Ride-Sharing Services: The Tumultuous Tale of the Rural Urban Divide

Completed Research

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Abstract

This research examines the presence of ride-sharing services through the lens of rural and urban communities. Currently, urban communities are the primary areas where ride-sharing services occur. As the number of ride-sharing companies has grown, several have extended their reach into rural communities. However, by large, rural communities do not have the same level of access to and utilization of ride-sharing services as urban communities. To address this gap, alternative models are emerging to fill some of the un-met needs in rural areas. This study examines the ride-sharing rural urban divide, and proposes a ride-sharing index (RSI) to identify communities that have untapped potential for ride-sharing services. The RSI is an exploratory framework to determine the degree to which ride-sharing, and ride-sharing alternative models are appropriate to address transportation needs for rural and urban residents. This study uses secondary data to examine the constructs presented in RSI, and presents a rating of high, medium or low for a region's readiness for ride-sharing services. This study is formative and can be adapted to wider geographical regions. Implications for different constituents including ride-sharing companies and alternatives, individuals and policy makers are included.

Keywords

Ride-sharing, RSI, ride-sharing index, rural urban divide, structural transformation

Introduction

The sharing economy has grown in significance in the recent past. As more individuals seek autonomy and flexibility for areas such as transportation, housing, employment, entertainment, and other services, the sharing economy will persist as an area for discussion and research. Of particular interest to this study, is the sharing economy as it pertains to transportation alternatives. Ride-sharing, facilitated through mobile apps, has added a new dimension as a transportation option for commuters around the world. Uber, founded in 2010 and Lyft founded in 2012 are the current leaders in the digital ride-sharing domain. Other players have entered the domain in geographically specific enclaves. For example, Juno is a ride-sharing service option located in New York City.

Many rural residents do not have access to viable public transportation. In urban areas, public transportation is more accessible, and commuters have alternatives such as ride-sharing companies. In general, ride-sharing services gained success in urban areas but are sparse in rural ones. A 2015 report showed that only 3% of rural Americans had used ride-sharing services, compared to 21% of urban adults (Smith, 2016a). Further, many rural areas have limited broadband access and unreliable cellular service, both of which are prerequisites for many ride-sharing services. Alternative ride-sharing models that rely less on broadband and cellular service may be more applicable for some rural areas.

Several research questions persist around ride-sharing services in rural communities. For example, are ride-sharing services feasible in rural regions? Is there demand for ride-sharing services in rural areas? What segments of the population are interested in ride-sharing services? What are the different factors that are facilitating and/or inhibiting the growth of ride-sharing services in rural communities? These questions

are all relevant to the subject of ride-sharing, but tangential to this study. This study can provide support and a foundation for future projects to help answer some of the above questions.

The single question motivating this study is how to determine if a region is ready for the presence of ride-sharing services? This study focuses on the development of a ride-sharing index (RSI) to provide a framework for addressing the degree to which a geographical region is ready for the presence of ride-sharing services. The RSI index is an emerging concept guided by the existence of indices used in other areas such as human development and business. This study focuses on the state of Pennsylvania as the test bed for the RSI. This paper proceeds with the following sections: a background on ride-sharing, the theoretical framework for the RSI, the methodology, findings and discussion. The implications and conclusion follow.

Ride-Sharing Services

The concept of ride-sharing services has been around for as long as there has been modes of transportation. However, technology has given birth to digital ride-sharing. Digital ride-sharing is the use of a mobile app to procure transportation services between a driver and a passenger. Throughout this paper, "ride-sharing" is an abbreviation for "digital ride-sharing". In the United States, approximately 30% of adults have participated in a ride-sharing service, ranking 6th globally after China, Mexico, Russia, Spain and Brazil (Dunn, 2017). A recent Pew report showed an even more modest number, where only 15% of U.S. adults have used ride-sharing services with the 18-29 age group as the largest group of users at 28%; 30-49 age group at 19%; and those 65 and older at 4% (Brown, 2016). These numbers represent a low to modest adoption rate, suggesting that there are opportunities for growth and exploration. Research projects such as this one can be pivotal in assessing current and future prospects for ride-sharing services, particularly in untapped markets such as rural areas.

Ride-Sharing Controversies

Ride-sharing is not without its share of challenges and controversies. One of the earliest challenges for ride-sharing companies was the ability to operate legally in specific geographical regions. For example in 2016, Uber did not have a license to operate in eleven Pennsylvania counties: Beaver, Clinton, Columbia, Crawford, Lawrence, Luzerne, Lycoming, Mercer, Montour, Northumberland and Union (Stonesifer, 2016). Part of this challenge originated in 2014, when both Uber and Lyft started operating in the state of Pennsylvania without the appropriate licenses.

In the spring of 2017 Uber agreed to settle their dispute with the Pennsylvania Public Utility Commission (PUC), and pay a fine of $3.5 million (Moore, 2017). This means that Uber now legally operates in the state of Pennsylvania, within the parameters defined by the PUC. These parameters include insurance requirements, driver authorization and vehicle safety. Uber was the first, but other companies in the ride-sharing domain are also seeking permanent authorization to operate from the PUC.

The contentious relationship between ride-sharing businesses and taxi services added another tumultuous dimension to the equation. Another controversy surrounding ride-sharing services originates from their impact on more traditional taxi service models. Taxi companies now have direct competition for riders that want a "semi-private" ride. Some can argue that this is not a true controversy by merely the result of a competitive environment. Ride-sharing companies in many markets can operate at a lower price point than taxis, and provide increased flexibility such as type of vehicle and prior-to-trip pricing. Ride-sharing companies such as Uber may have a competitive advantage over taxi companies dues to higher capacity utilization rates of drivers, non-existence of occupational licensing for drivers, and reduction of passenger search times (Cramer & Krueger, 2016). Additionally as part of the digital economy, barriers to entry are low for new drivers, unlike the entry requirements that traditional taxi drivers have to provide.

This leads yet to another controversy about the designation of ride-sharing drivers as contractors or employees. As part of the sharing economy, any individual that agrees to abide by the parameters set forth by the ride-sharing company can operate as a driver. There is a debate as to whether ride-sharing companies are actually "sharing" or exploiting the drivers that work for them (Leighton, 2016). Ride-sharing drivers in some states have organized to petition for unionization of drivers to improve their working conditions and address issues such as rates, healthcare and safety. Seattle was the first city in the United States to see Uber

and Lyft drivers united to unionize however, there is an on-going battle about that case, and as of September 2017, there was a federal appeals temporary block against unionization of those drivers (Johnson, 2017). The results of this case can set the precedence for ride-sharing drivers in other cities and countries around the world as it pertains to driver unionization.

Lastly, decisions made by some senior level ride-sharing executives have been questionable. Uber's CEO resigned in 2017 amid accusations of concealing information from investors, stealing trade secrets from competitors, and operating in a climate riddled with sexual harassment and discrimination (Durbin, 2017) These events may have damaged perceptions about the company, and may have affected individual user choices.

The Rural-Urban Context

Technology heralded a change from agriculture to industrialization. As technology migrated, there was a divide between the have and the have-nots, resulting in the digital divide. Today, in the world of the sharing economy, there is a divide is between rural and urban areas. The typical user of ride-sharing services is a young, college educated, urban dwelling adult (Smith, 2016b). Globally the growth of ride-sharing is occurring in urban areas.

For rural regions, the type of available technology infrastructure has an impact on the feasibility of ride-sharing. To adapt to rural communities, ride-sharing companies can use different models such as web-based solution e.g. a website; mobile app solution requiring an app download; telephone solution using a call center; or person-to-person (P2P) message solution requiring a low-bandwidth messaging app such as Whatsapp or Telegram. There are also ride-sharing services such as Liberty Mobility Now that are specifically tailored to rural community (libertymobilitynow.com, n.d.), and uses a mixed model of both an app and call centers. Unique to rural areas are community-based factors that include community participation, individual altruism and collaborative initiatives. In densely populated urban areas, ride-sharing services are more individualist and revenue-based.

Ride-sharing services in rural areas need to circumvent some technical, social and economic barriers. For example, Uber and Lyft require all drivers and passengers to have a valid credit or debit card. This may be a challenge for some lower income rural, and or senior residents that may prefer cash or checks. Some companies also have restrictions on the age and type of vehicles that are used. These restrictions may be counterproductive in rural communities and inhibit the growth of ride-sharing services. Libretaxi (libretaxi.org, 2017) is a ride-sharing, open-source alternative that uses a messaging app (Telegram) to connect drivers and passengers. Two strength of this solution is that it requires very low bandwidth, and it allows the driver and passenger to negotiate the price of the ride. LawrenceOnBoard (hopista.org, n.d.) is another solution started in Lawrence, Kansas, based on the concept of hitchhiking. There are emerging alternatives available in the world of ride-sharing services that specifically cater to the needs of rural communities.

High population density has a positive impact on the ride-sharing phenomenon (Clewlow & Mishra, 2017), and includes the availability of drivers and passengers, and transportation needs of the local residents. Population density is the number of people divided by the land area. Tis project uses Pennsylvania as a test bed for its concepts. Table 1 shows the main ride-sharing cities in the state of Pennsylvania and the counties where these cities are located. In Pennsylvania, the population density is 284 persons per square mile. Based on the classification adopted by the Center for Rural Pennsylvania, counties that have a density below 284 are rural, and those with a density above 284 are urban, resulting in 48 rural (72 % of all counties) and 19 urban (28%) counties in the state (Center for Rural Pennsylvania, 2014). In the state of Pennsylvania, Philadelphia has the highest rate of ride-sharing adoption, and is ranked 15th in the United States for Uber adoption in large metropolitan cities (Dent, 2015). Currently, in Pennsylvania Uber and Lyft are primarily concentrated in large urban cities and densely populated centers located in rural counties such as State College in Centre County PA. There are on-going efforts to reach residents that are more rural.

Table 1: Primary Ride-Sharing Areas in Pennsylvania

City/Region* with Ride-Sharing Services	County	County Designation
Allentown	Lehigh	Urban
Altoona	Blair	Rural
Erie	Erie	Urban
Harrisburg	Dauphin	Urban
Johnstown	Cambria	Rural
King of Prussia	Montgomery	Urban
Lancaster	Lancaster	Urban
Lebanon	Lebanon	Urban
Philadelphia	Philadelphia	Urban
Pittsburg	Allegheny	Urban
Reading	Berks	Urban
State College	Centre	Rural
Wilkes-Barre Scranton	Luzerne	Urban
Willamsport	Lycoming	Rural
York	York	Urban

(*Data sourced from uber.com and lyft.com)

Theoretical Framework

An index is a composite measure consisting of two or more underlying components. The creation of an index requires the identification of the relevant constructs that contribute to that unique value. As part of a rural urban conversation, there is a long-standing bias in favor of industrialization and urbanization at the expense of rurality (Losch, 2015). This study refrains from suggesting that there is a more preferred environment within a rural urban discussion. Instead, the approach here is to assess the constraints of each environment and identify the underlying constructs that will provide a salient indicator about the feasibility of ride-sharing services. Structural transformation (Atesagaoglu, Bayram, & Elgin, 2017; Sim & Oh, 2017) is the underlying theoretical basis to support the development of the RSI.

During the industrial age, there was massive structural transformation from agriculture to manufacturing. Technological advancement is an important mechanism explaining shifts in labor and resources during structural transformation. Structural transformation is the process of moving resources from one system or industry into another, coinciding with economic development or change. Much of structural transformation is informed from an economic perspective and can have a demand-side or a supply-side focus (Atesagaoglu et al., 2017).

From a demand-side view there is a non-homothetic preference for household goods resulting in different degrees of product acquisition for different income levels (Huang, 2017). Consider ride-sharing as a household service and thus extending this to a ride-sharing perspective, it suggests that income level is relevant to the utilization of ridesharing services. Further, as incomes increase, due to luxury alternatives for both potential drivers and riders, we expect an inverse relationship between income and utilization of standard ride-sharing services. This leads to the following proposition:

Proposition 1: Income is negatively associated with readiness for ride-sharing services.

The second demand-side variable is population density. The existing use of ride-sharing services demonstrates that utilization of ride-sharing services is dominant in urban areas and dense populations characterize urban areas (see table 1). As the density of the population increases, there is an expected increase in the utilization of ridesharing services. This leads to the following proposition:

Proposition 2: Population density is positively associated with readiness for ride-sharing services.

From the supply-side, ride-sharing drivers are primarily individuals in the community that want to earn extra income. Available employment has a direct net positive impact on the economic development of a region, particularly structural change from agricultural to non-agricultural sectors (Sim & Oh, 2017). The bimodal concept of moving across a continuum such as from agricultural to non-agricultural is relevant in the rural to non-rural (urban) context. In communities with a higher degree of unemployment, ride-sharing presents an opportunity for individuals to engage in either full-time or part-time income generating activities such as becoming a ride-sharing driver. This leads to the following proposition:

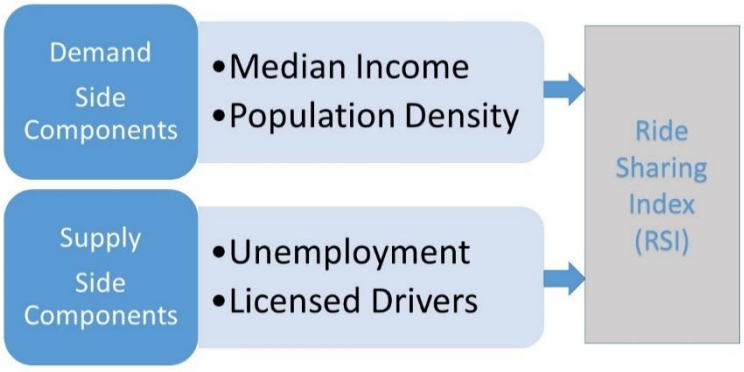
Proposition 3: Unemployment is positively associated with readiness for ride-sharing services.

One component that is imperative to the success of any ride-sharing service is the supply of qualified drivers. However, an abundance of qualified drivers, suggests that those individuals will most likely drive themselves to and from their destinations. Therefore, the forth component of the RSI is that of licensed drivers. Less drivers in a region can be an indicator of more reliance on public transportation and the need for more access to ride-sharing services. This leads to the following proposition:

Proposition 4: Licensed drivers are negatively associated with readiness for ride-sharing services.

The RSI is thus a composite index consisting of four underlying variables: two demand-side constructs of income and population density; and two supply- side constructs of unemployment and licensed drivers (figure 1). This study posits that of the four underlying constructs median income and licensed drivers are negatively associated with the readiness for ride-sharing services, and population density and unemployment are positively association with the readiness for ride-sharing services.

Figure 1: Ride-Sharing Index (RSI) Theoretical Framework



Methodology

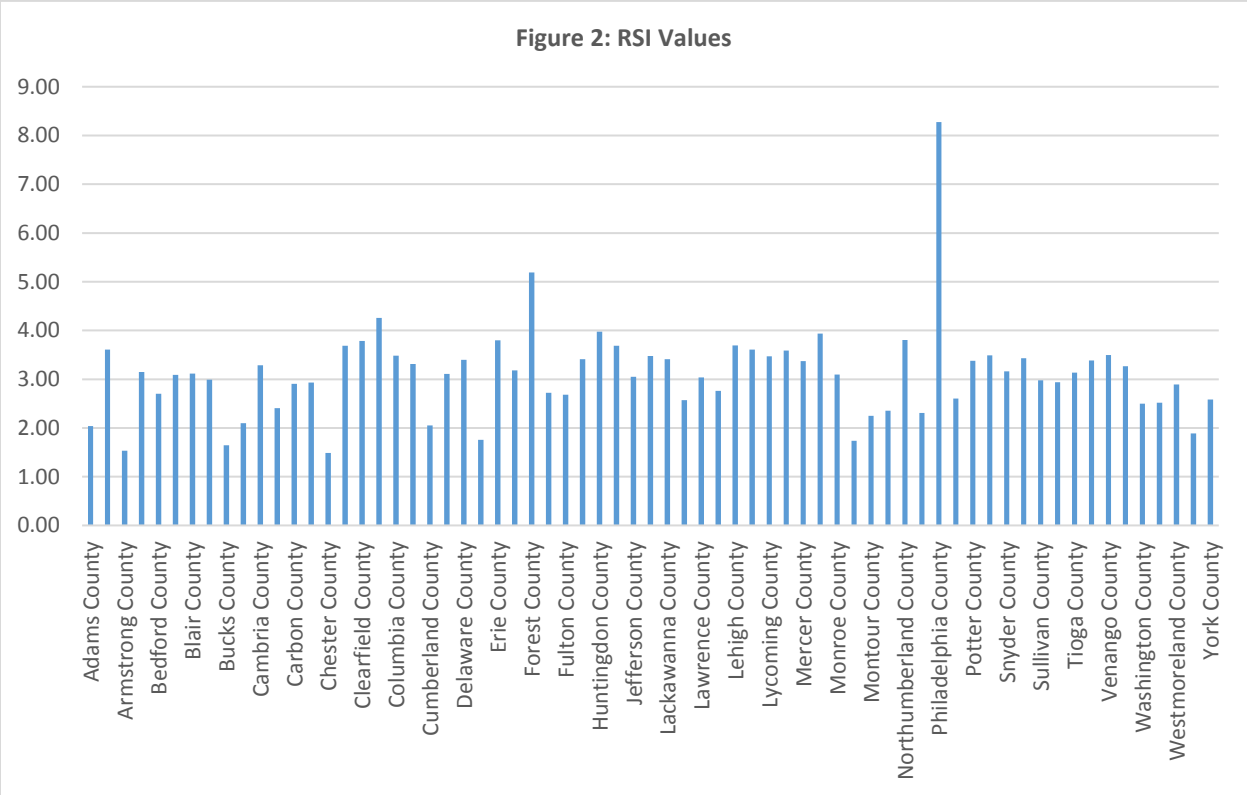
The methodology for this study uses a unique data set created from multiple secondary sources. The data is for a single state: Pennsylvania. A recent study examining the relationship between ride-sharing and alcohol related fatalities used single state data for its analysis (Greenwood & Wattal, 2017). Pennsylvania is appropriate for this study given its dichotomous divide of a large number of rural counties (72%) and home to the fifth most populous city in the United States, Philadelphia.

Data for the four underlying index variables were from different state and federal agencies. The data sources include the Center for Rural Pennsylvania, the United States Department of Labor, and the Pennsylvania Center for Workforce Information and Analysis. All data was for the period 2016-2017. Given that ride-sharing is a recent phenomenon, it was appropriate to use the most recent data available to the support this study, hence the 2016-2017 timeframe. Data for all constructs were normalized on a 1-10 point scale. As the basis for the index, a 1-10 range was adopted. On the RSI scale one (1) represents the minimum value and region least ready for ride-sharing services; and ten (10) represents the most ready region. An inverse function was used for the negatively related constructs. Lastly, the composite RSI index was a geometric mean on the underlying four constructs (two with direct correlations and two with inverse correlations). For the RSI, three categorical dimensions were created: high, medium and low. For these three categories, interquartile values, derived from the index data, were used to determine the cut-off values for the different levels in the RSI.

Initial Findings

This paper presents a summary of the findings derived from the creation of the RSI. For the median income and licensed drivers constructs, the value one (1) represents the highest income level, and the highest percentage of licensed drivers. Since our theoretical model posits that these constructs have a negative relationship with the utilization of ride-sharing services, a high value of 10 is more desirable for the RSI. This means that in the RSI calculation, a normalized median income of 10, is the lowest median income. Conversely, for population density and unemployment rate, a value of 10 indicates the highest population density and the highest rate of unemployment, both desirable inputs for the RSI model.

The data from all four constructs determined the RSI values (based on the geometric mean) as shown in figure 2. From the data (see figure 2), Philadelphia county, consistent with our expected findings, showed the highest level of readiness for ride-sharing services.



For the RSI values, 2.59 was the lower quartile and 3.47 represented the upper quartile. These values correspond to boundaries for low, medium, and high on the RSI scale. For the 67 counties, 26% registered as "Low", 46% registered as "Medium" and 28% registered as "High" on the RSI. The data from the RSI results was then compared to the initial 15 counties that had the most utilization of ride-sharing services.

Table 2: Comparison of Existing Ride-Sharing Counties with RSI Rating

City/Region* **With Ride-Sharing Services**	**County**	**County Designation**	**RSI Rating**
1. Allentown	Lehigh	Urban	High
2. Altoona	Blair	Rural	Medium
3. Erie	Erie	Urban	High
4. Harrisburg	Dauphin	Urban	Medium
5. Johnstown	Cambria	Rural	Medium
6. King of Prussia	Montgomery	Urban	Low
7. Lancaster	Lancaster	Urban	Low
8. Lebanon	Lebanon	Urban	Medium
9. Philadelphia	Philadelphia	Urban	High
10. Pittsburg	Allegheny	Urban	High
11. Reading	Berks	Urban	Medium
12. State College	Centre	Rural	Medium
13. Wilkes-Barre Scranton	Luzerne	Urban	High
14. Willamsport	Lycoming	Rural	High
15. York	York	Urban	Low

Three of the 15 initial ride-sharing counties returned a value of Low, from the RSI rating. The RSI values for those three counties are Montgomery County with 1.74, Lancaster County with 2.56, and York County with 2.58. Both Lancaster and York Counties are within a .03 distance from the "medium" range minimum of 2.59. One anomaly in the results is Montgomery County (additional information about this result is in the discussion below).

Discussion and Limitations

The findings of this study provide useful context about ride-sharing readiness in rural and urban counties. From the results 75% of counties registered as either high (28%) or medium (46%) on the RSI. As mentioned earlier in this paper, 72% of PA counties are rural and 28% are urban, this suggests that there is untapped potential for ride-sharing services in rural areas given the medium and high ratings from the RSI. Even though Uber reaches a large portion of Pennsylvania, the wait times for drivers can range from a few minutes to up to twenty based on whether you are in an urban or a rural area. This suggests that there are gaps in the quality of service riders receive based on different geographical regions and travel times.

New entrants to the marketplace can capitalize on opportunities where a region has a medium rating on the RSI and service quality is less than optimal. The dynamic nature of the sharing economy, also adds flexibility for both producers and consumers. From the RSI results Forest County (northwest Pennsylvania)

shows up as the second outlier. Forest is a rural county with a population of less than 7500 residents. From the original data set, Forest County had the highest rate of unemployment in the state, and shows up as an opportunity for residents to engage in the sharing economy. There may be opportunities for residents to engage in other aspects of the sharing economy such as housing through AirBnB, since the county is known for camping and hunting. The two counties in Pennsylvania with the highest median income are Chester and Montgomery Counties, both bordering Philadelphia County to the west. Given the high incomes, these counties were less likely to use ride-sharing. However, given their proximity to the city of Philadelphia the convenience and ease of using ride-sharing, may be discounting the preference for other transportation alternatives. Further, there is an opportunity to further examine the initial constructs of the model and further decompose the income variable.

Given the exploratory nature of this study, there are several limitation. The first is that there could be other underlying constructs that were omitted in the RSI theoretical model. This model should be further tested and refined with data from other states. The ultimate goal of this project is to present a comprehensive country level index that can be used by researchers and developers interested in ride-sharing for any of the 3007 counties in the United States. In this study, there is also an opportunity to do more in-depth analysis of the underlying constructs such as the inclusion of correlation matrices.

Implications

The RSI proposed in this study has implications in two main groups: transportation policies and technology access. From a policy perspective, transportation is either public (e.g. buses, trains) or private (e.g. personal vehicles, chauffeured rides). There is also the hybrid public/private transportation option encompassing features of both, such as taxis and ride-sharing services. In terms of impact, ride-sharing affects both public and private transportation because it can be a feasible alternative or addition to both. In the state of Pennsylvania, public transportation policy considerations are relevant to a variety of constituents including local communities, county agencies, state-wide organizations and state government (Marianne M. Hillemeier et al., 2012).

Public transportation providers in rural Pennsylvania, are an eclectic mix of public, private and special interest organizations funded mainly by federal, state, and state lottery dollars (Jeffery, 2004). Bus service provided by entities such as Area Transportation Authority of North Central PA (ATA), Crawford Area Transportation Authority (CATA), Indiana County Transit Authority (Indigo) and Carbon County Community Transit (CCCT) are integral to rural commuters but limited by fixed routes and pre-defined schedules. Ride-sharing services can supplement the existing public transportation infrastructure by increasing the number of transportation options available to residents. Including the RSI in transportation policy conversations can influence the allocation of limited public funds and encourage innovative solutions where opportunities exists.

Identifying the levels of demand for ride-sharing services across different groups based on factors such as demographics, travel patterns and technology usage, will provide insights about deployment of limited resources. An example of a specific recommendation for community organizations is to recruit volunteers and paid staff to participate in community-based ride-sharing solutions. Community-based ride-sharing services can use a carpool model with volunteer drivers accessible via a digital platform. This can result in economies of scale, increased efficiencies, and cost reductions to individual drivers and passengers. Larger bus systems can also work with small ride-sharing initiatives to expand the geographical coverage area for riders. Both private and public sector investments could make these initiatives feasible.

As already mentioned several times in this paper information technology is an underlying prerequisite for ride-sharing services. Cellular phone service is strongly desired, or even mandatory for most ride-sharing services. Even where low-bandwidth app solutions work, a cellular phone is necessary. Only models where drivers and passengers both use POTS and call centers are cellular phones circumvented.

As of August 1, 2017, 81% of PA had cellular phone coverage, with Verizon, ATT, T-Mobile and Sprint at 97%, 94%, 87% and 45% respectively (Robinson, 2017). This means that almost 20% of the state, particularly areas in rural counties still lack sufficient cellular coverage. Additionally, even though high-speed broadband services (25Mbps/3Mbps) is available in many parts of the Commonwealth, 22% of rural Pennsylvania's do not have access to any broadband service (Broadbandnow.com, 2017). Federal resources

such as the Connect America Fund are available to telecommunications companies to develop rural broadband infrastructure, but the case in several states including Pennsylvania, is that larger telecommunications companies are declining these funds and taking their business elsewhere.

Policy recommendations involving the expansion of cellular and broadband technology infrastructure may have the most significant impact on the growth and development of ride-sharing services. The RSI, if adopted on a large scale, can serve as one of the input factors for the expansion of a region's technology infrastructure. Where larger telecommunications companies are not fulfilling information technology gaps, smaller agile companies, are able to move forward. To promote ride-sharing services, the indirect path is through the growth of cellular and broadband services in rural areas. Addressing technical limitations can have an overall positive impact for residents, including access to viable transportation options such as ride-sharing services.

Conclusion

This study extends the ride-sharing literature by creating a preliminary index to assess a region's readiness to participate in ride-sharing services. As more companies and individuals innovate in the sharing economy, direct measures must exist to assess the feasibility and sustainability of such projects. Using a single state as the basis for this study provides a framework for continued growth and exploration on this subject. In spite of its challenges and controversies, ride-sharing provides an exciting new front for exploration. This research project is part of that adventure.

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