to avoid the worst impacts of climate change. The International Renewable Energy Agency (IREA) projects that, to achieve this target, renewables must provide 65% of the total global electricity supply by 2030 and 90% by 2050 (IREA 2022). Accomplishing this transition will provide a host of benefits beyond climate change mitigation, such as reduced pollution, access to clean energy technologies for the three billion people globally who lack electricity, and economic opportunity (IREA estimates that 85 million energy-transition related jobs could be created by 2030).

Related Drivers

While climate change is most directly related, energy intersects with other drivers such as the circular economy, housing, and smart cities. The clean energy transition has the potential to advance equity, diversity, and inclusion by creating jobs, improving health, and lowering energy costs.



(Source: U.S. Energy Information Administration)

Considerations for Triangle J Region

The Triangle is well-positioned to be a national leader in the transition to clean energy. While central North Carolina has relatively low wind energy potential, high sun exposure and the state’s [Renewable Energy and Energy Efficiency Portfolio Standard](#) for utility companies create high potential for solar energy development. Benefitting from the presence of Research Triangle Park, research universities, and active governmental partners, the region is home to the [Research Triangle Cleantech Cluster](#), one of the world’s leading cleantech industry clusters. Focus areas include clean energy systems, smart utility technologies, and clean transportation. The [Triangle Clean Cities Coalition](#) is part of the U.S. Department of Energy’s Clean Cities Coalition Network, working to save energy and promote the use of domestic fuels and advanced vehicle technologies. Five Triangle municipalities have developed [Clean Energy Reports](#) with the North Carolina Sustainable Energy Association. By leveraging these existing assets, The Triangle has the opportunity to scale up renewable energy investments throughout the region.



POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> • Work with Duke Power and other partners to set targets and incentives for renewable energy use and energy efficiency • Work with the North Carolina Sustainable Energy Association to prepare local governmental Clean Energy Reports • Conduct regulatory audits to identify barriers to and opportunities for renewable energy (solar facility siting in appropriate locations, EV charging capability, etc.) 	<ul style="list-style-type: none"> • Explore opportunities to deploy clean energy technologies in rural areas (e.g., agrivoltaics to compatibly integrate solar power with agriculture) • Implement strategies to expand the availability of EV charging stations (e.g., public/private partnerships, municipal fleet investment, regulatory provisions for new developments) • Develop a climate-positive development program to reduce energy use and carbon emissions 	<ul style="list-style-type: none"> • Position the Triangle J region as a recognized national and global leader in clean energy technologies • Establish renewable energy as a key economic development strategy and component of the regional economy • Set goals at the community and regional levels to achieve net-zero carbon emissions and monitor progress in achieving them

Key Stats

- In 2020, America produced almost four times as much renewable electricity from the sun and the wind as in 2011, increasing their share of the nation's total energy from 3% in 2011 to 11% in 2020 (Nick et al. 2021).
- North Carolina ranked third in the nation (after California and Texas) for growth in solar electricity generation from 2011 to 2020 and 10th in the nation for overall clean energy progress (growth in solar, wind, and electric vehicles sold combined) (Nick et al. 2021).
- A 2021 Electric Vehicle (EV) study found that Durham, Raleigh, and Cary ranked 36th, 61st, and 64th, respectively, among the 200 most populous cities in the country based on 11 factors relating to electric vehicles (Parker 2021). According to the [ChargeHub](#) website and mobile app, Cary has 124 EV charging stations, Durham has 156, and Raleigh has 205.

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- Nick, Sarah, Tony Dutzik, and Emma Searson (2021). [Renewables on the Rise: The rapid growth of renewables, electric vehicles and other building blocks of a clean energy future](#), Environment America Research & Policy Center and Frontier Group
- Parker, Jason (2021). "[Electric vehicle revolution is coming fast - and North Carolina isn't ready](#)," *WRAL TechWire*
- U.S. Energy Information Administration (2022). [Annual Energy Outlook 2022](#)

Agrivoltaics co-locates solar panels and agricultural uses in mutually beneficial ways. Benefits can include water conservation, higher crop yields, increased habitat, improved soil, crop protection, and economic returns from solar energy (Colorado Agrivoltaic Learning Center).



(Source: [Werner Slocum/NREL](#))



Driver of Change: Food Security

Overview

Food security means access to sufficient, safe, and nutritious food to support an active and healthy life for all household members. Approximately 10.5% of American households experienced food insecurity at some point during 2020 because they had insufficient money or other resources to obtain food (USDA Economic Research Service). Food security worldwide is being impacted by factors such as climate change and other environmental stressors, population growth, trade disruptions, and rising food prices. A sustainable local food system that connects food producers and consumers through a collaborative production, processing, and distribution network is key to addressing food security in a region such as the Triangle.

Implications

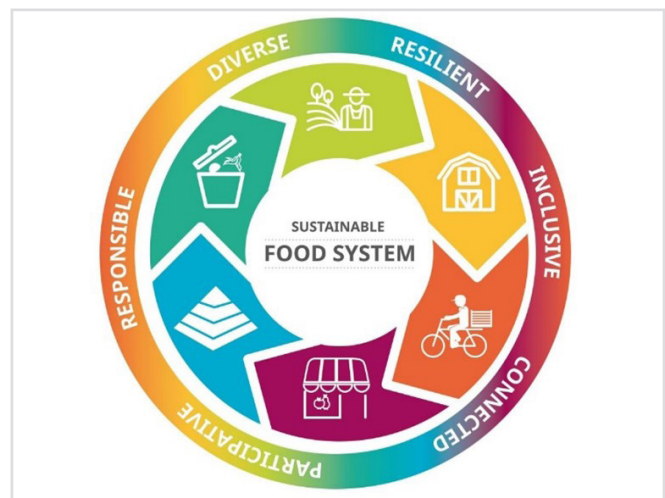
Food insecurity negatively impacts health due to the mental and physical stress it causes. Children are particularly susceptible to these impacts because their brains and bodies are still developing. Health-related costs (direct and indirect) attributable to food insecurity in the U.S. were estimated at \$179 million in 2014 (Bread for the World Institute 2015). On the positive side, a sustainable food system strengthens the local economy and improves health by promoting access to nutritious, locally grown foods.

Related Drivers

The social determinants of health and equity, diversity & inclusion are the most directly related. Other relevant drivers include aging population (seniors are particularly susceptible to food insecurity), globalization (due to impacts on local food supplies), and climate change, among others.

Considerations for Triangle J Region

Despite the Triangle region's overall prosperity, a significant minority of its population experiences food insecurity, making it an important equity issue. The region has a strong agricultural heritage and economy, indicating the potential to improve food security and health by increasing access to locally grown, fresh, and val-



Characteristics of a Sustainable Food System
(Source: [Santa Clara University](#))

ue-added products. The agricultural industry is being impacted by development pressures: according to the 2017 Census of Agriculture, five of seven counties lost farmland between 2012 and 2017 (USDA 2018; see table on page 2). The region hosts several county Food Councils and other organizations working to address food insecurity and strengthen local food systems. In Wake County, the Capital Area Food Network and Food Security working group led development of a comprehensive food security plan that could serve as a model for similar initiatives elsewhere in the region (Wake County 2017). The Orange County Economic Development Department has published a comprehensive guide to agricultural services and resources; the 2017 Census of Agriculture reported that the county (unlike others in the region) experienced significant gains in farmland and farm-related income since 2012. Actions to address food insecurity should be linked to broader efforts to build a more sustainable, resilient food system. The TRI-COG Food Ecosystem Economic Development Strategy (TRI-COG FEEDS), a partnership between the Triangle J, Kerr Tarr, and Upper Coastal Plain COGs, provides an unprecedented opportunity to address food security at a megaregional scale.



POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> Form partnerships to ensure access to fresh, healthy foods for the food insecure Use TRI-COG FEEDS study to identify actions that increase local purchasing power of small, BIPOC farmers as part of developing a more resilient, self-sustaining regional food system Initiate pilot projects to address food access gaps (e.g., mobile markets, community nutrition hubs in areas identified as food deserts) 	<ul style="list-style-type: none"> Develop a regional Food System Plan to coordinate local action Implement strategies to connect local farmers to local consumers (e.g., regional network of farmers markets, grocery stores, etc. providing access to fresh foods) Develop a regional food hub(s) to support aggregation, storage, processing, and distribution of local foods Address farmland preservation in land use plans and ordinance updates 	<ul style="list-style-type: none"> Establish the key components of a sustainable, resilient regional food system (protected agricultural base, access to markets for producers and consumers, a pipeline of farmers, etc.) Connect communities with technical assistance to accomplish these goals Monitor impacts of other drivers of change on food security and the resilience of the regional food system

Key Stats

- 10.5 percent (13.8 million) of U.S. households and 14.8 percent of households with children were food insecure at some time during 2020.
- Based on 2015-2017 data, 14.4 percent (590,000) of North Carolina households experience low (8.8 percent) or very low (5.6 percent) food security, making it the tenth hungriest state in the nation (North Carolina Justice Center 2018).
- One in seven (131,800) residents of Wake County were food insecure in 2014 (Wake County 2018).
- According to the 2017 Census of Agriculture, Johnston County ranks 3rd among North Carolina counties in crop production based on the value of products sold. Chatham County ranks 2nd, 5th and 12th among North Carolina counties for sheep and goats, cattle and calves, and poultry and eggs, respectively.

County	Number of Farms (2017)	Farmland Acreage (2017)	% Change, 2012-2017 Farms / Acreage
Chatham	1,116	105,995	-2 / -5
Durham	241	18,603	+4 / -11
Johnston	1,063	183,281	-10 / -6
Lee	250	35,170	+2 / -10
Moore	733	89,375	+2 / +8
Orange	686	69,608	+6 / +23
Wake	691	77,008	-12 / -9

Source: USDA, 2017 Census of Agriculture

References

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- USDA Economic Research Service (n.d.). [*Food Security in the U.S.: Key Statistics and Graphs.*](#)
- USDA National Agricultural Statistics Service (2018). [*2017 Census of Agriculture*](#) (County Profiles).
- Wake County, NC (2017). [*Moving Beyond Hunger: Comprehensive Food Security Plan and Action Manual*](#)



Driver of Change: Water

Overview

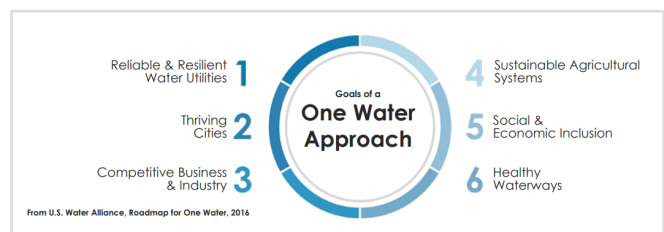
Our relationship with water varies with the circumstances. Growing regions often want more clean drinking water to serve new residents and businesses, and less polluted runoff from the growing number of roof tops and roads. As a warming climate generates more violent storms, flooding is damaging more lives and property. In many places, the 100-year storm is becoming a regular occurrence. Expensive infrastructure is needed to tap our water resources, maintain their quality and quantity, and help protect us from their harmful impacts during weather events. With greater demands and more uncertainty in the years ahead, water resource managers are increasingly exploring a ["One Water"](#) framework that takes an integrated, systems approach to water resources to serve broader community needs.

Implications

Growing demand and aging facilities are straining our ability to provide water and wastewater management services. New and expanded treatment facilities take years to design and permit, and are costly to build. Paying for facility construction and ongoing operation and maintenance is a [continuing challenge](#). Local governments provide public water and wastewater service to the majority of residents in the Triangle J region, and the State of North Carolina has established a strict framework for setting rates and fees for these services. Triangle communities are also subject to [state and federal](#) stormwater management requirements, and [a number of them](#) have established stormwater utilities as a funding source. There are also increasing examples of green stormwater infrastructure that [use natural solutions](#) to reduce costs and provide environmental, economic, and social co-benefits.

Related Drivers

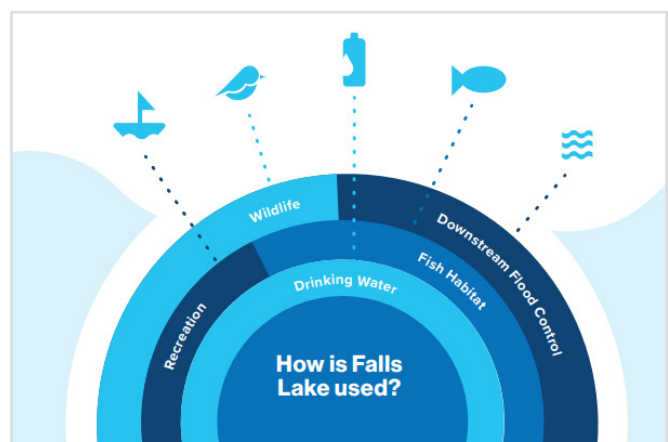
This driver is related to climate change, energy, food security, and the circular economy. It could also be managed better through the use of technological drivers (artificial intelligence, big data, and smart cities).



Benefits of One Water
(Sources: [Triangle Land Conservancy](#) 2019, [U.S. Water Alliance](#) 2016)

Considerations for Triangle J Region

With 46 inches of rainfall a year, on average, the Triangle is blessed with significant water resources. Jordan Lake and Falls Lake together can provide up to about 163 million gallons of drinking water a day during a severe drought, along with additional supplies in a number of smaller reservoirs. At the same time, regional growth is straining this capacity and degrading water quality, with [a number of urban streams](#) not supporting their intended use. Regional resources include the Triangle J Council of Governments' [water resources](#) program, the UNC School of Government's [Environmental Finance Center](#), and a number of university institutes, government agencies, and consulting firms to assist with this work.



A Multi-Use Framework for Falls Lake
(Source: [Upper Neuse River Basin Association](#))



POTENTIAL RESPONSES

Short-Term (0-2 years)	Mid-Term (2-5 years)	Long-Term (5-10+ years)
<ul style="list-style-type: none"> • Create a regional water resources dashboard to track water conservation, watershed protection, and other topics • Implement Jordan Lake One Water recommendations • Explore extending One Water concept throughout region • Continue sharing water resources management best practices 	<ul style="list-style-type: none"> • Implement recommendations of Triangle Resilience Assessment • Implement Jordan Lake Watershed Conservation Strategy • Promote utility coordination on water conservation measures • Explore extending utility watershed protection programs throughout region • Develop water resources funding toolkit 	<ul style="list-style-type: none"> • Create a calendar for coordinating and updating water supply plans and wastewater management plans in region • Hold annual regional water symposium to share latest ideas • Develop regional green infrastructure plan and promote integrated land and water mgt. • Track impacts of changing climate on regional water resources

Key Stats

- A typical city block generates nine times more stormwater runoff than a woodland area of the same size because of impervious surfaces such as rooftops and pavement (US Environmental Protection Agency).
- A major flooding event in the Triangle could make more than 30,000 properties in Orange, Durham, Wake, and northeastern Chatham Counties partially or fully inaccessible to residents and emergency vehicles due to inundated or damaged roads ([Triangle Regional Resilience Partnership – 2018](#)).
- The City of Raleigh expects water demand in the city and six towns its serves in eastern Wake County to nearly double to 98 million gallons a day between 2019 and 2047 (Raleigh News & Observer, 5-17-19).
- The average water consumed per person in Raleigh and eastern Wake County dropped from 117 gallons/day in 2007 to 86 gal./day in 2019 as a result of water conservation measures (News & Observer, 5-17-19).
- Local government utilities in North Carolina collectively face about \$10.7 – 13.7 billion (in 2020 dollars) in water and wastewater capital projects over five years ([UNC SOG Environmental Finance Center 2021](#)).

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N.C. Division of Water Resources (2021). [Falls Lake Nutrient Strategy 2021 Status Report](#). N.C. Dept. of Environmental Quality.
 Rouse, David and Econsult Solutions, Inc. (2022). [Financing Green Infrastructure: Lessons from the Chesapeake Bay Watershed](#), International City/County Management Association (ICMA).



Jordan Lake Is a Vital Water Resource for the Triangle Region (Photo: Ben Hitchings)

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CONCLUSION AND NEXT STEPS

From an aging population to the extreme weather of climate change to cryptocurrency, the world is changing before our very eyes. For many, the COVID-19 pandemic was a wake-up call. What a difference a month made. Communities that were able to respond more quickly to the outbreak with testing centers, mask protocols, assistance to vulnerable populations, more online services, and business support measures like expanded outdoor dining were able to save lives and reduce the harmful social and economic impacts of the virus.

Now we have to evolve our systems to prepare our communities to manage the next disruption. Our colleagues and constituents will expect nothing less. But how do we do this? Here are some recommendations on how to take the next steps.



1. Track the issues. The drivers of change described in this report are constantly evolving. The array of different drivers is like a meteor shower headed toward earth, with each driver in a different stage of approach. Creating a standing body to gather data and track trends can help us keep pace with these evolutions, building on existing metrics such as those in the Comprehensive Economic Development Strategy (CEDS). This might include a “tracking disruption” committee at the regional level with representatives from different member governments and an advisory group of subject matter experts from various sectors to gather data and share insights across the region. In addition, each local government may want to convene its own working group with representatives from different departments to track the issues most relevant to its community. These bodies can use tools such as strategic foresight and draw upon concepts such as the Drivers of Change Framework and Cone of Uncertainty described in the introduction, along with the myriad of resources identified in this report to help carry out their work.



2. Identify your priorities: Because of their differing trajectories, timeframes, and characteristics, and how they intersect with our community dynamics, some drivers of change in the meteor shower have the potential to impact us more profoundly than others. As a result, we need to establish an early warning system and target the most relevant drivers for our community to give us more chance to prepare and shorten our response time for delivering effective action following impact. One way to do this is by engaging a leadership team or stakeholder group in an Issues Prioritization Workshop that draws on this report and the companion set of trend cards, and other resources like them, to identify the drivers on which our community should focus. Such a workshop could be held with a regional Tracking Disruption Committee to examine issues of common interest across the region, and with each Working Group at the local level to prioritize the drivers most relevant to that community.

FOUR THINGS YOUR ORGANIZATION CAN DO TO HELP PREPARE FOR THE FUTURE

- 1. Create a “Tracking Disruption” Working Group** to gather data and track trends on drivers of change such as those described in this report.
- 2. Conduct an “Issues Prioritization Workshop”** to identify the most relevant drivers of change for your community and the region.
- 3. Draft a “Community Readiness Plan”** to prioritize actions to increase organizational and community resiliency and prepare for change.
- 4. Take Action to Implement the Plan** by launching pilot projects and other measures to improve the ability of your community to respond decisively to disruptive shocks like the pandemic.



3. Make a plan. Once we have identified our priority drivers of change, then we can make a plan to address them. The resulting “Community Readiness Plan” could function like a future-focused strategic plan and illuminate a pathway forward that will serve us well in times of need. Such a document differs from a traditional Strategic Plan in its future focus and targeted response to emerging issues, identifying impactful and feasible projects for improving community readiness.



4. Take action. Then it is time to build resiliency. We do some of this every day as we work to improve system health and strengthen the personal and financial wellness of our constituents and our organizations, giving them more cushion to weather disruption. At the same time, we need to improve our readiness to respond decisively to disruptive shocks like the pandemic. The preparations and investments we make in this work can help us do that. Some initial ideas on potential responses are included in each of the issue briefs in this report. Regardless of the topic, technical assistance can be secured on how to develop organization-specific measures for institutionalizing a future focus. We can test new ideas, pilot new tools and capabilities, and scale up new solutions. Each project that we implement in our communities will help us improve our readiness.

The future is filled with change. The extent to which this disruption brings new challenges or opportunities is up to us. Our response must occur at both a community level and on a regional scale. Organizations like the Triangle J Council of Governments provide a valuable resource through a diversity of in-house expertise and projects such as this trends report. Let us know of other ways that we can help you on this shared journey called the future.

APPENDIX A. GENERAL RESOURCES

- American Planning Association and the Lincoln Institute for Land Policy (2022). [2022 Trend Report for Planners](#).
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